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The Role of Consequentiality in the External Validation of Stated Preference Methods

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I am submitting herewith a thesis written by Sharon Bowen Watson entitled "The Role of Consequentiality in the External Validation of Stated Preference Methods." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Economics.

Christian A. Vossler, Major Professor

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The Role of Consequentiality
in the External Validation
of Stated Preference Methods
Through Public Referenda

A Thesis Presented for the
Master of Arts Degree
The University of Tennessee, Knoxville

Sharon Bowen Watson
August 2012

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ABSTRACT

This study examines consequentiality and information effects of stated preference methods by taking advantage of a unique opportunity to compare survey responses with a parallel, financially binding public referendum held in the Town of Middleborough, Massachusetts, concerning the adoption of a conservation and preservation policy to be funded by a property tax surcharge. Our survey setting departs from previous work in this area in that (1) many survey respondents were unaware of the upcoming referendum and (2) the survey “referendum” mirrors that of the public referendum. The survey and analysis are designed to elicit and control for respondent beliefs regarding the policy consequences of respondent choices and to take subsamples before and during a period of public information immediately prior the referendum vote. Using the survey sample of verified voters, we find no statistical differences between survey and referendum votes at either the aggregate or precinct levels for the consequential respondents, but do find evidence of negative bias at the precinct-level for the full sample. Highly significant negative bias is found in the inconsequential voter sample. Negative hypothetical bias is reinforced by comparing inconsequential estimates of willingness to pay (WTP) to those of consequential respondents. Tests of information effects revealed no evidence of bias in either consequential or inconsequential cases.

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CHAPTER I: INTRODUCTION AND OVERVIEW

Introduction

Surveys are used by business and government to elicit preferences for potential policies or products that might be offered, and ultimately provide vital information for influencing resource decisions. Germane to this study, survey-based methods are commonly used for estimating the non-market values associated with public goods, and for determining monetary damages associated with environmental harm. Despite widespread use of these methods, the economic incentives that motivate choices to value elicitation questions in surveys are not well understood. Appropriately analyzing and reporting results of stated preference surveys depend critically on such an understanding.

This study builds on existing work related to the external (i.e. criterion) validity of stated preference methods. In particular, we take advantage of a unique opportunity to compare survey responses with a parallel, financially binding public referendum held in the Town of Middleborough, Massachusetts, concerning the adoption of a conservation and preservation policy to be funded by a property tax surcharge. Our survey setting departs from previous work in this area in that (1) many survey respondents were unaware of the upcoming referendum and (2) the survey “referendum” mirrors that of the public referendum. Further, motivated by recent theoretical and empirical research that suggests that the incentive properties of surveys are strongly tied to beliefs regarding the policy consequences of respondent choices, we elicit and control for respondent beliefs. Using the survey sample of verified voters, we find statistical differences between survey and referendum votes at the precinct-level. These

differences stem from a negative hypothetical bias that arises from the subsample that viewed the survey as inconsequential, and go away when we focus only on consequential respondents. Negative hypothetical bias is also evident in the estimation of willingness to pay (WTP), and controlling for consequentiality increases the construct validity¹ of the study.

Related Literature

The majority of the literature related to the external validity of stated preference methods uses laboratory experiments wherein the stated preference “treatment” is a purely inconsequential, hypothetical elicitation. Given a wealth of recent evidence that suggests many field survey respondents do perceive there to be policy consequences to their decisions (Carson and Groves 2007; Carson et al. 2006; Harrison and List 2004; Landry and List 2007; Vossler and Evans 2009), we focus here on field survey studies and lab experiments that explore consequential “treatments”. In a field experiment, Carson et al. (2006) investigate consequentiality effects and test whether behavior is consistent with standard neoclassical theory. The particular tests conducted involved varying the probability a referendum is binding, and whether the percentage of “yes” votes are equal in consequential (i.e. positive probability) and inconsequential (i.e. zero probability) cases. Tests fail to reject equality of “yes” vote percentages except when the various inconsequential and consequential elicitations are considered. Both of these findings support theoretical predictions. In a laboratory experiment, Vossler and Evans (2009) examine a setting where participant votes are used as an input to the decision

¹ Construct validity refers to whether the measure of interest (e.g., willingness to pay) varies in ways suggested by economic theory.

process. This was operationalized by having the experiment moderator submit anonymous votes, and varying the proportion of the total votes cast made by the moderator. Findings support the conclusion that if stated preference respondents in an advisory referenda view their responses as consequential, such surveys have criterion validity.

As a departure from the majority of external validity studies, a handful of papers have used a naturally-occurring criterion measure – namely, the outcome of a public referendum. With few exceptions (noted below), existing studies rely on surveys that explicitly mention the upcoming referendum, and further are conducted just before the referendum. Vossler and Kerkvliet (2003) showed that field survey results matched actual voting percentages and WTP estimates for a public referendum for a riverfront improvement project in Corvallis, Oregon. This study has been widely cited as it is one of the early criterion validity studies that compared a field survey to public voting with a finding of no elicitation bias. Vossler et al. (2003) used an upcoming open space funding referendum in Corvallis, Oregon, to externally validate responses to a non-binding survey. The actual measure was defeated and in this case the vote percentages only matched those of the referendum if "undecided" votes are coded as "no".

Carson, Hanemann and Mitchell (1986) used a randomized telephone survey to simulate an ensuing referendum for the issuance of \$325 million in California state bonds for a clean water program. Funding for the bonds were proposed to be paid out of the state's general fund, but average annual estimated costs per household were used to poll survey participants. Voters were not verified in the analysis. Following the passage of the measure in November 1984, the actual percentage of "yes" votes was

determined to match those of the survey conditional on recoding 60 percent of the “don’t know” votes as “no.” Champ and Brown (1987) compared the results of a survey referendum with a subsequent 1996 vote on the retention of surplus revenue targeted for road maintenance in Fort Collins, Colorado. The percentage of “yes” votes from verified voting survey participants was similar that of the actual referendum only when “undecided” votes were coded as “no”.

