Income, giving, and egalitarianism: a real-effort experiment in Japan[*]

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In this study, we conducted a real-effort laboratory experiment to investigate the relationship between income and giving. In our experiment, subjects in the first round solved mazes in a piece-rate scheme and, in the second round, they solved mazes either in a four-player tournament or in a piece-rate scheme and then gave a part of their earnings to the other group members. The results revealed that an individual player's giving increases as the player's reward increases and the other players' reward decreases. This finding contrasts with the study conducted by Erkal et al. (2011) in which players ranked second in a four-player tournament gave more than those ranked first. We also observed that egalitarianism, as measured by a post-experiment questionnaire, is positively associated with giving, and has no relationship with increase in performance from the first to the second round. From these results, we conclude that selection based on other-regarding preferences either does not occur or it occurs but not always in the same direction.

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1. Introduction

Giving behaviors have been studied for a number of years (Camerer 2003; Andreoni and Payne 2013) and the studies revealed that there is substantial heterogeneity among individuals in giving; gender differences (Croson and Gneezy 2009 for a survey) and cultural differences (Henrich et al. 2004, 2005) for example. Meta-analyses of economic experiments have studied that how characteristics of experiments and subjects affect the results of the experiments; Zelmer (2003) for public goods game, Oosterbeek et al. (2004) for ultimatum games, and Johnson and Mislin (2011) for trust games.

The level of endowed incomes and where the incomes come from can affect giving behaviors. In a typical experiment, the experimenter endows subjects with incomes before giving or allocation decisions, where the subjects may think them as "windfall" money. Buckley and Croson (2006) shows that the level of income does not affect absolute contributions in public goods game, while Eckel et al. (2007) shows that the level of endowed income positively correlates with the

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absolute amounts of charitable giving. Hoffman et al. (1994) compares windfall income and earned income (by solving quizzes) in ultimatum and dictator game and found that individuals decrease their giving when the income has been earned.

Thinking the relationship between income and giving using economic experiment is important since empirical studies showed the relationship is not clear using the data in real world (Auten et al. 2000; Joulfaian 2001; Schervish and Havens 2003). As a substantial part of income originates from working and through competition, the relationship between income and giving may become complex.

Erkal et al. (2011), henceforth EGN, is the seminal study conducted an experiment in Australia examining the relationship between income earned through participation in a competition and giving behavior. In the experiment, a group of four subjects competing in a tournament performed a real effort task in the *effort stage*. The productive first subject received AU$60, the second AU$45, the third AU$30, and the fourth AU$15. The subjects were then presented with the opportunity to give part of their earnings to the other group members during the *giving stage*, which had been described to them before introduction of the effort stage. The results of this experiment were not intuitive. Comparison of giving behavior among the subjects revealed that the likelihood of giving to at least one group member was the highest for those who ranked second rather than those ranked first. The authors thus proposed the existence of a *selection* mechanism during the effort stage that leads other-regarding subjects to expend less effort such that they are more likely to rank second than first. The existence of this mechanism was supported by the results of an additional experiment in which the giving stage was introduced immediately after the effort stage, as the selection mechanism was unable to function. The results revealed that those ranked second no longer gave more than those ranked first.

Although this interesting finding has important implications for giving behavior, the experiment should be re-examined in other settings. The theory implies that effort provision during the giving stage is dependent on the specification of other-regarding preferences. If, as described by EGN, we assume the existence of inequality aversion, as had Fehr and Schmidt (1999), less effort will be provided during the giving stage, and thus other-regarding subjects will be selected for second rank rather than first rank. However, if we assume the existence of the warm glow, as had Andreoni (1990), more effort will be provided during the giving stage such that other-regarding subjects will be selected for first rank. Interestingly, all other-regarding preferences models have similar implications for giving behavior, but different implications for choice of effort provision.

We conducted an experiment in Osaka University, Japan along the lines of the study by EGN. Retaining the main setting used in the original experiment but adding several additional tasks, we first conducted a *production measurement* round in which the subjects earned their reward by piece rate before conducting the main round, in which giving was performed. Conducting the production measurement round allowed us to directly observe the change in productivity due to introduction of the giving stage, and check whether the selection mechanism had truly functioned. Second, we added another treatment such that the subjects earned their reward by piece rate in the main round, which allowed us to not only investigate giving behavior using another reward scheme but also the change in productivity due to introduction of the giving stage when the reward scheme was not changed. Third, we administered a post-experiment questionnaire to develop proxies for egalitarianism and competitiveness.

