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Is the inequity aversion universal?

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Abstract

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Is the inequity aversion universal?*

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Abstract

The ultimatum game experiments provide evidence countenancing the inequity aversion preferences. However, asymmetries between bargaining roles of two players may cause to exaggerate the fairness of outcomes, because there is lack of the fairness of opportunities in bargaining. In this paper, we propose a two-stage game with approval stage to check whether the inequity aversion depends on the context of a game. In our game, two players make a choice related to the division of the money simultaneously, and then determine whether accept reject another's decision. We find that there is almost no rejection and symmetries of bargaining roles can make players focus only on their material payoffs. And the majority of choices are concentrated on the subgame perfect Nash equilibrium. Finally, Japanese subjects are more likely to behave spitefully than Korean subjects consistent with the results of previous experiments.

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1 Introduction

For last two decades, many researchers have been investigating social preferences. Social preferences assume that people regard not only their material payoffs, but also other fairness notions like others' payoffs and intention. One of the famous models to formalize social preferences is the inequity aversion model (Fehr and Schmidt, 1999) and it assumes that people have motivation to reduce differences between own payoff and others'. The inequity aversion model is corroborated by enormous evidence of laboratory experiments. The game concerned primarily as evidence of social preferences is the ultimatum game.

The ultimatum game is a two-person bargaining game to divide certain amount of money between two players. There are two players, a proposer and a responder, and in the first stage, a proposer makes an offer to a responder how they allocate the money for both of them. In the second stage, if a responder accepts an offer, then they divide the money as proposed. Otherwise, if a responder rejects an offer, then two players get nothing instead of a positive amount of money. The subgame perfect Nash equilibrium is that a proposer offers the smallest unit of money to a responder and a responder accepts it. It is the stylized fact, however, that a responder frequently rejects offers below 20% of the total amount of money and major offers are in the range from 25% to 50% of the total amount of money (Camerer, 2003). Such departure from self-interest motivation is considered as evidence that people do not exploit their bargaining power in bilateral bargaining situation. And the inequity aversion model is one of alternatives to explain social preferences.

However, we want to raise a question mark whether the inequity aversion preference is universal in every context of game. In the ultimatum game, regardless of a way how the roles are given to players, the fairness of opportunities in bargaining is not guaranteed to both players. A responder might be more sensitive to the allocation of outcomes, because he believes that he has inferior bargaining power to a proposer's. This can perturb the behavior of a proposer to avoid the extreme distribution of outcomes which might stimulate a responder's sensitivity. In

other words, the lack of fairness in opportunities might make people exaggerate the fairness of outcomes. Therefore, it is important to check whether asymmetries of players' roles in bargaining situation induce the inequity aversion inequity aversion preference or not.

We propose a two-stage game with the approval stage which rules out asymmetries of bargaining positions. Our game has similar game structure with the ultimatum game that the first stage is related to divide given amount of money and the second stage is the approval stage to accept or reject the division of the money. However, one big difference between two games is that in our game, two players bargain with the same bargaining positions. In the first stage, two players make a decision related to the division of the money simultaneously, and in the second stage, they should determine to accept or reject another player's decision. If two players accept each other's decision, then the money is given to them as they proposed. Otherwise, if any one of two players rejects another's decision, then they both get 0 instead of certain amount of money. Therefore, the main purpose of our game is to check whether introducing symmetries in bargaining positions make people focus on their own material payoffs, not others'. Our game will provide evidence that the inequity aversion preference is game-dependent, i.e. the inequity aversion is not universal in every kind of bilateral bargaining game.

The rest of the paper is organized as follows. We present the theoretical framework in section 2. In Section 3, we describe the experimental design and procedures. We report our experimental results in Section 4, and concluding remarks follow in Section 4.

