Contingent valuation and real referendum behaviour

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Abstract

This paper compares contingent values for a hypothetical landscape protection programme with respondents' voting behaviour in an actual referendum. We use the example of a proposed increase of expenditures for landscape protection in the canton of Zurich, Switzerland. In particular we examine (i) CVM bid magnitudes of the different voter groups, (ii) relationships between qualitative response categories, (iii) consistency of responses assuming tax increases are known, and (iv) associations with socio-economic characteristics. Results suggest a strong upward bias of hypothetical values, possibly indicating that many respondents failed to realistically consider their budget constraints in the hypothetical choice situation.

Key words: Contingent valuation, external validity, public goods, referendum voting.

Introduction

Economists usually determine the welfare benefits to society from a proposed project by estimating changes in consumer surplus measured from market demand functions. However, when public goods and particularly passive use values of such goods are involved, market demand functions are not available. Economists can then try to set up hypothetical markets, in which individuals are asked to state their maximum willingness to pay for a proposed project. The question of whether hypothetical willingness to pay is a valid measure of actual willingness to pay has been approached from the perspective of both internal and external validity tests. Internal validity tests examine if stated values are consistent with the basic assumptions of the Hicksian model of consumer preferences. However, internal consistency cannot rule out systematic disparities between hypothetical and actual behaviour, nor must human behaviour always be consistent with the Hicksian model. Therefore, whenever possible, external validity tests remain a preferred means for validation.

External validity tests, also called tests of "criterion validity", of stated willingness to pay for public goods are comparatively scarce. The small literature reflects the difficulty in finding equivalent situations for hypothetical and actual choices. With public goods that have no adequate private substitutes and important passive-use values, the market based indirect valuation methods fail as external tests of validity. The main operational approach has been to carry out experiments to measure the relationship between hypothetical versus real payments using private goods (Bishop and Heberlein, 1979; Cummings et al., 1995; Loomis et al., 1996; Frykblom, 1997; Fox et al., 1998). An alternative approach has been to compare actual with hypothetical payments in donation-type contexts (Seip and Strand, 1992; Duffield and Patterson, 1992; Champ et al., 1994; Brown et al., 1996; Foster et al., 1997; Ethier et al., 2000; MacMillan et al., 2000; Carlsson and Martinsson, 2001). However, hypothetical bias

may differ between private and public goods choices (Fox et al., 1998), whilst tests using voluntary contribution mechanisms are subject to free riding in both actual and hypothetical behaviour (Ethier et al., 2000).

An alternative source of information about the reliability of stated choices is the comparison with actual choices in the political domain. Voting behaviour in referenda has long been used to characterise preferences for public goods (e.g., Deacon and Shapiro, 1975; Rubinfeld, 1977). To our knowledge, however, only one study has used information on voter behaviour in the context of applied valuation. Shabman and Stevenson (1996) present numbers of CVM respondents, who also participated in a local referendum on the same issue, however do not report *how* they voted. Thus no systematic attempt to compare stated values with actual voting behavior currently exists in the literature. This article provides the first such comparisons of contingent valuation responses with the same individuals' actual voting behaviour in closely related (although not identical) propositions.

Hypothetical and actual voting behaviour are compared here in four ways. We examine (1) median and mean stated WTP of approving and disapproving voter groups, (2) frequencies of and relationships between qualitative response categories in the two choice situations, (3) external consistency of the actual voting choices with CVM responses, assuming that individuals knew expected tax increase due to the real referendum, and (4) socio-economic characteristics explaining both hypothetical and actual choice behavior and whether they were consistent.

The remaining part of this paper is organized as follows. The next section identifies conceptual issues in setting up the hypothetical and actual voting choices. A third section describes the survey and voting procedures. The fourth section presents the results. A final section offers a summary and conclusions.

Conceptual issues

At first glance the procedure of comparing contingent values with real political choices is straightforward. Valuation surveys can easily be formulated in the desired comparable format, i.e., as referenda, and the 'payment vehicle' can be chosen to correspond with that in a real referendum, as a change in tax payments. For several reasons, including claims of incentive-compatibility and similarity to habitual choice situations, the NOAA panel on contingent valuation considered the referendum format combined with a voting context as the most desirable design for contingent valuation (Arrow et al., 1993). There appear to be two main issues to consider in setting up pairs of hypothetical and real referenda.

(1) Only referenda which involve alternative levels of public good expenditures may be useful for comparison. In other referenda on public goods issues a substantial portion of the costs may arise not in the form of a change in the tax burden but as, for example, lost production and employment opportunities with unknown costs to the individual.

