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FIELD EXPERIMENTS

Instrument-Induced Bias in Donation Mechanisms: Evidence from the Field

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Abstract

Eliciting actual donations toward a public good has been proposed as a means of estimating a lower bound to individuals' compensating surplus, and can be accomplished using mail/phone surveys or field experiments. This study shows that when warm-glow is present, the elicitation instrument decreases the transaction costs of donating. This presents an obstacle to using the donation mechanism. As a remedy, we propose the use of a multi-donation mechanism where subjects can direct their donation to alternative public goods. Results from a field experiment confirm this instrument-induced bias can be large, suggesting field experiment practitioners should seriously consider how their experimental procedures may alter economic behavior.

KEYWORDS: donations, donation mechanism, nonmarket valuation, warm glow

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A major goal of non-market valuation is the estimation of compensating surplus (*CS*), which represents the maximum amount of money an individual is willing to pay for a good or service. Numerous methods for estimating *CS* exist and are generally categorized as either revealed or stated preference methods. Both methods have advantages and disadvantages. The revealed preference genre has the desirable property that value estimates are derived from observed economic behavior using real money, but the disadvantage that *CS* is inferred indirectly and requires assumptions that are difficult to validate. For example, hedonic methods require one to specify functional forms for econometric estimates, where the true functional form is never known, and travel cost methods require assumptions about the opportunity cost of leisure time, which is difficult to verify. Moreover, most revealed preference methods do not account for passive values.

One revealed preference mechanism that avoids these problems and accounts for passive values is the donation mechanism described by Champ et al. The donation mechanism works by eliciting donations towards a public good. Donations are used to estimate the maximum willingness-to-donate. This maximum willingness-to-donate can then, under some circumstances, be interpreted as a lower bound to the true *CS* (Champ et al.), but in other circumstances cannot (Chilton and Hutchinson).

Stated preference methods, for the most part, estimate the value of a good by direct questioning. An example is contingent valuation where subjects are asked if they will pay a certain amount of taxes each year for a particular public good, which implicitly includes passive values. An obstacle is that the corresponding *CS* estimates are based on hypothetical situations, where subjects do not actually pay any money, which leads to hypothetical bias. The presence of hypothetical bias implies that *CS* will be overestimated.

It is unlikely that any valuation method will be unbiased in all aspects. However, reliable estimates can still be obtained by exploiting the nature of each method's bias. Contingent valuation can be used to provide an upper-bound *CS* estimate and the donation mechanism can provide a lower-bound *CS* estimate, such that an interval estimate for *CS* is obtained.

The validity of this interval estimate hinges crucially on the assumption that contingent valuation will overestimate *CS* and the donation mechanism will underestimate *CS*. It is well established that hypothetical bias exists in stated preference methods (List and Gallet), unless corrections such as cheap-talk or certainty-calibrations are used. The ability of the donation mechanism to underestimate *CS* is less established, mainly because donations suffer from a "warm-glow" effect.

Warm-glow is the increase in utility from giving money to a public good, net of the utility from greater public good provision. Warm-glow exists when people derive utility from a donation even if it does not enhance public good provision. When warm-glow is present, donations need not represent a lower-bound to *CS* (Chilton and Hutchinson).

In addition to the warm-glow problem, this study introduces the concept of an instrument-induced bias, where the value elicitation mechanism lowers the transaction costs of donating to one particular public good. This essentially subsidizes donations to the public good, and as shown later, makes it more difficult to interpret maximum willingness-to-donate as a lower-bound to compensating surplus. We propose the use of a multi-donation mechanism to mitigate this instrument-induced bias.

The next section discusses the relationship between willingness-to-donate and compensating surplus, and introduces the instrument-induced bias. Then, a multi-donation approach is discussed, and is followed by several sections illustrating how to administer the multi-donation mechanism in the field, using antibiotic use in livestock production as a case study.

1. Donations and Compensating Surplus

The usual purpose of non-market valuation is to estimate compensating (or Hicksian) surplus for a public good. Compensating surplus (*CS*) is the amount of money taken from individuals to fund a public good which leaves the individual with the same utility as if the public good were not provided. Mathematically, if U(Y,G) is utility where Y is income and G = 1 if the public good is provided and zero otherwise, compensating surplus is the value S which satisfies U(Y-S,1) = U(Y,0). Obtaining an unbiased estimate of compensating surplus through contingent valuation is complicated by the hypothetical nature of the decision task, which has been shown to inflate valuation estimates relative to the case when real money is on the line (e.g., List and Gallet). One remedy to this problem is to tie survey and field experiment responses to real monetary payments. In the case of public goods, this can be accomplished by soliciting actual donations toward a public good. While donations are not unbiased estimates of compensating surplus, Champ et al. showed that under certain assumptions, maximum willingness-to-donate (*WTD*) is a lower-bound for compensating surplus.

The reasoning behind the Champ et al. result is simple. Public goods can be provided through private donations which are subject to free-riders, or taxes which do not suffer the free-rider problem. If asked on a referendum whether one would support a $10 *tax* increase to fund a public good, they are more likely to respond “yes” than if a *donation* of $10 is requested. The reason is that the $10 tax increased will be matched by $10 from all citizens, leading to greater public good provision. In contrast, a $10 donation does not imply reciprical donations. Compensating surplus is typically defined as the maximum tax individuals are willing to pay for a public good. If people's willingness-to-donate is less than their willingness-to-pay through taxes, it then stands to reason that maximum willingness-to-donate is a lower-bound to compensating surplus.

