Decomposing Altruism: An Experiment to Quantify Warm Glow by Demographic Group.

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Abstract

I conduct an on-line experiment to decompose giving in a dictator game into amounts motivated by pure altruism and amounts motivated by warm glow. By manipulating the price of benefit to the recipient while holding the price of the act of giving constant, I estimate values for a coefficient of altruism α, as defined in Andreoni (1989). I find significant evidence of both pure altruism and warm glow as motivations for giving. The fraction of amounts sent to an anonymous recipient that are motivated by warm glow is increasing in age of the dictator and decreasing in dictator's income. Female subjects are not sensitive to price suggesting they are mostly motivated by warm glow rather than pure altruism, while male subjects demonstrate the opposite behavior.

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"How selfish soever man may be supposed, there are evidently some principles in his nature which interest him in the fortune of others and render their happiness necessary to him though he derives nothing from it except the pleasure of seeing it"

Adam Smith, The Theory of Moral Sentiments

"It is not from the benevolence of the butcher, the brewer, or the baker, that we can expect our dinner, but from their regard to their own interest"

Adam Smith, The Wealth of Nations

1. Introduction

In this paper, I apply a novel analysis technique to experimental data from a dictator game conducted over the internet to decompose giving into its altruistic and egoistic components, thus allowing a direct measurement of the warm glow effect, quantified as α (Andreoni 1989). I find α separately for demographic groups based on self-reported responses to an exit survey, which allows a comparison of altruistic versus egoistic motivations in giving based on age, gender, marital status, income, and having children.

In economic experiments, subjects routinely choose not to maximize their payoffs. In prisoners' dilemmas, subjects frequently cooperate (Doebeli and Hauert 2005). In public goods games, subjects often contribute (Zelmer 2003). The simplest example of this behavior is seen in the dictator game. In the dictator game, one subject is given an amount of money and then allowed to send any portion of that amount to another subject. The Nash equilibrium is to send nothing. While it is true that many subjects do keep all the money, many do not. A significant fraction of subjects sends positive amounts (Engel 2011). Traditional, neo-classical economic theory presents man as a rational, maximizing agent, motivated solely by material rewards to self. This interpretation of human action does model economic behavior well in many circumstances. However, in addition to failing to account for a wide variety of results in

economic experiments, it does not explain large portions of economic activity seen in the real world.

Addressing this gap in our understanding, Andreoni (1989) developed an impure altruism model of giving that included two distinct forms of other-regarding preferences. He proposed that giving could be motivated by pure altruism where the giver derives utility from the benefit the gift provides to the recipient, and by pure egoism where the giver derives utility from the act of giving itself independent of its impact on the recipient; calling this latter effect pure egoism or warm glow. That paper also proposed an index of pure altruism α_i such that:

$$\alpha_i = \frac{f_{ia}}{f_{ia} + f_{ie}} \tag{1}$$

Where f_{ia} is the amount given by person *i* that is motivated by pure altruism and f_{ie} is the amount given person *i* that is motivated by warm glow (Ibid., p.1452)

Several prior studies have tested for the existence of warm glow and pure altruism as motivations for giving, but few have attempted to quantify the effect and to the author's knowledge none have developed values for Andreoni's α by demographic group. Research addressing warm glow frequently takes the perspective of giving in a public goods context. An example of this is Palfrey and Prisbrey (1997) which uses a public goods game with variable private values. They find evidence of a small warm glow effect, but no significant evidence of pure altruism. By contrast and also in the context of a public goods game, Goeree, Holt, and Laury (2002) find statistically significant evidence of altruism but reject warm glow as a causal factor in subject behavior. Crumpler and Grossman (2008) use a simple and innovative design where subjects can give to a charity, but with a perfect crowding out effect. Any amount given by the subject reduced by an equal amount a donation given to the charity by the experimenter.

Knowing that their contributions would not alter the amount received by the charity, 57% of subjects still made a positive contribution. Across all subjects, contributions averaged 20% of their endowments which is strong evidence of warm glow as a motivation. Lilley and Slonim (2014) examined warm glow giving in a study of the volunteering puzzle, where people donate time to charities even when donating the wage equivalent sum of money is more efficient. They find evidence of a mixture of pure altruism and warm glow as motivating factors in charitable contribution and estimate between 15.5% and 21% of amounts donated were motivated by warm glow. Tonin and Vlassopoulos (2010) find a demographic difference in giving motivation with warm glow being a significant factor for women but not for men, and for neither gender do they find evidence of pure altruism.

The remainder of this paper is organized as follows. The next section presents the theoretical model of giving. Section 3 describes the experimental design. Section 4 reviews results. Section 5 is discussion, and section 6 concludes.

2. Model

I differentiate between giving motivated by benefit to the recipient and giving motivated by benefit to the giver by varying their relative prices. If I observe dictators sending the same amount of money regardless of how much I as experimenter multiply it, then I can conclude that they are motivated by the constant price of the act of giving and not by the varying price of benefit to the recipient.