2 The theoretical framework

2.1 The basic model

There are two subjects (1 and 2) and each subject i has w_i units of initial endowment of a private good. Two subjects confront a decision to split w_i between his own consumption of the private good (x_i) and contribution (y_i). The level of the public good each subject receives from the contribution is $y = y_1 + y_2 + w_y$,

where w_y is the initial level of the public god. Therefore, each subject's decision problem is to maximize his payoff $u_i(x_i, y)$ subject to the constraint $x_i + y_i = w_i$. We assume that all subjects have the same payoff function that is a monotonic transformation of a Cobb-Douglas type function. That is, $u_i(y_1, y_2) = \frac{(((w_i - y_i)^{\alpha}(y_1 + y_2 + 3)^{(1-\alpha)})^{\beta})}{50} + 500$. We set $(w_1, w_2, w_y) = (24, 24, 3)$, $\alpha = 0.47$, and $\beta = 4.45$. With there parameters the Nash equilibrium contribution pair of the voluntary contribution mechanism is $(\widehat{y}_1, \widehat{y}_2) = (7.69, 7.69)$ and the equilibrium level of the public good is $\widehat{y} = \widehat{y}_1 + \widehat{y}_2 + w_y = 18.38$. The Pareto efficient level of the public good is $y^* = y_1^* + y_2^* + w_y = 12.02 + 12.02 + 3 = 27.04$, which is determined uniquely by the Samuelson condition and the feasibility condition. Clearly, the level of the public good with the voluntary contribution mechanism $\widehat{y}$ is less than the Pareto efficient level of the public good y^*. In our experiment, subjects choose integer contribution numbers only. Hence the Nash equilibrium of this game is for each subject to contribute 8 and the Pareto efficient level of contribution is 12. No other Nash equilibria sneak into our model due to the discrete strategy choice set.

2.2 A two-stage game with the approval stage

We incorporate the approval stage into the basic model above to test whether some specific economic environment induces subjects to exploit their bargaining power in a two person game. The first stage is the strategy choice stage, and in this stage, two subjects make a decision that how much they contribute to the public good under the voluntary contribution mechanism. This decision is determined simultaneously so that they don't know another subject's contribution. The next stage is the approval stage. In this stage, knowing an amount of each other's contribution, two subjects determine whether accept or reject another subject's decision of contribution. If only two subjects accept each other's decision, then the public good is operated as they contribute. However, if anyone of two subjects rejects another subject's decision, then they get 0 instead of a certain positive amount.

Assuming that two subjects are rational to maximize own payoff, the subgame perfect Nash equilibrium is that by the backward induction, both subjects accept each other's decision in the second stage and contribute as much as 8 which is a best response to another subject's contribution in the first stage. This is the unique equilibrium of the game, and two subjects can get (7345, 7345).

Notice that according to the inequity aversion, any subject who gets more or less money than another subject's can reject a decision because he might be suffered from a difference of payoffs between two subjects. Therefore, a high rejection rate is possible to be interpreted that inequity aversion parameters α and β have strong effects on subjects' behavior. In contrast, a low rate of rejection might indicate that inequity aversion parameters α and β don't have significantly important effect on subjects' behavior or the inequity aversion doesn't emerge apparently in this kind of economic environment.

2.3 The characteristic of a two-stage game with the approval stage

The characteristic of the game is lucid when compared to another two stage bargaining game, the ultimatum game. Two games have common in game structure that in the first stage, a player makes a decision related to a division of money, and the second stage is the approval stage. However, one big difference stands on whether the roles of two subjects are identical to each other, or not. In the ultimatum game, regardless of a way how the roles are given to subjects, there is distinction of roles between subjects, a proposer and a responder. It is a quite typical fact that two players do not exactly follow the subgame Nash equilibrium which demands for a proposer to offer the smallest unit of money and for a responder to accept any positive amount of money offered. The bargaining power of a proposer is generally considered superior to responder's and a responder is more likely to exaggerate the fairness of outcomes so as to postulate the inequity aversion. In contrast to the ultimatum game, our game rules out asymmetries between two players. In the first stage, two players participate in a decision of contribution to the public good. Then, given another's decision, they determine whether accept

or reject it. Since a single rejection by any player of two players is able to veto the public good, they are considered that they have the same bargaining power. In other words, it can be interpreted that two players are guaranteed the fairness of opportunities in the bargaining game.

