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Abstract

This comment takes up the discussion about the incentive compatibility of contingent valuation surveys revived by a recent paper of Carson, Groves and List (2014) in this journal. We feel that the conclusions the authors draw from their theoretical and experimental work cannot be generalized to contingent valuation (CV) surveys. We single out the lack of cost credibility as the principal obstacle to incentive compatibility and propose some amendments to the survey protocol that foster the cost credibility of random-bid CV studies.

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In what might be called a decennial project Carson, Groves and List (2014, hereafter CGL) theoretically and experimentally explore the incentive properties of the single binary choice (SBC) mechanism and prove that SBC are, under some assumptions, incentive compatible. We endorse the elegance of CGL's proof, but doubt that it applies to the binary referendum with *randomly assigned* bids that the NOAA panel (Arrow et al. 1993) recommended as blue print for contingent valuation (CV) surveys. In this comment we contend that the random bid assignment makes binary referendum CV surveys incentive incompatible because, by their very nature, random bids differ for most respondents from the actual cost of the project under consideration.

We seize on a number of arguments that have been made before (Green et al. 1998; Horowitz 2000; Flores and Strong 2007; Schläpfer 2008), but that have been largely ignored by the field. Our comment is structured as follows. We first summarize the argumentation of CGL and formally show that their proof of incentive compatibility readily applies to a binary referendum with unambiguous actual costs. We then demonstrate that incentive compatibility does not hold as soon as actual costs and randomly assigned bids differ. We discuss this negative result in light of its consequences for CV practitioners and propose amendments to the CV protocol that provide some means for relief, but no cure.

1 Binary referendum with unambiguous actual costs

In the first part of their paper, CGL provide eight propositions that pin down the conditions under which binary referendums with unambiguous actual costs are incentive compatible. They then present a field experiment in which subjects voted for or against the provision of a public good in exchange for a lump sum payment equal to their show-up fee. The results support their theoretical claim that truthful revelation of preferences is the optimal strategy as long as choices are believed to be consequential. From this CGL conclude (2014:195) that "consequentiality and realism need to permeate all parts of a valuation survey". We could not

agree more with this conclusion. However, the mechanism of CGL's field experiment differs decisively from the mechanism of random bid CV surveys. While their subjects faced a binary referendum with known, unambiguous and non-negotiable costs, a typical CV respondent is presented with a randomly assigned bid that might be very different from what they actually had to pay if the referendum passed.

The difference might seem subtle at first but, as already noted by Horowitz (2000), it creates incentives for various strategic behaviors. We will draw on the behavioral model of Green et al. (1998) to substantiate this claim.[1] Consider a CV respondent i who believes the probability of implementing a project, conditioned on actual cost c, is proportional to the survey plurality for the project at this cost. Let r denote the largest bid at which i will still approve the project. Similar to CGL's field experiment we shall first presume that i's actual cost share is known, unambiguous and non-negotiable. The plurality for implementation of the project at the respondent's actual cost is given by $N^{-1}\left(n(1-F(c))+\mathbf{1}(r\geq c)\right)$, where $N=n+1$ is the number of CV respondents and $F(\cdot)$ is a CDF that reflects i's beliefs about the responses of the other n respondents. The indicator function $\mathbf{1}(\cdot)$ is equal to one if its argument is true and zero otherwise.

If the respondent believes her vote is consequential she will choose a response that maximizes her expected payoff $\mathbb{E}\left[\pi\right]$, which is simply the difference between her true but unobserved willingness-to-pay $\tilde{\omega}$ and her actual cost share in the project multiplied by her subjective probability of approval:

$$\begin{aligned}\mathbb{E}\left[\pi\right] &= (\tilde{\omega}-c)\lambda N^{-1}\left(n(1-F(c))+\mathbf{1}(r\geq c)\right)\\ &= K+\lambda N^{-1}\textstyle\int_0^r(\tilde{\omega}-c)G'(c)\mathrm{d}c.\end{aligned} \tag{1}$$

K is a constant term independent of r, λ reflects i's belief about the consequentiality of her response, and $G(\cdot)$ is the CDF of i's belief about c conditioned on the framing of the survey. If c is known, the payoff function is maximized at $r=\tilde{\omega}$ as long as $G'(\cdot)$ is positive in the

[1] Although the Green et al. model is rooted in expected utility, its results readily apply to CGL's model.

vicinity of $\tilde{\omega}$. Hence, the respondent will answer truthfully if she believes that:

(i) There is one and only one project to be approved or rejected;

(ii) The survey answer is deemed consequential, i.e. $\lambda > 0$;

(iii) The probability of implementation is proportional to survey plurality; and

(iv) The payment vehicle is decoupled in the sense that r has no impact on c.[2]

The attentive reader will note that the set of beliefs invoked by Green et al. (1998) are consistent with both the propositions and the field experiment presented by CGL. Holding these beliefs leads to a trivial Nash equilibrium in which i's optimal action does not depend on the actions of the other n respondents. In other words, a truthful answer is the best strategy to play.

