Model Choice, Hypothetical Bias and Risk Aversion: A Charitable Donation Application

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Abstract

Hypothetical bias (HB) is prevalent in stated preference studies. Using a discrete choice experiment involving both hypothetical and incentivized choices, we show that HB might be a consequence of the difference in the estimated value of the good involved but might also result from variation in risk aversion in hypothetical versus incentivized choices. Our findings suggest, in addition to incentive compatibility in stated preference survey design, using more flexible functional forms to accommodate possible curvature in utility functions may also be useful to account for HB.

Introduction

Stated Preference (SP) valuation studies in environmental and other applied economics fields are derived from hypothetical choices, which will not accurately reflect true valuations in the presence of hypothetical bias (HB) (Loomis 2010; Murphy et al. 2005; Carson and Groves 2007; Penn and Hu 2018). Many SP valuations also assume risk neutrality, either explicitly or implicitly through specifying linear utility in respondent income, the amenity being valued, or typically both. This is often argued to be credible for goods and services that translate to relatively small changes in income/wealth, and there is evidence that risk aversion increases as the stakes increase (Holt and Laury 2002; 2005), though this linear utility assumption is rarely tested in practice. This is perhaps in part because welfare estimates become increasingly cumbersome, and model convergence can become more difficult, when utilities are nonlinear.

This paper explores the interplay of model choice, levels of estimated risk aversion, and HB in an SP survey that values three different goods in the form of donations to three distinct charities. While we generally find HB in the form of increased willingness to pay (WTP) for charitable donations across all models, we observe several key differences in HB based on model specification. First, HB tends to be highest for “low-value” goods, which in our application translates to less desirable charities. We also find evidence that subjects exhibit greater levels of risk aversion in incentivized decisions than in hypothetical ones. When considering the willingness to pay for an expected donation of $5, we find that relaxing the linear utility assumption reduces estimated HB by reducing the ratio of hypothetical to incentivized WTP from 2.25 to 2.05. This is suggestive that HB is not an omnibus concept but rather can be broken into a variety of channels, and that the misspecification of curvature of the utility function may be one of the contributors to HB.

The rest of the paper proceeds as follows. The next section describes the design administration of our survey. This if followed by a description of our econometric approach, a description of our models of interest, and the derivation of our welfare estimates. We next present our results and end with discussion and concluding remarks.

Study Design and Data Collection Methods

We conduct a Discrete Choice Experiment (DCE) for the decision to donate to charity with an embedded lottery to measure risk aversion and hypothetical bias. The lottery determines if, in addition to the respondent's contribution, the charity will receive an additional matching contribution from the research team. The DCE elicits risk preferences and willingness to donate to charity based on four attributes, which include the charity receiving the donation (Feeding America, National Forest Foundation, and Against Malaria Foundation); contribution amount ($1, $3, $5); match amount, or the multiplier that determines how much additional money is donated to the charity if respondents choose to donate and "win the lottery" (0, 1, 1.5, 2); and chance of winning the match (0%, 20%, 40%, 60%). A previous DCE by Penn et al. (2023) demonstrated several patterns relevant to this present study. First, it showed preference heterogeneity to donate to charities, and relatively strong preference for Feeding America and

National Forest Foundation relative to other charities. We expect that a donation to the Against Malaria Foundation to be less preferable. Second, Penn et al. (2023) showed consistent evidence of hypothetical bias; the opt-out rate was higher in the incentivized elicitation for all charities used compared with hypothetical donation choices.

We used an efficient design in Ngene using priors collected from a pilot data collection period. The final design was constrained such that a 0% chance of winning and no match (i.e., 0) must be presented jointly, which is a standard donation decision without any chance of match. The final design featured 36 choice sets, blocked into six groups of six.

Each choice set is a binary choice of whether to donate to the charity shown, with each respondent completing six choice sets. The survey was collected via an online Qualtrics panel in Spring 2022. Respondents were randomly assigned to either 1) a within-respondent experimental design, first completing six hypothetical choice sets, then the same six as incentivized/binding or 2) a incentivized-only DCE. All respondents received $5 in additional compensation at the beginning of the survey, enabling a incentivized DCE.