Chilton and Hutchinson argue otherwise, noting that Champ et al. do not account for warm-glow and note that warm-glow differs across donations and taxes. People may donate to a cause even if it has little to no impact on the provision of good. They donate because it "feels good," and this feeling is a good in and of itself (or at least, can it can be modeled as such).

A good example of warm-glow giving is provided by Bennett and Blaney, where subjects were asked whether they were willing to give up money in exchange for stricter animal welfare laws. The authors ask the respondents why they were willing to give up the money, and some reported "for welfare generally" or because it was "like a charitable donation." If subjects will give up money to a particular cause because it is "like a charitable donation," it is evident they care less about the provision of the public good and more about obtaining warm-glow.

Chilton and Hutchinson argue that subjects receive less warm-glow from providing a public good through taxes than donations. That is, people "feel good" about themselves when they make a donation but not when they pay taxes. This suggests that people's willingness-to-donate may be greater than their compensating surplus. The reason is that donations go towards two goods—the public good and warm-glow—while taxes do not. The relationship between willingness-to-donate and compensating surplus is summarized nicely by Chilton and Hutchinson, "*actual willingness to donate for private provision will be pulled down by the tendency to free ride and will be pulled up again by the warm glow of giving. Thus, the relative strength of the two opposing motivations determine whether actual donations exceed, equal, or fall short of the Hicksian value of public provision*," (page 208).

There is another obstacle to using the donation mechanism not yet studied. In studies using the donation mechanism (Champ et al.; Champ and Bishop) individuals were informed via mail surveys about one particular public good (wind-energy or road removal projects) and were given an opportunity to donate only that good. By simply checking a "yes" box and returning the completed questionnaire an individual can contribute to the public good. The instrument reduces the transaction costs of providing the public good, and to the transaction costs of obtaining warm-glow. Instruments used in field experiments to elicit donations suffer the same problem.

The ease in which instruments allow individuals to obtain warm-glow is especially troubling. Subjects may give just to feel good about giving even if they care little about the public good receiving the donation. This magnifies the warm-glow problem, making it less reliable as a lower-bound estimate of compensating surplus. In a sense, the instrument subsidizes donations to the public good, and subsidizes warm-glow, and for this reason is referred to as a *instrument-induced bias*.

Consider the following example. You are in a checkout line at the grocery store that contains a jar eliciting donations to the American Cancer Society. You see in the adjacent line a similar jar for the National Humane Society. After receiving $0.18 in change you decide to be nice and give the change to a charity. If the two jars were side-by-side you would give to the Humane Society, but unfortunately, giving to it would incur transaction costs. In fact, you rather give the $0.18 to any charity in your checkoug line and receive general warm-glow than to pay the transaction cost of giving to the Humane Society, where you receive both warm-glow and an increase in a public good you value.

Thus, you give the money to the American Cancer Society. While your *CS* from American Cancer Society services is zero, you give to receive general warm-glow. In this case your donation is not a lower-bound estimate of *CS*. But if the jars were side-by-side, your donation to the American Cancer Society would be zero, which is less than or equal to your *CS* of zero. This suggests an approach to mitigating the instrument-induced bias: allow donations to other charities on the instrument. The benefit of this multi-donation approach is outlined below.

2. The Multi-Donation Approach

The previous section describes the instrument-induced bias inherent in the donation mechanism where the instrument, in a sense, subsidizes donations to the public good. This section introduces a multi-donation mechanism that mitigates, though does not totally eliminate, the instrument-induced bias. An economic model is developed to demonstrate the multi-donation mechanism and its benefits.

Suppose there are two public goods, *G* and *B*, which can be funded by individuals through donations. One dollar spent on private goods yields utility λ. An individual is administered a survey instrument that gives her the choice of donating *$D* dollars towards G or simply keeping the *$D* dollars. If she does not donate towards *G*, she may donate towards *B* or simply keep the money.

The individual will donate *$D* to *G* if it yields higher utility than using the money to fund *B*, buy private goods, or some combination of both. The utility from the donation can be separated into three types. One is the utility from knowing there will be greater provision of *G*. The other two types relate to warm-glow. Specific warm-glow refers to warm-glow that can be derived from a specific public good only; it occurs when the individual possesses a fondness for a particular public good. An animal lover may "feel good" giving to the Humane Society, while a mother who lost a child to cancer may derive a warm feeling by donating to the American Cancer Society, even if they both suspect the donations will have little to no impact. In these cases, the two charities are not substitutes in specific warm-glow provision. The animal lover does not derive as much warm-glow giving to the American Cancer Society as giving to the Humane Society, because the level of warm-glow is specific to the public good.

In addition to specific warm-glow, there is reason to believe people donate to achieve general warm-glow as well. General warm-glow is the increase in utility from giving to a public good, net of the impact on the public good provision and regardless of the public good type (so long as the donation goes to a legitimate charity). The simple act of giving becomes a good, regardless of the charity, so long as it promotes societal welfare in some fashion. When subjects in the Bennett and Blaney study indicated they would give money towards the animal welfare cause "for welfare generally" or because it is "like a charitable donation", they are referring to general warm-glow because they were not concerned which particular public good receives the donation. Think of all the times you have donated spare change to charities at checkout counters, and ask yourself how your donations would change if the particular charity had changed. If you answer it would change little, you are giving mainly to receive general warm-glow.[1]

For a fixed donation of *$D* to *G*, let the average value of these three utility types (utility from greater public good provision, specific warm-glow, and general warm-glow) be denoted R_G^D, SW_G^D, and GW^D, respectively. The first two types have "G" subscripts because their values are public good specific. General warm-glow does not have a subscript because it is identical across public goods by definition. The superscript "*D*" implies utility changes under different donation amounts.

