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Decisions on Exits

– A Social Dilemma Experiment with Intergroup Mobility –

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Abstract

Using experimental data from a social dilemma experiment, we examine the differences in exit behavior between cooperators and non-cooperators. Our results show that the cooperators have a higher probability for exit choices than the non-cooperators. The non-cooperators are more sensitive to the cooperation rate of others in their groups. We also investigated intentions of the exit choices in terms of predicted payoffs and predicted group sizes. For the predicted payoffs, the non-cooperators try to move into groups with higher predicted payoffs. For the predicted group sizes, the cooperators try to move into smaller groups. These facts are consistent with Ehrhart and Keser (1999) that non-cooperators try to enjoy free riding, and cooperators try to escape from free riding.

JEL classification: C91, H41

Keywords: Free riding, mobility, laboratory experiments

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1 Introduction

Modern societies enjoy increasing mobility in areas such as job changes, moves and immigration. On the other hand there is the free-riding problem, manifested in shirking in workplaces and a collapse of social norms.

Theoretically, there is a relation between these two phenomena; there are negative effects of mobility on cooperation. Where there is no mobility, players continue to interact with each other in a fixed group or society. They know that free-riding will bring about harmful effects on their future payoffs. In situations where there is mobility, however, players can cut relationships with other members of their group. The more mobility increases, the less that players care about the harmful effects of free riding. This argument is based on the "folk theorem" of the repeated prisoners' dilemma game.

Conversely, there are positive effects of mobility on cooperation in the coordination game (Dieckmann (1999), Bhaskar and Vega-Redondo (2004), Oechssler (1997)). In the usual interesting coordination game, there exist both Pareto-efficient equilibrium and a risk-dominant but inefficient equilibrium. The risk-dominant equilibrium gives an advantage to risk taking. The decrease in a player's payoff that arises from a miscoordination in the risk-dominant equilibrium is less than that in the Pareto-efficient equilibrium. The risk-dominant but inefficient equilibrium is selected under various conditions (Kandori, Mailath and Rob (1993), Ellison (1993), Young (1998)). If, however, there is a choice to move into another group, the Pareto efficient equilibrium may preferred over the risk dominant equilibrium. This logic is very simple. Players in the inefficient group can exit in order to change the action from the inefficient one to the efficient one.

The logic in the coordination game does not apply directly in the social/prisoners' dilemma game. In the coordination game, all players wish to change for the efficient action, so that the action of players who are moving into a group is desirable for players who have been in the group. On the other hand, in the social/prisoners' dilemma game, the non-cooperators aim to enjoy free riding by moving into another group. Because of these free riders, the cooperators in the group do not continue to cooperate. Consequently the Pareto efficient equilibrium is not supported by the mobility.

In the social/prisoners' dilemma game, the cooperators and the non-cooperators both move. However, if there are differences in moving behaviors among them, we can look at the possibility that the exploitation of differences makes it possible to sort out the cooperators from the non-cooperators in a social/prisoners' dilemma game.[1] Ehrhart and Keser (1999) show the differences in moving behaviors, such that the cooperators are on the run from the non-cooperators, who follow them around. Less attention has been paid to the moving behavior in a social/prisoners' dilemma game. There is a need for experimental work to investigate this.

This paper examines a social dilemma experiment with intergroup mobility. There are 17 subjects and 4 groups in a session. Subjects play a social dilemma game within each group. After five times of the social dilemma games, players simultaneously offered an exit option. This process is repeated. We have 9 samples for moving decisions per subject. Ten sessions were conducted, so that the sample size for moving decisions is 1,530. By applying maximum likelihood methods to the panel data of our experiment, we estimate moving behaviors and analyze the differences between the cooperators and the non-cooperators.

Our results are as follows. First, the cooperators have higher probability for exit choices than the non-cooperators. The non-cooperators, on the other hand, are more

[1]Concerning sorting effects, see also Orbell and Dawes (1993) and Bohnet and Kubler (2005), Hayashi (1993).

sensitive to the "cooperation rate of others in their group". We also investigate subjects' intentions for exit choices in terms of predicted payoffs and predicted group sizes. The non-cooperators, on average, try to move into groups with higher predicted payoffs. This bias is not found for the cooperators. Non-cooperators also try to move into larger groups, whereas cooperators try to move into smaller groups.

These results are consistent with the principle that the non-cooperators try to enjoy free riding and the cooperators try to escape from free-riding (Ehrhart and Keser (1999)). We also shed further light on the moving behaviors. In Ehrhart and Keser (1999) use the Spearman rank correlation coefficient. With this method it is a possible that other conditions in the experiments were not adequately controlled, and there is a limit to the examination of behavior patterns. To overcome these problems, we estimate the exit behavior function including control variables.

