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On Misrepresentation of Altruistic Preferences in Discrete-Choice Experiments

Per-Olov Johansson and Bengt Kriström

The purpose of this note is to address a problem faced in using stated preference methods to estimate willingness to pay (WTP) for a project. The considered problem occurs under pure altruism. Even though an agent is equipped with well-behaved preferences, a conventional closed-ended (binary) valuation question may induce her to overrate or underrate her true WTP. On the other hand, an open-ended valuation format seemingly provides a correct answer, but such a format fails to be incentive compatible.

Key words: altruism, closed-ended payment vehicle, distortionary taxation, environmental goods, open-ended payment vehicle, willingness-to-pay

Introduction

How to handle altruism is an important issue in stated preference studies, where the aim is to use survey techniques to estimate the willingness to pay for a policy proposal or other project. Contributions to the theoretical treatment have been provided by Jones-Lee (1991, 1992, 2004); Milgrom (1993); Johansson (1994); McConnell (1997); Quiggin (1997); Flores (2002); Bergstrom (2006); Jacobsson, Johannesson, and Borgquist (2007); and Hahn and Ritz (2014), among others. There are several types of altruism. Following Jones-Lee (1991), pure (sometimes referred to as nonpaternalistic) altruism occurs when an individual cares about the well-being of another person and respects that person's preferences. A paternalistic altruist cares about a particular aspect of another person's well-being (e.g., the person's health or wealth) irrespective of that person's preferences.¹ In contrast, the conventional economic agent, what we term a pure egoist, is only concerned about her own consumption of goods and services (i.e., what could be labeled private values).

However, as far as we can tell, neither the NOAA 1993 panel on contingent valuation (Arrow et al., 1993) nor the Contemporary Guidance for Stated Preference Studies (Johnston et al., 2017) addresses the issue of how to handle altruism in empirical studies. What they touch upon is Andreoni's (1989) concept of warm glow, a concept recently and excellently addressed by Bishop (2018) but not further considered in this note. Nevertheless, in many empirical evaluations of environmental assets as well as in health economics, how to handle and assess altruistic concerns is an issue of great concern (see, e.g., the references provided above).

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¹ Preference interdependence between public goods and income distribution à la Flores (2002) is not considered here.

In this note, we reconsider the question how to handle pure altruism in surveys used to estimate willingness to pay (WTP) for a project. It is shown that adding a particular constraint to the evaluation of a project induces the respondent to handle altruistic preferences in a theoretically consistent manner. This result holds also in the presence of distortionary income taxation.

The next question is how to apply the result in terms of empirical evaluations. We focus here on the “pure” open- and closed-ended valuation formats but also briefly consider payment intervals (typically based on the assumption that agents are unable/unwilling to report unique amounts). An open-ended format in its simplest form asks a person of her maximal WTP for a project. In contrast, a (simple) closed-ended format provides only two options for the respondent: to accept or reject paying a particular amount of money. This amount is varied across respondents to enable statistical analyses.

Pure Altruism: Theoretical Background

Pure altruism poses a problem in WTP experiments. This problem has recently been addressed by Beeson et al. (2019). Drawing on their contribution, we provide a slightly different analysis and focus on the impact of the payment vehicle on the reported WTP. In contrast to Jones-Lee (1991) and Johansson (1994), we introduce the more general case in which there is proportional or progressive income taxation. For notational simplicity, there are just two individuals. The first individual is assumed to be a pure altruist, while the second is a pure egoist who cares exclusively about her own well-being; this approach avoids some notational clutter without loss of generality in the present context. The first individual’s indirect utility function is assumed to be of the form

$$(1) \quad V^1 = V^1[\mathbf{p}, f(m^1), z; V^2(\mathbf{p}, f(m^2), z)],$$

where \mathbf{p} denotes a vector of prices (with the numéraire price set equal to unity), m denotes gross or pretax income, $m^D = f(m)$ denotes disposable income, and z denotes what we term an environmental public good. We assume that $0 < f_m(\cdot) < 1$ and $f_{mm}(\cdot) \leq 0$, where subscript m refers to a derivative with respect to income. Thus, the tax system allows for a proportional or a progressive income tax.² The person is termed a pure altruist because she respects the preferences of the second person.