Johnston (2006) differs from the above studies that analyze intended and actual voting behavior. In particular, he compares survey and parallel public referendum votes in a unique setting where the survey votes were unambiguously consequential. The survey was being used to determine whether a binding referendum would be held. Also, the identifiable agency was a local government body of largely known and trusted individuals, and the study sample and population were relatively small and well defined. The survey was described as genuine² and parallel to the validating referendum in its offering of an identical, quasi-public good. A questionnaire requested a single “yes” or “no” vote on the provision of public water to the Village of North Scituate, Rhode Island, based on one of five estimated quarterly payment levels. Johnston (2006) found no elicitation bias in validating the survey and cited the familiarity of the good, the equivalence of the information content in the survey and the referendum, and consequentiality as possible explanations for the result.

Two studies focus on the consequentiality effects of stated preferences in a field survey setting. Herriges et al. (2010) investigated the effects of perceived consequentiality on elicited WTP distributions. They employed a treatment-response

²² Schlapfer et al. [2004, p. 4-5] identify a *genuine* survey as one carried out as “an independent CV study on an appropriate issue *before* the actual referendum proposition becomes the subject of public debate.”

model that controlled for unobserved confounding and made use of data from a subsample of individuals that had been provided with documentation demonstrating influence of past survey results on water quality improvement policy. Herriges et al. (2010) reported a statistically different WTP distribution between the inconsequential group and consequential respondents (regardless of the strength of their beliefs). Bulte et al. (2005) surveyed a large panel of Dutch households on the potential policies for the protection of seals to assess effects of consequentiality, hypothetical script treatments, and environmental causes. For the sample of respondents receiving detailed information on how the surveys would be used to inform policy, elicited WTP was significantly lower. Our study has the ability to shed additional light on the importance of consequentiality by analyzing its effects in a setting where consequentiality and external validity can be simultaneously assessed.

The Middleborough Study

Since understanding the role of consequentiality in stated preference methods is critical to providing reliable measures for public goods, it is important to emulate as closely as possible the standard field survey used to value public goods. This includes letting respondents be free to form beliefs regarding potential policy consequences. In existing studies comparing field survey votes to public voting, survey participants are frequently aware of the upcoming ballot measure. Critics express concerns that such studies are reporting intended voting behavior rather than the results of freely formed beliefs and value formation desired from a typical stated preference survey. Knowledge of the vote and public information likely alter the economic incentives to provide a truthful response in unknown ways.

In our study, we make use separate survey samples taken prior to and during the public information period associated with the actual referendum vote so that information effects could be evaluated. We are thus able to rule out differences in participant choices before and during the public information period, to show that survey and referendum voting proportions match up by precinct. As noted earlier, existing external validity studies from field surveys, for the most part, require recoding “undecided” / “don't know” votes to “no” to achieve matching results. Only Vossler and Kerkvliet (2003) and Johnston (2006) find no evidence of elicitation bias.

Motivated by theoretical and empirical evidence in support of consequentiality treatments, likert-scaled participant perceptions were directly elicited in the CPA survey so that analyses could be conditioned on consequentiality. The earlier descriptions of the work of Johnston (2006) and Herriges et al. (2010) note important prior contributions to the understanding of consequentiality effects within field survey settings. The following observations highlight contrasting treatments from those used in our study. Johnston's full (2006) sample for the public water provision study is considered consequential because the survey itself noted the possibility of a public referendum. Herriges investigated consequentiality effects and elicited scaled perceptions but did not conduct analyses for external validation. Our primary conclusions are consistent.

The next section presents key issues and conditions related to using a public referendum as a criterion measure. Chapter 3 discusses the Massachusetts Conservation and Preservation Act and Town of Middleborough referendum. Chapter 4 describes the study design and data used in the study. Chapter 5 provides a comparison of the advisory survey results with the public referendum votes, and

Chapter 6 describes the empirical analysis for estimation of willingness to pay. The final chapter shares concluding remarks and suggestions for future research.

CHAPTER 2: USING A PUBLIC REFERENDUM AS A CRITERION MEASURE

The public referendum offers an approve/disapprove choice on a policy issue using a plurality provision rule. The outcome of a binding public referendum provides a desirable criterion for external validity testing since it is well-known to be incentive compatible (Farquharson 1969). Other potentially desirable characteristics of referenda are that they are familiar to voters, and are increasingly used to determine the provision of environmental and other public goods. Further, majority voting is unambiguously the fairest method when only two choices are at stake (Moulin 1988). May's Theorem describes majority voting in axiom form and states that it is the only method that provides anonymity for voters, neutrality on voting choices, and monotonicity (no less chance of passage with greater proportion of votes) (May 1952).

Based primarily on the incentive properties of binding referenda, the National Oceanographic and Atmospheric Administration (NOAA) Panel's Report on Contingent Valuation recommended the use of a single WTP question framed as a referendum (Arrow et al. 1993). The use of this elicitation format continues to be viewed as accepted practice.

Carson and Groves (2007) discuss the incentive properties of stated preference surveys. Vossler, Doyon and Rondeau (forthcoming) show theoretically that four conditions identified by Carson and Groves (2007) are together sufficient to ensure that participants will truthfully vote according to their preference between a single project and the status quo. These conditions are that:

- i) An agent answering a survey question must view the response as potentially influencing the agency's action,

- ii) The agent cares about the outcome of those action(s),
- iii) The elicitation involves a yes or no vote on a single project, and
- iv) The agency can compel payment of a good or service it provides.

Condition(i) implies a weakly monotonic influence function, meaning that a higher proportion of “yes” votes will not decrease the probability of provision and that one’s vote has potential influence on a decision. This condition thus directly relates to beliefs over consequentiality.

