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Understanding the consequences of consequentiality: Testing the validity of stated preferences in the field

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Abstract: This study pursues the external validation of stated preference methods by comparing survey responses from verified voters with the outcome of a parallel public referendum on a conservation and preservation program to be funded by a local property tax surcharge. The majority of respondents were unaware of the upcoming referendum, and the experimental design allows us to control for referenda-related information effects as well as respondents' perceptions regarding the consequentiality (i.e. the potential policy impact) of their survey votes. We find the survey under-predicts "yes" referendum votes at the precinct-level. These differences go away, however, if we focus only on respondents who perceived their survey vote to be consequential. Negative hypothetical bias among inconsequential survey respondents is also evident in the estimation of willingness to pay, and controlling for consequentiality increases construct validity.

Keywords: stated preferences; voting; external validity; consequentiality; field experiment

JEL classification: C93, H41, Q51

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1. Introduction

Estimating the values of nonmarket goods such as local parks or reductions in air pollution is vital for policymaking and judicial decisions. Stated preference (SP) methods are favored theoretically for their ability to measure total economic value, and are widely used for estimating preferences over nonmarket goods and goods not yet available in markets. An abundance of research addresses various aspects of validity regarding SP methods, and while much of the evidence is supportive, criterion (i.e. external) validity remains the subject of much debate.

In their seminal paper, Carson and Groves (2007) correctly argue that incentive compatibility, i.e. the incentive to truthfully reveal preferences, in a SP survey depends on whether a respondent views her response as “consequential”. Specifically, a survey elicitation is consequential if the respondent cares about the policies contemplated (i.e. they enter her utility function) and further views her response as potentially influencing agency action. Building on this, Vossler et al. (2012) provide sufficient conditions under which both single binary choice (SBC) and binary discrete choice experiment (DCE) value elicitation mechanisms are incentive compatible.

The theoretical importance of consequentiality has been echoed by empirical findings. In a survey of Dutch households on seal protection policies, Bulte et al. (2005) find that including information on how results would be shared with policy makers decreases estimated willingness to pay (WTP). Nepal et al. (2009) and Herriges et al. (2010), using respondent self-reports on perceived policy consequences, reject the null hypothesis of equal WTP distributions among those who perceived the survey to be consequential and those who did not. Turning to research that informs criterion validity, a few recent experiments have investigated probabilistic

“advisory” referenda for publicly-provided private goods (Carson et al., 2004; Landry and List, 2007) and public goods (Vossler and Evans, 2009). The basic finding is that with (induced) consequentiality, the evidence is favorable with respect to external validity. In a framed field experiment, Vossler et al. (2012) find that elicited WTP from a SP, DCE elicitation matches that from financially binding, incentive compatible treatments only for participants who believed their responses had more than a “weak” chance of influencing policy.

In this study we examine the role consequentiality plays in external validity tests by comparing a SP mail survey with a parallel, naturally-occurring public referendum. A binding referendum with a majority vote implementation rule is incentive compatible under standard assumptions (Farquharson, 1969), making it a suitable criterion. This research provides a bridge between existing field survey studies (that do not have a criterion to assess external validity) and controlled external validity studies (that abstract from field conditions) that focus on consequentiality.¹ In particular, this is the first study that compares survey results with a naturally-occurring public referendum where: (i) the survey proposal is identical to the public referendum; (ii) the majority of survey respondents are unaware of the upcoming referendum, which of course better represents typical SP applications; and (iii) information regarding consequentiality is elicited, which allows us to explore not only possible interactions between consequentiality and external validity, but between consequentiality and knowledge of the public referendum.

Evidence from previous studies based on public referenda is somewhat positive, providing unconditional support of external validity (Vossler and Kerkvliet, 2003; Johnston,

¹ To maintain parallelism with the referendum, our SP survey necessarily provides a limited amount of information regarding the proposal. The information provided in standard SP surveys is generally extensive, based on input from experts in relevant disciplines (e.g. survey research, ecology), and vetted by focus groups comprised of persons from the targeted respondent population.

2006) or evidence of external validity when “undecided” survey responses are interpreted in particular ways in the analysis (Carson et al., 1986; Champ and Brown, 1997; Vossler et al., 2003). One exception is the study by Schläpfer et al. (2004), which finds estimated WTP from the survey to be statistically higher. The divergent results may be explained by the fact that the survey and public referendum studied involve different goods and elicitation formats. The study by Johnston (2006) represents the strongest validity test to date as respondents were aware that the survey would in fact be used to determine whether a binding referendum would be held.² Survey respondents in our study are free to form beliefs regarding the survey’s policy impact and thus, relative to Johnson (2006), our study can be characterized as relaxing control while more closely capturing the nuance of SP field surveys.