- To aid participant comprehension, we provided a two-minute video[1] to explain the attributes and levels of the DCE information (Lim, et al., 2020).
    - A separate video was created for the incentivized DCE. This video explained that one of the participant's decisions in the incentivized DCE will be binding, meaning that if they donated, the corresponding amount will be subtracted from their $5 participation incentive. It also provided an example of the potential outcomes for the randomly selected, binding choice set.

[1] https://youtu.be/NjBWN_U9SrM

- Participants had to confirm they understood they were making a incentivized donation decision before answering the incentivized choice sets.
- These protocols increase the salience of the incentivized tradeoffs of the respondent's decisions.
- This was validated both by individual interviews and focus groups as well as by comprehension check questions embedded in the survey after the instructions and just prior to the DCE choice sets.

After completing the six incentivized choice sets, one is randomly selected as the binding scenario. If the respondent chose to donate in that choice set, the contribution amount indicated in the choice is subtracted from their $5 compensation. If the binding choice set featured a chance to winning a matching amount, then a random number generator determined if they win the lottery. If so, the additional funds are donated to the charity.[2]

Methods

Econometric Approach

All models assume that the utility respondent *i* receives in choice *t* is a function of income and expected donations, as illustrated below:

$$U_{it} = V_I(I_{it}) + V_D(D_{it}) = V_I(5 - C_{it}) + V_D(C_{it}, P_{it}, M_{it}), \quad (1)$$

Where I_{it} = survey income, D_{it} = the expected charitable donation, C_{it} = respondent contribution, P_{it} = the probability of a matching donation, and M_{it} = size of the matching donation. V_I is utility derived from survey income and V_D is utility derived from charitable

[2] All such donations were made to the three charities in summer 2022.

donations. When making contributions in the context of our survey, income and contribution amount are deterministic. Because the outcome of the match is uncertain, the final donation to the charity entails risk. To model utility for donations, we use an expected utility framework:

$$V_D(C_{it}, P_{it}, M_{it}) = P_{it}*V_D(C_{it}*(1+M_{it})) + (1 - P_{it})* V_D(C_{it}). \quad (2)$$

The total donation is equal to the respondent contribution if a match does not occur (with probability 1 – P) and equals the respondent contribution plus the match if the match does occur (with probability P).

Given this broad framework, our primary interest is in estimating hypothetical bias by examining whether decisions (and underlying preference parameter estimates) differ between hypothetical and incentivized charitable contribution choices (Whitehead et al. 2016). We use a series of models that vary both the assumptions regarding marginal utilities for different donation types and the assumptions about the curvature of marginal utilities (or, equivalently, risk preferences).

In all models we estimate a marginal utility (MU) of income, denoted β_I, an MU of expected donations, denoted β_D, and a utility for the alternative-specific constant ASC of the opt-out (i.e. no donation) option. This coefficient is denoted β_{OptOut}. This ASC coefficient controls for any differential preferences beyond income and donation size considerations that impact utility between donating and not donating. While multiple psychological phenomena could be accounted for in this parameter, we will note briefly that this parameter controls for any warm-glow effect (Andreoni 1990; Harbaugh 1998; Nunes and Schokkaert 2003). As a result, the utility of not donating = $V_I(5) + \beta_{OptOut}$, and increasing levels of the warm-glow effect would indicate decreasing values of β_{OptOut}, or $\frac{\partial \beta_{OptOut}}{\partial (Warm\ Glow)} < 0$.

In all models, we allow each of these parameters (β_I, β_D, and β_{OptOut}) to differ for incentivized versus hypothetical choices. In the results that follow we consider four models that differ along two dimensions: their assumptions regarding curvature of the utility function and their assumptions about heterogeneity of preferences by charity. Regarding utility curvature assumptions, models that impose linear utility (i.e., risk neutrality) in income and expected donations are defined using the equation below:

$$V(C_{it}, P_{it}, M_{it}) = \beta_I * (5 - C_{it}) + \beta_D * \left(P_{it} * \left(C_{it} * (1 + M_{it})\right) + (1 - P_{it}) * C_{it}\right) + \beta_{OptOut} * I(Donation = 0), \quad (3)$$