Assume a dictator i has an endowment y_i and utility function $u_i = f(x_i, z_i, z_j)$ where $x_i \in [X|0 \leq x_i \leq y_i]$ is the portion of y_i retained, $z_i \in [Z_i|z_i = y_i - x_i]$ is the amount sent to another subject j, and given multiplication factor μ, $z_j \in [Z_j|z_j = \mu z_i]$ is the amount received by

subject j. Also assume $\mu = 1$. The choice of z_i may be motivated by the welfare of the recipient entering directly into the utility function of the dictator z_i; utility from the act of giving unrelated to the welfare of the recipient z_j; or a mixture of the two motives, balanced against the amount retained x_i. Now, assume that for an amount z_i sent by the same dictator, an anonymous recipient will receive $z_j = \mu z_i$ where $\mu > 1$. If the dictator is motivated by $x_i$and z_j, then the dictator will reallocate towards z_j and away from x_i compared to the prior case where $\mu = 1$. However, if the dictator receives utility from z_i but not from z_j then no reallocation will occur. By observing the extent to which subjects vary z_i as a function of μ , I can infer the relative contributions to utility from both z_i and z_j.

I implement this analysis through a series of regressions, performing a separate regression for each of five demographic categories: age, gender, marital status, income, and having children. Each regression takes the form shown in equation 2, where x_i is the amount retained, μ is the value of the multiplier, and D_i is the demographic indicator. The initial endowment is \$1.00, so $1 - x_i$ is the amount sent by dictator i.

$$(1 - x_i) = \hat{\beta}_0 + \hat{\beta}_1 \mu + \hat{\beta}_2 D_i + \hat{\beta}_3 \mu D_i + \epsilon_i \qquad (2)$$

For a given demographic indicator, the estimate of the amount sent that does not vary as a function of the multiplication factor is $\hat{\beta}_0 + \hat{\beta}_2 D_i$. This is the portion of $1 - x_i$ that was motivated by factors unrelated to the benefit of the recipient and so is the isolated influence of warm glow. $\hat{\beta}_1 \mu + \hat{\beta}_3 \mu D_i$ represent the portion of of the amount sent that was motivated by the benefit of the recipient, and so is the isolated influence of pure altruism. Andreoni's α can then be calculated by setting $\mu = 1$ and substituting $\hat{\beta}_0 + \hat{\beta}_2 D_i$ and $\hat{\beta}_1 \mu + \hat{\beta}_3 \mu D_i$ into equation 1 yielding

$$\alpha_i = \frac{\hat{\beta}_1 + \hat{\beta}_3 D_i}{\hat{\beta}_0 + \hat{\beta}_2 D_i + \hat{\beta}_1 + \hat{\beta}_3 D_i} \tag{3}$$

In addition to the demographic specific regressions, I run one simple regression on the entire data set as shown in equation 4. This provides the full sample values of amount sent motivated by warm glow $\hat{\beta}_0$ and amount sent motivated by pure altruism $\hat{\beta}_1 \mu$.

$$(1 - x_i) = \hat{\beta}_0 + \hat{\beta}_1 \mu + \epsilon_i \tag{4}$$

For each demographic group, I test two hypotheses:

1a.) There is evidence of warm glow in the demographic group.

$$H_1: \beta_0 + \beta_2 > 0$$

$$H_0: \beta_0 + \beta_2 \leq 0$$

2a.) There is evidence of pure altruism in the demographic group.

$$H_1: \beta_1 + \beta_3 > 0$$

$$H_0: \beta_1 + \beta_3 \leq 0$$

For the sample as a whole, I test the equivalent hypotheses:

1b.) There is evidence of warm glow.

$$H_1: \beta_0 > 0$$

$$H_0: \beta_0 \leq 0$$

2b.) There is evidence of pure altruism.

$$H_1: \beta_1 > 0$$

$$H_0: \beta_1 \leq 0$$

3. Experiment Design

3.1. Treatments

The general form of the experiment is a dictator game with a variable multiplication factor increasing or decreasing the amount received across subjects for a given amount sent. Dictators receive an initial endowment of $1.00 and are instructed that they may send some, all, or none of the endowment to a randomly selected subject in another group. Amounts sent are multiplied by one of four randomly selected multiplication factors $\mu \in \{0.5, 1, 3, 6\}$. Subjects in treatment levels 0.5, 1, and 6 are informed that the amount sent will be multiplied by that amount and a table of examples is displayed. Multiplication factor is not mentioned in the $\mu = 1$ treatment level group. Instructions as seen by subjects is included in appendix A.

Prior to starting the experiment, prospective subjects are asked to solve $x = 5 - 3$ posed as a word problem: *"You have a basket containing five apples. You eat one apple and sell two apples. How many apples are now in your basket?"* This question serves to prevent automated scripts from entering the experiment, similar in function to CAPTCHA[1] codes seen on websites where automated spam is a concern. Subjects are not allowed to enter the experiment without entering the correct answer. Next, subjects are shown instructions followed by a question to test understanding. After answering the understanding question, subjects are shown the correct answer with an explanation of why it is correct. Unlike the automated script filter question, subjects are allowed to proceed to the main body of the experiment regardless of whether they answered the understanding question correctly or incorrectly. After entering the amount they wish to send to a randomly paired subject in a second group, subjects are presented with an exit

[1] Information and examples of the use of CAPTCHA systems is available at https://www.google.com/recaptcha/intro/index.html.

questionnaire which collects basic demographic data. They are also invited to add an unstructured message to the experimenter about any technical difficulty encountered in the experiment or anything else they wish to share. They are then shown their payoffs and the experiment concludes. For reasons discussed in the next section, subjects in the recipient group are recruited in a separate asynchronous session.