The results of our experiment revealed that approximately one-third of the subjects gave their reward to at least one group member, as had the subjects in EGN's original experiment. However, we found the relationship between income and giving to differ from that identified by EGN, with subjects giving more when their rank or reward was higher and the other's rank or reward lower. We also found that those who are egalitarian give more than those who are non-egalitarian, and that those who are highly competitive give less than those who are not highly competitive, but that these preferences do not affect the change in productivity from the first to the second round. These findings imply the existence of two possibilities regarding the selection mechanism: either the selection mechanism is not important in our experiment, and thus effort provision is not affected by introduction of the giving stage or that selection occurs but not always in the same direction, with some other-regarding subjects selected for a higher rank and others for a lower rank. Although we cannot identify these two possibilities, we can conclude that the other-regarding preferences of Japanese students differ somewhat from those of Australian students.

Having described the background of this paper, we describe the experimental design in section 2, the theoretical background in section 3, and the results of the experiment in section 4 before presenting our discussions and conclusions in section 5.

2. Experimental Design

Our experiment was conducted in February 1st and 2nd of 2013 at the Experimental Economics Laboratory of the Institute of Social and Economics Research, Osaka University. All 232 subjects except two are the students in Osaka University and the other two subjects are excluded from the analysis below. Each day consists three sessions and 36 or 40 subjects participated in each

session. Each subject participates only in one session. The experimental procedures are conducted mainly on computer and a part of post-experiment questionnaire is conducted on paper. Average earning in the experiment is ¥2,949 (about US$32 at that day) including participation fee ¥500, the maximum payment is ¥4,600, and the minimum is ¥1,000.

2.1. Experimental Treatments

Experimental treatment was different between first and second day; treatment Rank for first day and treatment Piece for second day. Both treatments consists two rounds; Round 1 is for the measurement of baseline productivity and Round 2 is our main regarding giving behavior. In Round 1, the subjects solve computerized mazes[1][2] for three minutes, where they use arrow keys on the keyboard to solve mazes. The reward is paid by piece-rate, ¥200 for one maze. Round 2 has two stages, Effort Stage and Giving Stage, and subjects are divided into anonymous group of four. In Effort Stage, the subjects again solve mazes for three minutes. In treatment Rank, the reward is determined only by the rank of solved mazes among the group. The reward is ¥4,000 for the first subject, ¥3,000 for second, ¥2,000 for third, and ¥1,000 for fourth. If more than one subject solve same number of mazes, the ranks among them are determined randomly. In treatment Piece, the reward is determined by piece-rate, ¥200 for one maze, which is same to Round 1. In Giving Stage, the subjects give their reward earned in Effort Stage to the other group members. Details are described below. The introduction of each round is held at the start of each round. Final earning is determined randomly by the lottery chosen individually between the earnings in Round 1 and Round 2 (reward in Effort Stage minus implemented giving plus received giving). Table 1 summarizes experimental design.

In the Giving Stage of Round 2, subjects are given information about all members' ranks, rewards, and the numbers of solved mazes. Based on this information, the subjects determine the amount of giving to transfer to each member of the group. The transfer should be non-negative and the sum of transfers should not be more than his/her reward in Effort Stage. To avoid free-riding in giving that prevents the subjects from positive transfer, only one suggested transfer of is implemented for each subject. (Note that we use *a suggested transfer* as a variable of giving when reporting and analyzing giving behaviors.) Since the explanation of Giving Stage is given to the

[1] Mazes are frequently used for real-effort experiment. Gneezy et al. (2003) used a computerized maze and Freeman and Gelber (2010) used a maze in pen and pencil form.
[2] We use the number of solved mazes as a measure of "productivity" hereafter.

subject before the start of Effort Stage, the existence of Giving Stage potentially affects solving mazes in Effort Stage.