(2) Asking identical hypothetical (CVM) questions at the same time as a real referendum is not an option. Not only is the information available to the respondent then different from that in a typical CVM survey context, but it may also be fundamentally impossible to put respondents in the mindset of a hypothetical choice when they are making a real choice.

The most relevant comparison would seem to be to carry out a CVM study on an issue before an actual referendum occurs. It is also important to think about how best to get respondents to subsequently truthfully reveal how they voted in the actual referendum, to avoid a "compliance bias" in the sense that respondents may not accurately report their un-disclosed voting decision after the ballot. It is also necessary to have some way of sampling the same set of respondents for both tests of preference (CVM and actual referendum). The

data analyzed in this paper were obtained from a CVM survey and referendum pair, which combines some of these desired features. Data were obtained in a CVM survey conducted three months before the referendum, from official voter records, and from a survey of voting behaviour that was sent out after the referendum had occurred to the original CVM respondent sample. The procedures involved in obtaining these data sets are presented in turn in the following section.

Survey and voting procedures

Contingent valuation survey

The objective of the contingent valuation survey was to establish the magnitude and determinants of individual willingness to pay for improved protection of the cultivated landscape pattern in the Weinland region of the canton of Zurich, Switzerland (Roschewitz, 1999). In co-operation with a socio-economic research institute (LINK International, Research and Consulting, Lucerne) a telephone survey was conducted, in which 816 potential voters living in the Weinland region itself and in the neighbouring city of Winterthur were surveyed. To obtain a respondent sample that corresponds well with the structure of the sampled population the target persons for interviewing were drawn in a two-stage process. At the outset random samples were drawn based on the Swisscom electronic list of phone lines in the two survey areas. To convert the resulting household sample into a sample of individual respondents, the household structure was surveyed at the beginning of the interview, yielding number, age and gender of all target persons in the household. A random sample was then drawn from all target persons of the households. Half of the households reporting one target person were used for an interview. For the other half of these households, the interview was

terminated after recording household structure. For households with two target persons, only one person was asked for an interview. In three-person households an interview was held with one or two persons. Households were contacted five times before target respondents were replaced. A computer-assisted algorithm for the replacements ensured that the age, sex, and geographic distribution of the samples remained close to census distributions. A detailed description of the sources of loss at household and individual levels, of the replacement algorithm, and of the resulting sample distributions is given in Roschewitz (1999). A summary of the sample losses and resulting respondent numbers is shown in Table 2.

Following a short general explanation, the interviews consisted of three parts. In the first part, respondents were asked various questions about their knowledge of the Weinland region, their outdoor activities, attitudes, and the subjective importance of improving certain aspects of the landscape such as restoring more natural lakeshores or reducing disturbance from traffic.

In the second part, the interviewers stated that for the following it was important to be clear what exactly is understood by the "landscape". A definition was given as follows:

"The landscape is the habitat of people, animals and plants. It is composed of meadows, arable fields, forest, hedgerows, vineyards, and waters with their shores. These areas are being used for agriculture and forestry, for recreation and leisure activities and for nature protection. Depending on use, these areas are more or less natural".

A subsequent question asked respondents to rate the quality of the Weinland landscape on a scale from 1 to 6 (with a don't know option). Before the actual valuation question, respondents were reminded that protection or improvement of the landscape was costly, and that every person already payed on average 50 SFR (30 $) in taxes for agricultural support measures each month. The landscape protection programme was then described as follows:

"The municipalities of the Zurich Weinland could develop a programme for protecting the landscape of the Zurich Weinland. This protection programme would mean that the current state of the landscape is preserved."

On request, the following additional information about the protection was given:

"1. The composition of meadows, fields, forest, vineyards, and waters with their shores does not change. 2. Near-natural areas such as flower meadows, hedgerows and natural areas such as fens are preserved. 3. The use and management of these areas remains the same."

Then, the respondent was asked:

"Imagine that on the next weekend there was a vote on this programme to protect the landscape of the Zurich Weinland. If the proposition were accepted, you would have to expect a maximal tax increase of … Francs per month. How would you vote?"

Options for answering were "yes" and "no", and "no answer". Following a triple bounded referendum procedure, the question was repeated inserting adjusted tax payments taken from one of two search trees ("And how would you vote if you would have to pay… Francs per month?"). Two search trees were used to establish whether there was a starting-point bias. Finally, the interviewer added a follow-up question:

"In other words, you agree to pay up to about … Francs annually in additional taxes for the protection of the Zurich Weinland. If this sum now appears too high or too low, would you like to correct it?"