With the exception of Schläpfer et al. (2004) and Johnston (2006), past studies utilizing comparisons with public referenda have largely relied on the *intended* votes of respondents who were (made) aware of the upcoming referendum. Not only does this awareness represent a departure from typical SP applications, but it may alter beliefs regarding consequentiality as well as other facets of the elicitation essential for incentive compatibility. To investigate this issue, we implement the SP survey in two waves. The first wave corresponds with a time period where the vast majority of respondents are unaware of the referendum. The timing of the second wave corresponds with public outreach efforts, which are likely to have informed at least some respondents about the public referendum.³

² As discussed by Carson and Groves (2007, p. 189), a survey specifically used to determine whether a proposal is put up for a (binding) vote does not alter the survey’s incentive properties. However, it remains an empirical question whether explicit knowledge of the survey’s intent alters behavior.

³ It remains an open question what motivates responses in a pre-election survey. Since past studies did not suggest (through a preamble or otherwise) any possible tie to policy, respondents may simply have viewed the elicitation as inconsequential. Another possibility is that respondents may have believed that survey results would be announced prior to a vote. Although this provides an opportunity to influence the outcome, it may do so in ways that discourage a truthful response (e.g. by increasing the predicted number of “yes” votes, the respondent may motivate those in opposition to participate in the election).

The particular referendum we study is a proposal to fund conservation and preservation efforts in Middleborough, Massachusetts through a one-percent property tax surcharge. Survey participants are asked to vote on a proposal that contains the exact language of the forthcoming ballot question. Voting records are used to verify which survey respondents voted in the election. Our analysis focuses on verified voters given that differences in the underlying preferences of voters and non-voters could confound a comparison between survey responses and actual referendum votes. The survey instrument, as described in the cover letter, is simply cast as potentially providing input to the policy decision and makes no mention of the public referendum.

Comparing SP survey and binding referendum votes on a precinct-by-precinct basis, we find differences in three of the six voting precincts, unless we restrict our sample to only those who believed it to be consequential. We find that among inconsequential respondents there is a negative hypothetical bias, i.e. the survey under-predicts “yes” referendum votes. As the controlled external validity studies conducted to date find evidence of positive hypothetical bias, our study provides a missing counterfactual and demonstrates the robustness of using a consequentiality measure as a conditioning or calibration device. Further, analysis of survey voting suggests that inclusion of inconsequential respondents introduces considerable noise in WTP estimation and lowers mean WTP. Overall, our evidence supports the external validity of *consequential* SP elicitations, and emphasizes the important role that consequentiality plays in external validity tests in not only controlled experiment settings but in broader field applications.

2. The Massachusetts Community Preservation Act and Middleborough Referendum

Following nearly two decades of debate, the Massachusetts Community Preservation Act (CPA) was approved by the state legislature and signed into law in September 2000. The Act specifies legal requirements and offers intergovernmental financial support to communities that choose to participate in its provisions for managing future growth, development and conservation. The Act requires governmental approval of a property tax surcharge of three percent or less to generate revenues for establishing a fund.

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 ten 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.

At a town meeting in May 2010, Middleborough residents voted to place a CPA measure on its ballot for the November 2010 general election. The measure proposed a property tax surcharge of one percent on the annual tax levy on real property, which would be assessed beginning fiscal year 2011 and continue indefinitely. The wording of the measure identified many targeted areas, specifically that funds would be used 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...” However, details regarding specific projects were not provided. The proposal included an exemption for 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 assessed residential property value would be exempt from the surcharge for all households.

The timing of public information activities for the referendum through media coverage and political advertising were largely limited to the final three weeks prior to the election. The restriction of information flow and local debate made this ballot initiative well-suited for our investigation.⁴ 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, most residents were unaware of the upcoming vote until late in the campaign. 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.⁵

3. Study design and data

3.1. Survey Instrument

The survey instrument is deliberately short and accompanied by a cover letter. Similar to standard SP surveys, the survey focused on the proposal of interest. The cover letter was on University letterhead, personalized and individually signed. As is a standard practice to encourage response as well as engender consequentiality, the SP survey stated: “The results and

⁴ Based on personal communication with community leaders and advocates, it is our understanding that the control and timing of information was deliberate, and intended to limit the influence of opposition groups.

⁵ <http://middleborocpa.org/>

conclusions of the research will be shared with policymakers, and made available to community leaders and interested citizens.” The survey itself began with a primer question asking about Middleborough spending needs and then asked respondents to vote on the proposal. The wording of the proposal was exactly as it would appear on the November 2010 Ballot. As a preamble to the proposal, the survey stated: “We now 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?”

The advisory referendum was followed by standard questions probing the respondent about the reasons underlying her vote. Important to our analysis regarding consequentiality, as part of the debriefing we included a five-point likert-scale question, “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?”, where a response of “1” indicates “Not taken into account” and a “5” indicates “Definitely taken into account”. Throughout the analysis reported in this paper, we assume that self-reports regarding consequentiality accurately reflect respondent beliefs. The remainder of the survey solicited opinions on local issues, collected information on demographics, asked about home ownership and assessed property values, and elicited information on local activities and community involvement.