Suppose that the provision of the public good is increased from z^a to z^b . We want to define the WTP of the pure altruist, assuming that everyone pays according to her own WTP. It is critical to observe that the framing assumes that not only the altruist but also the second individual remains at her initial level of utility. Drawing on equation (1), the WTP of individual 1 is implicitly defined by the following equation:

$$(2) \quad V^1[\mathbf{p}, f(m^1 - CV^1), z^b; V^2(\mathbf{p}, f(m^2 - CV^2), z^b)] = V^{1a},$$

where CV^i refers to the WTP of individual i (for $i = 1, 2$) and V^{1a} refers to the initial utility level of the first individual (i.e., the level of utility experienced when $z = z^a$).

However, also the second individual pays according to her WTP. Thus, she remains at her initial level of utility:

$$(3) \quad V^2(\mathbf{p}, f(m^2 - CV^2), z^b) = V^{2a}.$$

Therefore,

$$(4) \quad V^1[\mathbf{p}, f(m^1 - CV^1), z^b; V^{2a}] = V^{1a}[\mathbf{p}, f(m^1), z^a; V^{2a}].$$

It follows that the pure altruist behaves as if she was a pure egoist (i.e., values only what in terms of equation 4 could be termed use values or private values). Thus, she pays only for her

² $m^D(m) = m - T(m)$, where $T(m)$ is a tax function. Typically, a tax function is assumed to be piecewise continuous on an interval (i.e., is continuous on each open subinterval); see also the Appendix.

own additional consumption of the public good when provision increases from z^a to z^b . This result holds even in the presence of distortionary taxation, hence replicating and generalizing the result obtained for economies without taxes (refer to Jones-Lee, 1991, or Johansson, 1994). The same qualitative outcome is obtained if the second individual is a pure altruist and in the case with an arbitrary number of individuals. The outcome also remains unaltered if the public good is replaced by individual survival probabilities à la Jones-Lee (1991) and the project is interpreted as affecting these probabilities; the reader is referred to Viscusi (2018) for a recent and thorough discussion of how to value fatality risks. Finally, in all these cases we can consider a change/project of arbitrary size, as in equation (4); below, we use the approach to consider WTP for a marginal change in z . In the Appendix we illustrate how increases of marginal tax rates can be used to estimate WTP. Changing tax rates may provide a more realistic (but also technically more challenging) approach than the one used above, although it should be remembered that they produce the same qualitative results.

Thus far, we have assumed that an agent assumes that others pay according to their WTP. Relaxing this assumption causes a kind of double-counting or overpayment problem within the present theoretical model with a public good; at a social optimum, both individuals pay according to their WTPs (implying that a marginal increase in the provision of z leaves utility levels unchanged when the agents pay dCV^1 and dCV^2 , respectively). The pure altruist has an incentive to increase her contribution over and above the socially optimal level, CV^1 , provided she assumes that the second individual gains utility from the policy proposal (by paying less than CV^2). Adding the second agent's WTP to arrive at their combined WTP would contradict the first agent's assumption that the second agent pays less than CV^2 for the proposal. Matters might be different if we turn to voluntary contributions (e.g., if the agent is considering donating for charitable purposes), in which case it is up to the agent to donate whatever amount she prefers.

Open- and Closed-Ended Valuation Experiments

The obvious way to estimate CV^1 in a survey is through an open-ended valuation format. In its simplest form, the respondent is asked about her WTP for the considered policy proposal. However, this simple approach would fail in the case of pure altruists. Such an agent must make an assumption with respect to what other people pay for the proposal. There is obviously an infinite number of different assumptions, ranging from 0 to CV^2 . Hence, the amount that the pure altruist reports depends on what assumption she makes. The consistent approach requires that she be told that the second person also pays according to her own WTP. Then, the resulting amounts are consistent and can be aggregated to reflect the social value of the proposal (setting aside any distributional issues here).

However, the open-ended format is known to not be incentive compatible (Carson and Groves, 2007, 2011; Carson, Groves, and List, 2014). An incentive-compatible mechanism is one in which the respondent theoretically has the incentive to truthfully reveal any private information asked for by the mechanism, such that truthful preference revelation is the dominant strategy (Carson, Groves, and List, 2014). An open-ended format may, for example, induce the respondent to act strategically to influence the outcome of the valuation experiment. The optimal strategy might be to report either a small or a very large WTP response (Carson and Groves, 2007, p. 202).