Following the random utility framework of McFadden, let total utility from donating *$D* to *G* for individual *i* be $R_G^D + SW_G^D + GW^D + \varepsilon_{i,G}$, and utility from giving the same amount to *B* instead is $R_B^D + SW_B^D + GW^D + \varepsilon_{i,B}$. The utility of spending the *$D* on private goods instead of donations is $\lambda \$D + \varepsilon_{i,v}$. The terms $\varepsilon_{i,G}$, $\varepsilon_{i,B}$, and $\varepsilon_{i,v}$ are assumed randomly distributed according to the Type I Extreme-Value Distribution.[2]

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1 Other evidence for warm-glow can be found in Kagel and Roth; Andreoni 1990 and 1993. Andreoni 1990 states, "the experiment reveals that on average about half of all cooperation comes from subjects who understand free-riding, but choose to cooperate out of some form of kindness," (page 891).

2 If ε_i is a Type I Extreme-Value random error term, its cumulative distribution function is $F(\varepsilon_i) = \exp(-\exp(-e_i))$. Sometimes it is written as $F(\varepsilon_i) = -\exp(-\exp(-e_i))$ instead. This is the error distribution that gives rise to the familiar logit model.

Under the assumed error distribution, Train shows the probability of donating to *G* is

$$(1)\ \ \Pr_{i,G} = \frac{\exp\left(R_G^D + SW_G^D + GW^D\right)}{\exp(\lambda \$D) + \exp\left(R_B^D + SW_B^D + GW^D\right) + \exp\left(R_G^D + SW_G^D + GW^D\right)}.$$

In the absence of warm-glow, the probability is

$$(2)\ \ \widetilde{\Pr}_{i,G} = \frac{\exp\left(R_G^D\right)}{\exp(\lambda \$D) + \exp\left(R_B^D\right) + \exp\left(R_G^D\right)}.$$

Equation (2) is important because the stated probability is central to estimating maximum willingness-to-donate (*WTD*). At a fixed donation opportunity of *$D*, total donations equals $\$D * \widetilde{\Pr}_{i,G}$. By varying *$D* across instruments, one can find the *$D* for which $\$D * \widetilde{\Pr}_{i,G}$ is the highest, and that is the *WTD*. Since the probability in (2) is not a function of warm-glow, the *WTD* value is a lower-bound to compensating surplus. The presence of warm-glow in (1) increases the probability of donating to *G*, making it more difficult to interpret *WTD* in relation to compensating surplus. However, when value elicitation instruments decrease transaction costs of donating the problem becomes more pronounced. Suppose that the lower transaction cost increases the utility from giving to *G* by *s*. This includes savings in money, time, and cognitive effort.[3] The probability of donating to *G* is now

$$(3)\ \ \overline{\Pr}_{i,G} = \frac{\exp\left(R_G^D + SW_G^D + GW^D\right)\exp(s)}{\exp(\lambda \$D) + \exp\left(R_B^D + SW_B^D + GW^D\right) + \exp\left(R_G^D + SW_G^D + GW^D\right)\exp(s)}.$$

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[3] The effect of lower transaction costs could be seen in a full income utility maximization model. Let *Q* be consumption of private goods, *g* be donations to public good *G* and *b* be donations to public good *B*. The monetary cost of these three items are P_Q, P_g, and P_b. Total time is *T*, which is divided among labor (*L*) and leisure (*l*) ($T = L + l + r_g g + r_b b + r_Q Q$). The term r_i is the time it takes to spend on dollar on good *i*. The wage rate is *w*. The budget constraint is $P_Q Q + P_g g + P_b b = wL$. Replacing *L* with ($T - l - r_g g - r_b b - r_Q Q$), the full income constraint is $P_Q Q + P_g g + P_b b + wr_g g + wr_b b + wr_Q Q + wl = wT$. Utility is given by $U(Q,g,b,l)$. The indirect utility function will then be $V(P_Q, P_g, P_b, r_Q, r_g, r_b, w, T)$, and will be increasing in *w, T,* and decreasing in the other terms. Lower transaction costs can be seen as lowering P_g and/or r_g. Both serve to increase the utility, so we can just model lower transaction costs as an increase in utility from donating a particular level.

This is the probability one observes when asked whether they would like to make a donation of *$D* to *G* or to keep their money. If they keep their money, they will either donate it to *B* or spend it on the "other" good after leaving the experiment.

The donation rate to *G* rises due to the elicitation instrument. Now suppose that the instrument allows donations to *G* and *B*, making donations equally convenient. Now the lower transaction cost increases the utility of giving to *B* by *s*, just as it did for donations to *G*. The probability of donating *$D* to *G* is now

$$(4)\quad \Pr_{i,G} = \frac{\exp\left(R_G^D + SW_G^D + GW^D\right)\exp(s)}{\exp(\lambda \$D) + \left[\exp\left(R_B^D + SW_B^D + GW^D\right) + \exp\left(R_G^D + SW_G^D + GW^D\right)\right]\exp(s)} \, .$$

The probability in (4) falls relative to (3). The instrument-induced bias is not completely removed because (4) is still greater than (1); it would only be removed if the utility of spending the *$D* on all private goods also increased by *s* (which would make *s* fall out of the equation).[4] However, the probability in (4) is a better lower-bound estimate of compensating surplus because the instrument-induced bias is mitigated. The probability in (4) lies between (1), where the instrument-induced bias is not present, and (3) where it is present. The bias is not removed, but it is dampened.