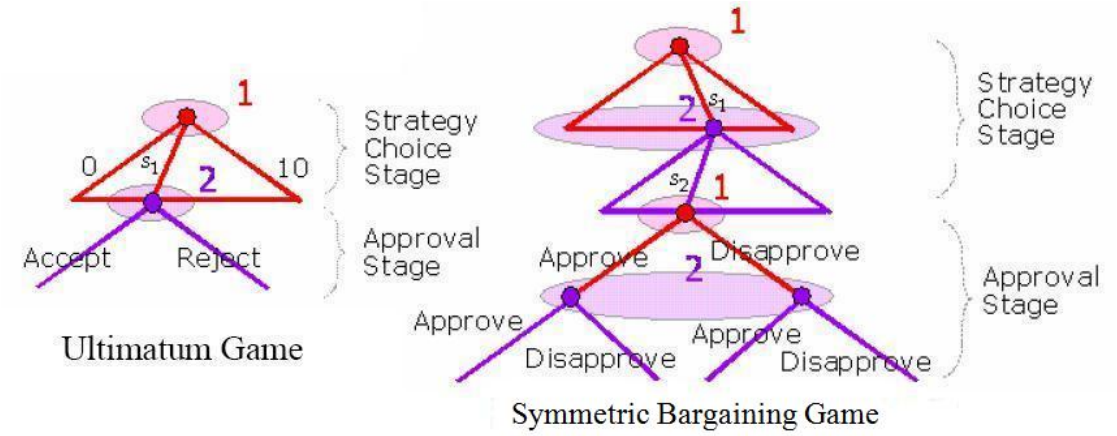

Figure 1: The structure of the game.

Figure 1 shows the game tree of the ultimatum game and our game. The ultimatum game is a sequential game that in each stage, only one player is asked to play a certain role. Interestingly, our game is the symmetric hull of the ultimatum game. Because it replicates the ultimatum game and extends the original game into the symmetric structure where both players are given the same tasks.

3 Experimental design and procedures

Our experiment was consisted of two sessions and each session was conducted in Osaka University, Japan (Japanese session) and Seoul National University (SNU), Korea, (Korean session). Each session is consisted of 19 periods. In each session, the twenty subjects were seated at desks with a computer and got identification numbers randomly. These identification numbers were not publicly displayed, however, so subjects could not determine who had which number. In each period, we made ten pairs out of twenty subjects, and these ten pairs played the two-stage game with the approval stage as described in the previous section. The pairings

were anonymous and were determined randomly so as not to pair the same two subjects more than once-a so-called "strangers" design. Instructions were read loudly by experimenter.

In the first stage, every subject made a decision how much he contributed to the public good simultaneously. At this time, every subject had the same payoff function and every subject knew this fact. We distributed a detailed payoff table, which contains every possible outcome made by two subjects' contribution. All subjects were able to readily calculate their payoffs following the practice periods in instructions. The tables used for the practice and real periods were different. Tentative payoffs determined by two subjects' contribution were calculated and presented on the screen after the first stage was finished.

In the second stage, knowing an amount of each other's contribution, two subjects determine whether accept or reject another subject's decision of contribution. If anyone of two subjects rejects another subject's decision, then they get 0 instead of a certain positive amount. After the second stage, subjects could find whether the public good was operated at the end of every period. The communication among the subjects was prohibited, and we declared that the experiments would be stopped if the communication among the subjects was observed. This never happened in both sessions.

In each session, subjects were undergraduate students at Osaka University and SNU, and were recruited by the university internet board. It took approximately two and half hours in each session. An average payoff is $46.5 (4650 yen with $1 = 100 yen) in Japanese session and $43.12 (47777 won with $1 = 1,108 won) in Korean session. We used the experimental software z-Tree (Fischbacher, 2007) to run the experiments.

4 Results

4.1 Almost no rejection

Table 1 shows the summary statistics about frequencies of subjects' relative profit to the total profit of his group and frequencies of rejections. (More concrete data

of choice about contribution will be discussed in the next section.) First of all, the total number of rejections is so small in both countries. In Japanese session, there are only three times of rejections in whole 380 times of approval decision, and its ratio is 0.8%. In Korean session, the number is slightly increased to 9, but its ratio is still very low, 2.4%. Therefore, we can say that there is almost no rejection in both sessions.

