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Alternative value elicitation formats in contingent valuation: Mechanism design and convergent validity☆

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ABSTRACT

To date, much of the theoretical work on the incentive properties of contingent valuation surveys has focused on the oft-recommended single binary choice (SBC), referendum format. This work has identified conditions under which an SBC elicitation is incentive compatible, and empirical evidence lends support to the predictive power of the theory. Nevertheless, researchers and practitioners commonly use alternative elicitation formats, and defend their design choices based on efficiency and other criteria. In this study, we demonstrate that it is possible to identify conditions under which alternative elicitation formats are incentive compatible, using as examples open ended (OE) and payment card (PC) question formats. We then implement theory-informed value elicitations in the context of a flood control policy for New York City. We fail to reject convergent validity in mean willingness to pay when comparing the theory-driven OE format with SBC, but reject convergent validity between the theory-driven PC and SBC formats. As an informative counterfactual, we find that a "standard" OE elicitation congruent with prior work leads to significantly lower values and a lower proportion of respondents who view the elicitation as consequential.

1. Introduction

Though stated preference surveys remain a standard approach for estimating values for public goods in the context of government cost-benefit analysis and in litigation over damages to natural resources, no consensus has been reached over a large number of important design issues.[1] Perhaps the most central issue is the choice over methods for eliciting Hicksian welfare measures. Dating back to at least the report of the US National Oceanic and Atmospheric Administration Blue Ribbon Panel (Arrow et al., 1993), a single binary choice (SBC) question framed as an advisory referendum has been viewed as the industry standard. This guidance was reaffirmed recently by Johnston et al. (2017), who provide best practice recommendations for stated preference studies used to inform public decision making. Nevertheless, many alternatives, such as open-ended (OE) questions, are used in practice.[2] Researchers routinely adopt alternative formats, as they can reduce complications associated with experimental design (e.g. bid design) and increase the power of the experimental design (e.g. by asking about multiple goods in the same survey and/or by eliciting more precise information on preferences). However, alternative value questions are argued to be more complex and unfamiliar to respondents, and are hypothesized to give rise to strategic, untruthful responses.

A handful of recent papers use mechanism design theory to establish conditions under which an SBC elicitation is incentive compatible (Carson and Groves, 2007; Carson et al., 2014; Vossler et al., 2012; Vossler and Evans, 2009). This theory work has motivated refinements in survey design, such as emphasizing that surveys are inputs to public decision-making in order to incentivize responses. Moreover, since incentive compatibility pivots on unobserved beliefs, surveys now routinely include questions to measure these beliefs. That theory is important to contingent valuation is further emphasized by empirical evidence. For instance, enhancing beliefs over policy consequences has been shown to increase construct validity (Herriges et al., 2010), predictions from theory are supported by controlled experiments (Carson et al., 2014), and evidence from field tests suggests that external validity can pivot on whether theoretical assumptions appear to hold (Vossler and Watson, 2013). Johnston et al. (2017) strongly recommend the use of incentive-compatible response formats, and indicate that the "most straightforward means" to accomplish this is with a SBC question.

In this study, we demonstrate that it is possible to identify conditions under which alternative elicitation formats are incentive compatible,

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[1] See Kling et al. (2012) for a thoughtful discussion of accumulated evidence on contingent valuation.

[2] We refer to any format other than a SBC elicitation as an "alternative" format.

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using as examples OE and payment card (PC) question formats. In doing so, following in the footsteps of prior research on the SBC format, we hope to identify ways to improve survey design as well as enhance the validity of alternative formats. In the context of a flood control policy for New York City (NYC), we develop survey elicitation mechanisms informed by the theory, and test for convergent validity through comparisons with parallel SBC elicitations. As an important counterfactual, we include in the experimental design a "standard" OE elicitation that better resembles current practice.

Alternative formats face at least two incentive challenges related to SBC. First, as in market settings, e.g. when purchasing a car, a participant may believe that her response can influence the price paid for the good thus incentivizing her to under-reveal demand. This is true for an OE elicitation, as well as formats that present respondents with more than one possible cost. The second challenge stems from the lack of an implementation rule. Although an explicit rule is largely absent in SBC applications, it is natural for respondents in this familiar setting to believe that (if anything) a response in favor will increase the chance of implementation. In contrast, implementation rules that would seem natural for alternative elicitation formats can give rise to untruthful responses. For example, as discussed by Carson and Groves (2007), respondents to an OE question may believe that the chance a policy is implemented increases with the sum (or average) of stated valuations. Thus, if the respondent believes that the cost to her is fixed, but her true valuation is less than the expected cost, the optimal response to an OE question is to state zero. To overcome these issues in theory, we assume that the respondent believes her stated valuation will be interpreted as a yes or no vote to the proposed policy at the actual cost, which is unknown to the respondent when taking the survey and determined exogenously.[3] The basic logic of using an uncertain and exogenous price stems from the Becker-DeGroot-Marschak (BDM) mechanism (Becker et al., 1964) and the random price voting mechanism (RPVM) of Messer et al. (2010), which elicit continuous responses (bids) for private and public goods, respectively.