If the answer was "yes" the respondent could then adjust the figure. In the following results section mean WTP is calculated from these final figures of the triple-bounded referendum with follow-up. Those respondents who stated a zero WTP were asked the reasons for this response, in order to distinguish protest responses from true zero responses. Zero-bidding respondents were allocated to the following six categories.

(1) "The landscape is not worth anything to me"; (2) "I already pay enough taxes. The money would just have to be better used for the landscape"; (3) "I cannot afford additional expenses"; (4) "I need more information about the programme"; (5) "one cannot value the landscape in Francs and Centimes"; (6) "this referendum is completely unrealistic".

In the following results, when one or more of reasons (4), (5), or (6) were agreed on, zero responses were interpreted as protests.

In a third section of the questionnaire, respondents were asked about membership in environmental groups, annual donations to environmental causes, and socio-economic characteristics including age, number of children, degree of occupation, education, profession, rural vs. urban background, years at current residential location, and income group.

The Referendum

The amendment to the canton of Zurich's "act on measures for nature and heritage protection and for recreation areas" was submitted to the voters (and adopted with 57 % approval) in September 1996 (Office of the Parliament, 1996). The proposition envisaged increasing annual instalments into the public (cantonal) fund for nature and heritage protection by SFR 10 million from SFR 10-20 million to a new SFR 20-30 million. Further, the amendment empowered the parliament to decide on an additional yearly instalment of SFR 10 million into the fund to pay off debts. The changes to the act were justified by "increasing expenditures for the maintenance, restoration and management of the objects of nature and heritage protection", and by the inflation since the fund was established in 1974. The use of the fund's money was described in the voter information journal as: "From the fund for nature and heritage protection the canton finances measures for creating, maintaining, enabling access to, improving or managing landscapes, townscapes, natural and cultural objects, and recreation areas worth of protection." (Executive Council, 1996). With 82 votes in favour and 74 against, the cantonal parliament recommended adopting the proposition. In 1996 about half of the means were allocated to nature and landscape protection and management (primarily cost-sharing payments to land owners for managing old growth orchards, marginal species-rich

grassland and fen meadows). The remainder went to the support of restoring historical buildings, and maintaining parks and archeological sites (Canton of Zurich, 1997a).

Voter survey

The survey on voter behaviour was conducted in co-operation with the socio-economic research institute LINK International, Research and Consulting, Lucerne. A questionnaire on voting behaviour was mailed to all 816 CVM respondents' addresses in April 2001. Among these addresses there were 157 CVM respondents who had moved and whose new address was not readily available; 16 had deceased. Potential respondents, who had not returned the completed questionnaire after four weeks, were reminded by telephone. When asked on the phone a considerable additional portion of the sample agreed to participate. Those who had already disposed of the questionnaire received a replacement by mail immediately. Finally, 67 individuals who declined to fill out the questionnaire even on repeated request were willing to answer the questions directly on the phone. These answers were recorded but may be less reliable. However, only 29 of these 67 responses made it into the sample of 176 valid responses on voter behaviour. Due to exclusion of income non-responses and protest zero bids, only 16 of these are among the 123 observations used in the regression analysis. Eighty-two respondents could not be reached by phone. (For a summary of sample sizes see Table 2).

In an accompanying letter the respondents were reminded of their participation in a contingent valuation survey of the Weinland landscape in 1996. They were informed of this subsequent research project, for which it was important to obtain information on how those interviewed in 1996 voted on issues related to the Weinland landscape[1]. Respondents were then asked to answer a questionnaire with ten multiple-choice questions.

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[1] Actual votes cast cannot be retrieved directly from the voting records due to votes being confidential.

The questionnaire listed dates, issues, voting recommendations of parties and large interest groups, and voting outcomes of four referenda from the period 1995 to 1999, including the 1996 vote on nature and heritage funding (see questionnnaire structure in the Appendix). For each voting issue a copy of the summary page from the government's official voter journal was included with the questionnaire. Question 1 asked: "How did you vote on these issues?" For each voting issue the options "yes", "no" and "did not vote" were given. Question 2 stated: "Considerable time has passed since these referenda were held. How certain are you of your answer given in question 1?" Here choice options were "certain", "quite certain" and "uncertain". To be able to establish whether questionnaires had been completed by the addressees themselves the questionnaire included two control questions on top. All questionnaires were marked with a code for the 1996 interview respondent number, as well as for age and gender, for easy comparison with answers to control questions.

