E C O N O M I C S B U L L E T I N

Does gender matter for demand revelation in threshold public goods experiments?

Yohei Mitani
Institute of Behavioral Science, University of Colorado at Boulder and Graduate School of Economics, Waseda University

Nicholas Flores
Department of Economics and Institute of Behavioral Science, University of Colorado at Boulder

Abstract

We examine the effect of gender on real and hypothetical contributions in a threshold public goods experiment using heterogeneous induced-values approach. Our analysis of the experimental data leads to several findings. First, gender differences in contributions are found for hypothetical payments, but not for real payments. This result is obtained while controlling for subjects' true values (induced-values) as well as socio-economic variables. Second, females are more likely to truthfully reveal their true value than males for hypothetical payments, but this effect is not significant for real payments. One could interpret these results as suggesting that females are more likely to state their value through hypothetical payments.

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1 Introduction

In this paper, we examine the influence of gender on real and hypothetical contributions in a threshold public goods experiment using a heterogeneous induced-values approach. Our research is motivated by several strands of the research literature. Research in social psychology indicates that females think about moral problems in a more socially-oriented manner than males (Gilligan, 1982). Research that examines gender differences in public goods experiments has produced mixed results. Brown-Kruse and Hummels (1993) find that females contribute significantly less than males in a continuous public goods experiment, whereas Cadsby and Maynes (1998) find no significant differences between contributions of males and females in a threshold public goods experiment. However, recent studies have concluded that females are more likely to respond to context than males, or females are more likely to conform to others than males (Cadsby and Maynes, 1998; Eckel and Grossman, 1998; Cadsby et al., 2006). Using first-year undergraduate students as subjects, these studies use a homogeneous induced-value for the individual benefit of the public good and the good is provided if contributions meet or exceed a specified threshold. We extend on this previous work examining gender differences in a threshold public goods experiment by employing heterogeneous induced-values and using subject who are randomly selected from the general public as opposed to first-year undergraduates.

In the field, survey-based, stated preference methods have been used to measure people's preferences for "real world" public goods (ex. water quality improvement, conservation of national parks, etc.). The contingent valuation method, which is the most widely used, asks respondents to state their willingness to pay for a particular public good in a hypothetical survey. Empirical studies often control for gender, but they have shown mixed results. Recent studies focusing on gender differences in contingent valuations include Dupont (2004) and Farreras et al. (2005). This survey-based method provides no real incentive for subjects to state their true values or to lie about their values. Meta-analysis of contingent valuation studies shows that a divergence exists between real and hypothetical payments (Murphy et al., 2005). Brown and Taylor (2000) is the only existing study that compares gender differences between hypothetical and real treatments using a "real world" public good: conservation of the rainforest in Costa Rica. Their results show that gender differences exist in a hypothetical payment setting whereas the differences do not exist in a real payment setting. This finding is consistent with their interpretation of Gilligan (1982)'s work that "females pay more attention to the particular context of a problem than males." However, the relationship between true values and gender is not controlled in their experiments, since they use a "real world" public good for which subjects' true values are unobservable. We extend Brown and Taylor (2000) by employing a heterogeneous induced-value experimental design, which allows us to control for true values as well as gender.

In our experiment we employ a threshold public goods game with continuous

contributions, both real and hypothetical, along with a money-back guarantee. This approach is similar to work in several experimental economics papers (Rondeau et al., 2005). Our subjects are selected from a general public adult pool that balances gender and age. In this paper, we examine gender differences for hypothetical and real payments as well as whether gender contributes to truth revelation of value. Following Brown and Taylor (2000), we hypothesize that gender differences will exist for hypothetical payments, but not for real payments.

2 Experimental Design

All experiments were conducted at the laboratory for political economy at Waseda University in November 2006. Subjects for our experiment were 45 general public individuals who live in Tokyo and were recruited by a pooling agency. There were 3 sessions including 15 subjects in each. Session 1 consisted of 7 males and 8 females, session 2 consisted of 8 males and 7 females, and session 3 consisted of 9 males and 6 females. At the end of the experiment, subjects received a uniform participation fee and an extra experimental payment ranging from 0 to 2000 Japanese yen (about 17 USD) depending on their amount that they earned in experiments. Subjects were appointed to a computer with privacy shields and no communication was allowed between subjects. The experimenter provided oral instructions with a front screen and answered any questions. The Z-tree software (Zurich Toolbox for Readymade Economic Experiments) was used in all stages.