2.2. Post-experiment Questionnaire

After the subjects finished the experiment explained above, they answer questionnaire both on computer and paper. The questionnaire is based on Preference Parameters Survey of Osaka University in 2010. For our analysis, we use the demographic variables (female dummy, age, grade[3], science department dummy[4]) and proxy variables for preference parameters (egalitarianism and competitiveness).

For the proxy of egalitarianism, we use the four questions[5] about the monetary distribution between "oneself" and "stranger". The proxy "egalitarianism" takes one if the subject chooses equal distribution in all four questions; otherwise zero. 16 percent of the subjects (37 subjects) are classified to egalitarian. This variable is based on Bartling et al. (2009), which investigates the relationship between egalitarianism and competitiveness. For robustness check, we also use the proxies "aheadness aversion"[6] and "behindness aversion"[7] the instead of egalitarianism, but the results under these proxies are qualitatively same under egalitarianism. The proxy "competitiveness" is the number of answers that the subject answers as he/she likes competition from three questions[8].

The basic statistics of the variables are summarized in Table 2. Note that the rate of female is small (about 30 percent) and that of science faculty is large (about 70 percent). Table 3 shows the correlation among variables. Female subject is more likely to have high egalitarianism and low competitiveness. Croson and Gneezy (2009) summarizes recent literature about gender

[3] For graduate student, we only know whether he/she M.A. student or Ph.D. student. We assume M.A. student is 5.5th year and Ph.D. student is 8th year.

[4] It takes one if the subject's department is dentistry, engineering, engineering science, medicine, pharmaceutical, and science and takes zero if the subject's department is economics, foreign studies, human sciences, law, and letters.

[5] Question 1: "¥10,000 (oneself): ¥10,000 (stranger)" vs. "¥10,000: ¥6,000";
Question 2: "¥10,000: ¥10,000" vs. "¥16,000: ¥4,000";
Question 3: "¥10,000: ¥10,000" vs. "¥10,000: ¥18,000";
Question 4: "¥10,000: ¥10,000" vs. "¥11,000: ¥19,000"

[6] It takes one if the subject chooses equal distribution both in Question 1 and Question 2.

[7] It takes one if the subject chooses equal distribution both in Question 3 and Question 4.

[8] Question 1: If the result of regular exam is told by the actual score or rank as well as pass-fail grading, which one do you want to know, actual score or rank?;
Question 2: I can demonstrate an ability beyond one's strength when competing with others. (five-point scale);
Question 3: I enjoy competing with others. (five-point scale)

differences in preference and conclude that egalitarianism in women are highly depend on conditions and women have less competitiveness.

2.3. Differences to Erkal et al. (2011)

Our experiment is based on the main experiment in EGN and adds some components to investigate more deeply about the relationship between income and giving. The main experiment in EGN (treatment E) is nearly identical to Round 2 in treatment Rank; the subjects do real-effort task at rank-based reward scheme and give their earnings to their group members. Our reward in rank-based scheme is same to EGN[9]; the proportion of reward among ranks is exactly same and the absolute amounts takes account into the currency rate. First difference is the addition of Round 1 that measures the subject's baseline productivity. This addition allows us to directly observe change in productivity due to the giving stage. Potential problem here is that Round 1 may affect the behavior in Round 2. In treatment Rank, the reward scheme changes from Round 1 to Round 2 and it may affect effort and giving decision. Treatment Piece allows us to avoid this problem since there' no difference in reward scheme between Round 1 and 2. Second difference is post-experiment questionnaire. This allows us to use the proxy variables for preferences that is important to understand the mechanism of giving behavior. Third difference is the task; EGN uses encryption task and ours uses mazes. We believe that this difference does not affect our result since the nature of the task, simplicity and easiness, is same to both tasks. The remaining difference is country and culture between Japan and Australia.

3. Theoretical Prediction

In this section, we make a prediction of effort and giving decisions in our experiment. The relationship between income and giving may be not straightforward since the subjects choose an effort level with consideration for the Giving Stage thereafter.

In Round 1 of our experiment, the earning is determined by only their productivity. Each individual would determine his/her effort level comparing how an additional effort affects productivity and an effort cost. In Round 2 of treatment Piece, the reward is still paid by piece-rate but there is the Giving Stage after providing effort. How is effort choice affected by the presence of Giving Stage? The problem is same in essence in treatment Rank though the reward is affected by the productivities of other group members.