3.2. Infrastructure

The design described in the previous section was conducted over the internet using two main technologies.

3.2.1. oTree

oTree (Chen, Schonger, and Wickens 2016) is a software platform that allows multi-player decision experiments to be conducted over the internet. oTree experiments are coded in Python and use the Django web framework.[2] Experiment development is done locally then uploaded to a remote web server along with the oTree supporting files. I used the commercial web hosting company Heroku[3] for hosting services. After server deployment, experiments are run through a web-based administrative interface. Since the experiment runs on a remote web server, subjects can enter the experiment from any location. Participation is not limited to any particular operating system or device form factor. All that is required is a browser with internet access.

Python, the language used to code oTree experiments, is a popular general purpose computer language which is well suited and commonly used for web development. It has the added advantage of being user friendly and relatively easy to learn. oTree uses Python on top of

[2] Technical details of Django can be found at https://www.djangoproject.com/.
[3] Technical details of Heroku can be found at https://www.heroku.com/.

the Django web framework[4]. However, Django is designed for professional level web development and requires a commensurate level of technical knowledge to navigate. Also, prospective users of oTree should be aware that as of this writing it is still under development and so should be considered a work in progress.

3.2.2. Mechanical Turk

Subject recruitment and payment was done through the Mechanical Turk micro-employment website. Mechanical Turk is an Amazon service which allows workers to perform small tasks for modest compensation. In Mechanical Turk terminology, a task is a Human Intelligence Task or HIT. Employers, called Requesters, register with the service and deposit funds to pay workers to perform HITs. Typical HITs are things that are very easy for a human to do but very difficult to automate, such as identifying objectionable content in user generated web posts or classifying photographs by subject. Thus, the Mechanical Turk marketing phrase *"Artificial, artificial intelligence"*.

The experiment is posted to Mechanical Turk as a HIT using IRB approved advertisement language. Workers who wish to participate accept the HIT and are transferred to the experiment website. After completing the experiment, subjects are returned to the Mechanical Turk website and are free to proceed to their next chosen HIT. Since there is no face to face interaction between requester and worker, automated scripts deployed to accept HITs and input random responses to generate payments are a possibility. It is for this reason that the script filtering question discussed in the previous section is a wise precaution. It has the added advantage of screening out persons who enter random responses, essentially mashing the keyboard in an attempt to receive payment with minimum time and effort. Interaction between

[4] A web framework is a collection of functions that automate common development tasks.

dictators and recipients are done asynchronously. All dictators make their choices of how much to send, then at a later time a second group of Mechanical Turk workers is recruited as passive recipients. Participants in the dictator group are ineligible to participate in the recipient group. Since the information flow is only from dictator to recipient, the small time delay this method imposes between money sent and money received should not bias dictator choices. This method was chosen due to a peculiarity of Mechanical Turk. After posting a HIT, workers see and accept the HIT with a variable delay of between a few seconds and a few minutes, depending on the number of workers searching for HITs at the time. If after having accepted the HIT, workers were paired with another worker, then whichever worker was the first of the pair to arrive would be unable to proceed into the experiment until the next worker accepted the HIT and completed the pair. If the rate of arrival exceeds a few seconds, workers with higher levels of impatience may preferentially return the HIT or otherwise exit believing that the wait may be excessive or that the HIT is malfunctioning. This could initiate a cascade of workers being unable to be paired in a reasonable amount of time causing the experiment to fail. Experiments have been run successfully on Mechanical Turk using real-time interaction between group members (Mayo, McCabe, and Kreuger 2016), but this issue must be taken into consideration in experiment design.

3.3. Sample and randomization

No personally identifying information is passed from worker to requester other than a unique Mechanical Turk worker identification number. Amazon securely stores workers' personal information including financial information required to process payments. This simplifies experimenter record keeping and ensures subject privacy, but also raises the possibility of workers attempting to participate in the experiment repeatedly. Through the oTree

API, a worker qualification can be set. This tells Mechanical Turk that the requester only wants the HIT to be accessible by workers who meet certain criteria. The two criteria used in this experiment were that the worker must reside in the United States and not have previously participated in the experiment. Amazon verifies workers' country of residence by requiring payments to workers claiming United States residence be deposited electronically to a United States bank account. The association between bank account and worker ID number also restricts the ability of one worker holding more than one Mechanical Turk worker account. Amazon also uses proprietary methods of fraud control not publicly disclosed.

Workers are not able to access any information about the content of the experiment prior to accepting the HIT assignment, other than IRB risk disclosure and a description of the HIT as an academic experiment in decision making. Therefore there is little reason to suspect significant bias in results caused by self selection into the experiment. The on-line environment does, however, raise methodological questions about the external validity of experiments conducted without substantial control of subjects' environments. In addition, stakes in on-line experiments using Mechanical Turk can be an order of magnitude lower than the same experiment would require if conducted in an in-person laboratory setting. Amir, Rand, and Gal (2012) studied both of these issues by replicating a series of classic economic experiments in an on-line environment and found no significant difference between the behavior of on-line and in-person subjects. Fortuitously, the stakes studied in the on-line treatments were the same as used in this experiment, $1.00.