Many aspects of the referendum we study support the presence of these conditions. Media coverage emphasized the community’s interest in preserving the Town’s rural character from excessive development through the acquisition of open space. Survey respondents expressed much interest in additional land uses as well as historic preservation and community housing. Participants communicated concerns about the policy from both sides of the issue. Primary funding will be raised through a property tax surcharge to be collected by the Town, and the limitations on the CPA fund and its activities are uniformly defined and guided by Massachusetts Law. Adoption of CPA requires a majority affirmative vote in a city or town. Citizens effectively voted to receive sizeable contributions through state matching funds and management protection. While it is possible to provide such activities through the private sector, resources for these uses were not being realized at levels desired by proponents (Lopes 2010).

CHAPTER 3: THE MASSACHUSETTS COMMUNITY PRESERVATION ACT AND MIDDLEBOROUGH REFERENDUM

The Massachusetts Community Preservation Act (CPA) was approved by the state legislature and signed into law by Governor Paul Cellucci in September 2000. The Act simplifies legal requirements and offers intergovernmental financial support to communities that choose to participate in its provisions for managing future growth, development and conservation. Pursuant to the Act, a city or town actively requests to offer a ballot measure for adoption of the CPA provisions by simple majority approval at a regularly scheduled election. The Act requires a community's acceptance of a property tax surcharge of 3 percent or less to generate revenues for establishing a fund. The legislation expressly targets projects for open space (including land for recreational use), preservation of historic community resources, and community housing. The legislative body of adopting communities may vote to include one or more of the three exemptions available in the law: (1) properties of those who would qualify for low income or low or moderate income senior housing, (2) certain commercial and industrial properties, and/or (3) \$100,000 of the value of each taxable parcel of residential real property.

The Massachusetts Community Preservation Trust Fund was formed to further enable adopting communities to meet the funding requirements of their projects. The Trust Fund acquires its resources through surcharges on fees for filing, recording, and depositing designated instruments associated with deeds, registered land, and municipal lien certificates. Matching funds distributed to the participating communities depend on the balance of the trust fund and can range from 5 to 100 percent of the local property tax surcharge revenues for a community that has adopted CPA. Communities

like Middleborough that levy a property tax surcharge of less than 3 percent are only eligible for the first of three potential rounds of funding. From the Trust Fund's initial payout in Fiscal Year 2002 through Fiscal Year 2008, revenues were sufficient to support 100 percent matching to all CPA communities. However, the first round of matching funds fell to 67.6 percent of local surcharge revenues in Fiscal Year 2009, and the most recent Fiscal Year 2011 payout was 27.2 percent (Massachusetts DOR 2009, 2011). The first year for the Town of Middleborough to receive CPA matching funds will be Fiscal Year 2012.

A city or town that adopts the CPA must establish a Community Preservation Committee as defined in the Act. The Committee is charged with studying the needs, possibilities, and resources for projects and making recommendations to the legislative body for approval. Thus, communities enjoy much flexibility in creating and implementing projects and plans that promote development and preservation goals specific to their localities. Adopting communities are required to spend or set aside not less than 10 percent of the annual revenues in the Community Preservation Fund for each of the following purposes: open space (including land for recreational use), historic resources, and community housing.

Massachusetts' passage of CPA resulted from nearly two decades of debating and searching for viable policy alternatives. The final legislation displays the efforts of innovative government and community leaders and the influence of experiences in Nantucket, Cape Cod, and the State of New Jersey. The concept of a statewide enabling authority originated with the Nantucket Island Land Bank. The Bank was established in 1983 to acquire, hold, and manage important open space resources and

endangered landscapes of the Island for the use and enjoyment of the general public (Zieper 2009). Similarly, Cape Cod residents established a Land Bank in the mid-1990s in response to local development concerns and potential threats to its sole aquifer. Following political deliberation, the Massachusetts legislature granted permission to Cape Cod towns to adopt provisions for levying a tax and establishing the land banks. State lawmakers reached a consensus after the funding mechanism was changed from a real estate transfer tax³ to a property tax surcharge. Massachusetts lawmakers also provided a state matching fund.

At a Town Meeting in May 2010, Middleborough voted to place the CPA measure on its ballot for the scheduled November 2010 election. Previously in 2002, the Town had voted down a CPA ballot measure (54 to 46 percent) proposed to be funded by the levy of a 3 percent property tax surcharge. However, the new measure proposed a property tax surcharge of 1 percent on the annual tax levy on real property, which would be assessed beginning in fiscal year 2011. During the campaign, proponents noted that the lesser percentage for the surcharge proposed in the 2010 measure would be much more favorable for passage. An exemption would be provided to those who own and occupy their homes and qualify for either low income housing or low- or moderate-income senior housing. In addition, the first \$100,000 of the value of residential property would be exempt from the surcharge. The Middleborough vote yielded a win for CPA adoption at 4,371 to 3,795 (53.53 to 46.47 percent).

³³ A real estate transfer tax (RETT) is imposed on the sale or transfer of real property located in the state. The tax is usually based on or measured by the consideration paid for or the fair market value of the real estate (FTA Bulletin, B-03/06, February 16, 2006).

CHAPTER 4: SURVEY DESIGN AND DESCRIPTION OF DATA

Survey Design

The survey instrument and its implementation were carefully designed for gathering data consistent with the purposes of investigation, namely, testing for external validity, consequentiality effects and the effects of public information activities prior to the actual vote. The survey presentation was formal and a cover letter stated that the results and conclusions of the research would be shared with policymakers and made available to community leaders and interested citizens. The introduction to the survey emphasized the importance of local policy issues addressed as well as the importance of thorough completion of the questionnaire.