3.2. Survey sample

Our sample frame is a list of registered voters obtained from the Town Clerk of Middleboro prior to the election. From this, we constructed a sample of 2,000 individuals using a stratified random sampling approach. As we are primarily interested in comparing survey and referendum results of actual voters at the precinct level, we placed voters into 18 strata based on

voting precinct (6 precincts) and voting history (i.e. whether they voted in neither, either or both the April 2010 and November 2008 elections). We then randomly sampled from each stratum so as to have an approximately equal number of voters in each precinct while heavily weighting the sample towards those who participated in past elections, given they were assumed to be more likely to vote in the upcoming election. Due to the stratified random sampling scheme, we use sampling weights to compute aggregate and precinct-level vote proportions from the survey data and throughout the econometric analysis.⁶

A total of 1,250 individuals were sent surveys eight weeks prior to the election, and the remaining 750 were mailed surveys four weeks prior, which corresponded with anticipated local newspaper coverage and limited referendum outreach efforts. The survey implementation followed recommended practice (Dillman et al., 2008). 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. The mail format comes closest to replicating the process of voting in a polling booth. Recent research cites support for the continued use of mail surveys as 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 et al., 2008).

Respondents were provided with the option of completing the same survey over the Internet. Nearly ten percent of respondents took advantage of this option. Postmark and Internet response dates were tracked to determine when participants responded. Returned surveys with postmark dates after the election were treated as nonrespondents in an effort to ensure that

⁶ The sampling weight, for a voter in stratum k , is constructed by dividing the probability a voter in stratum k is in the population by the probability a voter in stratum k is in the sample. As the relevant survey sample (and sometimes the relevant population) varies across our analyses, sampling weights are necessarily analysis-specific. Wooldridge (2010, pgs. 854-863) provides good coverage of sampling weights and their use in estimating means and model coefficients.

election results did not influence responses. Identification numbers were placed on surveys, and a database of actual voters was obtained post-election in order to verify which individuals in our sample voted. As it was possible that an untargeted household member may have completed the survey, successful matches were based on the survey identification number as well as the limited demographic information included in both the voter database and survey (age and gender). Focusing on verified voters, and discarding bad addresses, there are 508 returns yielding a response rate of 35.6 percent (508/1,426).⁷ Thirty of the respondents did not indicate a vote on the proposal but otherwise sufficiently filled out the survey.

3.3. Other data

Other information was gathered on respondents and election voters. Precinct-level election results were obtained from the Town Clerk of Middleborough. A few respondents did not indicate their assessed property value, and to the extent possible we obtained assessed values from a property database located on the Town of Middleborough Assessors' web site. 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.^{8,9} The response rate to the email inquiry was high at 86% (64/74), and just 11 of 64 (17.2 percent) suggested they were aware of the public referendum. Breaking the sample in accordance with publicity efforts (three-weeks prior to the election), just 2 of 35 respondents (5.7 percent) were aware of the referendum prior

⁷ Excluding bad addresses, 74.8 percent (1,426/1,906) of those sent surveys are verified to have voted in the Election. Among Election non-voters, just 13.8 percent (66/480) responded to the survey. Given the very low response rate for the non-voter sample and the corresponding small sample size, we forego formal comparisons between the voter and non-voter survey samples.

⁸ We deliberately did not provide this information in the survey, in order for our survey to be more representative of standard SP surveys.

⁹ The results reported here correspond with only those respondents verified to have voted in the election.

to media coverage and 9 of 29 (31.0 percent) otherwise. Although the results of this exploration are not necessarily representative of the larger respondent samples, this provides suggestive evidence that: (a) most respondents were unaware of the forthcoming ballot measure when responding to the survey; and (b) there is a pronounced shift in referendum awareness after the onset of media coverage.

4. Comparing public referendum and survey votes

Table 1 presents public referendum and survey results. Middleborough voters approved the bond measure by a vote of 4,371 (53.53 percent) “yes” to 3,795 (46.47 percent) “no.” Approximately 9.4 percent of election participants 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.¹⁰ There is some variation across precincts, with a range of 47.19 to 59.78 percent “yes” votes, as reported in the second column of Table 1.

Using the full sample of respondents verified to have voted in the election, 50.68 percent of participants voted “yes”. Based on a one-sample *t*-test, this percentage is not statistically different from the referendum outcome of 53.53 percent (*t*-statistic = -1.25, *p*-value = 0.21). Using precinct-level tests, we reject equality between survey and public referendum voting for Precinct 2 (*t* = -2.00, *p* = 0.05), Precinct 3 (*t* = -1.86, *p* = 0.07) and Precinct 4 (*t* = -1.79, *p* = 0.08). In all three cases, the survey under-predicts the percentage of “yes” votes cast by roughly 10%.