Another issue of potential concern is the demographic composition of the subject pool and how it may differ from the demographics of subjects available for in-person experimentation in ways that might call into question the generalizability of results. Berinsky, Huber, and Lenz

(2012) examined the demographics of Mechanical Turk workers who participated in experiments and found the distribution to be closer to that of the United States population than is found in subjects reported in a group of studies published in major political science journals.

4. Results

4.1. Summary statistics

The experiment was run over four consecutive weekdays. 279 Mechanical Turk workers accepted the HIT and 223 completed the experiment giving a dropout rate of 20.1%. This dropout rate is quite high when compared to the typical in-person laboratory experiment, but is actually quite good for on-line experiments. Dropout rates of over 50% are not uncommon in on-line experiments (Dandurand, Shultz, and Onishi 2008). This is understandable given the lack of social sanction for exiting an experiment prematurely by simply closing a browser window.

The sample has a mean age of 35 and has reasonable gender balance at 60% male and 40% female. Mean income is $48,000 per year. 32% of the sample is married and 24% have children. A full demographic breakdown in shown in table 1. The mean amount sent by dictators in the full sample and by demographic group is shown in table 2.

Table 1. Summary statistics by demographic group.

Variable	Obs	Mean	Std. Dev.	Min	Max
Age	223	35.41	10.65	19	76
Female	223	0.40	0.49	--	--
Income in $1,000's	223	48.00	28.95	5	105
Married	223	0.32	0.47	--	--
Has children	223	0.24	0.43	--	--
Number of children	223	0.44	0.91	0	4
Household size	223	2.44	1.30	1	6

Table 2. Amounts sent by multiplier and demographic group.

Group	Multiplier			
	0.5	1	3	6
Full sample	0.12	0.23	0.22	0.41
	(0.23)	(0.23)	(0.30)	(0.40)
	[54]	[44]	[68]	[57]
Male	0.02	0.22	0.18	0.43
	(0.09)	(0.23)	(0.30)	(0.41)
	[32]	[28]	[36]	[38]
Female	0.27	0.25	0.27	0.39
	(0.29)	(0.23)	(0.30)	(0.40)
	[22]	[16]	[32]	[19]
Age < 40	0.08	0.23	0.22	0.40
	(0.18)	(0.23)	(0.30)	(0.40)
	[45]	[35]	[59]	[34]
Age > 40	0.31	0.24	0.26	0.43
	(0.36)	(0.22)	(0.34)	(0.41)
	[9]	[9]	[9]	[23]
Income < 40k	0.19	0.28	0.22	0.44
	(0.28)	(0.23)	(0.32)	(0.43)
	[23]	[24]	[30]	[25]
Income > 40k	0.07	0.17	0.23	0.40
	(0.18)	(0.21)	(0.29)	(0.39)
	[31]	[20]	[38]	[32]
Married	0.16	0.27	0.28	0.34
	(0.23)	(0.22)	(0.33)	(0.39)
	[18]	[12]	[23]	[18]
Not married	0.10	0.22	0.19	0.45
	(0.23)	(0.23)	(0.28)	(0.41)
	[36]	[32]	[45]	[39]
Children	0.13	0.26	0.25	0.35
	(0.26)	(0.24)	(0.31)	(0.39)
	[19]	[7]	[18]	[10]
No children	0.12	0.23	0.21	0.43
	(0.21)	(0.23)	(0.30)	(0.41)
	[35]	[37]	[50]	[47]

Standard deviations in parentheses, number of observations in brackets

4.2. Regression results

4.2.1. Full sample

Estimates regressing amount sent on multiplication factor for the full sample are shown in table 3. In this regression, the coefficient on the variable μ represents the effect of changing the price of benefit to the recipient in the dictator's choice of amount to send, while the constant term represents the choice of amount to send that is not a non-constant function of the price. As an example, if the multiplier were zero and so the recipient would receive nothing regardless of the amount sent, then any amount sent must be motivated by factors other than concern for the welfare of the recipient. Given the regression function $\widehat{1-x_i} = 0.121 + 0.046\mu$ where μ is the multiplication factor, when $\mu = 0$ this would be $(1 - x_i) = 0.121$ which is the constant term of the regression. Since both the multiplier and constant term are statistically significant at the 0.1% confidence level, the null hypotheses 1b and 2b can be safely rejected. This confirms the existence of both pure altruism and warm glow in the full sample.

Table 3. The effect of multiplier on amount sent for the full sample.

Variable	Amount sent
Multiplier	0.046^{***}
	(0.010)
Constant	0.121^{***}
	(0.033)
Observations	223

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Analysis of regression results by demographic group are presented in tables 4 – 8 below.

4.2.2. Age

The coefficient on *age* is positive and significant showing that warm glow exists, rejecting the null of hypothesis 1a, and is increasing in age. The interaction term *age* * μ is negative suggesting that pure altruism is decreasing in age, but the result is not statistically significant at the 5% level.

Table 4. The effect of multiplier on amount sent by age.