Where I(Donation = 0) is an indicator for the opt-out option. This simplifies to

$$V(C_{it}, P_{it}, M_{it}) = \beta_I * (5 - C_{it}) + \beta_D * (C_{it} + C_{it} * P_{it} * M_{it}) + \beta_{OptOut} * I(Donation = 0). \quad (4)$$

Models that do not impose linear utility instead allow for constant relative risk aversion (CRRA) utility using the functional form below:

$$V(C_{it}, P_{it}, M_{it}) = \frac{[\beta_I * (5 - C)]^{1-\alpha}}{1-\alpha} + \frac{[\beta_D * (C_{it} + C_{it} * P_{it} * M_{it})]^{1-\alpha}}{1-\alpha} + \beta_{OptOut} * I(Donation = 0) \quad (5)$$

These models additionally estimate the CRRA parameter α. Linear (risk neutral) utility is nested within this more flexible functional form when α = 0.

Our second variation across models involves their handling of preference heterogeneity by charity. When our models do not allow for this heterogeneity, they estimate a single coefficient for each parameter (Income, expected donation, opt-out ASC, and sometimes CRRA coefficient) for each decision type (incentivized vs. hypothetical). Models that allow for preference heterogeneity by charity estimate separate parameters for choices involving different charities for all parameters save income, which is akin to assuming that the marginal utility of income cannot differ by the prospective charity one is considering, an assumption we believe is suitable for our context. Table 1 present a summary of the parameters estimated across our four model specifications.

Welfare and Hypothetical Bias Estimates

One metric to estimate hypothetical bias is to take the ratio of the marginal utility of expected donations with the marginal utility of income and compare these ratios for incentivized and hypothetical choices. This ration is akin to a marginal WTP for additional expected donations, and our expectation is that, in the presence of hypothetical bias, this ratio will be larger for hypothetical choices. This is based on the assumption that the marginal utility of income is constant regardless of whether choices are incentivized or hypothetical. This is different than asserting that coefficient estimates of the marginal utility of income are equal. Differences in coefficient estimates can represent differences in error variance in addition to differences in preferences. However, taking the ratio of two coefficients produces an estimate that is independent of scale or error variance, and so for this estimate comparisons between ratios are not confounded by differences in error variance.

For each model, we can additionally estimate compensating variation, or total willingness-to-pay, for a specified expected donation (Hanemann 1984). This is straightforward for risk neutral models, but more complicated for CRRA models, so we initially define the general approach then highlight how the calculation differs based on model specifics. Consider V(I, D), where I is income and D is the expected donation. Given that initial income from completing the survey is \$5 and comparing a donation of X dollars to no donation, WTP solves

$$\int_{5-WTP}^{5} V_I(5,0) = V(5,X) - V(5,0) \quad (6)$$

Here, $V_I(5,0)$ represents the derivative of the utility function with respect to income when expected donations are zero.[3] In this formulation, the left-hand side of the equation reflects the change in utility a respondent experiences when they decrease their income by WTP. The right-hand side of the equation reflects the *ceteris paribus* increase in utility that results from a donation of expected size X. Essentially, WTP captures the change in income that counterbalances the change in utility resulting from an expected donation of X dollars.

When imposing risk neutrality, utility is defined by Equation (4) which simplifies to the standard[4] compensating variation formula:

$$\text{WTP} = \frac{(V_D - V_{SQ})}{\beta_I} = \frac{\beta_D * X - \beta_{OptOut}}{\beta_I}, \tag{7}$$

Where V_D and V_{SQ} are the estimated utilities of the donation and status-quo or opt-out alternatives, respectively. When using CRRA utility as defined in Equation (5), compensating variation simplifies to:

$$\text{WTP} = 5 - \frac{[(1-\alpha)\beta_{OptOut} + (\beta_I * 5)^{1-\alpha} - (\beta_D * X)^{1-\alpha}]^{1/_{1-\alpha}}}{\beta_I}. \tag{8}$$

Results

Summary Statistics

Table 2 presents the percentage of respondents who chose to donate for different contribution amounts. Our pooled data are monotonically decreasing in selecting to donate as the contribution

[3] This last point of specifying the starting value of D is largely irrelevant for our model, as it only impacts welfare estimates when utility for income and donations are not additively separable, or more generally $V_{ID} \neq 0$, which is not the case in our models. However, we include the point for the sake of completeness.