[9] The reward is 60 Australian dollars for the first subject, $45 for second, $30 for third, and $15 for fourth.

Suppose that the subject i have a utility described as

$$U_i = u(y_i) + \beta_i v(y_i, y_j; g_{ij}) - c(e_i)$$

where y_i is a post-transfer income level of the subject, y_j is a vector of post-transfer income level of group members, g_{ij} is a vector of giving from the subject to group members, and e_i is the effort level. The first term, $u(y_i) \geq 0$, is a monetary utility. The second term is an other regarding preference where β_i is a parameter represents the strength of an other-regarding preference and the sign of $v(y_i, y_j; g_{ij})$ depends on its specification. The third term, $c(e_i) > 0$, is an effort cost function.

A lot of papers tried to model other-regarding preferences, including relative earnings (Bolton 1991), inequality aversion (Fehr and Schmidt 1999 and Bolton and Ockenfels 2000), and warm glow (Andreoni 1990). All models would have same prediction of giving behavior given the reward earned in Effort Stage; the larger the reward (and the stronger the other-regarding preference), the larger the subjects give.

A prediction of effort choices, however, depends on the specification of other-regarding preference. For one example, warm glow model in Andoreoni (1990) assumes that giving itself increases one's utility, $v(y_i, y_j; g_{ij}) = v(g_{ij}) \geq 0$. In this case, the presence of Giving Stage can induce higher effort. It becomes simple to understand to think giving as one of consumption goods. The utility should increase (or at least not change) when new goods are added to consumption menus and it means that the benefit of effort increases. For another example, inequality aversion model in Fehr and Schmidt (1999) assumes that inequality among monetary income reduces one's utility, $v(y_i, y_j; g_{ij}) = -\frac{1}{n}\sum_n |y_i - y_j|$ (assuming symmetry between *compassion* and *envy*)[10]. In this case, the presence of Giving Stage induces lower effort. The reason is that the players suffer utility loss in the presence of Giving Stage since they should transfer more to reduce the inequality.

As previous studies showed, there is large heterogeneity in other-regarding preference among individuals and cultures. In our experiment, it causes *selection* of individual based on other-regarding preferences. Suppose that all individual have a preference like warm glow model but there is heterogeneity in the strength of this preference β_i. Individuals who have high β_i provide more effort by the presence of Giving Stage than those who have low β_i. It means that productivity increase from Round 1 to Round 2 is positively associated with β_i. Conversely, if all individual have an inequality aversion but there is heterogeneity in the strength of this preference β_i,

[10] Grund and Slikwa (2005) showed that inequality averse agents exert higher effort than self-interested agents in tournament but the model does not consider giving decision after the competition.

Individuals who have high β_i provide less effort by the presence of Giving Stage and productivity increase from Round 1 to Round 2 is negatively associated with β_i.

4. Results

In this section, first we will describe and analyze giving behaviors in Giving Stage of Round 2 to study the relationship between incomes earned in Effort Stage and giving behaviors. Then, we will describe and analyze the measure of productivity—the number of solved mazes—to study how effort choice is changed by the presence of Giving Stage.

4.1. Giving behaviors

Figure 1 reports (a) percentages of individual who transfer a positive amount to at least one of his/her group member and (b) average amount of positive transfers divided by ranks and treatments. Similar to EGN, approximately one-third of the subjects gave their reward to at least one group member. However, the relationship between rank and giving is different. In treatment Rank, it seems that both the percentage and the amount are positively correlated with ranks and those ranked first gives most. This result does not support the fact found in EGK that those ranked second give more than those ranked first. In treatment Piece, the relationship between ranks and giving behaviors is ambiguous perhaps because rank itself is not related to reward. Figure 2 shows the percentage and the amount of giving divided by reward in treatment Piece. The amount is positively correlated with reward similar to treatment Rank, while the percentage seemed to be negatively correlated with reward. Note that, however, the observation in reward of ¥1,800 (N=4) and ¥1,600 (N=1) is smaller.