Similarities and differences between propositions

Basic characteristics of the CVM/referendum pair are listed in Table 1. Apart from the more technical features given in the Table similarities of the propositions include the focus on protection of the *presently existing* landscape elements and patterns rather than creation of new ones, a proposed *change (increase)* of already substantial public expenditures, and an *infinite time horizon* of the project.

The most important difference regards the amount of detail regarding involved institutions and procedures potentially available to the interested voter/respondent. Instruments of protection through the nature and heritage fund such as voluntary land management contracts between farmers and the cantonal government are well established and potentially known about by a wide group of people. The presentation of the related

referendum issue was presented in about 1500 words and illustrated with two pictures in the voter information journal. The CVM survey in contrast formulated the protection programme very coarsely in terms of its landscape protection effect, leaving the involved institutions and procedures largely unspecified. Further, the real proposition included the protection of traditional townscapes, such as by providing subsidies to cultural heritage owners for costly restoration work. The hypothetical voting proposition did not encompass the protection of this architectural heritage, although it is reasonable to assume that many CVM respondents viewed the maintenance of the traditional rural architecture of the region as an integral part of the proposal.

While some differences of the propositions thus existed, they may have been of minor importance for individual decision-making in the face of proposed protection programmes. Decisions about the quantity of complex public goods may be resolved into two parts, (1) a decision about the relative priorities of various component services and (2) a decision as to the amount of the overall level of the good (Bowen, 1943). In the case of Zurich landscape protection, the extent rather than the priorities of protection have been a recurring subject of controversy in political debates. In such cases the quantity of the good can be usefully measured in terms of the amount of money expended. Therefore, any observed differences between the hypothetical and actual landscape protection propositions at hand should indeed reflect the different payment conditionality in actual vs. hypothetical choices. Based on the usual assumption of stable preferences we tested the hypothesis that individuals' WTP stated in the CVM survey is equal to their actual WTP implicit in real referendum decisions.

The specific hypotheses tested are as follows:

(i) Median and mean stated WTP of approving and disapproving voter groups differ significantly and in the expected ways;

(ii) The frequency of the qualitative CVM response categories "WTP non-response" and "protest zero bid" is equal in the different voter groups;

(iii) Actual voting choices are consistent with those predicted from CVM responses and individuals' expected tax increase in the real referendum; and

(iv) Socio-economic characteristics affect predicted and actual voting behavior in identical ways.

Results

Swiss citizens are generally reluctant to give information about their political attitudes[2]. Steps taken to obtain maximal voter survey response included an accompanying letter emphasizing that respondent addresses would be immediately separated from responses by LINK and that the information would be used only for scientific purposes. The letter was printed on the paper of the Swiss Federal Institute of Forest, Snow, and Landscape Research, which is located near Zurich (affiliation of the second author), and was signed by the first two authors and a representative of LINK. An overview of sample size over the survey process is shown in Table 2. Given the rather low effective response rate (26-29%) we examined how the distributions of independent variables in the sub-samples compare with those in the original CVM samples. The upper portion of Table 3 lists respective means of the basic socio-economic variables. The voter sub-sample featured a somewhat higher education level and household income than the full sample of the CVM survey. The lower portion of Table 3 lists respective means for qualitative and quantitative measures of CVM response. Mean WTP was slightly higher in the voter sub-samples than in the complete CVM samples, but the differences were not statistically significant. Changes in the percentage of WTP non-

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[2] Personal communication by Peter Grau of LINK Institute, Lucerne.

responses, protest zero and true zero bids when moving from the CVM samples to the voter sub-samples do not indicate systematic bias in the sub-sample.

The proposed regional landscape protection programme of the CVM survey has a somewhat different scope for residents of the Weinland region and residents of the neighboring city of Winterthur. For the region's inhabitants the programme covers all of their surrounding landscape. For the city residents on the other hand, the Weinland is but one (the northern) of two important regions for short recreation trips. To the south of the city there is an equally attractive and important region for short recreational trips. Moreover, the surrounding area of the city itself also includes landscapes with some recreational value that are not covered by the hypothetical Weinland protection programme. Thus the urban and the rural samples are initially not pooled in the following comparison of CVM samples and voter sub-samples. In spite of a difference of scope of the protection programme, mean WTP did not differ significantly in the urban and rural samples. It should be noted, however, that this observation alone does not imply scope insensitivity. The voting outcome presented below suggests that a difference in scope of the project may have been compensated by a generally higher demand for landscape protection of the urban population. However, the observation justifies pooling the two samples where an increased sample size is required.