The timing of public information activities for the referendum through media coverage and political advertising were largely limited to the final three to four weeks prior to the election. Although residents who followed the Town Meetings were aware that the issue had been approved to be on the ballot and a brief article appeared in the local newspaper, residents were largely unaware of the upcoming vote until late in the campaign. Survey comments suggested strong reactions to the measure. As the election drew very close, editorials and articles were submitted and published in the local newspaper, a local radio station aired a forum led by a representative of the CPA Coalition and other proponents, and flyers were disseminated at local farmers markets. A temporary website was established which shared general information on CPA and chronicled many of these activities. Some of this information has been transferred to the Middleborough's permanent CPA website.⁴

⁴ <http://middleborocpa.org/>

During the eight weeks prior to the November 2010 election, a total of 2,000 mail questionnaires were sent in two waves to a random sample of registered Middleborough voters. The surveys were accompanied by letters informing recipients that the purpose of the study was academic and not political. The survey process was implemented using a modified approach of Dillman's Tailored Design Method (Dillman 2009). Cover letters, printed on University of Tennessee letterhead, were personalized and individually signed. Reminder postcards and follow-up surveys were sent out, and incentives in the form of dollar coins and two-dollar bills were used to encourage response.

The mail survey mode was chosen for its familiarity, accessibility, and effectiveness. Voters are accustomed to a referendum ballot. The format for responding to the survey referendum is similar that used in the actual referendum. Recent survey research cites support for the continued use of mail surveys because postal addresses provide good coverage for developing the sample frame and response rates can be significantly higher than those obtained from telephone and web surveys (Dillman 2009). On the whole, mail survey response rates have not declined over the past few decades to nearly the same extent that they have for telephone surveys. (Hox & de Leeuw 1994). Studies also suggest that many people still prefer to respond to surveys via postal mail rather than to internet surveys (Couper 2005; Dillman et al. 2008). Even for individuals that favor the internet mode, the use of the postal mode for the initial contact is often considered less intrusive and a more reliable means of connecting with the individual.

Respondents were provided the option of completing an analogous survey over the internet. Almost 10 percent of respondents took advantage of this option. A total of 574 persons responded to the survey, and 94 surveys were returned as undeliverable. Because this study involves comparing survey results with the actual referendum outcome, it is the results of voters that are of ultimate interest in our analysis. Eliminating those who did not actually vote, we are left with a total of 508 usable surveys. For the conditional sample of actual voters, our response rate is 35.6 percent (508/1,458) response rate.

The full sample was developed using a stratified random sampling approach. Since the purpose was to compare survey votes from verified voters and referendum votes at the precinct level, registered voters were placed into 18 strata based on voting precinct (6 precincts) and voting history (based on whether individuals had voted in either or both the April 2010 and November 2008 elections). A random sample was taken from each stratum so that an approximately equal number of voters represented each precinct and so that weighting heavily favored active voters as measured by participation in the two recent elections.

Surveys were sent in two distinct waves to obtain responses before and after the onset of the period of public debate, which primarily involved newspaper and radio coverage, a preservation website, and limited coalition outreach activities as described earlier. The first wave represented the pre-information sample of 1,250 individuals who were mailed questionnaires eight weeks prior to the November 2010 election. Questionnaires for the second wave or post-information sample were mailed to 750 individuals four weeks prior to the election. Respondents could be expected to fill out

the questionnaires throughout the eight weeks prior to the CPA vote. Postmark dates were carefully tracked. Returned surveys with postmark dates after Election Day were not included in the response rate or analysis.

Survey Instrument

The survey instrument was titled “A Survey of Middleborough Residents’ Interest in Funding Conservation and Preservation Activities.” The survey was short and elicited responses concerning competing issues, the vote on the proposal, factors related to voting decisions on the ballot measure, and demographic information. The first section of the four-part questionnaire addressed opinions on local issues, asking the recipient to express her beliefs regarding the spending needs of the Town. This question was designed to encourage the respondent to frame the CPA–related issues within the larger context of the other important policy issues for Middleborough.

Following the initial questions, the respondent was simply presented with the exact referendum, provided by the Town Clerk’s Office, that later appeared on the ballot. In contrast to the common practice in stated preference research of providing a good deal of information about the policy being studied, there was no additional information other than what was provided in the (lengthy) referendum. The participant was given the final language of the ballot measure preceded by the question below and the options to vote “Yes (For)” or “No (Against):

We would like you to consider carefully the following Proposal. We have found that some would vote for the proposal and others would vote against it. Both have good reasons why they would vote that way. If you had a chance to vote on this Proposal, how would you vote?

Beliefs regarding policy consequences were directly elicited from respondents, and presented as a follow-up question to the survey referendum. In particular, the following question was included:

To what extent do you believe that the indicated votes on the Proposal from you and other survey participants will be taken into consideration by policymakers? (Please circle a number below.)

Not taken	1	2	3	4	5	Definitely taken
Into account						into account

After referenda-related questions were presented, homeowners and renters were directed to answer targeted questions for them. Homeowners were asked to provide the assessed property values of their residences. Other questions posed to homeowners and renters addressed possible impacts of the proposed measure. The remainder of the survey requested key demographic information from respondents, including age, gender, residence, income, educational background, and employment. Personal questions potentially relevant to CPA voting decisions, such as memberships in environmental or historical organizations and frequency of park visits, were also included.

Other Data

Other information was gathered on respondents and the population of Middleborough residents who voted in the election. Precinct-level election results were obtained from the Town Clerk of Middleborough. A few respondents did not indicate their assessed property value, so supplemental assessed values were obtained from a property database located on the Town of Middleborough Assessors' web site.^{5,6}

⁵ <http://www.middleborough.com/assessors/index.html>

⁶ <http://www.visionappraisal.com/databases/>

Finally, we requested email addresses from those who wished to receive information regarding the study results. For this (small) sample of 74 respondents, we sent emails asking whether they were aware that the proposal would appear on the November ballot. The response rate to the email inquiry was high at 86% (64/74). For those in the pre-information sample, just 2 of 37 (6 percent) respondents answered in the affirmative. In the post-information sample, the proportion is slightly higher, with 9 of 27 (33 percent) stating they were aware of the public referendum.⁷ Although the results of this exploration are not necessarily representative of the larger respondent samples⁸, this provides suggestive evidence that: (a) many respondents were unaware of forthcoming ballot measure when responding to the survey; and (b) nearly all of the pre-information respondents were unaware of the referendum.