Figure 3 divide the result of Figure 1 by egalitarianism measured in post-experimental questionnaire. Overall, egalitarian gives more than non-egalitarian (the exception is the amount of first and second ranks in treatment Piece), which shows the post-experiment questionnaire is consistent with giving behavior.

Table 4 and 5 summarize the giving behavior divided by the ranks both of sender and receiver. Table 5, which summarizes the result of treatment Rank, reports that giving increases as sender's rank goes up and receiver's rank goes down. Table 6, which summarizes treatment Piece, reports that giving increases receiver's rank goes down but its relationship to sender's rank is ambiguous.

To further investigate giving behavior, we run regression analyses. As the relationship between giving and reward may be different in the percentage and the amount of giving as we saw in Figure 3, we employ a hurdle model, which divide decision process into the decision to give and the

decision to amount of giving. The hurdle model is the generalization of the Tobit model. In the hurdle model, first we regress probit model on whether to transfer a positive amount and second we regress a truncated-linear model. The unit of observation is the combination of a sender and a receiver and standard errors are clusters by senders.

Table 6 reports the result in treatment Rank. Main independent variables are the dummies for senders' and receivers' ranks, which captures how ranks affect giving behaviors. We also include the difference between senders' number of mazes and group mean in order to consider the absolute number of solved mazes that is not concerned in calculating reward in treatment Rank. If, in one extreme case, all numbers of solved mazes are same in the group, we can expect those ranked higher are more likely to give to those ranked lower since the difference in reward is came only from luck. If the numbers of mazes are sufficiently different among the group, those ranked higher are less likely to give since the difference is justified by the absolute differences. We include two variables, a positive and a negative difference, to consider asymmetric effects.

Columns 1 show that the subjects gives more both in the probability and the amount if the sender's rank is higher and the receiver's rank is lower, though some differences are not statistically significant and the relationship is reversed between second and third of sender's rank. At least we cannot say that those ranked second (, third, nor fourth) gives more than those ranked first. The difference in solved mazes to group mean is not statistically significant and it does not seem that the absolute number of solved mazes is accounted for giving decisions.

Columns 2 add egalitarianism and competitiveness as independent variables. Egalitarians give more significantly both in the probability and the amount, which is consistent to their preferences revealed in the questionnaire. Those who have high competitiveness give less, which implies that they respect the result of the competition. The effect of ranks are slightly changed but not changed qualitatively. Columns 3 add other individual characteristics. Women are more likely to give in probability but less in amount than men. The effect of ranks and preferences are not changed qualitatively. Columns 4 restrict the sample to non-egalitarian. (We do not report the result of egalitarian since the sample is too small to analyze.) The effect in probability is similar to previous estimates, but the coefficient of ranks in amount is smaller in absolute values. This would imply that egalitarians give more in amount to fill the reward's gap among group members.

Table 7 reports the regressions of treatment Piece where the specifications are same to Table 6. Columns 1 shows that sender's ranks do not affect giving behavior in probability but those ranked third and fourth gives more than those ranked first in amount significantly. However, columns 2 and 3 show that this difference is not significant if we control individual preferences and

characteristics. The coefficients of receiver's ranks are positive and highly significant, similar effect to treatment Rank. The effect of egalitarian and competitiveness is also similar to treatment Rank. In Table 8, we use linear rewards of sender and receiver as independent variables instead of ranks. Sender's reward has positive effect on giving but the effect is significant only in amounts. Receiver's reward has negative effect on giving, which is consistent with Table 7 and 8. Positive mazes difference negatively affect giving both in probability and amount, which implies that subjects who can solve many mazes consider the difference among group. Egalitarians give more but competitiveness has little impact on giving behavior.

The result of our experiment shows that the players who earn high income in experimental games give more to the other players but regression analysis shows the relationship is sometimes insignificant. Strong findings here is that the players who earn low income *receive* more. These results are not counterintuitive as in EGK. We also show that egalitarian, judged by post-experimental questionnaire, gives more than non-egalitarian. To explain our results, it is sufficient to use well-known models of other-regarding preferences and selection based on other-regarding preferences via Effort Stage is not needed. In next subsection, we will see the analysis of the number of solved mazes to study what happened in Effort Stage.