2 When bids differ from actual costs

Unfortunately, inducing the above set of beliefs in a CV survey is less trivial than many researchers seem to presume. Perhaps the biggest concern relates to belief (iv). In CV studies, bids are randomly assigned to respondents to generate the statistical variation that enables the estimation of willingness-to-pay values. While statistically sound, the random assignment makes some bids incredibly high or low for there are always poor respondents who receive high bids and wealthy respondents who receive low bids (Flores and Strong 2007). Why does this matter? Let us reconsider the expected payoff, only that this time we replace c by the *anticipated* cost $\tilde{c} = \tilde{\phi}c$, where $\tilde{\phi}$ is an unobserved scaling factor expressing the respondent's belief about her cost relative to the average person's cost. For example, a wealthy and a poor respondent may have scaling factors of $\tilde{\phi} = 5$ and $\tilde{\phi} = 0.5$, respectively. Not surprisingly, the poor respondent has an incentive to overstate $\tilde{\omega}$ while the wealthy

[2]In the framework of Carson and Groves (2007:191), belief (iv) is replaced by the belief that the price (i.e. the bid) offered in the survey is equal to the true cost c: "The agent needs to believe that if the agency implements a particular alternative: the specified good Q will be provided and the stated price P will be assessed." In substance, the two beliefs are equal. Yet Carson and Groves make it explicit that respondents must take the bid at face value for SBC questions to be incentive compatible.

respondent has an incentive to understate $\tilde{\omega}$.[3]

Under which conditions should we expect CV respondents to *process* the bids assigned to them and hence to answer different questions than those asked in the survey? One answer is whenever belief (iv) breaks down; that is, whenever the respondent has any reason to believe that what they state may not only affect the probability of approval, but also the amount of the good provided or the cost charged for its provision (Horowitz 2000). Yet, as just shown, it is not even necessary that the respondent abandons belief (iv). It suffices that they believe their own contribution would differ from the median person's contribution (Flores and Strong 2007). This seems a reasonable belief in many cases of public good provisions—for instance, when the project is to be financed through common sources of tax revenue (income taxes, property taxes) or relative to individual consumption (water bills) or stake (shareholding in co-property). In all of these settings respondents might actually believe their answer is going to affect the probability of approval but not the overall amount or cost of the public good. They may nevertheless over- or understate their willingness-to-pay for the project, simply because they infer the anticipated cost from the bid presented to them.

What about bids that are framed as one-time lump sum tax payments? Under this payment mechanism, which is closest to the binary referendum format endorsed by the NOAA panel, the respondent may behave strategically if they doubt that the payment mechanism is coercive. Such doubts might be well justified. Take a person who lives on social security and receives the invitation to participate in a CV study on the amelioration of a public park. It seems obvious to us that the respondent would anticipate he could not be forced to make a payment of, say, $200.

How big an issue is the lack of cost credibility? Empirical evidence on cost credibility is still scarce, but the little evidence we have suggests that a considerable proportion of respondents do not believe in the bids presented to them. In a CV study on open space

[3]If we were to know $\tilde{\phi}$, we could even predict the optimal over- or understatement. Consider the modified payoff function $\mathbb{E}[\pi] = K^* + \lambda N^{-1} \int_0^r (\tilde{\omega} - \tilde{\phi} c) G'(c) \mathrm{d}c$, which is maximized at $r = \tilde{\omega}/\tilde{\phi}$. It is optimal for a respondent with $\tilde{\phi}$ to state an amount that is exactly $1/\tilde{\phi}$ times their true willingness-to-pay.

preservation in Colorado, Champ et al. (2002) found that 38% of the respondents believed their actual contribution would be higher than the bid they faced, while 4% believed their actual contribution would be lower. Flores and Strong (2007) report on a CV study valuing the local clean up of mine contamination in which only one third of the respondents believed that the presented bids would match their actual cost. Again, there were far more respondents (63%) who thought they ought to pay more than the bid amount if the project was to be implemented. The proportion of cost skeptics has to be judged against the relatively narrow bid ranges used in these studies ($10-$140 and $17-$270, respectively). In agreement with Flores and Strong (2007), we strongly suspect that the proportion of cost skeptics would be even larger with a wider bid range.