As economic theory (Carson and Groves, 2007; Vossler et al., 2012) suggests that consequentiality is needed for incentive compatibility, we explored whether the statistical

¹⁰ Consistent with the voting ballot, there was no explicit “undecided” or “no vote” response option in the survey.

differences highlighted above may be driven by a violation of this. In particular, based on the consequentiality question we included in the survey, we divided the respondents into “inconsequential” and “consequential” samples. Those placed in the former selected the lowest option, “1 – Not taken into account”, and those in the latter group selected a response option of 2 or higher.¹¹ This division is supported by existing theory, which only suggests a distinction between those believing a potential link exists between surveys and policy and those believing otherwise. Of the 461 respondents who answered this question, 91 are in the inconsequential group. The last four columns of Table 1 report the voting results from the two samples.

Overall, consequential respondents are more likely to have indicated a “yes” vote. However, there are no statistical differences between consequential sample and referendum voting percentages either overall or for any precinct. This suggests that, conditional on consequentiality, our survey demonstrates external validity. Focusing on just the inconsequential sample, the percentage of “yes” votes is just 25.6 percent, which is statistically different from the public referendum ($t = -6.07, p < 0.01$). This suggests that there is a negative hypothetical bias among this group. Further, we find statistical differences at the precinct level for Precinct 2 ($t = -7.70, p < 0.01$), Precinct 3 ($t = -4.75, p < 0.01$) and Precinct 4 ($t = -4.39, p < 0.01$). These are the same precincts for which equality is rejected for the full sample, and further for these precincts the number of “yes” votes grossly under-predicts referendum “yes” votes by over 30 percent. Thus, the statistical differences observed when analyzing survey votes from the entire sample appear to be driven by the prevalence of “no” survey votes among inconsequential respondents.¹²

¹¹ The complete distribution of responses to the consequentiality question is as follows: “1” ($N=91; 19.74%$); “2” ($N=124; 26.90%$); “3” ($N=158; 34.27%$); “4” ($N=49; 10.63%$); and “5” ($N=39; 8.46%$).

¹² If we instead define the inconsequential (consequential) group as those responding either “1” or “2” (“3” or higher) to the consequentiality question, the above conclusions continue to hold.

5. Econometric analysis

5.1. Estimation of willingness to pay

To assess the construct validity of the survey instrument, as well as to further investigate possible interactions between consequentiality and elicited preferences, we estimate WTP regressions based on the maximum likelihood estimator of Cameron and James (1987). Unlike typical SP surveys using a SBC question, identification here is not achieved by randomly varying possible prices across respondents. However, the ballot measure contains a property tax surcharge, the amount of which does vary across respondents, and this variation facilitates estimation of WTP. To obtain an estimate of the tax surcharge, we first use the homeowners' assessed property value, less \$100,000, to calculate their annual property tax based on the 2010 tax rate of \$13.05 per \$1000 assessed value. This amount is then multiplied by 1% to determine the tax surcharge upon passage of the referendum. Consistent with the proposal, those identified as low-income households or low- to middle-income senior households are assumed to have a surcharge of zero. Estimates of the cost of the proposal to the average homeowner were reported at \$23 per year (Lopes, 2010), and this corresponds closely to the estimated annual tax surcharge for homeowners in our sample. The range of the estimated tax increase for our sample is \$0 to \$53.83.

Let WTP_i denote respondent i 's willingness to pay for the proposal. WTP_i is not directly observed, but instead can be treated as a censored dependent variable for which we obtain the signal $WTP_i \geq t_i$ if participant i votes "yes" to the tax increase, t_i , or the signal $WTP_i < t_i$ if she votes "no". Assume WTP_i is a linear function of a column vector of covariates, \mathbf{x}_i , such that $WTP_i = \mathbf{x}_i' \boldsymbol{\beta} + \varepsilon_i$, where $\boldsymbol{\beta}$ is a column vector of unknown parameters and ε_i is a normally distributed mean-zero error term with standard deviation σ . With the linear conditional mean

function, assuming the error term has a normal distribution is analogous to assuming a normal distribution for WTP_i . Let $y_i = 1$ denote a “yes” vote and $y_i = 0$ indicate a “no” vote. Further, let w_i denote the sampling weight. Then, the log-likelihood function is

$$(1) \quad \ln L = \sum_{i=1}^N w_i \left\{ y_i \ln \left[1 - \Phi \left(\frac{t_i - \mathbf{x}'_i \boldsymbol{\beta}}{\sigma} \right) \right] + (1 - y_i) \ln \left[\Phi \left(\frac{t_i - \mathbf{x}'_i \boldsymbol{\beta}}{\sigma} \right) \right] \right\}.$$

Table 2 provides descriptions of the variables used in the WTP regressions, which include respondent characteristics (attainment of a college degree, age, gender), indicators for membership in environmental and historical organizations, and an indicator variable for Internet respondents. In addition, we include two controls for referendum awareness: the number of days between when the survey was returned and the election, and an indicator for surveys returned within three weeks of the election.¹³ With our functional form and error distribution assumption, interpretation of estimated parameters is analogous to that of a standard linear regression model that treats WTP_i as a directly observed (i.e. uncensored) dependent variable. Estimation is carried out with user-defined maximum likelihood procedures programmed by one of the authors in Stata.