Relationships between qualitative response categories

There are 176 observations for which both CVM and voting information is available. Table 4 lists mean WTP values for the different voter groups. Compared with a recorded voting outcome of 40 percent approval in the rural study area and 60 percent approval in the city, approving voters are strongly over-represented in the voter survey, which yielded an outcome

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of 72 percent approval. Further, potential voters who did not vote were strongly under-represented with only 15 percent, compared to 74 percent in the official voting records.

Within the sample at hand, WTP non-respondents were more likely to be disapproving than approving voters ($\chi^2 = 6.5$). In line with expectations, zero bids were more frequent in the disapproving than in the approving voter group ($\chi^2 = 53.9$) and mean WTP was higher in the approving than in the disapproving voters (t=3.2). However, the mean of positive WTP bids alone was not significantly different for approving and disapproving voters (t=0.39, p=0.70) (Table 4). Abstaining voters were not numerous enough to apply statistical tests. However, they appeared to be similar to disapproving voters in terms of their high WTP non-response rate, and similar to approving voters in terms of a low zero-response rate in the CVM survey. With respect to mean and median WTP the abstaining voters were intermediate between the approving and disapproving voter groups. Finally, a remarkable five out of seven WTP bids that had been classified as 'protest zero' bids based on auxiliary survey information, turned out to be 'true zero' bids in terms of these respondents' actual voting behavior.

Consistency of choices based on expected tax increases

According to received public choice theory, an individual has a preferred level of public expenditures (given a particular tax system) at the point where the marginal benefits of increased public expenditure is equal to the marginal cost the individual bears in additional tax payments (Stiglitz, 2000, p. 159). Following this rationale, an individual's vote in the present referendum depends on whether the expected benefit from a proposed public good expenditure exceeds his or her costs (in tax payments). Empirical studies of voter behavior based on such explicit decision models have yielded consistent results (e.g., Bergstrom et al.,

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1982). Given an individual's tax price[3] and the cost of the proposed public expenditure, we here interpret the expected tax increase as an implied lower bound (in the case of approval) or upper bound (in the case of disapproval) to the individual's WTP for the proposed public good. This implied value may be examined for consistency with WTP stated in the CVM survey. In other words, stated WTP, together with the individual's expected tax increase, may be used to predict the individual's voting decision in the subsequent real referendum, which can then be compared with the actual decision.

Tax prices are not immediately available for the respondents of the voter survey. However, household incomes reported in the CVM survey allow to estimate voters' expected tax increase due to the proposed 10 million expansion of the NHP budget. Coarse estimates of the expected tax increase of households were computed using the canton of Zurich's income tax schedule (Canton of Zurich, 1997b). For citizens of the canton of Zurich cantonal income tax represents about one third of total income taxes. An individual's income tax T_i was calculated as

$$(1) \qquad T_i = F(I_i) \, r_{1996} \, ,$$

where I_i is the household income of individual i (as reported in the CVM survey), $F(I_i)$ is the 'basic income tax' figure given by the tax schedule of the cantonal tax law (Canton of Zurich, 1997b), and r_{1996} is the 'tax rate', which was at 1.08 in 1996 (Office of the Parliament, 1993). The individuals tax price (the additional amount an individual must pay when government expenditures increase by one unit) is approximated by

$$(2) \qquad tp_i = T_i/B$$

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[3] The tax price is the amount an individual must pay when government expenditures increase by one unit.

B is the total cantonal budget expenditure. Individual i's expected additional tax burden DT_i due to the additional annual 10 million expenditure DG is thus given by

(3) $DT_i = tp_i\,DG$.[4]

Table 5 lists mean stated WTP for the landscape protection programme, mean expected tax increase due to the actual referendum, and the number and percentage of individuals displaying 'consistent' behaviour in terms of their stated and revealed implicit WTP. Approving voter decisions were in all but very few cases consistent with stated figures of WTP. Due to small expected tax increases (up to about 25 SFR), this is equivalent to observing that there were only few very low CVM bids given by approving voters. In contrast, the disapproving voter group's average expected tax increase of about 10 SFR is clearly at odds with the average WTP of SFR 330 for the CVM proposition. Moreover, it suggests that also in the approving voter group, absolute figures of WTP should be regarded with caution. Respondent characteristics explaining the consistency of hypothetical and actual choices are presented below, together with a comparison of conditional models for actual and hypothetical voting behavior.