[4] Normally, compensating variation is given by the negative of Equation (7), but this is because the coefficient in the denominator typically represents the marginal utility of a price change, and so is the negative of the marginal utility of income that we are estimating.

level increases, a finding that is pleasantly surprising given the very small range of contributions ($1-5). When separating choices by charity, we find that monotonicity largely holds as well, though some mild violations appear. These violations are concentrated in hypothetical responses (both for Feeding America and Against Malaria Foundation), though there is a mild violation in incentivized responses for the Against Malaria Foundation. We also observe evidence of hypothetical bias, with the pooled-charity opt-in rates being roughly 16-20 percentage points higher in the hypothetical choice sets compared to the incentivized choice sets.

Model Results

Table 3 presents the parameter estimates from our models. Keeping in mind our 2x2 model variation design, we have four main models of interest, each corresponding to a column in the table:

I. Risk Neutral: All MUs are linear; Single MU for all donations
II. Risk Neutral: Different MUs for each charity except for MU income
III. CRRA utility: Single MU for all charities
IV. CRRA utility: Different MUs for each charity except for MU income

We first outline our general findings, several of which match expectations and previous work in this area. Across models we find the marginal utility of income and the marginal utility of donations to be positive and statistically significant. We further find in all models that the marginal utility of income exceeds the marginal utility of a donation under both the incentivized and hypothetical treatment, which is as one would expect. We also find that, when the assumption of risk neutrality is relaxed, our data suggests respondents exhibit mild but statistically significant risk aversion, indicated by a positive CRRA parameter.

Our evidence suggests the values respondents place on different charities are markedly different. In our model, these value differences can manifest in two ways. First, the charities could produce different coefficients for their opt-out ASCs. Second, the charities could produce different marginal utilities for increases in expected donation amount. These can be reasonably interpreted as differences on the extensive and intensive margin, respectively. In our data, we find statistically different coefficients[5] for opt-out ASCs by charity, with the Against Malaria Foundation exhibiting larger values (and a stronger preference against donating) than the other charities. Conversely, estimated marginal utilities of additional donations are not statistically different[6] between charities. These findings taken together suggest that our charities produce different utilities (including potentially warm glow) on the extensive margin but carry relatively similar effects on the intensive margin.

Our key findings, however, relate to hypothetical bias. Our models indicate several ways in which incentivized responses differ from their hypothetical counterparts. First, across all models, coefficients for opt-out ASCs are consistently larger in incentivized decisions compared with equivalent hypothetical decisions, indicating a greater hesitancy to donate when incentivized money is on the line. We additionally find greater levels of risk aversion, or concavity of the utility function, for incentivized choices illustrated by a larger CRRA parameter estimate. Considering the model from Column III of Table 2, tests with null hypothesis of equal CRRA parameter estimates for incentivized vs. hypothetical choices produce a p value of 0.045.

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[5] Considering incentivized choices in the model from Column II of Table 2, tests with null hypotheses of equality of ASC coefficients for Feed America vs. National Forest Foundation, Feed America vs. Against Malaria Foundation, and National Forest Foundation vs. Against Malaria Foundation produce p-values of 0.817, < 0.005, and < 0.005 respectively.

[6] Considering incentivized choices in the model from Column II of Table 2, tests with null hypotheses of equality of expected donation coefficients for Feed America vs. National Forest Foundation, Feed America vs. Against Malaria Foundation, and National Forest Foundation vs. Against Malaria Foundation produce p values of 0.433, 0.535, and 0.092 respectively.

Marginal utilities of expected donations are higher for hypothetical choices (again, across all models). This is suggestive of hypothetical bias, but the same is true for estimates of the marginal utility of income (hypothetical estimates exceed incentivized estimates). As a result, it is hard to draw conclusions about how the magnitude of hypothetical bias changes without a deeper examination of the models.

Our more nuanced analyses of hypothetical bias appear in Table 4. This table provides three main estimates of interest. First, we take the ratio of the marginal utility of expected donations with the marginal utility of income and compare these ratios for incentivized and hypothetical choices. This ratio is larger for hypothetical choices, indicating hypothetical bias in all our models. Further, statistical tests indicate that this difference is statistically significant, with a null hypothesis of equal ratios yielding a p-value of 0.010 for the model in column I (standard errors generated using the delta method).