In section 2 we outline the experimental design. Section 3 reports the estimations and the results for exit behavior. Section 4 examines intentions of players and Section 5 presents conclusions.

2 Experimental Design

Our experiment consisted of ten sessions, utilizing 170 students in 4 Japanese universities in or near Tokyo. There are 17 subjects in a session. Seats were assigned to them by a lottery in a large room with no partitions. They were connected by computers on a local area network, and made decisions by clicking their mouse anonymously. All information about the game was shown on a laptop computer display to each subject.

Structure of the game: The game was designed as follows:

1. at the start, subjects were randomly assigned to one of four groups by computer. Each group had four or five subjects;

2. at a single stage, they played a social dilemma game within their groups;

3. in a round, they repeated five stages and then had an option to move to another group;

4. in a session, ten rounds were repeated.

In total, subjects played the social dilemma game for 50 stages, with nine chances to exit (Figure 1). Subjects did not know when the session would come to an end.

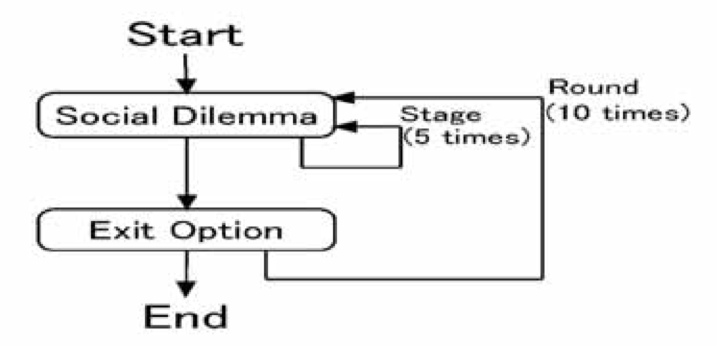


Figure 1: Structure of Experiment

Social Dilemma Game at Each Stage: At each stage, subjects received 20 yen as a resource.[2] They decided whether to provide it to their group as an investment ("cooperation" or "C"), or to keep it ("non-cooperation" or "N").

The rate of return depended on group size. Let n denote the number of all members in a group and m be the number of providers in the group.

[2] 110 yen was about one U.S. dollar at the time of the experiment.

In multiple-player groups, $n \geq 3$, the investment was multiplied by 2. The payoff function, $U(\cdot)$, is defined as follows:

$$U(C) = 40\frac{m}{n}, \qquad U(N) = 40\frac{m}{n} + 20. \tag{1}$$

In two-player groups, $n = 2$, the investment was multiplied by 1.5:

$$U(C) = 30\frac{m}{2} = 15m, \qquad U(N) = 30\frac{m}{2} + 20 = 15m + 20. \tag{2}$$

In single-player groups, $n = 1$, the return was equal to the investment because there were no "social" effects:

$$U(C) = U(N) = 20. \tag{3}$$

These payoff functions satisfy Dawes (1980)'s conditions of social dilemmas, apart from the single-player groups.[3]

Subjects were given an instruction for this structure before the game. They were also asked to complete two confirmation tests, to check that they had understood the

[3]Dawes (1980) gives a formal definition of social dilemmas. In a social dilemma,

1. persons have options of "cooperation" (voluntary contribution to the group) and "non-cooperation" (non-contribution);
2. non-cooperation always provides higher payoff than cooperation
3. but if everyone defects, they receive less payoff than if everyone cooperates.

There is another confirmation of the social dilemma. An individual return per extent of "cooperation", $r(n)$, varies according to the size of the group. In our setting, it follows that

$$r(2) = 0.75, \qquad r(n) = 2/n \quad (n \geq 3). \tag{4}$$

We confirm that, for $n \geq 2$, $r(n)$ is less than 1. However, the return to the entire group, that is, $2 \cdot r(2) = 1.5$ or $n \cdot r(n) = 2$, is greater than 1, for $n \geq 2$. This is another criterion for the social dilemma. Also, $r(n)$ is a strict decreasing function for $n \geq 2$. These facts are consistent with the assumptions in Ehrhart and Keser (1999).

structure. Solutions were aslo provided by an instructor after the tests.

At the beginning of each stage, each subject saw the following information on the computer display: all his/her past decisions and payoffs in the current round; each group's size; each group's average payoffs at the previous stage and those in the current round; his/her total payoff.

After decision making, each subject was given the following information: the number of providers in his/her group, his/her own decision and payoff at that stage.