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[4] The proposed 10 million SFR expenditure corresponded with 0.298 percent of the 1995 cantonal budget of 3359 million SFR. (Canton of Zurich, 2001). For instance, a household with a taxable income I_i of 10'000 SFR per month had a 'basic income tax' figure $F(I_i)$ of 8800 SFR. This figure, multiplied by 1.08 (the 1996 'tax rate'), yields the household's total cantonal income tax of 9504 SFR and tax price of $2.83 \cdot 10^{-6}$. Multiplying by the proposed new annual expenditure yields the estimate of the household's expected tax increase of 28.29 SFR. (As we do not have information on households' *taxable* income, the calculations are based on the *net income* (before taxes) given by the CVM respondents. This procedure tends to rather overestimate households' tax burdens.

An indicator variable for voter behavior was defined as $Y_v = 1$ if respondent's vote was "yes" and $Y_v = 0$ if respondent's vote was "no". To appropriately compare explanatory patterns in the actual referendum behavior with those in the CVM survey, the individual CVM responses were coded as $Y_p = 1$ (*p* for predicted) if respondent's stated WTP was higher than the expected tax increase due to the real referendum proposition and $Y_p = 0$ otherwise. The conditional models for the CVM and voting decisions were formulated as follows. Denoting approval of the proposition by $Y = 1$, we have in the case of both actual and predicted choices:

(1) $\text{Prob}[Y = 1 \mid \mathbf{x}] = \text{Prob}[\boldsymbol{\beta'}\mathbf{x} + \boldsymbol{\varepsilon} > 0 \mid \mathbf{x}]$

, where $\boldsymbol{\beta}$ is a vector of coefficients and $\mathbf{x}$ is a vector of socio-economic characteristics of individual *i*.[5] Sign expectation for income is ambiguous in these models because expected tax increase is higher for the higher income groups (Table 6). Finally, a model for consistency of behaviour was formulated as:

(2) $\text{Prob}[Y_p = Y_v \mid \mathbf{x}] = \text{Prob}[\boldsymbol{\gamma'}\mathbf{x} + \boldsymbol{\varepsilon} > 0 \mid \mathbf{x}]$

, where $\boldsymbol{\gamma}$ is a vector of coefficients relating individuals' characteristics to the probability of consistent predicted and actual choices. The results of estimation are summarized in Table 7. The logit model shows a consistent explanatory pattern for actual voting behavior (Model 1a),

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[5] Due to the taxation of *income* separate effects of income and tax price cannot be estimated. This contrasts e.g. with analyses of school expenditure referenda in the US where the tax was raised on property (Rubinfeld 1977).

but a limited explanatory power for the voting behavior predicted from CVM responses (Model 1b). Variables for education, gender, urban residence, and farm occupation were all significant in explaining voting choice, while only urban residence was a (weakly) significant determinant of predicted voting behavior, a pattern that does not support internal consistency of the predicted choices. When the same regressors were used to examine determinants of external consistency of actual and predicted choices (Model 2) education tended to have positive and age and farmer occupation negative effects, although coefficients were mostly insignificant.

Summary and conclusions

External validity tests of hypothetical choices about public goods using laboratory experiments is severely limited in terms of the type of goods being valued. CVM/voting behaviour comparisons can thus provide information on otherwise intractable issues of CVM validation. This study focussed on four issues: (i) comparison of mean and median stated WTP in different voter groups (ii) relationships between qualitative response categories in hypothetical and actual voter behavior, (iii) consistency of hypothetical WTP with implicit actual WTP, and (iv) comparison of explanatory patterns in CVM choices with equivalent regressions for actual voting choices. Results based on the sub-sample of respondents for whom both CVM and voting choices were obtained can be summarized as follows.

(i) Although mean and median WTP differed among voter groups in the expected ways, the magnitude of positive WTP bids alone did not.

(ii) There may be substantial proportions of high WTP bids, which are not backed by actual voting decisions. 'WTP non-response' frequency was strongly biased towards actual

disapproving voters. CVM bids classified as 'protest zero' in the survey could mostly be identified as effectively 'true zero' based on the voter survey.

(iii) A strong upward bias of hypothetical values was found that can hardly be attributed solely to any perceived differences is the valuation objects or uncertainty about individual tax payments. The magnitude of positive WTP values apparently contained only limited information about respondents' preferences. It appears that many individuals did not fully consider their budgets when making the CVM decision.