Variable	Amount sent
Multiplier	0.103**
	(0.034)
Age	0.009**
	(0.004)
Age * Multiplier	-0.002
	(0.001)
Constant	-0.198
	(0.128)
Observations	223

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.2.3. Gender

The coefficient on *female* is positive and significant at the 1% level, indicating that females in the sample are motivated by warm glow more than are males. Conversely, the negative sign on the interaction term *female* * μ suggests that males in the sample are motivated by pure altruism more than are females. The latter result, however, is not statistically significant at the 5% confidence level.

Table 5. The effect of multiplier on amount sent by gender.

Variable	Amount sent
Multiplier	0.060***
	(0.012)
Female	0.180**
	(0.067)
Female * Multiplier	-0.036
	(0.020)
Constant	0.050
	(0.042)
Observations	223

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.2.4. Marital status

The positive coefficient on Married and negative coefficient on Married * Multiplier imply that married subjects are motivated by warm glow more than, and pure altruism less than, unmarried subjects. But in both cases the effect is not statistically significant at the 5% confidence level.

Table 6. The effect of multiplier
on amount sent by marital status.

Variable	Amount sent
Multiplier	0.055***
	(0.012)
Married	0.094
	(0.078)
Married * Multiplier	-0.027
	(0.021)
Constant	0.091*
	(0.040)
Observations	223

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.2.5. Income

There the negative coefficient on *income* provides statistically significant evidence that warm glow as a motivation is decreasing in income. The positive coefficient on *income* * μ suggests that pure altruism is increasing in income, but the effect is not statistically significant at the 5% level.

Table 7. The effect of multiplier
on amount sent by income.

Variable	Amount sent
Multiplier	0.016
	(0.019)
Income	-0.002*
	(0.001)
Income * Multiplier	0.001
	(0.000)
Constant	0.235***
	(0.064)
Observations	223

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.2.6. Children

The coefficients on both Has children and Has children * Multiplier are very far from significant at any reasonable level and so I cannot conclude there is any relationship between motivation for giving and status as a parent.

Table 8. The effect of multiplier
on amount sent by having children.

Variable	Amount sent
Multiplier	0.049***
	(0.011)
Has children	0.026
	(0.076)
Has children* Multiplier	-0.013
	(0.023)
Constant	0.114**
	(0.039)
Observations	223

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.3. Estimates of Andreoni's α

The coefficient of altruism, α has to be calculated in a slightly different fashion for demographic indicators that are coded as dummy variables and those coded as continuous variables. If a demographic indicator is coded as a dummy, for instance Female, then the demographic variable takes the value of 1 and drops out of the calculation. However, if the variable is coded as continuous, for example age, then the value of the age variable must be specified to solve for α. In the table 9 below, I have chosen to calculate α for the two continuous demographic indicators, age and income, for values of 20, 40, 60, 80 and $20,000, $40,000, $60,000, and $80,000 respectively.

The estimate of α across the full sample is 0.28, suggesting that less than 1/3 of giving was motivated by pure altruism. The results suggest that females in the sample are motivated by warm glow to a much greater extent than are males. There is only a small difference in warm glow versus pure altruism when comparing married subjects to unmarried and those with and

without children. There are obvious patterns in α as a function of both age and income. There is a clear increase in α, and so in pure altruism as a motivating factor compared to warm glow, with increasing income of subjects. By contrast, there is an even stronger decline in α with increasing age. This effect is so strong that out of range values are predicted for the two age extremes. For an age of 20, the model predicts a value of α greater than one (1.21) and for an age of 80, the model predicts a value of α that is less than zero (-0.05). Since $\alpha \in [0,1]$, these estimated values may indicate a non-linearity in the data that was not accounted for in the regression.

Table 9. Estimates of coefficient of altruism α by demographic group.

Group	Warm glow $\hat{\beta}_0 + \hat{\beta}_2 D_i$	Pure altruism $\hat{\beta}_1 \mu + \hat{\beta}_3 \mu D_i$	α
Full sample	0.12	0.05	0.28
Males	0.05	0.06	0.55
Females	0.23	0.02	0.09
Married	0.19	0.05	0.23
Single	0.09	0.05	0.38
Children	0.14	0.05	0.26
No children	0.11	0.05	0.30
Income			
$20,000	0.19	0.03	0.13
$40,000	0.14	0.04	0.22
$60,000	0.10	0.05	0.36
$80,000	0.05	0.07	0.58
Age			
20	-0.01	0.07	1.21
40	0.17	0.04	0.18
60	0.36	0.01	0.01
80	0.55	-0.03	-0.05

5. Discussion

The results presented in the previous section confirm that both warm glow and pure altruism are motivating factors in subjects' sending part of their endowment to an anonymous paired subject. The nulls of hypotheses 1b and 2b as stated in section 2, that there is no evidence of warm glow or pure altruism in the full subject group, are both rejected with high confidence. Conclusions regarding hypotheses 1a and 2a, which ask the same questions as applied to individual demographic sub-groups are more ambiguous. Given the smaller n of data sub-sets, a loss of significance is not surprising. However, there are several conclusions I can make with confidence.