Exit Options in the Round: After five stages, the subjects were simultaneously offered an exit option. The subjects decided which group to join in the next round. They could choose to stay in the same group. If another group was chosen, the subjects had to pay moving costs. We considered three different conditions: high moving costs, low costs, and no costs. The cost function, $C_{\mathsf{T}}(\cdot)$, is defined as follows:

$$C(E) = 50, \qquad C(S) = 0 \qquad \text{in high cost condition,} \tag{5}$$

$$C(E) = 20, \qquad C(S) = 0 \qquad \text{in low cost condition,} \tag{6}$$

$$C(E) = C(S) = 0 \qquad \text{in no cost condition,} \tag{7}$$

where E denotes "Exiting", and S "Staying".

At the decision making for exiting (or not), each subject saw the following information on the computer display: all his/her past decisions and payoffs in the current round, each group's size, each group's average payoffs in all past rounds, and his/her total payoff.

Total Payoffs: In summary, each subject earned a payoff in the session as follows:

$$\sum_{t=1}^{50} U(a_t) - \sum_{T=1}^{9} C(b_t), \tag{8}$$

where $a_t \in \{C, N\}$ and $b_T \in \{E, S\}$ in each period $t \in \{1, \ldots, 50\}$, and $T \in \{1, \ldots, 9\}$.

Subjects knew that they would receive a monetary reward (in yen), which would be equal to the payoff they earned in their session.[4]

3 Differences in Exit behavior

3.1 Descriptive statistics of sessions

Descriptive statistics of sessions are summarized in Table 1. At the macro level, we confirm that the mobility rates differ significantly with different moving costs.[5] However, the cooperation rates does not show such a significant difference. An accompany paper, Kobayashi, Koyama, Fujiyama and Oura (2005), investigates macro behavior more closely. Below, we focus on individual behavior patterns (micro level analyses).

3.2 Data and Variables

A player has nine chances to exit from a group in a session. There are ten sessions in which 17 subjects are included. The sample size is therefore 1,530 (= 9 × 17 × 10). We construct an "exit variable" which, if a subject exits from a group, takes value 1, and is otherwise 0. The degree of individual cooperation is represented by the "individual

[4] They would receive 1,000 yen as a minimum reward, regardless of their earnings. They did not know this in advance.

[5] According to the Kruskal-Wallis test, there are differences between the three conditions at the five percent significance level. The test value is 7.875 (> 5.991).

session	moving cost	Cooperation Rate Mean	(S.D.)	Mobility Rate Mean	(S.D.)	Payoffs Mean	(S.D.)
1	50	0.349	(0.209)	0.203	(0.180)	1236.5	(171.9)
2	50	0.360	(0.184)	0.203	(0.116)	1228.2	(113.8)
3	50	0.256	(0.181)	0.209	(0.201)	1145.0	(181.7)
4	50	0.268	(0.178)	0.131	(0.116)	1203.9	(142.4)
5	20	0.295	(0.161)	0.327	(0.145)	1217.1	(111.8)
6	20	0.296	(0.207)	0.216	(0.210)	1223.7	(102.5)
7	20	0.395	(0.224)	0.281	(0.162)	1331.8	(199.3)
8	20	0.286	(0.163)	0.268	(0.166)	1218.8	(88.1)
9	0	0.288	(0.231)	0.693	(0.181)	1261.8	(100.1)
10	0	0.416	(0.186)	0.654	(0.178)	1381.2	(138.3)
All sessions		0.320		0.318		1244.8	

Unit is the individual subject.

Table 1: Descriptive Statistics of Sessions

cooperation rate," which is the ratio of the number of choosing cooperation to all 50 decisions. This measure is not based on potential attitudes, but on actual behaviors[6].

In this section we investigate whether there is a difference in exit behavior between the cooperators and the non-cooperators. In the regression equation, the "exit variable" is a dependent variable, and the "individual cooperation rate" is an explanatory variable. We test the exogeneity of the "individual cooperation rate", and whether the hypothesis that the variable is exogeneous is accepted.[7]

To control the environment, we consider several control factors. The first factor is one by which subjects are pushed to another group. From this point of view, there is a "cooperation rate of others in their group," which is the group's average cooperation rate excluding the subject concerned in the round under consideration. For example, there

[6]This kind of measurement is used in Ehrhart and Keser (1999).

[7]More precisely, the test follows the procedure recommended by Wooldridge (2002, p. 474). In this procedure we use the size of the group to which the subjects belong as an additional exogenous variable. The p value for this test is 0.185. Consequently, we cannot reject the null hypothesis that the "individual cooperation rate" is exogenous.

are four subjects in a group, and the cooperation rate of Subject 1 is 0.4; the cooperation rate of Subject 2 is 0.6; the cooperation rate of Subject 3 is 0.2; the cooperation rate of Subject 4 is 0.3. For Subject 2, the "cooperation rate of others in their group" is $\{0.4 + 0.2 + 0.3\}/3 = 0.3$. If this value is low, the subject is likely to leave the group.