Estimation results from three models, all which include the control variables discussed above, are presented in Table 3. Model 1 does not include any controls for consequentiality. In Model 2, we include *Inconsequential*, which is an indicator variable for inconsequential respondents.¹⁴ In Model 3, we restrict the sample to only include those in the consequential sample. Reported estimates of mean WTP are calculated at the sample means of covariates.

¹³ As discussed above, the three-week cutoff coincides with publicity events as well as an observed increase in referendum awareness as evidenced through our email inquiry.

¹⁴ There is mixed evidence on whether self-reported measures of consequentiality should be treated as endogenous in a WTP regression: Herriges et al. (2010) find statistical support for this whereas Vossler et al. (2012) do not. We explored the possibility of treating *Inconsequential* as endogenous in Model 2. The candidate instrumental variables

Three important results emerge from this analysis. First, the WTP regressions suggest that inconsequential respondents have a statistically lower stated WTP. Assuming that stated preferences from this sample do not represent their actual preferences, which is implied by the earlier voting comparison, this suggests a negative hypothetical bias. The clearest evidence of this is from Model 2, which yields estimates of mean WTP for consequential and inconsequential respondents of \$27.87 and -\$8.06, respectively. Estimated WTP is statistically different across the two groups, as illustrated from the statistically significant coefficient on *Inconsequential*. The inconsequential mean WTP estimate is not statistically different from zero.

Second, controlling for consequentiality improves construct validity. As described by Carson et al. (2001), construct validity is typically assessed by: explanatory power of the valuation function; observing whether the probability of wanting the good decreases as price increases; observing WTP increases with income; and observing whether other factors are correlated with WTP as suggested by theory or *a priori* expectations.¹⁵ As indicated by McFadden's R^2 , goodness-of-fit nearly doubles when controlling for consequentiality. The scale parameter is identified by the variation in the tax, and its sign and significance in all models suggests that the propensity to vote "yes" decreases as the tax (i.e. price) increases. However, as indicated by the scale parameter (i.e. the standard deviation of WTP), which is 40% larger in Models 1 and 2 relative to Model 3, considerable "noise" is introduced by including inconsequential respondents in the regression. Estimation noise is also evident in other estimated

we have available are unfortunately insufficiently correlated with *Inconsequential*, resulting in weak identification. However, the results from the sample selection models discussed in section 6.2 lend support to our treating the estimation samples as random draws from the population, and we therefore expect our main results to hold under proper instrumental variables estimation. The preferred treatment of self-reported indications of consequentiality in regression models remains an important issue for future work.

¹⁵ In settings where a public good improvement may be considered a normal or luxury good, it is possible theoretically for income to have a zero or even a negative effect on WTP (Flores and Carson, 1997). However, as discussed by Schläpfer (2006), failure to observe positive and significant income effects tends to raise concerns over the validity of a study's design.

coefficients. In Model 1, only the covariate *Environmental* is statistically related to WTP. Allowing mean WTP to differ across inconsequential and consequential groups in Model 2 leads to significant coefficients on *Environmental*, *College* and *Age* (albeit marginally in the latter case). When the sample is restricted to consequential respondents in Model 3, and in addition to significant coefficients on *Environmental*, *College* and *Age*, the coefficient on *Income* is now positive and statistically significant.

Third, there is no discernible effect of awareness of the forthcoming public referendum on WTP, as the coefficients on the variables *Days to Election* and *Media Coverage* are jointly insignificant in all three models. This is somewhat unexpected, as – even if the respondent believes the survey to be consequential – knowledge of the referendum could influence the survey elicitation in ways that would result in a loss of incentive compatibility. As one possibility, the respondent may believe that the survey was put in place to gather information from which to devise alternative proposals. This leaves open the possibility that the respondent would answer untruthfully to the survey referendum if this was perceived by her to increase the likelihood a more preferable alternative proposal would be put up for a public referendum or otherwise approved by the policy makers.

5.2. Drivers of consequentiality

The stark difference in elicited preferences across the consequential and inconsequential respondent groups naturally begs the question of whether there are identifiable factors, such as knowledge of the referendum, that are correlated with perceived consequentiality. We explore this issue through two models, which we present in Table 4. The first, Model 4, is a probit that uses as the dependent variable a binary indicator for those in the consequential sample

(*Consequential*). As Model 5, we instead estimate an ordered probit model where the likert-scale measure of consequentiality (*Consequential2*) is the dependent variable.