subject's profit/ total profit of his group			Japan	
	%	frequency	rejection rate	frequency
less or equal 10%	0.0%	0		
more 10% and less or equal 20%	0.3%	1	0.0%	0
more 20% and less or equal 30%	0.5%	2	50.0%	1
more 30% and less or equal 40%	5.5%	21	4.0%	1
more 40% and less or equal 50%	57.9%	220	0.5%	1
more 50% and less or equal 60%	29.5%	112	0.0%	0
more 60% and less or equal 70%	5.5%	21	0.0%	0
more 70% and less or equal 80%	0.5%	2	0.0%	0
more 80% and less or equal 90%	0.3%	1	0.0%	0
more 90% and less or equal 100%	0.0%	0		
All	100.0%	380	0.8%	3
subject's profit/ total profit of his group			Korea	
	%	frequency	rejection rate	frequency
less or equal 10%	0.8%	3	0.0%	0
more 10% and less or equal 20%	0.3%	1	0.0%	0
more 20% and less or equal 30%	1.1%	4	50.0%	2
more 30% and less or equal 40%	10.5%	40	7.5%	3
more 40% and less or equal 50%	48.9%	186	2.2%	4
more 50% and less or equal 60%	25.8%	98	0.0%	0
more 60% and less or equal 70%	10.5%	40	0.0%	0
more 70% and less or equal 80%	1.1%	4	0.0%	0
more 80% and less or equal 90%	0.3%	1	0.0%	0
more 90% and less or equal 100%	0.8%	3	0.0%	0
All	100.0%	380	2.4%	9

Table 1. Frequency and Rejection rate in Japan and Korea.

However, this is quite contradicting results to what the inequity aversion model might predict. Even though the inequity aversion model assumes that people have heterogeneous preferences varying parameters α and β, if people have the inequity aversion preferences, we might expect higher rejection rates when someone has less money than his partner's. To check whether these results are significantly robust, we compare these data with the results of the ultimatum game which are

used to corroborate the inequity aversion model. Unfortunately, our data doesn't contain enough samples for the intervals when one player has less than 30% of the total profit of his group. Therefore, we choose two intervals of 'more 30% and less or equal 40%' and 'more 40% and less or equal 50%' to compare with rejections of those same intervals where responders are given by proposers in previous ultimatum game experiments. Camerer (2003) summarizes the results of 41 previous ultimatum game experiments (pp.53-55, Table 2.3) and we calculate the average rejection rate across the experimental conditions.

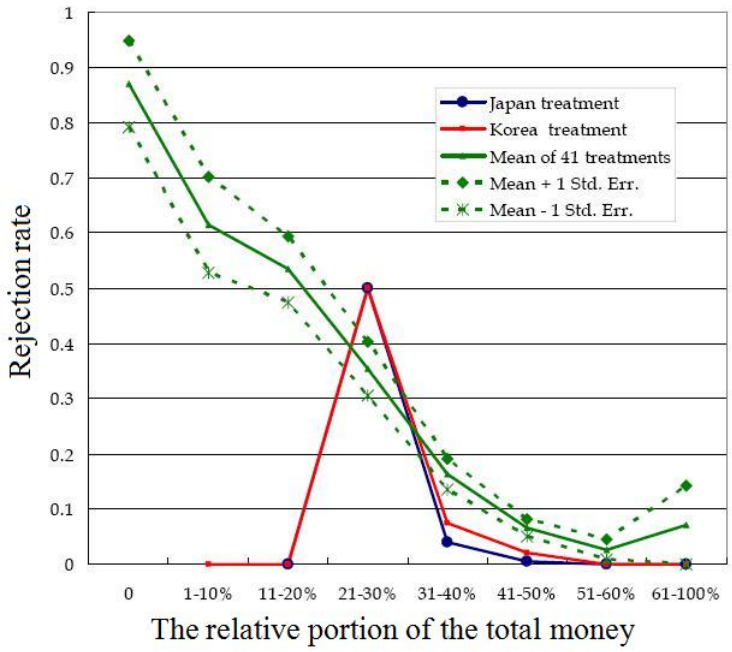

Figure 2: Rejection rates in previous ultimatum game experiments and our experiments.