It is important to understand that the multi-donation approach does not increase the number of choices in the consumers' utility maximization problem. While there are more choices on the instrument, those choices exist outside the field experiment as well. Instead of increasing the number of choices, the multi-donation approach makes the donation choices equally convenient, thereby reducing the instrument-induced bias. By allowing donations to other public goods, one can be more confident that the maximum willingness-to-donate (*WTD*) is a lower-bound estimate of compensating surplus. Moreover, the decrease in *WTD* from allowing multiple donations is not arbitrary. It represents real donations towards a public good and is therefore a revealed preference mechanism.

[4] A proof is as follows. An identical subsidy (increase in utility) across all choices of *s* amounts to multiplying each element in the numerator and denominator in (4) by exp(*s*). The term exp(*s*) would then fall out of the equation and would equal equation (1). Now, imagine every element in the numerator and denominator of (4) is multiplied by exp(*s*) except exp(λ*$D*). The denominator decreases, which means the probability increases. This proves (4) is greater than (1). If we then apply the subsidy to donations to *G* only, the probability must rise more, proving (4) is less than (3).

3. Incorporating Other Donation Opportunities

In practice, one must specify how many other public goods to include. One might be inclined to include as many choices as possible, based on the belief that more choices will always be well-received by the subject, yet research has demonstrated a limit to the extent to which more choices enhance utility. Iyengar and Lepper conducted two laboratory experiments and one field experiment where subjects are given an opportunity to obtain a good by either giving up money, working harder, or incurring cognitive costs. Subjects had the opportunity to choose one good among an array of varieties, where the number of varieties varied. The results indicated a greater willingness to purchase from a limited set of six choices than a more extensive set of 24-30 choices.

Similar findings emerged from the Chernev study. When faced with a very large number of choices, people elect not to make a complicated decision and instead used their money for other goods that involve simpler choices. This has important implications for how other donation opportunities are included on a preference instrument.

On the one hand, subjects should be presented with at least several public goods in addition to the one of interest to reduce the instrument-induced bias. On the other had, if too many goods are listed, some subjects will elect not to donate simply to avoid making a tasking choice. The "no donate" option will be chosen out of a protest of the instrument, which does not provide information about the value of the public good. While some donations may still be made, they will not represent a *maximum* willingness-to-donate (WTD).

How, then, does one choose the number of other donation opportunities? One method is to vary the number of donation opportunities across instruments, evaluate how subjects respond to increased cognitive costs, and then evaluate WTD at a number that properly balances choice and cognitive burden. For example, one could construct an instrument where the no donate option is clearly differentiated from the donation opportunities, making it represent a default choice for those unwilling to incur significant cognitive costs. Then, one could estimate the probability of donating to the public good of interest as a function of the number of alternative donation opportunities. Finally, donations could be evaluated at a number of alternatives which decrease the probability of donating to the public good of interest (indicating the instrument-induced bias is mitigated) but does not increase the probability of not making a donation (which would indicate too many choices are present).

To illustrate the multi-donation approach under a varying choice set, a field experiment was conducted on donations to a public good. The particular field experiment conducted allows one to nest the single donation mechanism and multi-donation mechanism in the same instrument.

4. Data

This section describes a field experiment used to empirically illustrate the difference between the single donation mechanism and the multi-donation mechanism. The public good of interest in this study is a reduction in subtherapeutic antibiotic use at the finishing stage of pork production. Most hogs in the U.S. are regularly administered antibiotics through feed and water, regardless of whether the hogs are sick. These doses are typically too low for disease treatment; hence the term "subtherapeutic antibiotic use." Regular, low antibiotic doses enhance swine health, leading to higher growth rates and lower mortality rates.

As subtherapeutic antibiotic use continues, microorganisms eventually develop antibiotic-resistance. While this raises hog production costs, it also poses a human health threat. Many of the antibiotics used in swine production are also used to treat human diseases, including penicillin. Experts believe bacteria which develop antibiotic resistance at the farm can be transferred to humans. The National Academy of Science states, "There is no doubt that the passage of antibiotic-resistant bacteria from animals to humans occurs and that it can result from direct contact with animals or their manure, through indirect exposure to food contaminated with animal-derived bacteria, or from person-to-person contact after a primary exposure of non-farm persons (page 80)."

Faced with this human health risk, the World Health Organization has called for a ban on subtherapeutic antibiotic use in livestock production. Interest groups such as the Union of Concerned Scientists, Center for Science in the Public Interest, and the Environmental Defense have also played an active role in protesting subtherapeutic antibiotic use. These organizations have led a campaign called "Keep Antibiotics Working" lobbying for such a ban. Although legislation for a ban has not passed, the campaign has impacted antibiotic use. McDonalds in 2004 implemented a new policy where their pork suppliers may not use antibiotics used for human health solely for growth promotion purposes (McDonalds).

Agricultural use of antibiotics has received more attention in Europe than in the United States. Denmark banned subtherapeutic antibiotic use at the finishing stage of pork production in 1998, and at the weaning stage in 2000 (Hayes and Jensen).[5] The World Health Organization viewed the finishing stage

[5] Baby pigs are weaned at 2-3 weeks of age, where they are sent to a nursery where they are fed for 6-10 weeks of age: this is the weaning stage. After the weaning stage they are sent to a "finishing" facility where they stay until about six months of age, and are slaughtered at about 250 lbs. Some animals are saved from slaughter for breeding purposes.

ban as a success, stating the ban "appears to have achieved its desired public health goal," (World Health Organization, page 8) by reducing total antibiotic use by one-half. The ban at the nursery stage met with less success. Pigs at the weaning stage are more susceptible to disease, and lower subtherapeutic antibiotic use caused greater sickness and lead to greater therapeutic antibiotic use. A ban at the nursery stage actually led to an increase in total antibiotic use (after the ban at the finishing stage was in place).