The second control factor is one by which subjects are pulled from other groups. We assume that subjects predict the next round payoffs very simply, such that they suppose the payoff in the current round significantly affects the payoff in the next round. The data for payoffs of the other groups in the current round is therefore interpreted as a simple predicted average payoff for each group in the next round (Figure 2).[8] We call this variable a "simple predicted payoff". There are more complicated (sophisticated) ways of predicting outcomes. However, the subjects have no prior experience of playing the game, so this simple mode of prediction is reasonable.

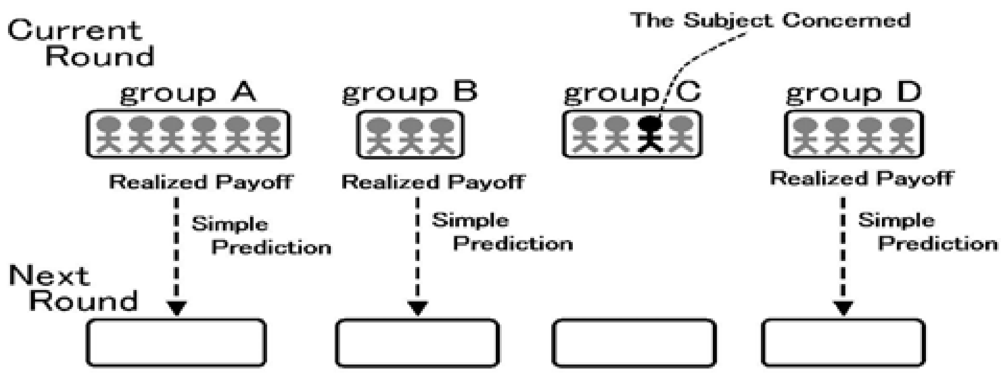


Figure 2: Simple Prediction

From the standpoint of payoff maximization, these are the most important factors.

[8]If there is an empty group in a current round (no subject is in the group), we take 20 yen as the predicted payoff for the group. This is because, if one subject moves to the empty group in the next round but all other subjects stay in the same groups, then that the subject belongs to the single-player group, and by definition the subject's payoff is 20 yen.

We consider the cooperation rate in the "push" factor and payoffs in the "pull" factor. The reason is that the payoff of a subject in a round is determined by the "cooperation rate of others in their group" and the subject's cooperation rate. Therefore, to control the environment, the "cooperation rate of others in their group" is relevant in the "push" factor. Also, the subject's action is not included in the "pull" factor. In addition, the average payoffs of other groups are displayed on the computer displays of all subjects in the session.

Further control factors are the dummy variables for the 50-yen-cost and 0-yen-cost conditions.

We omit the "exit variable" for the exits from single and two subject groups, because the formula for payoffs in single and two subject groups are different, and the "cooperation rate of others in their group" cannot be calculated in a single-subject group. Figure 3 summarizes the relationships among the variables.

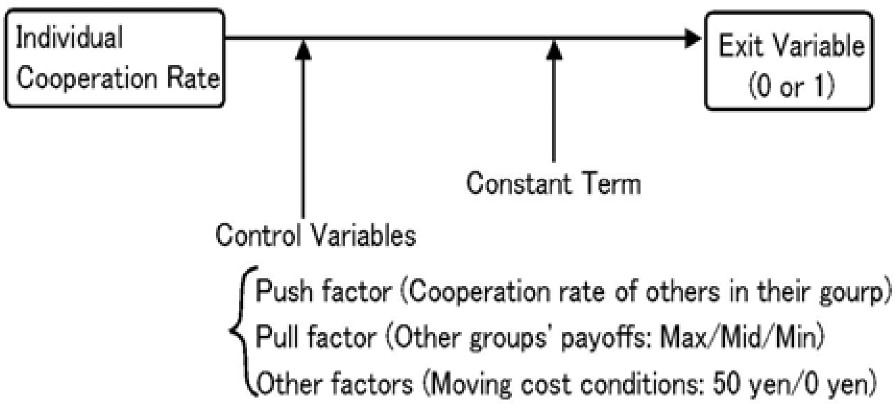


Figure 3: Dependent and Explanatory Variables

3.3 Estimation and Results

In the following two models, the dependent variable is the "exit variable," which is binary data, and there are individual effects. To estimate prameters we use the probit model with random effects specification for our panel data.[9] We believe there is no serious multicollinearity, because correlation coefficients for the explanatory variables are generally below 0.3.[10]

First, we make a simple estimation using all data (Model 1). Table 2 shows the estimated results. From Table 2 we obtain the following results:

Result 1: There is a positive correlation between the "individual cooperation rate" and the probability for the exit choice.