⁷ Most of the email addresses came from respondents to the Internet survey, and most of the second wave respondents who were emailed about knowledge of the referendum did so prior to most of the media coverage.

⁸ Most of the email addresses came from respondents to the Internet survey, and most of the second wave respondents who were emailed about knowledge of the referendum did so prior to most of the media coverage. As we later find no evidence of information or mode-of-administration effects, email sample representativeness may not be an issue.

CHAPTER 5: COMPARING ADVISORY SURVEY AND PUBLIC REFERENDUM VOTES

Middleborough referendum and survey results are reported in Table 1. In the Town's November 2010 election, its voters passed the local CPA measure with 4,371 approving (53.53 percent of the 8,166 "yes"/"no" votes) and 3,795 disapproving (46.47 percent). A total of 9,010 voters cast ballots (57 percent voter participation). Approximately 9.4 percent of referendum voters failed to cast a "yes" or "no" vote, and this corresponds closely with the 5.9 percent (30/508) of survey participants who did not indicate a vote on the proposal but otherwise filled out the survey.⁹

Advisory survey results are provided for respondents identified to have actually voted in the November 2010 election for full, consequential, and inconsequential samples. The inconsequential sample consists of participants who indicated a belief that surveys would *not* be taken into consideration by policymakers. In our analysis the consequential sample consists of participants that indicated any level of consequentiality (responses 2 to 5 on the likert scale). As we do not have a simple random survey sample of actual votes, in calculating vote percentages we constructed and used sample weights. The sampling weights are based on our sampling scheme (voting precinct and history), sample proportions are based on actual returns from verified votes, and population proportions are based on actual election voters. Unique sampling weights were calculated for different applications depending on the number of voters and participants being analyzed.

For the full survey sample of verified voters, 50.68 percent of the respondents that replied with a "yes" or "no" vote answered in the affirmative. Using a one-sample *t*-

⁹ Consistent with the voting ballot, there was no explicit "undecided" or "no vote" response option in the survey.

test, this percentage is not statistically different from the 53.53 percent yes votes from the public referendum. Looking at the respective precinct-level votes between the full sample advisory survey and the referendum, “yes” vote percentages are not statistically different in three precincts (Precincts 1, 5, and 6) and statistically different at the 10% level for the remaining precincts (2, 3, and 4). Only Precinct 2 had a percentage of “yes” votes meeting statistical difference from the referendum at the five percent level.

Moving to a key focus of this investigation, the consequential sample results are compared to those of the referendum. The “yes” vote percentage for the consequential sample was 57.41 percent and again not statistically different from that of the referendum. Perhaps more informative is the finding that none of the survey voting percentages from the six individual precincts were shown to be statistically different from the corresponding referendum percentages. In contrast, strong evidence of a negative hypothetical bias – in particular, a relatively high percentage of “no” votes - was found when comparing the inconsequential sample to the referendum. Further, the percentage of “yes” vote percentages from the inconsequential sample were shown to be statistically different in the aggregate and for Precincts 2, 3, and 4.

Table 1. Advisory Survey and Public Referendum Voting Results

	Public Referendum		Advisory Survey, Full Sample		Advisory Survey, Consequential Sample		Advisory Survey, Inconsequential Sample	
	<i>N</i>	% Yes	<i>N</i>	% Yes	<i>N</i>	% Yes	<i>N</i>	% Yes
Overall	8,166	53.53	478	50.68 (2.29)	370	57.41 (2.57)	91	25.60*** (4.60)
Precinct 1	2,153	59.78	85	63.29 (5.26)	67	66.15 (5.83)	11	33.30 (14.90)
Precinct 2	1,069	52.39	83	41.51** (5.44)	67	53.58 (6.14)	14	5.16*** (6.13)
Precinct 3	1,492	47.19	98	38.01* (4.93)	68	46.91 (6.10)	24	13.44*** (7.11)
Precinct 4	872	56.88	71	46.22* (5.96)	56	54.57 (6.71)	15	14.98*** (9.54)
Precinct 5	1,426	53.65	74	54.78 (5.83)	61	62.39 (6.25)	12	36.38 (14.51)
Precinct 6	1,154	48.44	67	47.58 (6.15)	51	52.71 (7.06)	15	37.31 (12.93)

Notes: Both the number of participants (*N*) and the percentage of “yes” votes are based on those who provided either a “yes” or “no” vote only.

Survey vote percentages and standard errors are adjusted according to sampling weights.

*, **, and *** denote survey vote percentage is statistically different than the corresponding referendum vote percentage at the 10%, 5%, and 1% level, respectively.

CHAPTER 6: ESTIMATION OF WILLINGNESS TO PAY

To assess the construct validity of the survey instrument, as well as to further investigate the role of consequentiality in preference elicitation, WTP regressions are estimated based on the maximum likelihood estimator of Cameron and James (1987). The “yes” and “no” votes from the referendum format signals information about values rather than revealing values for individual participants. In particular, the respondent faces an annual tax increase, denoted c_i . For this cost, a yes vote signals that $WTP_i \geq c_i$ and a “no” vote signals $WTP_i < c_i$. WTP is assumed to be a linear function of a vector of explanatory variables, X_i , such that:

$$WTP_i = X_i' \beta + \varepsilon_i$$

where β is a column vector of parameters and ε_i is a normally distributed error term with a zero mean and a standard deviation σ . The normal distribution of the error term implies a normal distribution of the latent dependent variable, WTP_i . Given the assumed linear conditional mean function and the normally distributed error term, the estimated parameters can be interpreted analogously to the parameters of a standard linear regression model where WTP were directly observed.

Table 2 describes the data used in the analysis that follows. The value of the policy to a participant is a function of the independent variables: the estimated additional tax, participant income, educational attainment, age, choice of survey response mode, the earlier or later group of surveys, receipt of survey before or after the information period, days prior to the election for responding to the survey, and indication of membership in an environmental organization.