3 Means to reduce strategic behavior

Although far from conclusive, the evidence on the lack of cost credibility in random-bid CV studies is alarming and calls for more attention in the way researchers ask the payment questions. Here, we summarize two ideas that have been proposed to foster the credibility of the cost credibility of CV studies.[4]

Realistic costs. The first idea is to use real, or better realistic, cost estimates as bids. For example, Johnston (2006) presents a CV study in which respondents voted on a water supply project. The respondents received random bids from a realistic range of costs, which experts had estimated based on data from neighboring water districts and engineering cost estimates. This decreases the scope for overstating the true willingness-to-pay because each respondent faced a bid that could, with some probability, be their actual cost of the project. We emphasize that the use of realistic cost estimates does not eliminate strategic behavior as there is still some chance that respondents deem the survey answer to be non-coercive.

[4] An alternative approach, which we do not pursue here, is based on recent progress in the econometrics of choice modeling. It is conceivable that the unobserved heterogeneity in the anticipated cost $\tilde{c}$ can be structurally modeled as a latent variable. The reader is referred to Walker and Ben-Akiva (2002) for a conceptual discussion, and to Hess and Beharry-Borg (2012) and Lundhede et al. (2015) for recent applications in environmental economics.

Moreover, the approach requires a relatively narrow cost bracket so that the cost range is credible and, hence, it might not provide the necessary variation in responses to reliably estimate the willingness-to-pay distribution.[5]

Exploiting heterogeneity in individual cost shares. As a means of addressing this problem, Strong and Flores (2008) turn to variations in federal/local cost shares, thereby creating different costs to respondents while maintaining a link to the project's estimated cost. In many applications it is even more convincing to generate variation by making the bids contingent on the respondent's last tax invoice. This can be achieved by framing the payment vehicle as a percentage increment in income taxes (Schläpfer 2008). In online surveys, it suffices to inquire about the respondent's last tax invoice and to present them with the absolute bid amounts corresponding to their tax payments; in pen-and-pencil surveys, simple conversion tables may help the respondent to convert relative increment into absolute bid amounts.[6] Income heterogeneity among the respondents then generates the variation needed for statistical identification in a credible manner.

Of course, respondents could still game the survey by stating unrealistically low numbers. Yet we believe that these two features reduce the scope of strategic behavior and foster the cost credibility of CV studies, particularly when combined with a thorough description of the payment mechanism that is foreseen to provide the public good. As Horowitz states (2000:69): "[I]n an open society it is important that citizens know what mechanism is being used to make public goods decisions."

4 Concluding remarks

CGL provide a paramount example of a SBC referendum question that is incentive compatible. The sports memorabilia fans who participated in their field experiment could only decide

[5] In Johnston's CV study on water supply, bids ranged from \$125 to \$425 per quarter. Corresponding approval rates dropped from 65.3% to 32.6%. The high approval of the largest bid used by Johnston makes it difficult to econometrically nail down the right tail of the willingness-to-pay distribution.

[6] An exemplary conversion table can be found in Schläpfer and Schmitt (2007).

whether to approve or reject the provision of a ticket stub to a prominent baseball game. There was no hope whatsoever that a rejection of the proposal would result in a more attractive proposal, ruling out logrolling. Participants had also no reason to believe they could be tricked. The voting mechanism was clearly stated and nobody could over- or understate their willingness-to-pay for receiving the stub. It is incontestable that in such situations SBC referendum questions are incentive compatible. This does not, however, imply in that CV studies using the random-bid SBC format are incentive compatible. To the contrary—if a lack of cost credibility induces strategic misrepresentation, then ensuring consequentiality as stipulated by CGL will only support strategic misrepresentation.

Some economists have concluded that CV studies are a "hopeless" enterprise to paraphrase Hausman (2012). We do not feel that such a drastic conclusion is warranted, but we certainly believe that cost credibility deserves more attention in the debate about the incentive compatibility of CV studies.

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