It follows that the cooperators have higher probability for choosing to exit than the non-cooperators.

Result 2: There is a negative correlation between the "cooperation rate of others in their group" and the probability for the decision to exit.

This results shows that the push factor, that is, the "cooperation rate of others in their group", is important information for the subjects.

[9] We also use the logit model with random effects specification. Estimated results are essentially the same in the logit model.

[10] Among the other group payoffs, we found some correlation coefficients of value approximately 0.5. However, the estimated values are similar with other formulations and estimation methods. We therefore include these variables into the regression equations.

Dependent Variable: Exit Variable	(random effects probit regression)	
Independent Variables	Coefficients	(p-value)
Constant	-1.245	(0.006)**
Individual Cooperation Rate	0.551	(0.024)*
Cooperation Rate of Others in their group	-1.575	(0.000)**
Other Group's Payoff (Max)	0.012	(-0.290)
Other Group's Payoff (Mid)	0.039	(0.024)*
Other Group's Payoff (Min)	-0.018	(-0.378)
Dummy for 50 yen Moving Cost	-0.398	(0.000)**
Dummy for 0 yen Moving Cost	1.122	(0.000)**

LR test (zero slope): $\chi^2(7) = 174.6$ (p-value $= 0.000$**)

LR test (no random effect): $\bar{\chi}^2(1) = 17.45$ (p-value $= 0.000$**)

Pseudo $R^2 = 0.171$

$N = 1425$

* significant at 5 % level, ** significant at 1 % level

Table 2: Decision on Exits

In Model 2, we consider the cooperators and the non-cooperators separately, in order to compare estimated parameters. We arrange the subjects in order, according to their "individual cooperation rate", and consider the top one-third as cooperators, and the bottom one-third as non-cooperators. It emerges that the cooperators' "individual cooperation rates" are higher than 0.4 and those for non-cooperators are lower then 0.2.

We first test for a significant difference in parameters between the cooperators and the non-cooperators. We use the Chow test. There is a significant difference at the 5 % level ($15.582 > \chi^2_{8,0.05} = 15.507$).

With dummy variables for non-cooperators, we estimate the difference more closely. The results are shown in Table 3.

Result 3: Both the "cooperation rate of others in the group (CRO)" and "non-cooperation dummy for CRO" have significant negative coefficients.

In other words, non-cooperators are more sensitive to the cooperation rate in their group. Figure 5 shows the difference more clearly. The vertical axis is the probability for the decision to exit. The horizontal axis is the cooperation rate of others in the group. We substitute common average values of other explanatory variables into both estimated cumulative density functions except for the "individual cooperation rate". The average value of the "individual cooperation rate" in each category is substituted into each density function, since we are focusing on the difference between cooperators and non-cooperators.

Dependent Variable: Exit Variable	(random effects probit regression)	
Independent Variables	Coefficients	(p-value)
Constant	-0.988	(0.237)
Individual Cooperation Rate (ICR)	1.520	(0.038)*
Cooperation Rate of Others in their group (CRO)	-0.946	(0.005)**
Other Group's Payoff (Max) (OGP-max)	0.003	(0.861)
Other Group's Payoff (Mid) (OGP-mid)	0.019	(0.523)
Other Group's Payoff (Min) (OGP-min)	-0.028	(0.418)
Dummy for 50 yen Moving Cost (D50)	-0.424	(0.034)*
Dummy for 0 yen Moving Cost (D0)	0.836	(0.000)**
Non-Cooperation Dummy for Constant	-0.556	(0.650)
Non-Cooperation Dummy for ICR	0.211	(0.894)
Non-Cooperation Dummy for CRO	-1.809	(0.003)**
Non-Cooperation Dummy for OGP-max	0.006	(0.824)
Non-Cooperation Dummy for OGP-mid	-0.001	(0.968)
Non-Cooperation Dummy for OGP-min	0.063	(0.232)
Non-Cooperation Dummy for D50	-0.162	(0.572)
Non-Cooperation Dummy for D0	0.381	(0.331)

Wald test (zero slope): $\chi^2(15) = 106.25$ (p-value $= 0.000$**)

LR test (no random effect): $\bar{\chi}^2(1) = 13.61$ (p-value $= 0.000$**)