Table 4 also displays the results of our welfare estimates. Using Equation (7) for our models in Columns I and II and Equation (8) for our models in Columns III and IV, we estimate average respondent WTP for an expected donation of $5, with Columns I and III showing the average using models that do not estimate separate charity effects and Columns II and IV showing charity-specific estimates. Comparisons from all models indicate hypothetical bias, which is best highlighted by the last section of Table 4: the ratio of hypothetical WTP and incentivized WTP, often referred to as the calibration factor. When charities are pooled and risk neutrality is assumed (Column I), this ratio is about 2.25, in line with much of the literature on hypothetical bias (Penn and Hu, 2018; Murphy et al. 2005). However, Column II shows that this average masks substantial heterogeneity in hypothetical bias by charity. In our application, there is a clear trendline between the incentivized valuation of the donation and the level of hypothetical bias, with more highly valued goods exhibiting lower levels of hypothetical bias. Bias here ranges from a modest 1.53 for Feed America to 7.49 for the Against Malaria Foundation.[7]

As a final point, when comparing hypothetical bias between risk neutral and CRRA models (specifically, Columns I and III), we find lower hypothetical bias in the CRRA model. The reason for this finding in our data lies in differences in the CRRA parameter between incentivized and hypothetical treatments. We find larger CRRA parameters, implying greater curvature of the utility function, for incentivized decisions, aligning with previous experimental work on this topic (Holt and Laury 2002; 2005). Specifically, we find a CRRA parameter of 0.180 for incentivized decisions compare to 0.067 for hypothetical decisions. Greater curvature results in a higher incentivized WTP in our application and translates to a decrease in the Hypothetical/Incentivized ratio from 2.25 to 2.[8] This is suggestive that hypothetical bias in standard choice experiment valuations (which typically assume linear utility) can potentially be decomposed into two sources. First and more thoroughly studied, bias enters through the over-estimation of the value of the good (and/or underestimation of the value of price/income) in hypothetical decisions relative to comparable incentivized-world situations. Second, our data suggests that some bias can also be attributed to different degrees of risk aversion as shown by different utility curvature between hypothetical and incentivized decisions; respondents exhibit greater risk aversion in incentivized decisions compared with hypothetical counterparts.

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[7] These differences are exacerbated by the ratio nature of the estimate, but the same pattern exists if one estimates hypothetical bias as the absolute differences in WTP between hypothetical and incentivized treatments. In this case, hypothetical bias from Column II of Table 3 would be $1.88, $2.40, and $3.20 for Feeding America, National Forest Foundation, and Against Malaria Foundation, respectively.

[8] This directionality may be due to the fact that the good chosen for our WTP estimate, a $5 donation, is on the high end of donations (and contribution levels) considered in our survey. This same increased curvature could simultaneously lead to lower estimates of incentivized WTP for smaller goods (such as a $2 donation), leading to a finding where the linear utility assumption leads to over-estimates of hypothetical bias for more valuable goods and an underestimate for less valuable goods.

Conclusion

This paper uses data from an online survey in which respondents were presented with a mix of hypothetical and incentivized charitable donation decisions. Donation decisions involved both an amount contributed by the respondent as well as a potential matched contribution from the experimenter, which varied in the probability of being provided and in magnitude. This variation allows us to estimate WTP for expected donations under both incentivized and hypothetical scenarios. The main goal of this work is to analyze how variations in model assumptions alter the level of HB we estimate from our data. We focus on comparing models that pool charities together with models that estimate different parameter values for different charities as well as models that impose linear utility with models that allow for utility curvature under a CRRA framework.

We find evidence of HB in all models, though there is significant variation between models. When parameters are allowed to differ by charity, we find the greatest levels of HB for charities that are perceived by respondents as the least valued. We also observe a decrease in HB (through reductions in the ratio of hypothetical and incentivized WTP for a donation) in models that allow for CRRA utility. This is due to greater estimated levels of risk aversion in incentivized choices compared to their hypothetical counterparts, though in both cases risk aversion is fairly mild as one might expect for relatively small stakes donation decisions. These findings support our hypothesis that HB may be due to both variations in preference and risk aversion exhibited in incentivized and hypothetical choice experiments.