Our experiment consists of two stages. The first stage was a threshold public goods experiment with continuous contribution, a money back grantee, and heterogeneous induced-values. Before beginning the public goods game, subjects were informed of their induced-value for the public good in tokens by a value card (3, 5, 7, 9, or 11 tokens). Following the instructions for explaining induced-values found in Vossler and McKee (2006), subjects were told that values varied across individuals, but they were not told the range or frequency of values. We controlled induced-values and age so that they would be the same across males and females. Table 1 shows the descriptive statistics.

Table 1: Descriptive Statistics (Mean)

Variables	**Pooled**	**Male**	**Female**
Induced-values (V_i)	7	6.833	7.19
Age (AGE)	34.889	34.583	35.238
Income ($*10^{-6}$ JPY, $INCOME$)	8.2	7.666	8.809
N in Household ($NHOUS$)	2.733	2.75	2.714
N	45	24	21

Subjects in groups of 5 were initially endowed with 10 tokens and asked "how

many tokens are you willing to pay for the provision of the public project? Please state your payment in integers of between 0 and 10." If the total contributions of their group exceed the pre-announced threshold of 25 tokens, subjects receive their values of public good minus their payment. Failure to reach the threshold results in a refund of all contributions. The earnings that subject i receives in round t can be calculated by subtracting her payment (C_{it}^R)[1] from the initial token (10 tokens) and adding her induced-value (V_i) to them. The real experiment was repeated 5 times. Following this stage, a hypothetical version of this threshold public good experiment was conducted, also consisting of 5 rounds. Every subject participated in all 10 rounds. At the end of each round, subjects got to see their own payoff in the round. The hypothetical and real payments in the threshold public good experiment were identical except that subjective language was used to describe the decision-making as Taylor et al. (2001) did. Subjects were told to "Please remember that the outcome of this hypothetical stage has no effect on your earnings at all. However, please put yourself in the following situation. Suppose that you faced such a decision." We denote the subject i's payment in this stage as C_{it}^H. (Superscript H means "hypothetical setting.")

3 Results

Result 1: *Gender differences in contributions to a public good exist for hypothetical payments, but not for real payments.*

We examine gender differences as a determinant of hypothetical and real payments. Table 2 reports estimation results from three models: real payment, hypothetical payment, and real payment/hypothetical payment pooled. The models were estimated using a censored regression framework where the dependent variables are the average payment over 5 rounds ($\in [0, 10]$) for both real and hypothetical settings.[2] The explanatory variables used in the pooled model include subject's induced-value V_i, the dummy variable $REAL$ which is equal to 1 if the payment is stated in the real setting, an interaction term of V_i and $REAL$, an interaction term of $REAL$ and $GENDER$ which is equal to 1 if subject's gender is male, which captures gender differences in the real payments decision, an interaction term of the dummy variable $HYPO$ which is equal to 1 if the payment is stated in the hypothetical setting and $GENDER$, which captures gender differences in the hypothetical payments decision, age AGE, income $INCOME$, the number in household $NHOUS$, and the dummy variable $EMPLOY$ which is equal to 1 if subject is employed full-time. The explanatory variables used in the real model and the hypothetical model include induced-values V_i, the dummy variable $GENDER$ which is equal to 1 if subject's gender is male, AGE, $INCOME$, $NHOUS$, and $EMPLOY$. In the pooled model,

[1] C_{it}^R is the subject i's contribution to the public good in round t (Superscript R means "real setting.").

[2] Each subject's contribution is bounded by 0 from below and by 10 from above and thus we employ the censored regression model.

the coefficient of $HYPO * GENDER$ is significant at the 10% level and has a negative sign, whereas the coefficient of $REAL * GENDER$ is not significant. Also, the coefficient of $GENDER$ is significant at the 10% level and has a negative sign for hypothetical payments, but is not significant for real payments. These results show that gender differences exist in the hypothetical setting but we find no statistical evidence for gender differeces in the real setting, after controlling for their true values as well as socio-economic variables.[3] This result supports the results of Brown and Taylor (2000) and also of Cadsby and Maynes (1998). The fundamental difference between our study and Brown and Taylor (2000) is that we control for heterogeneous true values for the public good in our statistical analysis. The results on gender are consistent with the findings from Brown and Taylor (2000). There are differences, however, in the overall contribution amounts to the public good. These differences may be attributable to the fact we are controlling for induced-values, or because we have a within subject design. The coefficient of $INCOME$ is significant at the 5% level in real payments and has a negative sign, but is not significant in hypothetical payments. We observe the opposite tendency between gender and income effects in real and hypothetical settings.