The public good analyzed in this paper is a reduction in subtherapeutic antibiotic use at the finishing stage of pork production. This is a public good because it enhances antibiotic effectiveness for human diseases, which displays non-excludability and non-rivalry. To analyze the value people place on reduced antibiotic use in the United States, a field experiment was conducted. The experiment was designed to provide consumers with information on the antibiotic-resistance issue at the same time and place they make their meat purchasing decisions. For this reason, the experiment is best described as a Framed Field Experiment (Harrison and List). Shoppers in a grocery store were invited to participate in the field experiment in return for a chance to win $500 of free groceries and a gift. This lottery may invite a particular type of risk-lover different from the average population, but was thought necessary to ensure a pleasant experience, which was important to the grocery store manager. The approach also encouraged participation from non-meateaters. Participants were given a short fact sheet to read, which described the antibiotic-resistance problem, the 50% antibiotic reduction from the Denmark Ban, and the World Health Organization's favorable opinion of the ban. Pork produced without subtherapeutic antibiotic use at the finishing stage was described as *antibiotic-friendly pork*.[6]

After reading the fact sheet, subjects were allowed to choose one gift from a set of alternatives. A coupon for money off grocery purchases constituted one gift. This coupon either took the value of $2 or $4. The other gifts entailed giving up the coupon to have us make a donation to a selected charity instead. Donations to the antibiotic cause were always available, while the number of alternative donations varied randomly across instruments as 0, 3, 5, or 9. The donation to the antibiotic cause could take two forms; (1) a donation to non-profit groups seeking to promote antibiotic-friendly pork or (2) a donation of antibiotic-friendly pork to other grocery shoppers. The two donation types were used because there is no one obvious donation vehicle for mitigating antibiotic resistance. We therefore felt it useful to use two different donations types with different strengths and weaknesses. Both seek to increase the amount of

[6] The term "antibiotic-friendly" was used instead of "antibiotic-free" because the latter is usually interpreted to include an absence of subtherapeutic antibiotic use at the nursery stage as well.

antibiotic-friendly pork at the expense of regular pork; one through giving to groups seeking the ban described above and the other by making other consumers more aware of the issue. One of the pro-antibiotic-friendly pork donations was always presented as an option, but never both.

Some subjects were only allowed to choose between a coupon and a donation towards the antibiotic-friendly pork cause, while others had the opportunity to donate towards other charities as well. The other charities are described in tables 1 and 2. Depending on the instrument, the subject may have 3, 5 or 9 other donation opportunities. The donation amount was always $2 more than the coupon value, reflecting the fact that most donations have a matching contribution mechanism.[7] If a consumer gives up the $2 coupon for a donation, she is essentially making a $2 donation. Using the coupon eliminates problems that would occur if direct donations were solicited. For example, people may not have the cash handy for a donation.

The data collected allow estimating the relationship between the number of choices and utility. The coupon option was always the first option in the instrument and was printed in red ink, while all other donation opportunities were in black ink. Subjects' attention will be naturally drawn to the coupon option, whereas the consideration of donations involves more thought. For this reason, when subjects do not wish to peruse a large number of choices, they will simply choose the coupon option and will not read the remaining options. Just as Iyengar and Lepper found consumers were less willing to purchase an item when they had to select from 24 choices compared to 6 choices, subjects will choose the coupon option if the number of choices becomes too large.

[7] In cases where a matching contribution is not made, one can use the results in Eckel and Grossman to adjust the donations here accordingly.

Table 1: Choice Experiment Description and Experimental Treatments

Treatment	Coupon Amount (Donation Amount)	Donate AF Pork Chops to Others	Donate to Non-Profit Groups	Number of Other Charities[a]			
				Zero	Three	Five	Nine
1	$2 ($4)	X		X			
2	$2 ($4)	X			X		
3	$2 ($4)	X				X	
4	$2 ($4)	X					X
5	$2 ($4)		X	X			
6	$2 ($4)		X		X		
7	$2 ($4)		X			X	
8	$2 ($4)		X				X
9	$4 ($6)	X		X			
10	$4 ($6)	X			X		
11	$4 ($6)	X				X	
12	$4 ($6)	X					X
13	$4 ($6)		X	X			
14	$4 ($6)		X		X		
15	$4 ($6)		X			X	
16	$4 ($6)		X				X

a) Other charities included American Civil Liberties Union, American Red Cross, Humane Society of the United States, Environmental Defense, United Way, Habitat for Humanity, Make-A-Wish Foundation, American Cancer Society and the Conservation Fund.

5. An Empirical Model of Donations

Using the data described above, a multinomial logit model is used to estimate a utility function for donations. Let the utility from donating towards the antibiotic cause be given by

$$(5)\quad U_{i,ANT} = V_{i,ANT} + \varepsilon_i = \alpha_0 + \alpha_1 Dmoney_i + \alpha_2 Damount_i + \varepsilon_i \,,$$

where $U_{i,ANT}$ refers to the utility of donating to the antibiotic cause for individual *i*. The variable *Dmoney* equals one if the donation is to interest groups seeking to limit subtherapeutic antibiotic use and zero if the donation involves giving antibiotic-friendly pork to other shoppers. $Damount_i$ equals one if the donation is \$4 and zero if \$2, and ε_i is a random error distributed according to the Type I Extreme-Value Distribution (see footnote 2).