A further important twist is worthwhile to point out. It is often observed that respondents are unable to report a unique WTP. A common suggestion is that this outcome is due to preference uncertainty. Hence, it is argued, a respondent is only able to report an interval for her WTP. A large and growing literature is devoted to developing payment vehicles for this case and to determining the width of the interval. For recent applications, the reader is referred to Angelov and Ekström (2017), Mahieu et al. (2017), and Angelov et al. (2019). In the present context, a pure altruist would probably report an interval in the absence of the information that everybody should pay according to their WTP. The agent must base her WTP estimate on the assumption that the other individual

pays in the interval $(0, CV^2)$. If so, a payment interval does not require preference uncertainty but is caused by a “foggy” payment format.

Next, let us turn to a referendum-type (or closed-ended) valuation question. In its simplest form, such a question asks the individual to accept or reject paying a particular amount of money in exchange for the project. Suppose the considered pure altruist is indifferent if the payment equals CV^{1P} . Then, equation (4) is modified to read

$$(5) \quad V^1[p, f(m^1 - CV^{1P}), z^b; V^2(p, f(m^2 - CV^{1P}), z^b)] = V^{1a}[p, f(m^1), z^a; V^{2a}],$$

where CV^{1P} denotes the amount individual 1 is willing to pay, conditional on individual 2 contributing the same amount of money. Recall that according to a referendum-style question everyone (belonging to a particular subsample) faces the same amount of money. It follows that $CV^{1P} > CV^1$ if the first agent believes that paying CV^{1P} implies that the second individual contributes less than her true WTP ($CV^{1P} < CV^2$), while the reverse outcome prevails if the second agent's utility decreases if she pays CV^{1P} ($CV^{1P} > CV^2$).

The outcome is most easily understood in the case of a small project for which the individual's marginal WTP is estimated as follows:

$$(6) \quad -V_{m^1}^1 dCV^{1P} + V_z^1 dz + V_2^1 [-V_{m^2}^2 dCV^{1P} + V_z^2 dz] = 0,$$

where a subscript m refers to a derivative with respect to income, a subscript z refers to a derivative with respect to the provision of the public good, and $V_2^1 = \partial V^1 / \partial V^2$. Suppose that dCV^{1P} also reflects the second individual's WTP ($dCV^{1P} = dCV^2$). Then the terms within square brackets sum to 0. In this case, the first individual also pays according to her private value (so that $dCV^{1P} = dCV^1$). Except for this special case, one expects the WTP of the first individual to exceed (fall short of) the private value whenever the expression within brackets is positive (negative), conditional on individual 1 having altruistic preferences.

Note that this problem disappears if the individual is only concerned with her own preferences (i.e., is either a pure egoist or a paternalistic altruist).³ In both cases, $V_2^1 = 0$ in equation (6). For the paternalistic altruist, there is a benefit in addition to dCV^{1P} in equation (6) because she values the second individual's consumption of z , but this benefit is independent of the beneficiary's preferences (i.e., V^2 in equation 5). Thus, she will vote yes if her estimate of these combined benefits at least matches the bid in a discrete choice experiment. We refrain from discussing how she would act facing an open-ended valuation question because of the lack of incentive compatibility of this format.

Returning to the case of pure altruism, we supply a simple numerical illustration. Suppose the pure altruist has an indirect utility function

$$(7) \quad V^1 = \ln(m^{D1}) + \ln(z) + [\alpha \cdot \ln(m^{D2}) + \ln(z)],$$

where prices are suppressed, a superscript D refers to disposable income, and the terms in square brackets represent the indirect utility function of the second agent. Set $m^{D1} = m^{D2} = 20 \times 10^3$, $z^a = 100$, and $z^b = 101$. Then $CV^1 \approx 198$, while $CV^2 \approx 394.1$ if $\alpha = 1/2$. In a closed-ended survey, the first agent would vote yes to bids up to 263.6. This would overrate her true WTP by up to around one-third. Change α to $3/2$, and $CV^{1P} \approx 158.6$ underrates her true WTP by up to around 25%. This simple exercise illustrates that binary payment vehicles could result in severely biased estimates of a pure altruist's true WTP.