(iv) Compared with the actual voting choices, which showed a consistent explanatory pattern in multivariate models, equivalent choices predicted from CVM responses showed only very weak patterns. Similar external validity tests involving various public goods and CVM surveys of various quality could reveal if this result is more pervasive or if it can be attributed to failures of the present CVM survey.

Presently CVM researchers must process problematic WTP bids such as 'non-response', potential 'protest zero', and 'outliers' largely on an *ad hoc* basis. Empirical studies on the relative size of hypothetical×actual qualitative response categories in a sampled population may provide an important empirical foundation for appropriately interpreting and aggregating stated WTP for public goods. Together with calibration studies on hypothetical *vs.* actual values (e.g., Fox et al.) such studies promise to yield increasingly reliable and thus policy relevant stated preference methods for the valuation of public goods.

There are two major assumptions on which parts of the present comparison of hypothetical and actual choices rely. First, it is assumed that the issues of the hypothetical and real decisions were comparable. Although there may be little difference in issue from the point of view of a relatively badly informed voter whose preferences may relate mainly to appropriate levels of the expenditure, propositions clearly differed in detail of description with the real good being better specified than the hypothetical good. Secondly, citizens were

assumed to 'know' their tax increase due to the referendum to an adequate degree. While voting patterns typically support this interpretation, it would be useful to simultaneously test it in similar future studies by asking voters about their personal estimate of the expected tax increase. We suggest that uncertainty due to both assumptions could thus be reduced in carefully designed future comparisons of CVM and voting behavior.

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Table 1. Basic characteristics of the CVM/referendum pair.

	Issue	Level of proposed government action[1]	Question format	Payment vehicle	Sampled population	Date
CVM survey	Regional landscape conservation programme	municipalities of the Weinland	triple-bounded referendum with follow up questions	municipal tax	Citizens with right to vote	20 June to 20 July, 1996
Referen dum	Increase of cantonal fund for nature and heritage protection	Canton of Zurich	simple referendum	cantonal tax	Citizens with right to vote	22 Sept., 1996

[1] Government in Switzerland knows three subsidiary levels, municipal, cantonal, and federal. Referenda are held and taxes are raised at each of these. The canton of Zurich encompasses 171 municipalities, of which 25 belong to the Weinland region.

Table 2. Description of the sampling process.

	City of Winterthur		Weinland region	
	Sample size	Percent of (sub)total	Sample size	Percent of (sub)total
Population	86915		23994	
Citizens with right to vote	56027		17165	
Contingent valuation survey				
Initial addresses	1443		816	
Valid household addresses	1096	100.0	709	100.0
Realized household interviews	661	60.3	523	73.8
Selected target persons	577	100.0	497	100.0
Realised personal interviews	404	70.0	412	82.9
Mail survey on voting behaviour				
Initial addresses	404		412	
Moved[1] or deceased	107		65	
Potential respondents	297	100.0	347	100.0
No questionnaire returned	200		191	
Questionnaires returned	97		156	
Valid responses on voting behaviour[2]	77	25.9	99	28.5

[1] Person moved and new address is not known

[2] This excludes the following categories from returned questionnaires: completed by wrong person; item non-response; respondent uncertain about correctness of response.

Table 3. Descriptives of CVM survey sample and voter survey sub-sample

	City of Winterthur				Weinland region			
	CVM sample (n=404)		Voter sub-sample (n=77)		CVM sample (n=412)		Voter sub-sample (n=99)	
Variable	n	mean	n	mean	n	mean / %	n	mean / %
Age (years)	404	47.1	77	52.8	412	46.5	99	46.7
Gender (1, 0)	404	0.47	77	0.51	412	0.48	99	0.47
Household income (1 to 6)	373	3.4	74	3.7	379	3.7	95	4.0
Education (1 to 7)	402	3.4	77	3.8	412	3.4	99	3.6
Landscape grade (1 to 6)	388	4.6	76	4.6	408	4.8	98	4.8
WTP non-response	46	11.4 %[a]	12	15.6 %[a]	33	8.0 %[b]	6	6.1 %[b]
WTP protest zero bids	18	4.5 %	2	2.6 %	31	7.5 %[c]	6	6.1 %[c]
WTP true zero bids	22	5.5 %	3	3.9 %	44	10.7 %[d]	14	14.1 %[d]
WTP excl. protest zeros (SFR)	340	430.77[e]	63	449.17[e]	348	437.43[f]	87	496.34[f]

Note: Superscript letters indicate tested but non-significant differences between voter survey respondents and non-respondents (χ^2- and t-tests): (a): χ^2=1.66; (b): χ^2=0.90; (c): χ^2=0.58; (d) χ^2=1.25; (e): t=0.36; (f): t=1.61; (p=0.11).