Figure 2 illustrates rejections rates in previous ultimatum game experiments and our experiment. In the interval of 'more 30% and less or equal 40%', while rejections rates in Japanese session and Korean session are 4% and 7.5%, rejection rate of previous ultimatum game experiments is 16.4%. In the interval of 'more 40% and less or equal 50%', these numbers are 0.4%, 2.1%, and 6.6%. To check whether these differences are significant, we use Wilcoxon signed rank test, and

the results are presented in Table 2.

subject's profit/ total profit of his group	Ultimatum vs. Japan	Ultimatum vs. Korea	P-value
more 30% and less or equal 40%	3.82	2.59	$p < 0.05$
more 40% and less or equal 50%	3.15	2.16	$p < 0.05$

Table 2. Tests for differences of rejection rates.

As seen in Table 2, all comparisons between previous ultimatum game experiments and our experiment are significantly different. Even in a bilateral bargaining game, if two players who participate in a game have symmetric bargaining positions, then the inequity aversion might be vague in this context of a game. Therefore, the inequity aversion can be considered game-dependent. And introducing symmetries of bargaining power between players might be a key to make them focus on their material payoffs.

4.2 Convergence to the Nash Equilibrium

In previous section, we analyze subjects' decision in the second stage. In this section, we focus on subjects' choice of contribution in the first stage. Figure 3 illustrates how Japanese and Korean subjects contribute to the public good in the first stage.

They show similar pattern of contribution that distribution of contribution is centered at 8 and has a bell shape around 8. An average contribution of Japanese session and Korean session are 7.56 and 7.96. Recall that contributing 8 is the subgame perfect Nash equilibrium. First of all, we check whether patterns of contribution in both sessions are significantly different from 8. By using Wilcoxon singed rank test, we find that while an average contribution in Japanese session is significantly different from 8 ($p < 0.001$), an average contribution in Korean session is not significantly different from 8 ($p > 0.100$). Such tendency is also advocated that average contributions in both sessions are significantly different from each other by the same test ($p < 0.001$). This finding might indicate that while

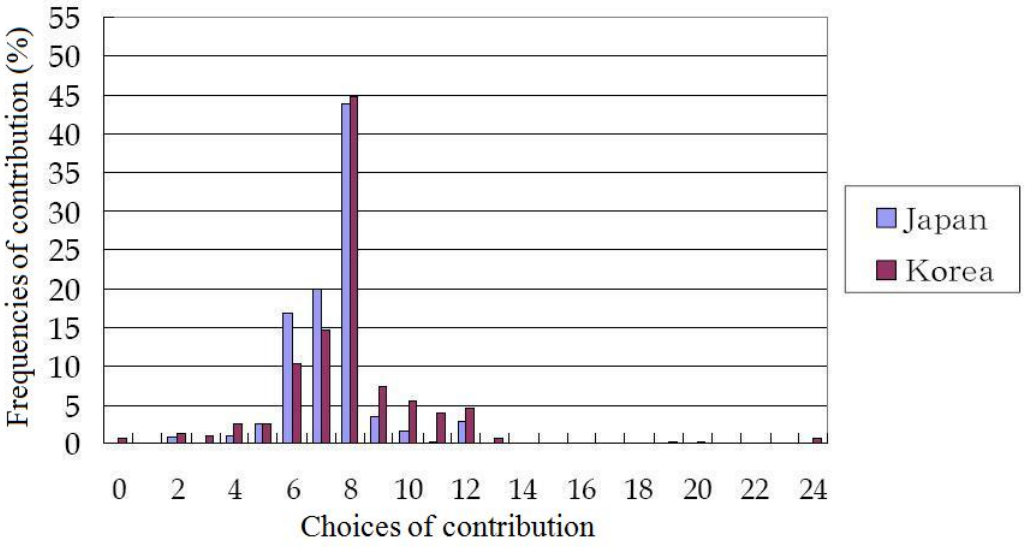

Figure 3: Frequencies of contribution in all periods.

Korean subjects are more likely to converge to the Nash equilibrium, Japanese subjects are more likely to converge to the level below the Nash equilibrium. Figure 4 presents an average contribution of every period in both sessions.

In early periods, patterns in both sessions are fluctuated around 8. However, after period 5, patterns in both sessions are maintaining somewhat stable contribution until the end of the session. It can be inferred that subjects are converging to the subgame perfect Nash equilibrium in which both subjects contribute 8 in the first stage and accept each other's decision simultaneously in the second stage.