According to equations (5) and (6), there is a valuation problem whenever individuals are pure altruists because the sum of payments might exceed the sum of private values. This “pollutes” the

³ The pure egoist's indirect utility function is $V^{PE} = V^{PE}(\mathbf{p}, f(m), z)$, while that of the paternalistic altruist is $V^{PA} = V^{PA}[\mathbf{p}, f(m), z, g(z)]$, where $g(z)$ reflects the utility the individual derives from the other individual's consumption of the public good. For example, the individual derives utility from knowing that the other individual can watch more birds or attain better health from more of z .

evaluation in the sense that it confuses a double-counting issue with other and legitimate motives for an individual to be willing to pay over and above own “use values.” Pure altruism seems to create a problem for discrete choice experiments that can possibly be avoided or at least relieved by using an open-ended payment vehicle, but then one faces the problem that the format is not incentive compatible.

Nevertheless, in closing this section let us point at a possible catcher in the rye. Suppose all respondents accepting a particular bid are identical. Moreover, all are almost indifferent between accepting and rejecting the proposed bid. Then, roughly speaking, the terms within square brackets in equation (6) sum to 0 and the respondent correctly reports her WTP. In the aggregate, one obtains a piecewise constant function, with each bid corresponding to a “step.” This approach results in a kind of lower bound (sometimes known as Hicks inner approximation) for average WTP. It must be admitted, though, that this approach, developed (for purely egoistic agents) by Harrison and Kriström (1996), draws on quite extreme assumptions.

Concluding Remarks

As is well known, stated preference methods do not necessarily induce participants to respond according to their true preferences. Therefore, it is important to examine the theoretical properties of different payment vehicles. Such examinations hopefully contribute to a better understanding of how and why respondents respond in a particular manner to specific designs. They may also help investigators to improve the design of payment vehicles. The purpose of this note has been to contribute to these efforts.

Pure altruism poses a problem in stated preference studies. If a pure altruist believes that everyone pays the same amount, she must evaluate how those she cares for are affected by the considered project. Will they gain or lose from paying a certain amount for the project? And how will such perceived gains or losses affect the altruist’s WTP? There is an obvious risk that the stated or estimated WTP deviates from the private value. In turn, such a deviation is difficult to separate from other, legitimate reasons for paying more than the private value (e.g., for existence values). This seems to provide a serious shortcoming of the closed-ended approach, previously ignored or not understood. At least in theory, the double-counting problem is avoided in an open-ended approach, where it is clarified that everyone pays according to her WTP. Then each respondent evaluates the private value plus any other reason for contributing. The problem, however, is that the basic open-ended format has been shown to not be incentive compatible.

Thus, we end up in a kind of catch-22 dilemma. An open-ended format can cope with pure altruism but suffers from lack of incentive compatibility. Closed-ended formats could be incentive compatible but cannot cope with pure altruism.

It is out of the scope of this paper to provide detailed suggestions for handling pure altruism in empirical studies. Nevertheless, we suggest a simple two-stage procedure in a referendum-style (closed-ended) experiment. Ask a subsample of respondents of yes/no to paying \$X for use or private values (ignoring any altruistic or other concerns). Ask another subsample if they are willing to pay \$Y in total (i.e., including any nonuse values, however defined in the survey). Second, add questions about their motives, designed such that pure altruists can be identified and “excluded” from the estimation of mean/median WTP in the second stage (instead estimating the WTP of a pure altruist from the first step).

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Appendix A

The same qualitative results as those reported in the section on pure altruism in valuation experiments can be obtained by instead adjusting the tax ladder. For example, the marginal tax rate paid by agents could be increased. In the small project case, one obtains

$$(A1) \quad dV^1 = -V_m^1 \Delta m^1 dt^1 + V_z^1 dz - V_2^1 [V_m^2 \Delta m^2 dt^2 - V_z^2 dz] = 0,$$

where V_m denotes the marginal utility of income, V_z refers to the marginal utility provided by the considered public good, Δm^i refers to the marginal income bracket (within which the tax rate by assumption remains constant), V_2^1 denotes the marginal utility derived by individual 1 if individual 2's utility increases marginally, and dt^i refers to the change in the marginal tax rate for individual i with $i = 1, 2$. Thus, the first individual's contribution equals $\Delta m^1 dt^1$. If the second individual pays according to her WTP the terms within square brackets sum to 0, and the maximal (voluntary) tax contribution by individual 1 equals her private value. Proceeding as in the main text, all remaining results can be replicated. A generalization of this approach allows all tax rates to be adjusted. However, in comparison to the approach used in the main text, both these approaches come at the cost of increased notational clutter and are possibly harder to understand by agents in a laboratory experiment or a survey.