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Tables

Table 1: Breakdown of Parameters Estimated in Each Model

Parameter	Model I	Model II	Model III	Model IV
β_I	Incentivized Hypothetical	Incentivized – Feed Incentivized – Forest Incentivized – Malaria Hypothetical – Feed Hypothetical – Forest Hypothetical – Malaria	Incentivized Hypothetical	Incentivized – Feed Incentivized – Forest Incentivized – Malaria Hypothetical – Feed Hypothetical – Forest Hypothetical – Malaria
β_D	Incentivized Hypothetical	Incentivized – Feed Incentivized – Forest Incentivized – Malaria Hypothetical – Feed Hypothetical – Forest Hypothetical – Malaria	Incentivized Hypothetical	Incentivized – Feed Incentivized – Forest Incentivized – Malaria Hypothetical – Feed Hypothetical – Forest Hypothetical – Malaria
β_{OptOut}	Incentivized Hypothetical	Incentivized – Feed Incentivized – Forest Incentivized – Malaria Hypothetical – Feed Hypothetical – Forest Hypothetical – Malaria	Incentivized Hypothetical	Incentivized – Feed Incentivized – Forest Incentivized – Malaria Hypothetical – Feed Hypothetical – Forest Hypothetical – Malaria
α	None ($\alpha = 0$)	None ($\alpha = 0$)	Incentivized Hypothetical	Incentivized – Feed Incentivized – Forest Incentivized – Malaria Hypothetical – Feed Hypothetical – Forest Hypothetical – Malaria

Notes: Incentivized indicates choices that are incentivized; Hypothetical indicates choices that are hypothetical; Feed indicates choices that involve the charity Feeding America; Forest indicates choices that involve the charity National Forest Foundation; Malaria indicates choices that involve the charity Against Malaria Foundation.

Table 2: Percent of Respondents who Donate by Charity, Donation Size, and Treatment

		Feeding America	National Forest Foundation	Against Malaria Foundation	All Charities
$1 Contribution	Incentivized	52.19% (502)	52.78% (523)	39.01% (523)	47.93% (1,548)
$3 Contribution		52.01% (523)	47.42% (523)	32.47% (502)	44.12% (1,548)
$5 Contribution		47.80% (523)	43.23% (502)	34.99% (523)	41.99% (1,548)
$1 Contribution	Hypothetical	65.00% (300)	70.82% (305)	56.57% (297)	64.19% (902)
$3 Contribution		70.16% (305)	65.99% (297)	50.67% (300)	62.31% (902)
$5 Contribution		66.33% (297)	63.00% (300)	50.82% (305)	59.98% (902)
	Treatment	Feeding America	National Forest Foundation	Against Malaria Foundation	All Charities
$1 Contribution	Incentivized	52.19% (502)	52.78% (523)	39.01% (523)	47.93% (1,548)
$3 Contribution		52.01% (523)	47.42% (523)	32.47% (502)	44.12% (1,548)
$5 Contribution		47.80% (523)	43.23% (502)	34.99% (523)	41.99% (1,548)
$1 Contribution	Hypothetical	65.00% (300)	70.82% (305)	56.57% (297)	64.19% (902)
$3 Contribution		70.16% (305)	65.99% (297)	50.67% (300)	62.31% (902)
$5 Contribution		66.33% (297)	63.00% (300)	50.82% (305)	59.98% (902)

Notes: Total number of choices for each cell are in parentheses.