In the full sample, subjects gave more than twice as much due to warm glow as dure to pure altruism. Examining the results by age, we see that older subjects tended to give more due to warm glow and less due to pure altruism as compared to younger subjects. Comparing the Age < 40 to the Age > 40 rows in table 2 shows that younger subjects were more responsive to change in the price of benefit to the recipient while older subjects gave at a higher base rate but with less increase as the price of benefit to the recipient declined. With regard to difference in motivation as a function of income, higher income does appear to be associated with a greater share of giving being motivated by altruism and smaller share motivated by warm glow. This result is complicated by the surprising observation that subjects with reported incomes below $40,000 gave an average total amount that was greater than the average given by those reporting incomes over $40,000 in 3 of the 4 multiplier levels. Average total amounts sent were $0.19/$0.07 at $\mu = 0.5$, $0.28/$0.17 at $\mu = 1$, $0.22/$0.23 at $\mu = 3$, and $0.44/$0.40 at $\mu = 6$ for lower income and higher income subjects respectively. The results do not suggest an obvious explanation for this anomaly.

The most striking result is the gender difference found in subjects giving motivations. In the $\mu = 0.5$ treatment level, where there was a 50% efficiency loss for giving, males gave almost nothing with an average amount sent of just \$0.02. At the other extreme with $\mu = 6$, where there was a 600% efficiency gain in giving, males gave an average of almost half their endowments, \$0.43. Women, however were almost entirely insensitive to the value of the multiplier, giving \$0.27 when $\mu = 0.5$ and only a small increase to \$0.39 at $\mu = 6$ when each cent given had a 12 times greater impact on the recipient. This result is consistent with gender differences found in Tonin and Vlassopoulos (2010).

There appears to be no substantial difference in giving motivations or overall giving levels based on whether the subjects are married or single, have or do not have children.

5.1. Alternative explanations and possible objections

The decomposition of motives into warm glow and pure altruism depends on the assumption that warm glow giving is unrelated to the amount received by the passive subject. It is possible that this is not true. If, for example, a dictator derived utility from the amount received by the passive player but had no concern for the welfare of that player, then the dictator could be highly responsive to price and simultaneouslymotivated only by warm glow. If so, then values generated by this model for giving motivated by warm glow would be a lower bound and values for α would be an upper bound.. Although this is possible, it would require a substantial revision of the impure altruism model that is beyond the scope of this paper.

The major results in terms of demographic differences could be artifacts of some form of self selection by workers prior to accepting the HIT or afterwards within the 20% who began the study but did not complete it. There is no evidence in this data suggesting that this is true and I

have found no studies reporting this effect in on-line experiments, but absence of evidence is not evidence of absence so the possibility cannot be ruled out.

5.2. Questions for Future Research

The gender difference in giving motivation is an obvious target for additional inquiry. Some specific questions for follow-on research are:

- Can this result be replicated?
- Is the gender difference robust to modest changes in experimental design?
- Is the gender difference robust to experiment venue, i.e. in-person vs. on-line?
- Is the gender difference robust to recruiting from a non-Mechanical Turk subject population?

Beyond the question of gender difference, comparing these results to values of α generated through an unrelated experimental design would provide a strong support of, or refutation to, these findings.

6. Conclusion

This paper reports the results of an on-line experiment designed to disaggregate giving in a dictator game into the fraction motivated by pure altruism and the fraction motivated by warm glow, as described in Andreoni (1989). By manipulating the price of benefit to the recipient while holding the price of the act of giving constant, I am able to estimate values for a coefficient of altruism α (Ibid. p1452). I find significant evidence of both pure altruism and warm glow as motivations for giving. In addition, I repeat the statistical estimation on sub-sets of the sample based on demographic criteria as reported in an exit survey. The fraction of amounts sent to an anonymous recipient that are motivated by warm glow is increasing in age of the dictator and

decreasing in dictator's income. An analysis by gender shows that male subjects responded strongly to price suggesting they are mostly motivated by pure altruism and only slightly motivated by warm glow, while female subjects were nearly insensitive to price suggesting a large fraction of giving motivated by warm glow and little motivated by pure altruism.