The included independent variables capture factors that we hypothesize to influence beliefs regarding consequentiality. First, as discussed earlier, it is plausible that knowledge of the upcoming public referendum may decrease perceived consequentiality. At the extreme, a respondent well aware of the referendum may think that the survey results will simply be used for academic purposes and not influence the outcome in anyway. As in the WTP regression, we control for referendum knowledge through the variables *Days to Election* and *Media Coverage*. Second, beliefs that citizens in general can influence policy are likely positively related with a person's level of community involvement. To capture this, we include indicators for participation in the past two elections, as well as an indicator for those who gave to charity within the past 12 months. Third, the strength of beliefs regarding consequentiality may be correlated with underlying uncertainty. For example, someone who is unsure about various aspects of the proposal (e.g. payment mechanism) may view the survey as preliminary and potentially less consequential. We include the indicator variable *Uncertain* that equals 1 for those who, through a five-point likert-scale question, indicated they were "very uncertain" about their voting choice. Finally, beliefs may be tied to socio-economic factors as well as mode-of-administration (i.e. internet respondents may be more inclined to search for information related to the referendum) and so we control for this using the same set of variables used to explain variation in WTP.

From the probit model we find that those who have a college degree and those uncertain about their vote are less likely to believe the survey is consequential.¹⁶ Internet respondents are more likely to believe the survey is consequential. Note that all three effects are fairly

¹⁶ Motivated by the significant relationship between uncertainty and consequentiality, we re-estimated the WTP models with the additional variable *Uncertain*. The coefficient on this variable is insignificant in all models.

pronounced, based on estimated marginal effects: -12.0 percent (*College*); -21.5 percent (*Uncertain*); and 11.1 percent (*Internet*). The strong partial correlation between uncertainty and consequentiality is interesting. Many previous studies have hypothesized there to be a relationship between uncertainty and hypothetical bias, and have found evidence that controlling for uncertainty helps mitigate the bias (e.g. Champ et al., 1997; Blumenschein et al., 2008).¹⁷ Uncertainty in our study is a poor proxy for inconsequentiality, however. If we split the data based on the uncertainty measure instead of the consequentiality measure, we no longer find the sharp distinction in voting results nor do we find any statistical relationship between uncertainty and WTP. Further, including instead the likert-scale certainty level leads to an insignificant relationship between certainty and consequentiality in the probit (and ordered probit) model.

Turning to the ordered probit model, estimates are generally consistent with the binary probit in terms of coefficient signs and significance. Both *College* and *Uncertain* remain at least marginally statistically significant. Model fit is lower and standard errors are relatively higher with the ordered probit, and there overall appears to be little benefit from modeling the intensity of consequentiality-related beliefs rather than simply whether the respondent believes there to be any chance of policy influence.

The lack of a statistical relationship between referendum knowledge and consequentiality is unexpected (note that, for both models, coefficients on *Days to Election* and *Media Coverage* are jointly insignificant). Note that the raw data also suggests that stated beliefs are largely unaltered by the timing of the survey: 79.8 percent and 81.3 percent of those responding prior to and after media coverage, respectively, believed the survey to be consequential. As anecdotal evidence, several respondents – through written comments on the

¹⁷ We considered the possibility that *Uncertain* is endogenous in the analysis. However, evidence from IV probit and IV ordered probit models (using as instruments most of the presented model covariates, which statistically satisfy the exclusion restrictions and rank condition) suggest we may consider it exogenous in this setting.

survey, phone calls, and emails –, expressed concern that the survey may inform, send messages, or provide information to interest groups in ways that may be detrimental to their respective interests. Proponents were concerned that the survey would draw attention to the actual referendum and thereby escalate opposition. Both participants and non-respondents expressed concerns about the source, funding and motive of the survey and particularly the potential for facilitating outside organization, influence and intrusion in local policy decisions. Thus, this evidence suggests that survey recipients take a broad view of the relevant policy process in public goods provision and what may be thought of as an “inconsequential” survey by researchers apparently is potentially “consequential” to even those respondents aware of the upcoming referendum.

6. Additional analysis and robustness checks

6.1. WTP regressions based on consequentiality “level”

In the analysis of WTP presented above, we used the stark characterization of inconsequential and consequential respondents as suggested by theory. To provide some additional empirical support for this designation, we estimated WTP regressions separately for each consequential level, as indicated through the likert-scale response to the consequentiality question. Using our original inconsequential group, all coefficients of the corresponding regression, including the scale parameter, are jointly equal to zero. Furthermore, mean WTP is not statistically different from zero. This is not purely due to the small sample size (75 observations). Indeed, if we artificially weight these observations so that they have the same effective sample size as the full sample, the above two results continue to hold. Further, the coefficients themselves suggest unrealistic underlying preferences, with most coefficient estimates greater than 50 in absolute value.

WTP regressions based on other consequentiality levels are in contrast well-behaved. In particular, in each possible case we find significant price effects (i.e. the scale parameter is positive and statistically significant), and further reject that the set of other model coefficients are jointly equal to zero. Further, mean WTP, as well as the signs and magnitudes of coefficients are similar to the presented Model 3 estimates. As such, the overall evidence points to the respondent group indicating no potential policy influence as driving the differences between survey and referendum votes, and further introducing considerable noise in the estimation of WTP from stated preferences.