Some individuals are given the choice of either donating a fixed amount towards the antibiotic cause or receiving a grocery coupon for the donation amount. This coupon therefore represents grocery savings, which can be used for private good consumption or for donations to other public goods. The utility obtained from keeping the money, whether it be used for private good consumption or other donations, is normalized to equal $0 + \varepsilon_i$. The probability of donating to the antibiotic cause in the single good case is then

$$(6)\quad \Pr_{i,ANT} = \frac{\exp(V_{i,ANT})}{\exp(0) + \exp(V_{i,ANT})}.$$

This is the same probability as in (3), as it represents the probability of donating when given only one donation opportunity on the instrument. The denominator in (6) contains less terms than (3). This is because it is impossible to estimate the utility of all the things individuals can spend their money on, so the baseline utility represents utility from any choice except giving to the antibiotic cause, and is normalized to zero.

Now, suppose that we allow donations to alternative charities. As discussed in the data section, the number and type of charities varies randomly across these multi-donation instruments. Adding donation opportunities on the instrument does not increase the number of donation opportunities, it only makes more donation opportunities equally convenient. All alternative charities are well-known and can be sent donations outside of the experiment. By making alternative donations just as convenient as donations to the antibiotic cause, the baseline utility in (6) increases.

This can be reflected by allowing the baseline utility in (6) to increase by a parameter β. The probability of donating to the antibiotic cause when alternative charities are available is now

Table 2: Summary Statistics of Donation Choices (Total Donation Opportunities = 151)

Option	Number of Times Option Appeared on Instrument	Number of Times Option was Chosen
Accept coupon for $2 or $4 off all grocery purchases	151	86
Or, make a $2 or $4 donation towards		
Groups promoting antibiotic-friendly pork	84	50
Give antibiotic-friendly pork to other grocery shoppers	67	36
American Civil Liberties Union	57	2
American Red Cross	59	7
Humane Society	52	3
Environmental Defense	68	2
United Way	59	4
Habitat for Humanity	60	7
Make-A-Wish Foundation	58	7
American Cancer Society	58	6
Conservation Fund	58	2

$$(7)\quad \Pr_{i,ANT} = \frac{\exp(V_{i,ANT})}{\exp(\beta)+\exp(V_{i,ANT})} = \frac{\exp(V_{i,ANT}-\beta)}{\exp(0)+\exp(V_{i,ANT}-\beta)}.$$

The true value of β will depend on the number of alternative public goods; the more alternatives the higher the likelihood of finding one you prefer and can donate to at a lower transaction cost. This implies that the value of β is increasing in the number of alternatives present. For this reason, we specify β to follow $-\beta = \beta_0 + \beta_1 Naltchoice\ 3_i + \beta_2 Naltchoice\ 5_i + \beta_9 Naltchoice\ 9_i$ where $NaltchoiceJ_i$ is a dummy variable signifying that J alternative donations are present on i^{th} instrument. The probability of donating to the antibiotic cause then becomes

$$\text{(8)}\quad \Pr_{i,ANT} = \frac{\exp(V_{i,ANT} - \beta)}{\exp(0) + \exp(V_{i,ANT} - \beta)} = \frac{\exp(V_{i,ANT} + \beta_0 + \beta_1 Naltchoice3_i + \beta_2 Naltchoice5_i + \beta_9 Naltchoice9_i)}{\exp(0) + \exp(V_{i,ANT} + \beta_0 + \beta_1 Naltchoice3_i + \beta_2 Naltchoice5_i + \beta_9 Naltchoice9_i)}$$

Notice that the intercept α_0 in $V_{i,ANT}$ will be confounded with the parameter β_0. For this reason, we drop α_0; its effect will be reflected in the value of β_0. The probability in (8) is now

$$\text{(9)}\quad \Pr_{i,ANT} = \frac{\exp\begin{pmatrix}\alpha_1 Dmoney_i + \alpha_2 Damount_i + \\ \beta_0 + \beta_1 Naltchoice3_i + \beta_2 Naltchoice5_i + \beta_3 Naltchoice9_i\end{pmatrix}}{\left(\exp(0) + \exp\begin{pmatrix}\alpha_1 Dmoney_i + \alpha_2 Damount_i + \beta_0 + \\ \beta_1 Naltchoice3_i + \beta_2 Naltchoice5_i + \beta_3 Naltchoice9_i\end{pmatrix}\right)}$$

The log-likelihood function for the series of instrument responses is

$$\text{(10)}\quad LLF = \sum_{i=1}^{N} \left(Y_i \ln(\Pr_{i,Ant}) + (1 - Y_i)\ln(1 - \Pr_{i,Ant})\right),$$

where Y_i equals one if the individual donates to the antibiotic cause and zero otherwise,

Table 3 shows parameter estimates when the parameters are chosen to maximize (10). This is often referred to as a logit model. First consider the unrestricted model in column 2. The negative coefficient on *Dmoney* signifies that subjects are more willing to donate antibiotic-friendly pork to other consumers than to interests groups seeking bans on certain uses of antibiotics in livestock production. Subjects are also less likely to give up the $4 coupon than the $2 coupon to make a donation, as shown by the negative coefficient on *Damount*. The coefficients on *Naltchoice3*, *Naltchoice5*, and *Naltchoice9* are all significantly negative, indicating that donations to the antibiotic cause decrease when the instrument includes other donation opportunities. The dummy variable point estimates become more negative the larger the number of alternative donations, but these differences between dummy variables are not significantly different.