Table 2. Model Variables and Descriptive Statistics

Variable Name	Description	Sample Mean (Std. Dev.)
Tax	The estimated annual tax increase to the participant's household for the property tax surcharge required to fund the policy	19.45 (13.71)
Income	Total annual household income (\$000s) for 2009 as stated by the participant	83.20 (52.05)
Inconsequential	=1 if participant indicated the lowest choice on the 1-5 scale representing a belief that no consideration of the survey results would be taken into account by policymakers regarding the policy proposed.	0.1677 (0.3740)
College	=1 if participant has a college degree or higher	0.49 (0.50)
Age	Years of age as stated by the participant	57.22 (14.37)
Internet Respondent	=1 if participant completed the survey on the internet website	0.12 (0.32)
Second Wave	=1 if participant received an initial survey from the second group that was mailed out	0.40 (0.49)
Days Prior	Date of participant's response based on the postmark date if returned by mail or on the actual date if submitted online	23.90 (14.89)
Information3	=1 if survey response submitted within 21 days prior to the referendum vote	0.54 (0.50)
Environmental Organization	=1 if participant is a member of an environmental organization	0.15 (0.36)

Note: Summary statistics are weighted and based on the entire sample of respondents verified to have voted in the election.

WTP models based on the full and consequential voter samples are reported in Table 3. In the first model for the full sample, the coefficient for membership in an environmental organization is positive and significant at the one percent level. The only other statistically significant parameter is the scale parameter, which here indicates that

demand is downward sloping. The model suggests a lack of construct validity, as covariates that are generally known to correlate with preferences for public goods, such as income, are insignificant. When evaluated at the means of the covariates, estimated mean WTP from this model is \$22.82. Note that none of the three variables that may be expected to account for information effects (Second Wave, Days Prior, or Information3) are statistically significant. We then test for the joint significance of these variables to find that result further confirms no statistical significance.

To investigate any differences between the consequential and inconsequential groups, we repeat the full sample model but include an indicator variable that equals one for the inconsequential respondents. By allowing mean WTP to differ between the two samples, we find that the measure is \$29.41 for the consequential respondents and \$-10.67 for the inconsequential participants. The coefficient on the inconsequential indicator variable is large, negative and statistically significant at the one percent level.

The third model reported in Table 3 includes only respondents in the consequential sample. Overall, this model displays strong evidence of construct validity, as indicated from the statistical significance of coefficients for income, college, age, and environmental membership (with income and environmental organization membership coefficients significant at the one percent level and college and age coefficients significant at the five percent level), all which have anticipated signs. The scale parameter is again positive and significant at the one percent level. The estimated mean WTP from this model is \$25.70. This result further reinforces the negative bias result observed in the above comparison of voter proportions.

Table 3. Willingness to Pay Models

Variable Name	1-Full Sample	2-Full Sample	3-Consequential
Income	0.0562 (0.0512)	0.6467 (0.0525)	0.1052*** (0.0386)
College	4.1347 (5.1233)	8.6134 (5.6579)	8.7255** (4.1895)
Age	0.1998 (0.1852)	0.3827* (0.2060)	0.3753** (0.1523)
Internet Respondent	2.8078 (7.8214)	-1.0220 (8.0829)	0.8152 (5.9209)
Second Wave	-7.4487 (7.6182)	-14.8150* (8.4587)	-7.8024 (6.2807)
Days Prior	0.3964 (0.3363)	0.0438 (0.3450)	-0.0368 (0.2575)
Information3	17.0601 (10.6796)	15.3149 (11.0651)	8.6412 (8.2618)
Inconsequential		-40.0766*** (10.9066)	
Environmental Organization	25.6766*** (8.3077)	28.5534*** (9.2607)	23.7329*** (6.9186)
Constant	-15.4406 (18.4648)	-9.7961 (18.9562)	-12.5174 (13.9583)
Scale (σ)	36.6320*** (7.2526)	36.3462*** (7.5186)	24.5243*** (4.2211)
Information Effects: χ^2	2.84 (0.4170)	3.63 (0.3047)	2.02 (0.5685)
Mean WTP, Overall	\$22.82*** (2.45)		
Mean WTP,Consequential		\$29.41*** (3.38)	\$25.70*** (2.14)
Mean WTP,Inconsequential		\$22.69*** (2.54)	
Log-Likelihood	-260.33	-233.72	-186.59
Pseudo-R²	0.0802	0.1438	0.1459
N	411	399	-234.7402

Note: Robust standard errors are in parenthesis. WTP estimates correspond to either the full sample (first model) or the consequential participant sample only (second and third models). *, **, and *** indicate that the parameters are significant at the 10%, 5%, and 1% levels, respectively. Information effects are based on joint significance test of Second Wave, Days Prior, and Information3 variables.

For each of the three models, results show a failure to find statistical significance in coefficients for the variables related to information. Similarly, no evidence was found for the joint significance for those variables in any of the full or consequential voter samples. These results suggest that media and political advertising activities had little if any effect on the survey voting choices.

Finally, in an attempt to investigate whether respondent characteristics are statistically tied to perceptions of inconsequentiality, we report the results of a probit model in Table 4. This probit uses as the dependent variable the indicator for inconsequential respondents, and uses select covariates from Table 2. Coefficients for attainment of a bachelor's degree or higher and internet survey respondent were statistically significant at the 5 percent level. The educational attainment variable was positive and thereby suggests that one possessing a college degree may be more inclined to have perceptions of inconsequentiality. In contrast, the negative coefficient of the variable flagging survey participants that responded by internet suggests that these individuals were more inclined to believe that survey results would influence policy. Clearly, a greater proportion of second wave survey recipients could be expected to have been made aware of the public referendum and to have experienced changes in perceptions more favorable towards consequentiality.