6.2. Sample self-selection bias

One yet unaddressed question is whether our findings are an artifact of sample selection. Our response rate is 36 percent, which although is in the ballpark of most SP mail surveys leaves open this possibility. We have information available on both respondents and non-respondents that can be used to model the decision to complete and return the survey. In particular, we have information provided by voting records – age, gender, voting precinct, and participation in the past two elections – along with whether persons were included in the first or second survey mailing. With the exception of age and gender, this information is not used to identify WTP and thus provides an opportunity to identify possible self-selection bias.

Coinciding with Models 1-3, we estimated three Heckman-type selection models using maximum-likelihood estimation. Note that the number of observations available for the selection equation is 1457, which includes persons we mailed surveys to that are verified to have voted and includes those we had incorrect mailing addresses for. All observations corresponding with persons not included in the relevant WTP regression are treated as nonrespondents. For all three models, we fail to reject the null hypothesis that the error terms of the two equations are

uncorrelated (Model 1: $\chi^2=0.97$, $p=0.33$; Model 2: $\chi^2=1.07$, $p=0.30$; Model 3: $\chi^2=0.00$, $p=0.97$), thus providing evidence of no selection bias. We note that for all three models, the set of variables used to identify the selection equation are jointly statistically significant. Further, the selection and non-selection versions of each model are similar in terms of coefficient signs, magnitudes and statistical significance.¹⁸

7. Discussion

A key consideration in recent theoretical and empirical work on stated preference (SP) methods is whether respondents perceive their decisions to be consequential, i.e. potentially influencing agency action. Theoretical work suggests consequentiality is essential for incentive compatibility. Empirical work in this area suggests that simple, survey-based assessments of consequentiality are integral to the analysis of SP data. In particular, estimated WTP distributions differ across “consequential” and “inconsequential” respondents in field surveys. Further, controlled experiment studies have generally found supporting evidence for external validity as long as some level of consequentiality is induced.

In this study, we use one of the few naturally-occurring yardsticks – the outcome from a public referendum – to assess the external validity of SP surveys that use a single binary choice (SBC) question to elicit values for a public good. In doing so, we provide insight as to whether the consequentiality dichotomy found in existing field survey studies (which have not had a criterion to assess external validity) goes hand-in-hand with implications from controlled experiments. In contrast to the handful of studies that compare field surveys with naturally-occurring referenda, our survey respondents are largely unaware that a public referendum is

¹⁸ The exception to this is the coefficient on *Age*, which is not significant in the selection versions of Models 2 and 3. This is likely due to the inefficiency introduced by jointly modeling the selection and outcome equations in this situation.

forthcoming *and* the survey and referendum elicitation involve identical question formats and goods. Thus, our design represents a relaxation of control in exchange for SP realism.

Our main result is that consequentiality appears to be vital to external validity. In particular, we find that votes from survey respondents who perceive the elicitation to be inconsequential (about 20% of the sample) under-predicts the proportion of “yes” votes in the actual public referendum. In contrast, there are no statistical differences between the referendum outcome and survey votes from those believing the elicitation to be consequential. As a complementary result, our analysis of WTP suggests that failing to control for consequentiality leads to a negative elicitation bias as well as a decrease in construct validity (i.e. WTP does not vary in ways suggested by theory).

Coincident with Herriges et al. (2010), controlled consequentiality experiments involving SBC elicitation, and consistent with economic theory, we find a sharp distinction in elicited preferences between those who perceive there to be policy consequences and those who do not; i.e. the strength of (positive) beliefs is not a driver of results. Further, consistent with Nepal et al. (2009) and Herriges et al. (2010) we find a positive relationship between consequentiality and WTP. This is suggestive of negative hypothetical bias, which is rarely found in controlled experiments on hypothetical bias (see List and Gallet, 2001). If future research establishes that there is generally a positive relationship between consequentiality and WTP, and further that consequentiality is necessary for external validity in the field, this would have profound implications for how we should interpret results from previous SP studies (at least those that involve a SBC elicitation). In particular, this would reverse the common perception that SP methods overestimate nonmarket values.

We find that having a college degree and being very uncertain about one's voting choice are negatively related to consequentiality. The latter result provides some possible explanation as to why, in previous work, elicited WTP has been found to be strongly related to uncertainty and further that controlling for uncertainty has proven useful in equating actual and stated WTP in field studies. On a final note, we acknowledge that this and related work focused on consequentiality represents the beginning of possible empirical explorations related to the theoretical assumptions underlying the incentive compatibility of SP surveys. For example, another key assumption is that respondents believe that the agency will coerce payment if the proposal under investigation is implemented. Direct elicitation and/or experimental manipulation of beliefs regarding this and other facets of the theoretical assumptions will likely reveal important new insights.

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Table 1

Stated preference survey and public referendum voting results.

	Public Referendum		Survey, Full Sample		Survey, Consequential Sample		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 (5.82)	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% significance level, respectively.