Pseudo $R^2 = 0.105$

$N = 910$

* significant at 5 % level, ** significant at 1 % level

Table 3: Difference between cooperators and non-cooperators

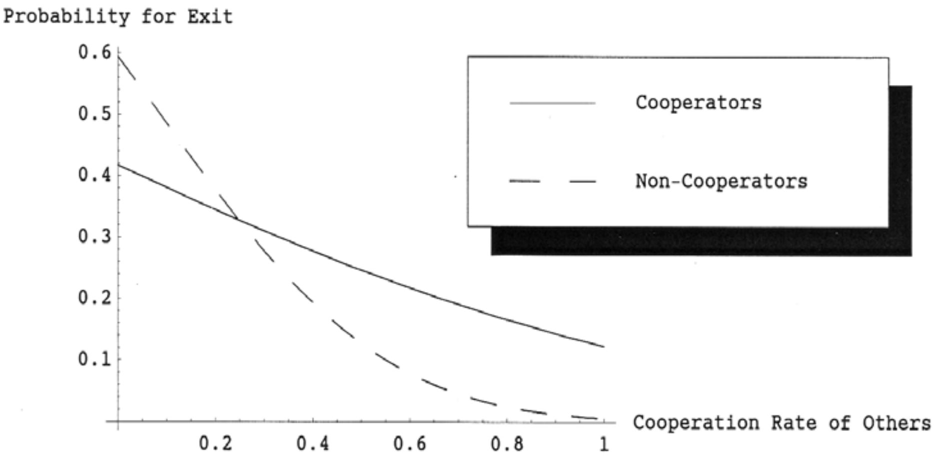


Figure 4: Probability for Exit

4 Intentions in Exit Choices

In this section we examine systematic deviations from random exit behavior. From the experimental data we can calculate the average expected payoffs or group sizes which were not realized with the actual exit behaviors. We can also calculate the average expected payoffs or group sizes which were realized. We look at the difference between these two values, since differences relate to subjects' intentions to exit or not.

4.1 Data and Variables

At the end of each round there are three groups to which a subject can move. The sample size is 5,100 (= 3 groups × 10 rounds × 17 subjects × 10 sessions).[11] Data include the average payoff (or size) of each group. As in the previous section, these

[11] In the last round, there is no chance to exit. However, data from it provide information on the situation in the session.

values are interpreted as a "simple predicted payoff (or group size)" in the next round. These simple "predicted payoffs (or sizes)" are dependent variables.

We construct an "exit dummy variable", such that if the group in the current round is the group to which the player actually moves, then its value is 1, and otherwise it is 0. Using this dummy variable, we divide all data into two categories. In the first category, the values of the "exit dummy variables" are 0. If the subjects select the group randomly in their exit choices, characteristics in this categories dominate over those in the other category.[12] In the second category, the values of the "exit dummy variables" are 1. The data in this category is data for the group to which subjects actually moved.

An explanatory variable used here is the "individual cooperation rate" defined in the previous section. To control the environment, we consider dummy variables for 50-yen-cost and 0-yen-cost conditions, and seven dummy variables for the sessions.[13] The data set is constructed as in Figure 5.

[12]This category is much larger than the other category because the average rate of exiting is about 0.318.

[13]With these 9 dummy variables, we can classify effects of each session in full.