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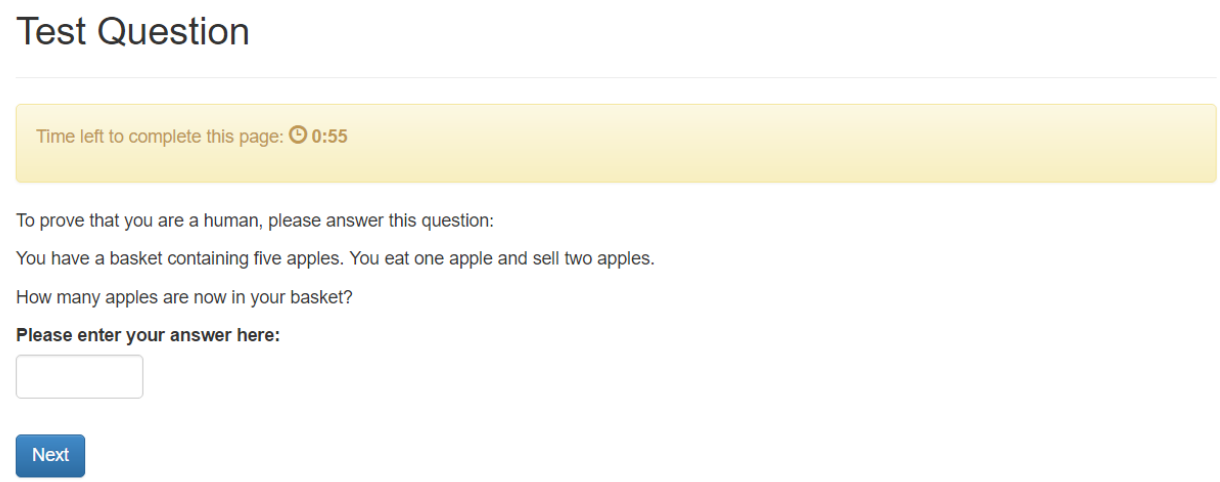
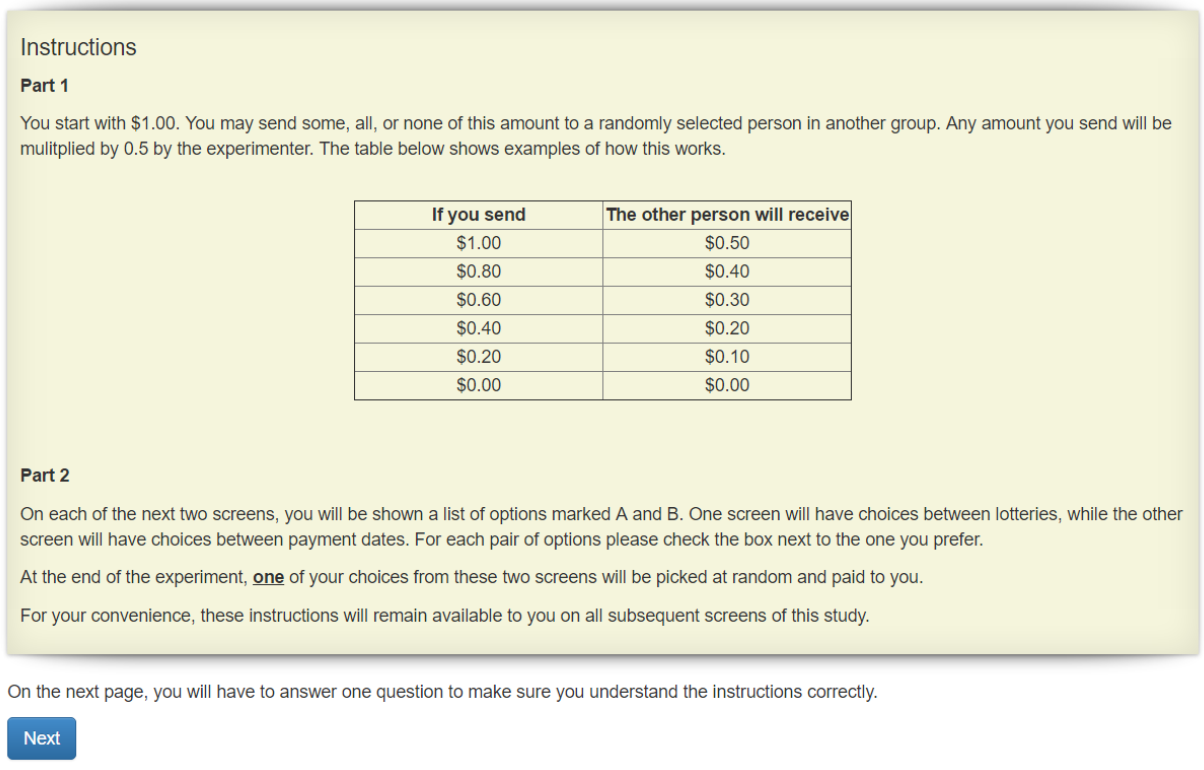
Appendix A. Experiment Interface

Subject screen 1



Subject screen 2



Subject screen 3

Understanding Test

If you start with $1.00, then decides to send $0.20 to the other person, how much would you each have at that point?

How much would you have?

$ 0.00

How much would the other person have?

$ 0.00

Next

Instructions

Part 1

You start with $1.00. You may send some, all, or none of this amount to a randomly selected person in another group. Any amount you send will be mulitplied by 0.5 by the experimenter. The table below shows examples of how this works.

If you send	The other person will receive
$1.00	$0.50
$0.80	$0.40
$0.60	$0.30
$0.40	$0.20
$0.20	$0.10
$0.00	$0.00

Part 2

On each of the next two screens, you will be shown a list of options marked A and B. One screen will have choices between lotteries, while the other screen will have choices between payment dates. For each pair of options please check the box next to the one you prefer.

At the end of the experiment, **one** of your choices from these two screens will be picked at random and paid to you.

For your convenience, these instructions will remain available to you on all subsequent screens of this study.

Subject screen 4

Answer

If you start with $1.00, then decides to send $0.20 to the other person, how much would you each have at that point?

Answer:

You would have **$1.00 - $0.20 = $0.80**, and the other person would have **$0.00 + 0.5 x $0.20 = $0.10**.

Next

Instructions

Part 1

You start with $1.00. You may send some, all, or none of this amount to a randomly selected person in another group. Any amount you send will be mulitplied by 0.5 by the experimenter. The table below shows examples of how this works.