Table 4. Model to Test for Factors Associated with Inconsequentiality

Variable Name	Full Voter Sample, Probit (Weighted)
Income	-0.0003 (0.0019)
College	0.4073** (0.1788)
Age	0.0092 (0.0075)
Internet Respondent	-0.7248** (0.3303)
Second Wave	-0.4479* (0.2613)
Days Prior	-0.0116 (0.0084)
Environmental Organization	0.2799 (0.2520)
Constant	-1.2272** (0.5976)
N	419
Log likelihood	-178.3716
Joint Significance (Second Wave & Days Prior) $\chi^2 / (Pr > \chi^2)$	3.03 (0.2197)
Joint Significance (College & Internet Respondent) $\chi^2 / (Pr > \chi^2)$	10.55*** (0.0051)

Note: Robust standard errors are in parenthesis.

*, **, and *** indicate that the parameters are significant at the 10%, 5%, and 1% levels, respectively.

CHAPTER 7: CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

To investigate the external validation of stated preference methods, this study has compared the results of a naturally occurring public referendum to those of a parallel survey of actual voters concerning a proposed conservation and preservation measure to be funded by a property tax surcharge. Key features of the experimental design were the abilities to test for effects of participants' perceptions of consequentiality and to assess the effects of public information activities related to the ballot measure. Aggregate and precinct-level voter proportions were compared between the survey and the public referendum for the full sample, consequential sample, and the inconsequential sample from the advisory survey. Although the aggregate voter proportions matched those of the actual referendum for the full sample, only those of the consequential sample showed no statistical differences at both the aggregate and precinct level.

In our analysis of WTP, we find strong evidence of construct validity only when we restrict the sample to include on consequential respondents or otherwise control for consequentiality in the modeling. Willingness to pay estimates from the consequential and full voter samples of the probit models were close to advertised estimates related to the referendum. Little effects of changes in voter preferences stemming from public information through media coverage and political advertising were evidenced in the empirical tests. This result is not surprising since public information activities were almost entirely limited to the final three to four weeks prior to the election.

The findings of this study suggest opportunities for future research related to advancing methods for implementing consequentiality treatments. Such opportunities

include furthering the knowledge of existing consequentiality perceptions among potential survey participants and advancing the methods and language for more effectively eliciting consequentiality measures. The order of the consequentiality question could be further explored. Some work has begun in these areas (Powe et al. 2005; Nepal 2010). Endeavors in these areas may require ongoing work to identify changes in perceptions among population groups and to overcome potential strategic responses to consequentiality questions.

A better understanding of the behaviors motivating the responses of participants in the inconsequential group presents a key challenge. Continued research is needed to gain insight into the extent to which participants do not care about the issue or not want to think about it, whether these participants as opposed to the issue as they may express, and whether they feel compelled to make some kind of response. Answers to such questions may help to determine which if any of the inconsequential responses contribute useful information to the overall survey results. Studies designed to vary the cost of opting out may identify some motives behind the responses of those with perceptions of inconsequentiality. We have reported variables associated with inconsequentiality by using an inconsequential dummy variable as the dependent variable. Similar tests across a broader range of studies may provide additional insight into inconsequential perceptions.

In the separate area concerning the assessment of awareness of an upcoming referendum used for external validation, more extensive work covering a greater proportion of participants and the related characteristic data would be useful. Further investigations in this area may help develop a better understanding of factors

associated with freely formed preferences and value formation as opposed to potential reactions to political activities and media advertising.

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APPENDIX

A SURVEY of Middleborough Residents' Interest in Funding Conservation and Preservation Activities



This survey is intended to collect information about your opinions on important local policy issues facing Middleborough. It is important to the scientific accuracy of our analysis that you complete the questionnaire as completely as possible. All of the information you provide will be kept confidential. Our results will be reported in the form of summary statistics. *This survey should only take a few minutes of your time. Most questions are multiple choice. Your help is very much appreciated.*

We thank you for completing and returning this survey.

SECTION A: YOUR OPINIONS ON LOCAL ISSUES

A1. How would you rate the spending needs for the Town of Middleborough regarding the following items? (Please circle a number rating for each item listed.)

Items	Spend Much Less	Spend Somewhat Less	About Right	Spend Somewhat More	Spend Much More
Education	1	2	3	4	5
Reduce Debt	1	2	3	4	5
Parks/Recreation	1	2	3	4	5
Support Historic Resources	1	2	3	4	5
Reduce Crime	1	2	3	4	5
Improve Water System	1	2	3	4	5
Community Housing	1	2	3	4	5
Open Space	1	2	3	4	5
Road Maintenance	1	2	3	4	5

A2. We would like you to consider carefully the following Proposal. We have found that some would vote for the proposal and others would vote against it. Both have good reasons why they would vote that way. If you had a chance to vote on this Proposal, how would you vote?

1 Yes (For) 2 No (Against)

PROPOSAL: Shall the Town of Middleborough accept sections 3 to 7 inclusive, of Chapter 44B of the General Laws, as approved by its legislative body, a summary of which appears below?

Sections 3 to 7 of Chapter 44B of the General Laws of Massachusetts, also known as the COMMUNITY PRESERVATION ACT, establish a dedicated funding source to acquire, create and preserve open space, acquire, preserve, rehabilitate and restore

historic resources, acquire, create and preserve land for recreational use, acquire, create, preserve and support community housing; and rehabilitate or restore open space, land for recreational use and community housing acquired or created as provided in Section 5 of the Act. In Middleborough, the Community Preservation Act will be funded by an additional surcharge of 1% on the annual tax levy on real property to be assessed beginning in fiscal year 2011, and by funds provided by the state. Property owned and occupied as a domicile by any person who qualifies for low income housing or low or moderate income senior housing in the Town, and \$100,000 of the value of each taxable parcel of residential real property will be exempt from the surcharge. A Community Preservation Committee will be established by a by-law following acceptance of the Act and will make recommendations to Town Meeting on the use of the funds.

A3. We are interested in why you would vote “Yes” or “No” to the Proposal. Please circle any of the statements below that reflect why you voted a certain way. (Please circle all that apply.)