The theory, in turn, provides new insight for survey design. Indeed, standard OE and PC implementations are very unlikely to adhere to theory stipulations for incentive compatibility, as highlighted above. In the context of a valuing a proposed flood control policy for NYC, we develop theory-driven OE and PC formats, which emphasize cost uncertainty and suggest the possible interpretation of responses as yes or no votes. Our designs further include a coercive payment vehicle and frame the elicitation as an advisory referendum. Some prior studies utilizing PC or OE elicitations have incorporated one or both features, but they are not systematically included by practitioners or in the academic literature.

As primary evidence on the theory-driven mechanisms, we implement two complementary field survey experiments. In the first, we use a split-sample approach to test for convergent validity between our theory-informed PC and a parallel SBC mechanism. We find that, consistent with prior comparisons involving PCs, SBC values are statistically higher (see Champ and Bishop, 2006). In a second experiment, we compare a theory-driven OE mechanism with SBC. As a third treatment in this experiment, designed to provide an indication of whether the modifications we propose matter empirically, we include a more standard OE elicitation. Interestingly, we find that mean willingness to pay (WTP) from the SBC treatment is statistically higher than the standard OE question, but observe statistical equivalence between SBC and our theory-informed OE mechanism. The frequency of zeroes is much lower in the theory-driven elicitation, which provides suggestive evidence that the zero-response strategies discussed by Carson and Groves (2007) may have been dampened by survey refinement. The above results are robust to the inclusion/exclusion of control variables, including whether respondents indicated beliefs consistent with both payment and policy consequentiality, which coincide with incentive compatibility assumptions.

Taking an appropriately designed SBC elicitation as a yardstick from which to measure alternative elicitation approaches, our results for the OE elicitation support the notion that truthful demand revelation using OE questions pivots on whether theory-based enhancements are implemented. The results for the PC suggest that convergent validity is rejected. Although additional work is needed to decipher the drivers of the result, it is possible that individuals form values based on the list of possible payment amounts included on the PC. Further, the PC elicitation produces an interval-censored signal of WTP, which gives rise to speculation over how responses will be interpreted should the (exogenous) cost fall within this interval; as a result, the assumptions for incentive compatibility are stronger relative to OE, and may have been violated in practice.

The valuation of flood protection measures is important in its own right. Climate change is predicted to alter the frequency and severity of flood events. While equity issues surrounding paying for climate change adaptation have been the subject of some attention in the literature (Bichard and Kazmierczak, 2012), the WTP for adaptation remains unclear. We take advantage of detailed flood maps and parcel-level data to identify households within and just beyond the 100-year flood plain to evaluate how WTP varies with exposure to flood risk.

Our results suggest that the WTP for flood control systems varies markedly with risk. Households just outside the 100-year flood plain are willing to pay significantly less (half as much) to install a flood control system in the city. We further find that factors correlated with actual or perceived attitudes towards risk (e.g., whether the household has flood insurance) influence WTP in expected ways. These results complement those found in a related literature that focuses on estimating the WTP for flood insurance (see Botzen and van den Bergh, 2012a, 2012b).

2. Theoretical framework

In this section, we discuss the incentives facing respondents to OE and PC questions, and identify a set of conditions that as a group are sufficient to establish the incentive compatibility of the elicitations. Similar to prior mechanism design work in this area, embedded in these conditions are beliefs assumed to be held by respondents in terms of how responses will be interpreted, aggregated and used in the context of public decision making. While we can speculate on the reasonableness of these beliefs, there are of course challenges to identifying whether they hold in practice or whether they are important empirical drivers of stated preferences.

In our analysis we build upon the conditions proposed by Carson and Groves (2007) for an SBC elicitation, and later formalized and expanded upon by Vossler and Evans (2009), Vossler et al. (2012) and Carson et al. (2014). Proceeding in this fashion allows us to highlight differences across formats. These conditions are as follows:[4, 5]

(i) the participants care about the outcome;
(ii) the authority can enforce payments by voters;
(iii) the elicitation involves a yes or no vote on a single project, which relates to the implementation of a single possible policy that is identical to the project; and
(iv) the probability that the proposed project is implemented is weakly monotonically increasing with the proportion of yes votes.

[3] At a late revision of this paper, we became aware of an unpublished manuscript by Guo and Haab (2003) who also use cost uncertainty to establish the incentive compatibility of an OE question.

[4] These conditions are identical to those in Vossler et al. (2012), with the exception of (iii) which is expanded upon for clarity.

[5] For our purpose, the use of the term "voter" here refers to a respondent who participates in the advisory survey referendum.