Column 3 of table 3 shows estimates when the coefficients on *Naltchoice5* and *Naltchoice9* are restricted to equal one another. This can be used to test the null hypothesis that increasing the number of alternative donations from 5 to 9 does not decrease the probability of donating to the antibiotic cause. If the null hypothesis is rejected, this suggests that more than nine donation opportunities may be warranted to mitigate the enhance warm-glow effect. Using likelihood ratio tests (see the log-likelihood function values at the bottom of table 3), the null hypothesis that the coefficients on *Naltchoice5* and *Naltchoice9* are equal is not rejected at the 5% level. Restricted Model 2 (fourth column of table 3) constrains the coefficients on *Naltchoice3, Naltchoice5* and *Naltchoice9* to equal, and again, likelihood ratio tests do not reject the null hypothesis that the coefficients are the same at the 5% level.

Finally, Restricted Model 3 constrains the coefficients on *Naltchoice3, Naltchoice5* and *Naltchoice9* to equal zero. If they are equal, this would suggest that including other donation opportunities does not influence donations towards the antibiotic cause. The multi-donation approach would provide no contribution over the single donation mechanisms if this hypothesis were true.

This null hypothesis is rejected at the 1% level. Thus, allowing donations towards alternative charities decreases donations to the antibiotic cause. Moreover, it appears 3 alternative choices are all that is needed to mitigate the instrument-induced bias. Further evidence is provided in table 4, which shows estimates of the following utility function.

$$\begin{aligned} U_{i,NONE} &= \gamma_1 Dmoney_i + \gamma_2 Damount_i + \eta_0 \\ &+ \eta_1 Naltchoice3_i + \eta_2 Naltchoice5_i + \eta_3 Naltchoice9_i + \varepsilon_{i,NONE} \end{aligned} \tag{11}$$

The term $U_{i,NONE}$ stands for the utility of choosing the “no donate” option. It is stated to be a function of the type of donation, the donation amount, and the number of alternatives donations. Assuming $\varepsilon_{i,NONE}$ is an extreme-value random error, (11) can be estimated as a logit model.

Estimates of (11) are shown in table 4. When the number of alternative donations is increased from 3, to 5, to 9, the utility of not donating does not appear to increase. This signifies that even with nine alternatives the decision task did not place an excessive burden on the subject. That is, subjects generally did not just choose “no donate” to avoid a tasking choice.

Table 3: Willingness-to-Donate Models (Sample Size = 151)

	Utility Function for Donating Towards the Antibiotic-Friendly Pork Cause *Parameter Estimates* *(test-statistic)*			
	Unrestricted Model	Restricted Model 1	Restricted Model 2	Restricted Model 3
Intercept	0.7979 (1.69)*	0.7994 (1.67)*	0.7643 (1.62)	-0.4203 (-1.20)
Dmoney = dummy variable for donation type (α_1)	-1.1318 (-2.06)**	-1.1371 (-1.97)**	-1.0317 (-1.83)*	-1.2935 (-2.68)***
Damount = 1 if donation for $4 and 0 if donation for $2 ($\alpha_2$)	-1.7729 (-3.13)***	-1.7720 (-3.10)***	-1.7815 (-3.19)***	-1.4115 (-2.85)***
*Naltchoice*3 = dummy variable for 3 alternative donations (β_1)	-1.7442 (-2.38)**	-1.7426 (-2.35)**	*-2.5158* *(-4.31)****	---------
*Naltchoice*5 = dummy variable for 5 alternative donations (β_2)	-2.9821 (-2.72)***	*-3.1054* *(-3.84)****	*-2.5158* *(-4.31)****	---------
Naltchoice9 = dummy variable for 9 alternative donations (β_3)	-3.2144 (-2.96)***	*-3.1054* *(-3.84)****	*-2.5158* *(-4.31)****	---------
Log-Likelihood Function Value	*-47.12*	*-47.14*	*-48.13*	*-59.94*

Notes: Coefficients in italics within each column are restricted to equal one another. The notation *, **, and *** denotes coefficients significant at the 10%, 5%, and 1% level, respectively.

Recall that the purpose of the instrument is to estimate the maximum-willingness-to-donate (*WTD*), and use this as a lower-bound estimate of compensating surplus. The *WTD* can be estimated using the logit model estimates in table 3. Since there are no significant differences in donations when 3, 5, or 9 alternative are present, and there did not appear to be too many alternative donations, we calculate *WTD* using the Restricted Model 2 in table 3, assuming the number of alternatives is either 3, 5, or 9.

Table 5 shows the percentage of people willing to donate towards the AFP cause under different scenarios. Assuming that the demographics of subjects at the field experiment match national demographics, *WTD* for the population can be estimated by multiplying the requested donation amount by the percent of people donating. Under certain assumptions, this can be interpreted as a lower bound to compensating surplus.

Consider the opportunity to donate $2 towards non-profit groups seeking a ban on subtherapeutic antibiotic use in agriculture. When subjects are given the opportunity to donate towards the antibiotic cause only, 43% make the donation. However, when given 3-9 alternative public goods to donate to, this percentage falls to 6%. Although the multi-donation approach only mitigates the instrument-induced bias, this shows the bias can be quite large.