Table 3: Parameter Estimates

			I	II	III	IV
Income	Incentivized		0.186*** (0.034)	0.206*** (0.034)	0.141*** (0.039)	0.162*** (0.039)
	Hypothetical		0.377*** (0.052)	0.414*** (0.054)	0.369*** (0.054)	0.407*** (0.057)
Expected Donation	Incentivized	Feed		0.112*** (0.031)		0.105*** (0.029)
		Forest	0.095*** (0.023)	0.085*** (0.027)	0.085*** (0.027)	0.087*** (0.027)
		Malaria		0.132*** (0.031)		0.111*** (0.030)
	Hypothetical	Feed		0.327*** (0.051)		0.315*** (0.045)
		Forest	0.252*** (0.038)	0.247*** (0.476)	0.259*** (0.040)	0.269*** (0.046)
		Malaria		0.275*** (0.438)		0.285*** (0.043)
Opt Out	Incentivized	Feed		-0.179 (0.117)		-0.030 (0.067)
		Forest	0.073 (0.069)	-0.143 (0.107)	0.234*** (0.054)	0.114* (0.065)
		Malaria		0.560*** (0.104)		0.631*** (0.070)
	Hypothetical	Feed		-0.636*** (0.171)		-0.688*** (0.093)
		Forest	-0.560*** (0.096)	-0.894*** (0.161)	-0.458*** (0.007)	-0.664*** (0.087)
		Malaria		-0.154 (0.135)		-0.049 (0.087)
CRRA Parameter (α)	Incentivized	Feed				0.087 (0.103)
		Forest			0.180*** (0.053)	0.270*** (0.074)
		Malaria				0.066 (0.112)
	Hypothetical	Feed				-0.027 (0.074)
		Forest			0.067* (0.037)	0.137** (0.069)
		Malaria				0.039 (0.067)
Log-likelihood			-9,335.76	-9,189.92	-9,368.13	-9,225.61

Notes: Standard errors in parentheses. *, **, and *** indicate statistical significance at 90, 95, and 99% levels, respectively.

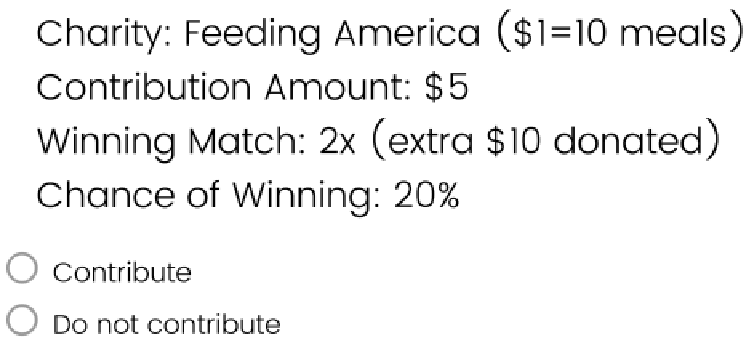
Table 4: Welfare Estimates

			I	**II**	**III**	**IV**
E(Donation)/ Income	Incentivized	Feed	0.509*** [<0.005]	0.540*** [<0.005]	0.605*** [<0.005]	0.644*** [<0.005]
		Forest		0.410** [<0.005]		0.538*** [<0.005]
		Malaria		0.641*** [<0.005]		0.684*** [<0.005]
	Hypothetical	Feed	0.670*** [<0.005]	0.789** [0.019]	0.702*** [<0.005]	0.772*** [<0.005]
		Forest		0.597*** [<0.005]		0.660*** [<0.005]
		Malaria		0.664*** [<0.005]		0.700*** [<0.005]
$5 Donation WTP	Incentivized	Feed	$2.15*** (0.385)	$3.60*** (0.336)	$2.36*** (0.413)	$3.68*** (0.381)
		Forest		$2.74*** (0.338)		$3.27*** (0.307)
		Malaria		$0.49 (0.626)		-$0.079 (0.997)
	Hypothetical	Feed	$4.84*** (0.236)	$5.48*** (0.319)	$4.84*** (0.195)	$5.57*** (0.434)
		Forest		$5.14*** (0.286)		$5.023*** (0.161)
		Malaria		$3.69*** (0.214)		$3.736*** (0.220)
$5 Donation Hypothetical/ Incentivized Ratio		Feed	2.247*** [<0.005]	1.53*** [<0.005]	2.05*** [<0.005]	1.52*** [<0.005]
		Forest		2.88*** [<0.005]		1.54*** [<0.005]
		Malaria		7.49 [0.491]		-47.03 [0.935]

Notes: E(Donation)/Income reports the ratio of the estimated MUs for expected donation and income. Standard errors in parentheses. Values in brackets are p-values for tests with null hypothesis that the estimate = 1.

Figures

Figure 1: Example choice set


Charity: Feeding America ($1=10 meals)
Contribution Amount: $5
Winning Match: 2x (extra $10 donated)
Chance of Winning: 20%

- ○ Contribute
- ○ Do not contribute