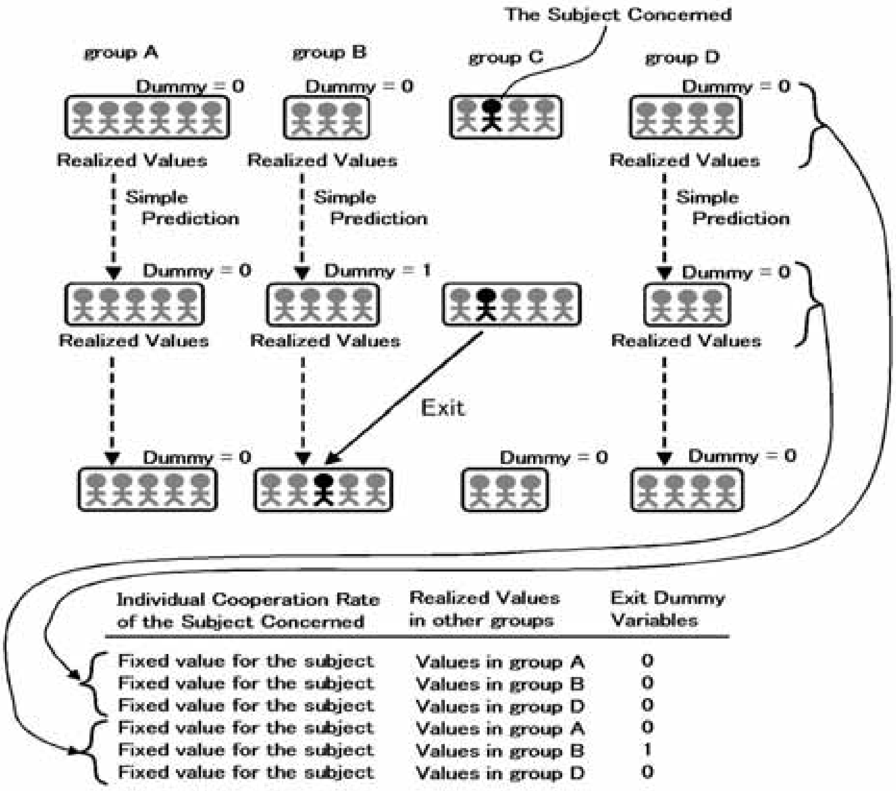


Figure 5: Data Set

4.2 Estimation and Results

We consider, two models in which the dependent variables differ. In the first model (Model 3), the "simple predicted payoff" is the dependent variable. In the second model (Model 4), the "simple predicted group size" is the dependent variable. In both models, the "individual cooperation rate" is a target explanatory variable. Using the "exit dummy variable", we examine the change in the constant term and the coefficient of the "individual cooperation rate". In these models there is no individual effect on the values in other groups, so that we use OLS estimations instead of panel estimations.

In Model 3, we examine what levels of "predicted payoffs" the subjects prefer when they decide to move other groups.

With Table 4, we have the following result:

Result 4: In considering the differences, the "exit dummy variable" for the constant term is significant and positive. The coefficient of the "exit dummy variable" for the "individual cooperation rate" is significant and negative.

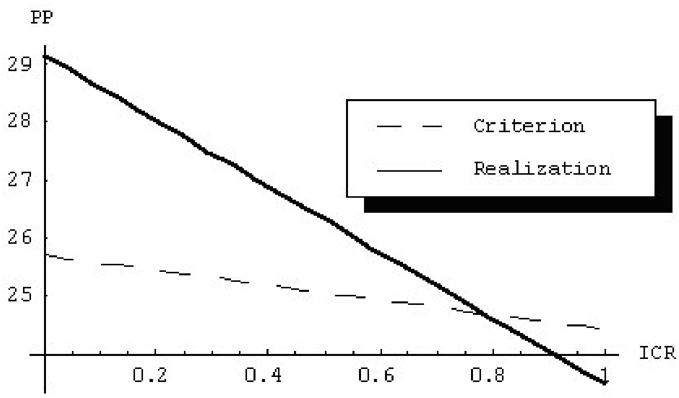
We draws a graph of the estimated function in Model 3 (Figure 6).[14]

Dependent Variable: Predicted Payoffs	(OLS estimation)	
Independent Variables	Coefficients	(p-value)
Constant	25.70	(0.000)**
Exit Dummy for Constant	3.463	(0.000)**
Individual Cooperation Rate (ICR)	-1.284	(0.000)**
Exit Dummy for ICR	-4.400	(0.000)**
Dummy for 50 yen Moving Cost	1.223	(0.000)**
Dummy for 0 yen Moving Cost	-0.476	(0.076)
Dummy for session 1 with 50 yen Moving Cost	-0.626	(0.019)*
Dummy for session 2 with 20 yen Moving Cost	0.585	(0.029)*
Dummy for session 3 with 0 yen Moving Cost	1.615	(0.000)**
Dummy for session 4 with 50 yen Moving Cost	-1.106	(0.000)**
Dummy for session 5 with 50 yen Moving Cost	-2.114	(0.000)**
Dummy for session 6 with 20 yen Moving Cost	-0.447	(0.095)
Dummy for session 7 with 20 yen Moving Cost	2.444	(0.000)**

F test (zero slopes) = 29.465 (p-value = 0.000**)
adj-R^2 = 0.062
N = 5100
* significant at 5 % level, ** significant at 1 % level

Table 4: Predicted payoffs

[14] In the graph, we omit the common control variables. We use the constant term, the "individual cooperation rate" and the corresponding dummy variables so as to see the difference more clearly.



PP: Predicted Payoffs, ICR: Individual Cooperation Rate
Criterion: The line that would be characterized if the participants exit randomly.
Realization: The line that was realized with the observed exiting.

Figure 6: Predicted payoffs and Individual Cooperation rate

These results show that the non-cooperators have a strong bias toward exiting to higher-payoff groups. Cooperators whose "individual cooperation rate" is close to 1 have a bias toward exiting to lower-payoff groups.

In Model 4, we examine what levels of the "predicted group sizes" the subjects prefer (Table 5).

Result 5: In considering the differences, the "exit dummy variable" for the constant term is significant and positive. The coefficient of the "exit dummy variable" for the "individual cooperation rate" is significant and negative.

We draws a graph of the estimated function in Model 4 (Figure 7).[15]

[15]In the graph, we omit the common control variables.