4.3 Are Japanese subjects Spiteful?

To investigate behavior pattern in a greater detail, we compare the behavior patterns of two sessions. We use Chi-square test and find that the difference of the frequency of each investment across all periods between Korea and Japan is significant ($p<0.05$). It indicates that Japanese subjects contribute to the public good lower than Korean subjects, and this tendency is significantly different. When we narrow our scope for the early periods from period 1 to period 5, we can find that this tendency is extreme at the beginning. Figure 5 shows choices of contribution

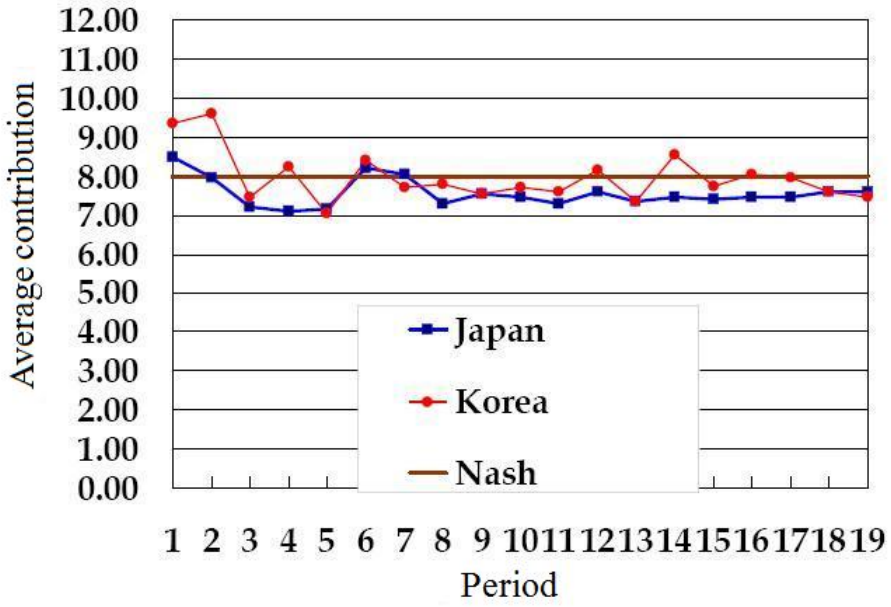

Figure 4: Average contributions in all periods.

in both sessions from period 1 to period 5.

One conspicuous feature is that While Korean subjects are more likely to choose 8 as their contribution, Japanese subjects are more likely to choose 6 and less likely to choose 8 compared to Korean subjects' decision. To understand this phenomena clearly, we need to recall that a contribution to achieve the Pareto efficient level is 12. In both sessions, the rate of choosing 12 is not much different, little lower than 10%. However, the choice of 6 which is a best response to 12 appears much higher in Japanese session, almost three times higher rate than Korean session's. This might indicate that in Japanese session, subjects are inclinable to behave spitefully assuming that another subject would choose 12 to accomplish the Pareto efficiency. This is consistent result with previous experiments that reveal Japanese subjects have tendency to behave more spitefully compared to their counterparts in other countries (Cason et al. (2002), Cason et al. (2004), and Chun et al. (2010)). However, after period 5, the rate of choosing 6 in Japanese subjects shrinks as period proceeds. It seems that they learn that choice of 6 is not the optimal strategy, because more subjects are more likely to choose 8 instead of