Result 2: *Females are more likely to truthfully reveal their value than males through hypothetical payments, but the gender difference is not significant through real payments.*

We also investigate gender differences for truth revelation, understatement, and overstatement of values through real and hypothetical payments. First, we create the individual level index of demand revelation which captures the tendency of understatement, truth revelation, and overstatement.[4] The results show that for real payments, 77.8% of subjects understate their true value, 8.4% reveal true value, and 13.8% overstate their true value, whereas in the hypothetical setting, 68% of subjects understate, 18.2% reveal truthfully, and 13.8% overstate their true values. Then, to investigate gender differences in the determinants of understatement, truth revelation, and overstatement under real and hypothetical settings, the censored regression analysis is employed in which the three individual level indices of U_i, T_i, and O_i ($\in [0, 1]$) are treated as the observed dependent variable.[5] The explanatory variables

[3]Our test power may not be large enough to detect small differences and therefore we are not accepting the null hypothesis of no gender differences for real payment.

[4]First we define the dummy variables:

$$\begin{cases} d_{it}^{U} & = 1 \text{ if } C_{it} < CS_i \ : \text{ Understatement} \\ d_{it}^{T} & = 1 \text{ if } C_{it} = CS_i \ : \text{ Truth Revelation} \\ d_{it}^{O} & = 1 \text{ if } C_{it} > CS_i \ : \text{ Overstatement} \end{cases} \tag{1}$$

Then we create an individual level index: $U_i = \sum_t d_{it}^{U}/T$ for understatement, T_i for truth revelation, and O_i for overstatement. For example, T_i shows the percentage that subject i reveals her value truthfully. We also note that $U_i + T_i + O_i = 1$ for all i.

[5]As the previous footnote defines, each dependent variable takes a number from 0 to 1 (0, 0.2, ...

Table 2: Determinants of Real Payment and Hypothetical Payment

	Pooled		**Real**		**Hypothetical**	
	Ests. (S.E.)	Marginal Effects	Ests. (S.E.)	Marginal Effects	Ests. (S.E.)	Marginal Effects
Const.	3.673	3.531	2.446	2.317	3.418	3.345
	(1.275)***		(1.616)		(1.360)**	
V_i	0.135	0.130	0.341	0.323	0.108	0.105
	(0.121)		(0.133)**		(0.112)	
$REAL$	-1.527	-1.468	-	-	-	-
	(1.380)					
$REAL * V_i$	0.176	0.169	-	-	-	-
	(0.166)					
$REAL$	-0.901	-0.866	-	-	-	-
$*GENDER$	(0.689)					
$HYPO$	-1.179	-1.133	-	-	-	-
$*GENDER$	(0.687)*					
$GENDER$	-	-	-1.004	-0.952	-1.069	-1.046
			(0.753)		(0.634)*	
AGE	0.041	0.039	0.048	0.045	0.032	0.032
	(0.025)		(0.037)		(0.031)	
$INCOME$	-0.114	-0.109	-0.216	-0.205	-0.015	-0.014
	(0.056)**		(0.084)**		(0.071)	
$NHOUS$	-0.197	-0.189	-0.139	-1.132	-0.254	-0.249
	(0.203)		(0.306)		(0.258)	
$EMPLOY$	0.264	0.254	0.200	0.189	0.302	0.296
	(0.552)		(0.832)		(0.700)	
Sigma	2.216	0.224	2.352		1.991	
	(0.176)***		(0.266)***		(0.222)***	
N	90		45		45	
LogL	-192.716		-97.913		-92.612	

*** means "Significant at the 1 % level", ** at the 5 % level, * at the 10 % level.

include subject's induced-value V_i, the dummy variable $REAL$ which is equal to 1 if the payment is stated in the real setting, an interaction term of V_i and $REAL$, an interaction term of $REAL$ and $GENDER$, which captures gender differences in the real payments decision, an interaction term of the dummy variable $HYPO$ which is equal to 1 if the payment is stated in the hypothetical setting and $GENDER$, which captures gender differences in the hypothetical payments decision, AGE, $INCOME$, $NHOUS$, and $EMPLOY$. Pooled data is used to estimate the impact of these variables on the respective indices of understate, truthful revelation, and overstate. Table 3 presents the estimation results.