4.2. Number of Solved Mazes

Figure 1 shows the distribution of the number of mazes and Table 9 shows the average number of solved mazes by treatment and round. The right column shows the p-value of the *t*-test between treatments. Comparing the number of solved mazes between rounds, the average number in Round 2 is about one maze larger than in Round 1. This change is caused by both learning effect and the effect of giving stage. The change in distribution shows the change is occurred at all numbers of mazes uniformly. Comparing the result between treatments, the average number in treatment Piece is about 0.6-0.8 maze larger than in treatment Rank both in Round 1 and 2. Both differences are significant at the ten percent level. Since the condition in Round 1 is identical in both treatments, this difference is due to the difference in individual abilities to solve mazes. The difference in the change in the number of solved mazes between rounds is not statistically significant between treatments. We cannot say the difference in reward scheme affects the number of mazes solved from this result.

Table 5 shows the result of regression analysis where the dependent variable is the numbers of solved mazes. The regression is linear random effects panel regression and the observation includes all rounds and treatments. In column 1, the independent variables are treatment Piece dummy, Round 2 dummy, and rank-based scheme dummy. As we see in the Table 4, the

number is larger in treatment Piece and Round 2. Rank-based scheme positively affects productivity but is statistically insignificant. Column 2 includes demographic variables (female dummy, age, grade, science department dummy). Female dummy and age negatively affect the number of mazes solved and instead the effect of treatment Piece become smaller and lost its significance. This result shows the difference between treatments is partly due to difference in subject's ability to solve mazes. Column 3 includes individual preference instead of demographic variables. It also includes the interaction effect between competitiveness and rank-based scheme since those who have high competitiveness may solve mazes harder when facing competition. The result shows that egalitarian solves less mazes but the effect is statistically insignificant. Those who have high competitiveness solve more mazes significantly. The possible reason is that those who have high ability are more likely to win in competition. The interaction between competitiveness and rank-based scheme is not statistically significant. Column 4 includes both demographic variables and preferences but the results are almost unchanged though some of the variables are correlated.

As we showed in section 3, if there is heterogeneity in other-regarding preference, we may observe selection based on other-regarding preference. The selection can be observed to see the production increase from Round 1 to Round 2. In the OLS regression in Table 6, the dependent variable is the increase in the number of solved mazes. Independent variables are same to Table 5 except that Round 2 and rank-based dummies are omitted. The purpose of regressions here is to investigate whether individual preference such as egalitarianism affect productivity change due to the giving stage. All specification shows almost all independent variables are not significant except science department dummy in column 4. This result implies that we cannot find any evidence that egalitarianism, one of the typical other-regarding preferences, explains the production change by the presence of giving stage. It does not seem that the selection mechanism based on other-regarding preference is important in our experiment different to EGN.

5. Discussion and conclusion

In this study, we conducted a laboratory experiment to investigate the relationship between income and giving. In the first round of our experiment, subjects solved mazes in a piece-rate scheme. In the second round, they solved mazes either in a four-player tournament or in a piece-rate scheme and then gave a part of their earnings to the other group members. The results indicate that individual giving increases as the individual's reward increases and other players' reward decreases. This indication differs from that based on the results of EGN's real effort experiment, which showed that those ranked second in a four-player tournament give more than

those ranked first because of selection based on other-regarding preferences. Our results also indicate that the level of egalitarianism, as measured by the post-experiment questionnaire, is negatively associated with giving, and has no relationship with the increase in performance from the first to second round. Competitiveness is positively associated with giving and has no relationship with change in productivity.

We propose two explanations for differences between the results of our experiment and those of EGN. One is that the selection mechanism was not important in our experiment and that our results can be explained only by other-regarding preferences, which implies that those who have more money give more. In other words, the subjects did not link effort to giving, and thus chose an optimal strategy in each stage individually. The other explanation is that selection occurs but not always in the same direction. While some other-regarding subjects have a preference like that in the warm glow model and are selected for a higher rank, other other-regarding subjects have a different preference such as an inequality aversion and are selected for a lower rank. These types of subjects are mixed, and as a result, the regression results indicate that the selection does not occur at an average level. Although we cannot identify these two explanations, we can conclude that the other-regarding preference of Australian students differ from those of Japanese students.

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