Table 4. Descriptive statistics of CVM responses of the different voter groups

Voter group	Voting 'yes'	Voting 'no'	'Did not vote'
n	108	42	26
Number of positive bids	93	18	20
Number of WTP non-respondents	6 [a]	8 [b]	4
Number of (all) zero bids	7 [c]	16 [d]	2
Number of protest zero bids	2	5	0
WTP median	480	86	360
WTP mean (and SD)	518.20 [e] (375.69)	275.06 [f] (405.96)	421.45 (376.40)
Mean (and SD) of positive bids only	556.38 [g] (360.81)	519.56 [g] (430.59)	463.60 (368.82)

Note: Different (equal) superscripts between columns indicate significant (non-sig.)

differences in χ^2- and t-tests (see text).

Table 5. Consistency of behaviour as CVM respondent and voter. (Only respondents with positive or zero WTP who reported income (excluding protest zero observations)).

	Number of voters	Mean WTP in the CVM survey	Mean expected tax increase	Number of correctly predicted actual votes	Percent of correctly predicted actual votes
Approving voters	95	535	13.25	90	94.7
Disapproving voters	28	330	10.26	11	39.3
All active voters	123	488	12.57	101	82.1

Table 6. Description of covariates in the multivariate models

Variable	Description	Sign expectation, Model (1)
INCOME[1]	categorical variable for household income (intervals of 2000 SFR): 0, less than 2000; 2, less than 4000; … 10, over 10,000 per month	?
EDU	categorical variable for highest educational level attained (1, obligatory school; …7, university)	+
AGE	age of respondent in years	−
GENDER	binary variable for gender of respondent: 1, male; 0, female	?
TOWN	binary variable for region of respondent: 1, Winterthur; 0, Weinland	+
FARMER	binary variable for profession: 1, farmer; 0, non-farmer	−
LSGRADE	categorical variable for grade/rating of the Weinland landscape; 1, very bad; … 6, very good	+

[1]Reported incomes of SFR 0 were recoded to SFR 100 to avoid log(0).

Table 7. *Logit* models for actual and predicted choices (Models 1a and 1b) and for consistency of actual and predicted choices (Model 2)

Variable	(1a)		(1b)		(2)	
	Actual voting behavior		Predicted voting behavior		Consistency of choices in (1a) and (1b)	
	Coefficient and SE	t-ratio	Coefficient and SE	t-ratio	Coefficient and SE	t-ratio
Constant	2.665	0.494	-9.260	-1.154	9.629	1.343
	5.400		8.026		7.168	
log (INC)	0.114	0.285	0.929	1.444	-0.408	-0.717
	0.402		0.643		0.568	
log (EDU)	1.659	2.187*	0.529	0.589	0.558	0.767
	0.758		0.899		0.728	
log (AGE)	-0.652	-1.138	0.310	0.508	-1.065	-1.659(*)
	0.573		0.610		0.642	
GENDER	-1.684	-2.820**	-0.574	-0.946	-0.342	-0.626
	0.597		0.607		0.546	
TOWN	1.220	2.006*	1.339	1.873(*)	0.184	0.332
	0.608		0.715		0.555	
FARMER	-3.220	-2.272*	0.679	0.513	-2.880	-2.271*
	1.418		1.323		1.268	
LSGRADE	-2.021	-1.171	-0.111	-0.061	-1.756	-1.008
	1.725		1.828		1.742	
Observations	123		123		123	
Chi-squared	32.7		8.2		15.1	
Percent correctly predicted	84.5		87.0		85.4	

Notes: (i) Significance levels: (∗): p < 0.1; ∗: p < 0.05, ∗∗: p < 0.01; (ii) SE: standard error

Appendix:

Structure of the voter survey questionnaire.

Date	Issue	Parties and interest groups recom-mending "YES"	Parties and interest groups recom-mending "NO"	Percent-age of "YES" votes	Percent-age of "NO" votes	**Question 1** How did you vote on these issues? Please mark the correct box			**Question 2** (…) How certain are you about your response to question 1? Please mark the correct box		
						"yes"	"no"	Did not vote	Cer-tain	Quite cer-tain	Un-cer-tain
…	…	…	…	…	…	ð	ð	ð	ð	ð	ð
						ð	ð	ð	ð	ð	ð