Dependent Variable: Predicted Group Sizes	(OLS estimation)	
Independent Variables	Coefficients	(p-value)
Constant	3.789	(0.000)**
Exit Dummy for Constant	0.525	(0.002)**
Individual Cooperation Rate (ICR)	0.454	(0.001)**
Exit Dummy for ICR	-1.645	(0.000)**
Dummy for 50 yen Moving Cost	0.152	(0.195)
Dummy for 0 yen Moving Cost	-0.003	(0.977)
Dummy for session 1 with 50 yen Moving Cost	-0.362	(0.002)**
Dummy for session 2 with 20 yen Moving Cost	0.137	(0.241)
Dummy for session 3 with 0 yen Moving Cost	0.303	(0.011)*
Dummy for session 4 with 50 yen Moving Cost	0.041	(0.726)
Dummy for session 5 with 50 yen Moving Cost	-0.031	(0.791)
Dummy for session 6 with 20 yen Moving Cost	-0.033	(0.778)
Dummy for session 7 with 20 yen Moving Cost	0.027	(0.812)

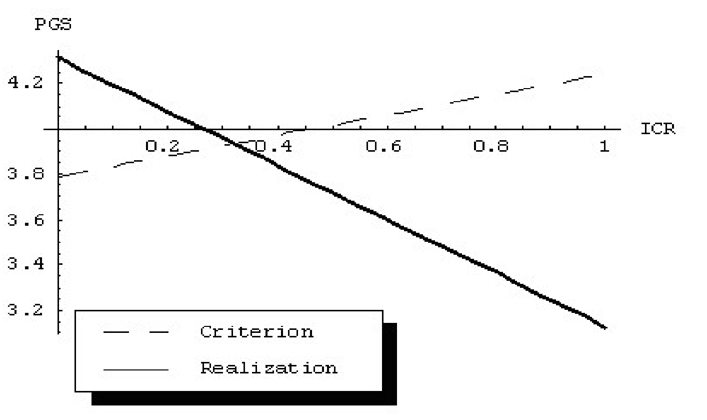
F test (zero slopes) = 4.137 (p-value = 0.000**)

adj-$R^2 = 0.007$

$N = 5100$

* significant at 5 % level, ** significant at 1 % level

Table 5: Predicted group sizes



PGS: Predicted Group Sizes, ICR: Individual Cooperation Rate

Criterion: The line that would be characterized if the participants exit randomly.

Realization: The line that was realized with the observed exiting.

Figure 7: Predicted group sizes and Individual Cooperation rate

These results show that the cooperators have a strong bias toward exiting to smaller groups. Non-cooperators whose "individual cooperation rate" is near 0 have a bias toward exiting to larger groups.

5 Conclusion

We have investigated factors that influence the decision to exit, and found the following conclusions. First, the "cooperation rate of others in their groups" was an important factor for all subjects (Result 2). The cooperators have a higher probability of exiting (Result 1, Figure 4). One reason is that the cooperators have a very high regard for the "cooperation rate of others in their groups", so the cooperators tend to exit from groups. The cooperators seek a high cooperation rate from others, and are not satisfied with middling (or even high) cooperation rates.

Second, there are clear differences in exit behavior between cooperators and non-cooperators. The non-cooperators are more sensitive to the "cooperation rate of others in their groups"(Result 3). One reason is that the non-cooperators attempt free riding. At a low "cooperation rate of others in their groups", they exit to other groups because they cannot get a free ride. At intermediate or high "cooperation rates of others in their groups", they do not exit to other groups because they get free riding. For the non-cooperators, the "cooperation rate of others in their groups" is the primary factor governing exit decisions.

Third are the facts to support these explanations. The non-cooperators try to move into groups with higher predicted payoffs (Result 4 and Figure 6). The cooperators have no such tendency. In focusing on the "predicted group sizes", the non-cooperators try to move into larger groups (Result 5 and Figure 7). Since the group size affects the cooperation rate negatively, the larger groups are undesirable for free riding. However, in the larger groups, free riding is less conspicuous than in the smaller groups. On the other hand, the cooperators try to move into the smaller groups (Result 5 and Figure 7). These observations are consistent with the results of Ehrhart and Keser (1999). They conclude that cooperators escape from free riders. The 'escape' insight explains why the cooperators tend to move into the non-higher-payoff and smaller groups, they suppose that the free riders leave such groups.

Finally, we can derive a practical lesson from the above arguments. The cooperators exit from the groups before the groups' cooperation rates decrease very much. After the cooperators exit, the non-cooperators begin to exit. Therefore, to achieve higher cooperation rates, it is important to create new groups and enclose the cooperators at early stages.

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