If you send	The other person will receive
$1.00	$0.50
$0.80	$0.40
$0.60	$0.30
$0.40	$0.20
$0.20	$0.10
$0.00	$0.00

Part 2

On each of the next two screens, you will be shown a list of options marked A and B. One screen will have choices between lotteries, while the other screen will have choices between payment dates. For each pair of options please check the box next to the one you prefer.

At the end of the experiment, **one** of your choices from these two screens will be picked at random and paid to you.

For your convenience, these instructions will remain available to you on all subsequent screens of this study.

Subject screen 5

Amount to Send

You have $1.00. Now please decide how much you will send to the other person.

How much do you want to send?

$

Next

Instructions

Part 1

You start with $1.00. You may send some, all, or none of this amount to a randomly selected person in another group. Any amount you send will be mulitplied by 0.5 by the experimenter. The table below shows examples of how this works.

If you send	The other person will receive
$1.00	$0.50
$0.80	$0.40
$0.60	$0.30
$0.40	$0.20
$0.20	$0.10
$0.00	$0.00

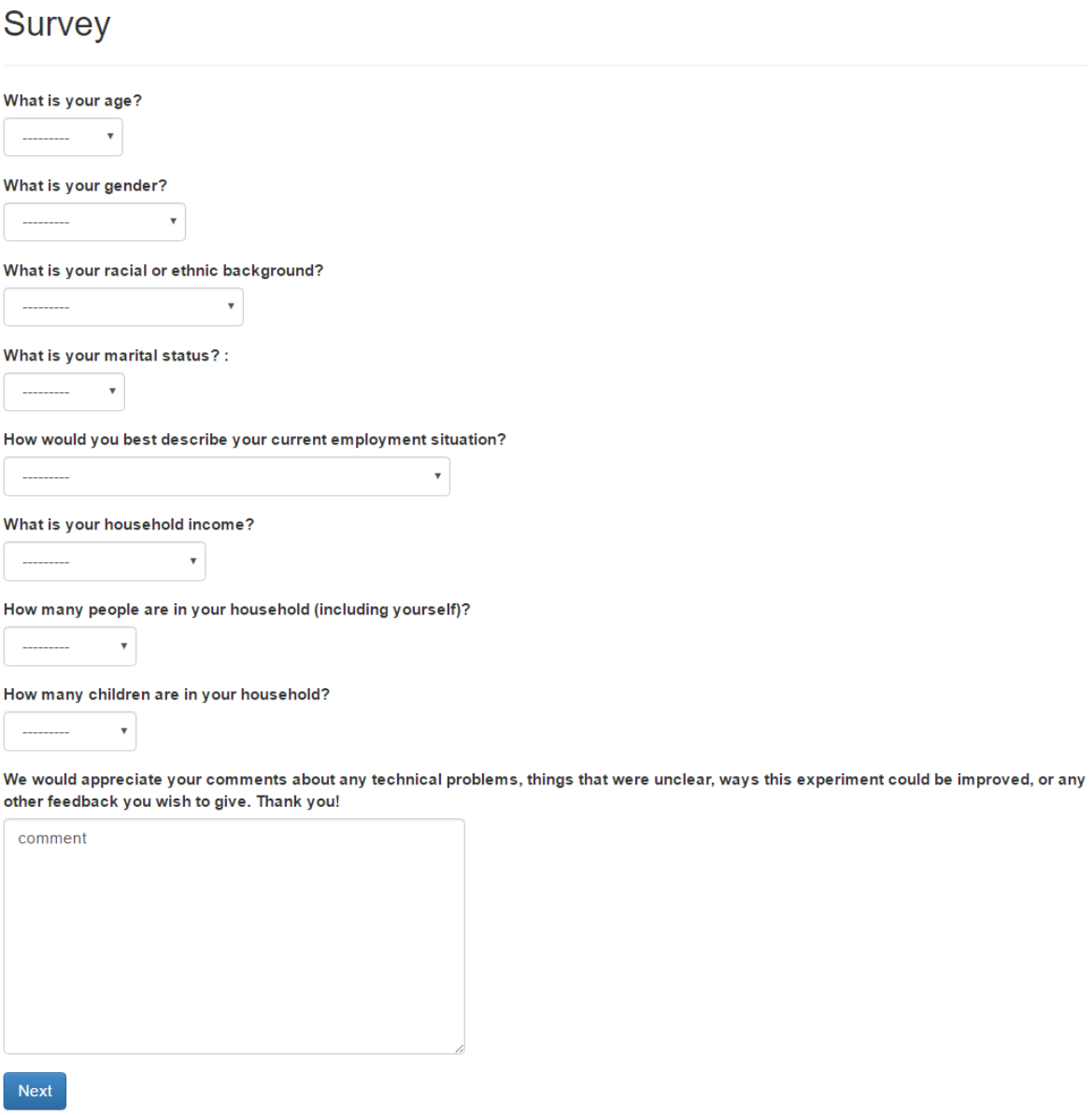
Part 2

On each of the next two screens, you will be shown a list of options marked A and B. One screen will have choices between lotteries, while the other screen will have choices between payment dates. For each pair of options please check the box next to the one you prefer.

At the end of the experiment, **one** of your choices from these two screens will be picked at random and paid to you.

For your convenience, these instructions will remain available to you on all subsequent screens of this study.

Subject screen 6



Subject screen 7