The lower-bound of compensating surplus would be obtained from table 5 as follows. First, one must decide which donation type is preferred. Giving antibiotic-friendly pork to others will help “spread the word” about this type of pork, but its contribution towards a ban on subtherapeutic use is questionable. Giving to the non-profit organizations who actively lobby for a ban seems a more direct route towards the ban, but if the lobbying is to no avail the donations accomplishes little. This topic is difficult because there is no one donation route towards less subtherapeutic antibiotic use, which is why we allowed for two types of donations. While this is a subjective judgment, we feel donations to the non-profit organizations are a better indication of a subtherapeutic antibiotic ban.

Recall that the donation mechanism uses the *maximum* willingness-to-donate as a lower bound for compensating surplus. Donation opportunities of $2 yield higher donations than $4, so we conclude that a lower-bound for compensating surplus arising from a ban on subtherapeutic antibiotic use at the finishing stage of hog production is approximately $0.1165 per person. Also, to the extent that the sample demographics do not match national demographics, this estimate could be calibrated to provide a more representative estimate.

Finally, it should be noted that donations to the antibiotic cause could be made outside of the experiment. If so, maximum willingness-to-donate is greater than that measured here, helping to ensure it the measured willingness-to-donate is a lower-bound to compensating surplus.

Table 4: Utility Function for Not Donating (Sample Size = 151)

	Unrestricted Model	Restricted Model A	Restricted Model B
		Parameter Estimates (test-statistic)	
Intercept	-0.1621 (-0.44)	-0.1388 (-0.38)	-0.4002 (-1.28)
Dmoney = dummy variable for donation type (α_1)	0.4733 (1.31)	0.3872 (1.10)	0.2963 (0.87)
Damount = 1 if donation for $4 and 0 if donation for $2 ($\alpha_2$)	0.9833 (2.87)***	1.0066 (2.95)***	1.0088 (2.97)***
*Naltchoice*3 = dummy variable for 3 alternative donations (β_1)	-0.8024 (-1.65)*	*-0.4804* *(-1.31)*	--------
*Naltchoice*5 = dummy variable for 5 alternative donations (β_2)	-0.1919 (-0.39)	*-0.4804* *(-1.31)*	--------
Naltchoice9 = dummy variable for 9 alternative donations (β_3)	-0.4640 (-1.02)	*-0.4804* *(-1.31)*	--------
Log-Likelihood Function Value	*-97.42*	*-98.03*	*-98.91*

Notes: Coefficients in italics within each column are restricted to equal one another. The notation *, **, and *** denotes coefficients significant at the 10%, 5%, and 1% level, respectively.

Table 5. Willingness-to-Donate Towards the Antibiotic-Friendly Pork Cause With and Without Other Donation Opportunities

	No Alternative Donation Opportunities	3-9 Alternative Donation Opportunities
	Percent of People Making Donations (Average Donation Per Person)	
Percent donating $2 to non-profit organizations seeking to promote antibiotic-friendly pork	43.35% ($0.8671)	5.82% ($0.1165)
Percent donating $4 to non-profit organizations seeking to promote antibiotic-friendly pork	11.42% ($0.4566)	1.03% ($0.0412)
Percent donating $2 of antibiotic-friendly pork to other shoppers	68.23% ($1.3646)	14.79% ($0.2957)
Percent donating $4 of antibiotic-friendly pork to other shoppers	26.56% ($1.0623)	2.84% ($0.1135)

Notes: The donation rate is calculated using the Restricted Model 2 in table 3.

6. Concluding Remarks

This study builds upon prior work by Champ et al. and Chilton and Hutchinson on how to use the donation mechanism as a revealed preference valuation tool for public goods. Much thought has been given to what donations reveal about individuals' compensating surplus, especially when warm-glow is present. Although warm-glow implies we cannot be completely confident that maximum willingness-to-donate (*WTD*) is a lower-bound to compensating surplus, the donation mechanism is still considered an informative valuation tool (Champ and Bishop).

Individuals donate to obtain public goods and warm-glow, but we would prefer to measure donations in the absence of warm-glow. At the least, we wish to measure donations while minimizing the warm-glow effect. Mail/phone surveys and field experiments providing convenient donations subsidize donations to public goods, leading to what we call a instrument-induced bias. They subsidize both the provision of public goods as well as warm-glow from donations. This serves to overstate *WTD* even more, lending less credence to the claim that *WTD* provides a lower-bound estimate of compensating surplus.

The field experiment conducted in this study shows the instrument-induced bias can be large. One way to mitigate the bias is to allow subjects to donate to public goods in addition to the good of interest. It is shown that this multi-donation approach does not eliminate the instrument-induced bias, though its magnitude is reduced. This study has two objectives. The first is to articulate how instruments used in mail/phone surveys and field experiments induces greater value estimates, which to our knowledge has not been considered. Second, in some cases researchers may want an interval estimate of compensating surplus, which requires one estimate that is upward-biased and one that is downward-biased. The multi-donation approach is more likely to underestimate compensating surplus, and yet still has the desirable property that it represents real donations to a public good. Researchers conducting these interval estimates may find the multi-donation approach more appealing.

The framed field experiment used here contains several features which Levitt and List argues limits our ability to generalize towards market settings. The first is that the subjects knew they were being watched. By design, the researchers knew whether subjects kept the money or made a donation. Second, the donations were elicited in a specific context or description of the antibiotic issue. Donations rates may be sensitive to this context. For example, the survey was advertised as an Oklahoma State University experiment, and those with an emotional connection may answer questions in a way they believe “pleases the researcher.” Third, not all grocery shoppers participated, leading to a possible self-selection bias. And finally, the donations we elicited were small in amount, and the impact of warm-glow on the donation mechanism may differ substantially when larger donations are allowed. For a greater discussion on how these limitations impacts our ability to generalize towards other settings, see Levitt and List.

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