- 1 Funding the proposal is well worth the money.
- 2 Funding the proposal is worthwhile, but I cannot afford the tax increase.
- 3 I will not directly benefit from these programs.
- 4 I do not have to pay property taxes, so there are no financial consequences to me for my decision.
- 5 I feel that only users should have to pay for such resources.
- 6 I object to paying more property taxes than I already do for any reason.
- 7 I do not have enough information to make a good decision.

A4. In addition to the statements listed above, are there other reasons why you would vote “Yes” or “No”?

A5. There are several programs mentioned in the Proposal. *If the Proposal passed*, in your opinion, how should the money collected be divided across the programs? (Please circle a number rating for each item listed.)

Programs	Should not receive funding	Should receive little funding	Should receive moderate funding	Should receive high level of funding	Should receive all of the funding
Open space	1	2	3	4	5
Historic resources	1	2	3	4	5
Land for recreation	1	2	3	4	5
Community Housing	1	2	3	4	5

A6. Of the possible uses of funds devoted to “acquire, create, preserve” or “rehabilitate or restore” open space, which of the following are important to you? (Circle all that apply.)

- 1 Scenic parks
- 2 Parks for sports activities
- 3 Protection of water resources
- 4 Protection of farmland
- 5 Other. Please indicate. _____

A7. How certain are you of your vote on the Proposal? (Please circle a number below.)

Very Uncertain 1 2 3 4 5 Very Certain

A8. To what extent do you believe that the indicated votes on the Proposal from you and other survey participants will be taken into consideration by policy makers? (Please circle a number below.)

SECTION C: QUESTIONS FOR RENTERS

C1. What is your approximate rent or lease per month? (Circle the number next to the most appropriate category.)

- | | | | | | |
|---|-----------------|---|-----------------|---|-----------------|
| 1 | Less than \$250 | 4 | \$700 - \$999 | 7 | \$1800 - \$2199 |
| 2 | \$250 - \$399 | 5 | \$1000 - \$1399 | 8 | Over \$2200 |
| 3 | \$400 - \$699 | 6 | \$1400 - \$1799 | | |

C2. Although you do not pay property taxes for your dwelling unit, *if* the Proposal passed, how much do you expect your monthly rent to increase as a result?

- | | | | |
|---|--------------------------|----|--------------------------|
| 1 | No change | 6 | Between \$20 - \$30 more |
| 2 | Less than \$5 more | 7 | Between \$30 - \$40 more |
| 3 | Between \$5 - \$10 more | 8 | Between \$40 - \$50 more |
| 4 | Between \$10 - \$15 more | 9 | Between \$50 - \$60 more |
| 5 | Between \$15 - \$20 more | 10 | More than \$60 |

C3. Indicate *if* and what categories of real property you OWN in Middleborough. (Circle all that apply.)

- 1 Do NOT own real property
- 2 Own residential property for rent
- 3 Own commercial property
- 4 Own industrial property
- 5 Other. Please Describe. _____

C4. Do you plan on purchasing a home in Middleborough?

- 1 Yes, I plan on purchasing a home within _____ years.
- 2 No
- 3 I already own a house in Middleborough.
- 4 I am not sure.

PLEASE CONTINUE ON TO THE NEXT SECTION

SECTION D: ABOUT YOU AND YOUR HOUSEHOLD

D1. How many people, including yourself, are in your household? _____

How many people are 18 years or older? _____

D2. How old are you? _____ years old.

D4. What is your gender? 1 Female 2 Male

D5. Describe your level of education. (Circle the number next to the most appropriate response for you.)

- | | | | |
|---|--------------------------------|---|----------------------------------|
| 1 | Obtained graduate degree | 5 | Trade school/vocational training |
| 2 | Some post-graduate study | 6 | Completed high school |
| 3 | Completed undergraduate degree | 7 | Did not finish high school |
| 4 | Some college | | |

D6. Are you currently a member of an environmental organization?

- 1 Yes 2 No

D7. Are you currently a member of a historical society or organization?

- 1 Yes 2 No

D8. How often do you or someone in your household visit a park or outdoor recreational area in Middleborough?

- | | | | | | |
|---|-------------|---|----------------------|---|----------------------|
| 1 | Never | 4 | 2 to 6 times a week | 7 | 5 to 11 times a year |
| 2 | Daily | 5 | 2 to 3 times a month | 8 | 1 to 5 times a year |
| 3 | Once a week | 6 | Once a month | | |

D9. Which of the following have you done in the past year? (Please circle all that apply.)

- 1 I have visited a history museum or historic site outside of Middleborough
- 2 I have visited a local history museum or historic site.
- 3 I have read a history book for my own pleasure.
- 4 I have researched my own family's history.

D10. Have you contributed money or time to a charity within the past year?

- 1 Yes 2 No

D11. Please remember your name will not be used in any way relating to your responses. **Please select the range that best describes the total income before taxes for all members of your household for the year 2009.** Include all sources such as wages, salaries, income from businesses, interest on savings accounts and bonds, dividends, social security or other retirement benefits, child support, alimony, and public assistance.

\$0 - \$4,999	\$35,000 – 39,999	\$90,000 – 99,999
\$5,000 – 9,999	\$40,000 – 44,999	\$100,000 – 119,999
\$10,000 – 14,999	\$45,000 – 49,999	\$120,000 – 139,999
\$15,000 – 19,999	\$50,000 – 59,999	\$140,000 – 159,999
\$20,000 – 24,999	\$60,000 – 69,999	\$160,000 – 179,999
\$25,000 – 29,999	\$70,000 – 79,999	\$180,000 – 199,999
\$30,000 – \$34,999	\$80,000 – 89,999	Over \$200,000

D13. Please describe your current employment status by circling the most appropriate number below:

- | | | | | | |
|---|--------------------|---|-------------------|---|---------|
| 1 | Employed full time | 3 | Unemployed | 6 | Retired |
| 2 | Employed part time | 5 | Full-time student | | |

D14. Please provide any comments you may have concerning conservation and preservation in the Middleborough area, or any issues related to this research.

VITA

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