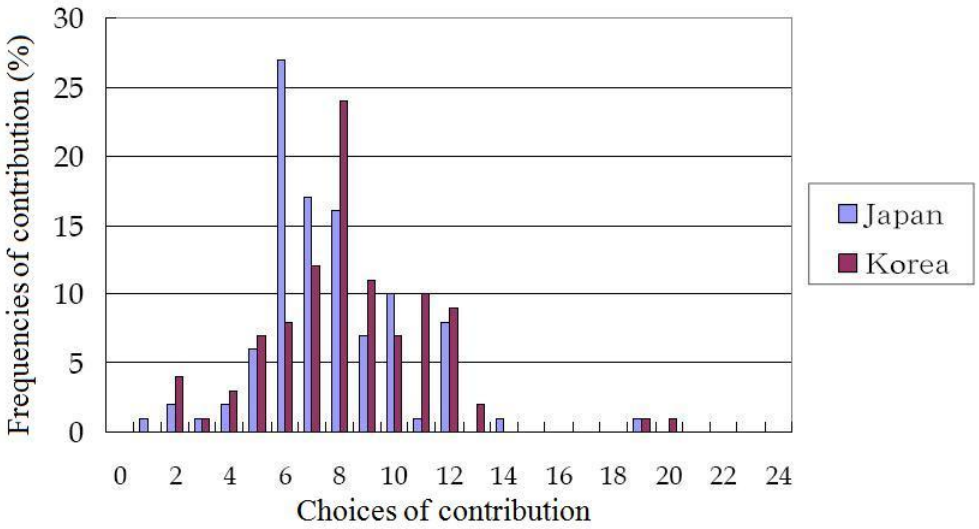

Figure 5: Frequencies of contribution in period 1-5.

12.

5 Concluding remarks

The inequity aversion model assumes that people not only concern their own payoffs, but also regard the differences of payoffs with other people. The stylized results from the ultimatum game experiments were used to countenance the inequity aversion preferences. In the ultimatum game, two players should conduct asymmetric bargaining roles, a proposer and a responder. It might exaggerate the fairness of outcomes between two players, because asymmetries of roles can be regarded as the unfair environment for bargaining. Therefore, we test whether the inequity aversion preferences can be revealed when symmetries of roles between two players are introduced into a two-person bargaining game.

In this paper, we propose a two-stage game with the approval stage. In the first stage, two players simultaneously determine how much they contribute to the non-linear public good. Knowing each other's contribution, in the second stage, they choose to accept or reject another player's decision. If both players accept each other's decision, they can get a positive amount of payoffs from the public

good as they contributed. However, if even one of two players rejects another player's decision, then they get nothing. We find that there is almost no rejection in this game. According to the inequity aversion model, if one player has more or less money than another player's payoff, he might reject a decision so that both players get nothing. It is because that it can prevent him suffering from the difference between payoffs. However, in our experiment, even when someone has less than 30% of the total money, only less than 10% of rejections occurred. It can be interpreted that the inequity aversion depends on the structure of game. That is, when two players have symmetric bargaining positions and they behave simultaneously, the driving force to lead players' behavior can be own payoff maximization.

In our experiment, the majority of choices are rather quickly converging to the subgame perfect Nash equilibrium. This can call the question of the mechanism where two subjects can achieve the Pareto efficient outcomes. Other interesting result is from the comparison between Japanese session and Korean session. Japanese subjects are more likely to behave spitefully than Korean subjects. This is consistent with the results of previous experiments.

References

J. Brandts, T. Saijo, and A. Schram, How universal is behavior? A four country comparison of spite and cooperation in voluntary contribution mechanisms, *Public Choice* **119** (2004), 381–424

C. Camere, *Behavioral Game Theory: Experiments in Strategic Interaction*, Princeton, (2003).

Y. Chun, J. Kim and T. Saijo, The spite dilemma experiment in Korea, *forthcoming* in *Seoul Journal of Economics*.

T. N. Cason, T. Saijo, and T. Yamato, Voluntary participation and spite in public good provision experiments and international comparison, *Experimental Economics* **5** (2002), 133–153.

T. N. Cason, T. Saijo, T. Yamato, and K. Yokotani, Non-excludable public good experiments, *Games and Economics Behavior* **49** (2004), 81–102.

E. Fehr and K. Schmidt, A Theory of Fairness, Competition, and Cooperation, *Quarterly Journal of Economics* **114** (1999), 817–868.

U. Fischbacher, z-Tree: Zurich toolbox for readymade economic experiments, *Experimental Economics* **10** (2007), 117–178.

M. Ito, T. Saijo, and M. Une, The tragedy of the commons revisited, *Journal of Economics Behavior and Organization*, **28** (1995), 505–531.

T. Saijo, Spiteful behavior in voluntary contribution mechanism experiments, Plott, C., Smith, V. (Eds.), *Handbook of Experimental Economics Results*, Elsevier Science, (2008).

T. Saijo and H. Nakamura, The "spite" dilemma in voluntary contribution mechanism experiments, *Journal of Conflict Resolution* **39** (1995), 535–560.

T. Saijo, J. Shen, X. Qin, and K. Akai, The spite dilemma revisited: Comparison between Chinese and Japanese, *Mimeo*, 2007.