Table 2
Description of data.

Variable Name	Description	Sample Mean (Std. Dev.)
Tax	Estimated annual increase in the participant's property taxes, in \$	19.87 (13.42)
College	= 1 if participant has a college degree or higher	0.49 (0.50)
Income	Participant's household income, in \$1000s; the midpoint of the category chosen by the participant is used	82.98 (51.48)
Age	Participant's age, in years	57.59 (14.43)
Female	= 1 if participant is female	0.55 (0.50)
Environmental	= 1 if participant is currently a member of an environmental organization	0.15 (0.36)
Historical	= 1 if participant is currently a member of an historical society	0.08 (0.28)
Internet	= 1 if participant responded via the Internet	0.10 (0.30)
Days to Election	Number of days between survey postmark (or online submission) and Election Day	23.10 (14.75)
Media Coverage	= 1 if survey returned 21 or fewer days prior to Election Day	0.57 (0.50)
Inconsequential	= 1 if participant indicated the survey would have no influence on policy	0.18 (0.38)
Consequential	= 1 if participant indicated the survey would have some potential influence on policy	0.82 (0.38)
Consequential2	Likert-scale response to consequentiality question; 1 ("Not taken into account") to 5 ("Definitely taken into account")	2.64 (1.15)
Uncertain	= 1 if participant indicated she was "very uncertain" about her advisory referendum vote	0.06 (0.24)
Voted November 2008	= 1 if participant voted in November 2008 Election	0.94 (0.25)
Voted April 2010	= 1 if participant voted in April 2010 Election	0.36 (0.48)
Charity	= 1 if participant gave to charity within the past 12 months	0.93 (0.26)

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

Table 3
Willingness-to-pay regressions.

Variable / Parameter	Full Sample: Model 1	Full Sample: Model 2	Consequential Sample: Model 3
College	6.62 (5.03)	11.24** (5.67)	9.95** (4.20)
Income	0.07 (0.05)	0.07 (0.05)	0.10*** (0.04)
Age	0.24 (0.19)	0.36* (0.20)	0.34** (0.15)
Female	7.11 (4.82)	6.48 (4.92)	3.26 (3.70)
Environmental	19.16*** (7.47)	23.82*** (8.41)	19.01*** (6.36)
Historical	3.47 (8.21)	2.76 (8.68)	5.16 (6.78)
Internet	5.05 (7.41)	0.57 (7.80)	1.68 (5.81)
Days to Election	0.19 (0.31)	0.13 (0.32)	0.02 (0.25)
Media Coverage	8.87 (9.08)	7.45 (9.48)	4.88 (7.25)
Inconsequential		-35.93*** (9.92)	
Constant	-18.54 (18.41)	-19.19 (19.26)	-16.06 (14.18)
Scale (σ)	34.60*** (6.69)	35.19*** (7.16)	24.11*** (4.15)
Mean WTP, overall	\$21.79*** (2.30)		
Mean WTP, Consequential		\$27.87*** (3.11)	\$25.42*** (2.09)
Mean WTP, Inconsequential		-\$8.06 (8.27)	
Log-Likelihood	-256.13	-240.89	-191.49
McFadden's R^2	0.079	0.133	0.153
N	401	401	326

Note: standard errors are in parentheses. *, **, and *** denote estimate is statistically different from zero at the 10%, 5%, and 1% significance levels, respectively.

Table 4
Exploration of beliefs about consequentiality.

Variable	Model 4: Probit (<i>Consequential</i>)	Model 4: Ordered Probit (<i>Consequential2</i>)
College	-0.530*** (0.203)	-0.262* (0.154)
Income	-0.240 e-3 (0.002)	-0.001 (0.001)
Age	-0.013 (0.008)	-0.003 (0.005)
Female	0.148 (0.185)	0.133 (0.132)
Environmental	-0.244 (0.250)	-0.034 (0.218)
Historical	0.035 (0.304)	0.354 (0.288)
Internet	0.653* (0.341)	-0.020 (0.165)
Days to Election	0.011 (0.013)	0.014 (0.010)
Media Coverage	0.249 (0.395)	0.354 (0.319)
Uncertain	-0.716** (0.343)	-0.586* (0.333)
Voted November 2008	-0.193 (0.184)	-0.094 (0.129)
Voted April 2010	0.344 (0.497)	0.496 (0.330)
Charity	0.546 (0.354)	0.684*** (0.203)
Constant	0.128 (0.927)	-0.820 (0.666)
Log-Likelihood	-167.68	-588.84
McFadden's R ²	0.090	0.029
<i>N</i>	412	412

Note: standard errors are in parentheses. *, **, and *** denote estimate is statistically different from zero at the 10%, 5%, and 1% significance levels, respectively. Estimated thresholds for ordered probit: $\mu_1=0.897$ (0.098); $\mu_2=1.933$ (0.126); $\mu_3=2.44$ (0.144).