, 0.8, 1) and thus we employ the censored regression model.

Table 3: Determinants of Understatement, Truth Revelation, and Overstatement

	Understate		**Truth Revelation**		**Overstate**	
	Ests. (S.E.)	Marginal Effects	Ests. (S.E.)	Marginal Effects	Ests. (S.E.)	Marginal Effects
Const.	-0.680	-0.272	1.811	0.332	0.392	0.106
	(0.417)		(0.527)***		(0.389)	
V_i	0.262	0.105	-0.225	-0.041	-0.142	-0.038
	(0.054)***		(0.063)***		(0.047)***	
REAL	0.852	0.341	-1.286	-0.236	0.118	0.032
	(0.469)*		(0.511)**		(0.436)	
$REAL * V_i$	-0.098	-0.039	0.131	0.024	0.020	0.005
	(0.063)		(0.073)*		(0.059)	
REAL	0.395	0.158	-0.107	-0.020	-0.347	-0.094
$*GENDER$	(0.226)*		(0.224)		(0.224)	
HYPO	0.464	0.186	-0.839	-0.154	0.103	0.028
$*GENDER$	(0.231)**		(0.275)***		(0.221)	
AGE	-0.017	-0.007	0.010	0.002	0.011	0.003
	(0.008)**		(0.008)		(0.008)	
INCOME	0.008	0.003	-0.003	-0.001	-0.024	-0.006
	(0.018)		(0.019)		(0.018)	
NHOUS	0.041	0.016	-0.132	-0.024	-0.006	-0.002
	(0.065)		(0.077)*		(0.063)	
EMPLOY	0.087	0.035	-0.377	-0.069	0.061	0.017
	(0.169)		(0.179)**		(0.167)	
Sigma	0.570	-	0.510	-	0.547	-
	(0.085)***		(0.089)***		(0.091)***	
N	90		90		90	
LogL	-53.945		-39.31		-49.155	

*** means "Significant at the 1 % level", ** at the 5 % level, * at the 10 % level.

Before reporting the gender differences, we first note that the estimates of V_i (induced-value) are significant at the 1% level in all models with a positive sign in the Understate model, a negative sign in both the Truth Revelation model and the Overstate model. This means "over contributions at low induced-values" in Ferraro et al. (2003) and Rondeau et al. (2005). *REAL* allows us to analyze whether the truth revealing (understating, or overstating) tendency is explained by the difference between real and hypothetical settings. The results of *REAL* indicate that the real payment has a positive effect on the tendency to understate, and the hypothetical payment has a positive effect on the tendency to truthfully reveal value.

Now, we report the results of gender differences in truth revelation and understatement, after controlling for true values as well as socio-economic variables. In the Truth Revelation model (columns Truth Revelation in Table 2), the coefficient of

$HYPO * GENDER$ is significant at the 1% level and has a negative sign, whereas the coefficient of $REAL * GENDER$ is not significant. This result indicates that females are more likely to truthfully reveal their value than males in the hypothetical treatment. In the Understate model (columns Understate in Table 2), the estimation results about $GENDER$ show that males are more likely to understate their true value than females. We could interpret these results as females may be more likely to state their values through hypothetical payment than males.

4 Concluding Remarks

We examine the effect of gender on real and hypothetical contribution payments in a threshold public goods experiment with heterogeneous induced-values. We find no evidence of hypothetical bias in both females and males.[6] Our analysis of experimental data leads to several results. First, gender matters for contributions through hypothetical payments, but not for contributions through real payments, after controlling for true values as well as socio-economic variables. Second, females are more likely to truthfully reveal their value than males though hypothetical payments, but gender is not significant for truthfully revealing their value through real payments. One could interpret these results as suggesting that females be more likely to state their value through hypothetical payments than males. Our results support previous studies of Brown and Taylor (2000) and Cadsby and Maynes (1998). Furthermore, like Cox and Deck (2006), we also find that "gender differences are dependent on the decision context." We believe that our results contribute to well understanding of gender differences in economic behavior as well as additional developments of survey-based methods.

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