A Cash Effect in Ultimatum Game Experiments

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April 2, 2013

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Abstract

This paper reports two experiments involving an ultimatum game, conducted in Japan. There were two treatments in our experiments. One was called a cash session and the other was called a point session. The cash session means introducing cash into the ultimatum game. In other words, in a cash session, subjects bargained money in cash but not points or tokens as most prior experiments did. We found that compared to those in the point sessions, proposers offered more and responders rejected less in the cash sessions. These evidences imply that a cash effect does exist in the ultimatum game experiments.

Keywords: Cash effect; Ultimatum game; Cost-loss discrepancy; Experimental design

JEL classification: C72, C91

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1. Introduction

Standard economic models of human decision-making have typically minimized or ignored influence of emotions on people's decision-making behavior, idealizing the decision-maker as a perfectly rational cognitive machine. However, in recent years this assumption has been challenged by behavioral economists, who have identified additional psychological and emotional factors that influence decision-making. One of the experimental games that produced very convincing evidence in this regard is the ultimatum game. In this game one player (i.e., the proposer) proposes to the second player (i.e., the responder) the division of a sum of money. If the responder accepts the division, then both players earn the specified amounts. If the responder rejects it, they both get nothing.

The backwards induction prediction of the ultimatum game is so simple that the proposer offers any amount more than zero and the responder accepts. However, being encouraged by Güth et al. (1982), which is the first experimental study of the ultimatum game, many experimental studies observed evidences that deviate from this theoretical prediction (e.g., Andersson et al., 2010; Bolton and Zwick, 1995; Cameron, 1999; Croson, 1996; Eckel and Grossman, 2001; List and Cherry, 2000; Rankin, 2005; Roth et al., 1991; Ruffle, 1998; Schotter et al., 1996; Slonim and Roth, 1998; Tompkinson and Bethwaite, 1995). In experiments, although average offers and rejection rates varied across studies, proposers normally offer an average of 40% of the money and responders reject small offers of 20% or so half the time. In a detailed survey of many studies on ultimatum game, Camerer (2003) listed five variables that might have effects on the experimental results. They are methodological variable (e.g., repetition, stakes, anonymity), demographic variables (e.g., gender, race, academic major, age), culture, descriptive variable (e.g., labeling, context), and structural variable (e.g., identity, communication, competitive pressure, information). However, we feel that besides these variables there might be one extra issue (i.e., creating a cash environment in the ultimatum game experiments) possibly affecting the experimental results. Reviewing the ultimatum game experiments conducted in previous studies, almost no study introducing cash into the procedure of the experiments. Instead, during the experiments subjects played the games with points or tokens and after the experiments these points or tokens earned by the subjects were then changed into cash according to a certain exchange rate.[1]

Creating a cash environment in the ultimatum game experiments refers to the situation that both proposers and responders face the real money (i.e., cash) but not points or tokens written on paper or appeared on the computer screen. In our view, introducing cash into the ultimatum game experiments is important because the issue of cash versus point or token could be considered a case

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[1] There were several studies asking the subjects to split the pie within a certain amount of money. However, even the pie was in the unit of money (e.g., 10 USD or 1000 JPY), it was still not in cash.

of cost-loss discrepancy.[2] Under this consideration, a split of the pie in cash can be viewed as a direct loss for both the proposer and responder if the split is rejected by the responder. On the other hand, since an offer in point or token rejected by the responder is not a direct loss as in cash, it can be viewed as a cost for both players to earn money in the next rounds or periods of the experiment. Therefore, we believe that in a cash environment both proposers and responders would be more cautious in making an offer and rejecting an offer.

In the current study, we conducted two laboratory experiments to examine the cash effect in the ultimatum game. Our prediction of the cash effect is twofold. First, introducing cash into the experiments may induce proposers to make relatively higher offers, because they would be more afraid of being rejected by responders than in a point or token environment. Second, receiving offers in cash may cause responders to hesitate to reject, therefore, rejection rates in a cash environment will be lower than in a point or token environment. An additional note should be given that, to our knowledge, there is almost no published literature examining such a cash effect on participants' experimental behaviors. Therefore, our study could be viewed as a first attempt on this issue.[3]

The remainder of the paper is organized as follows. Section 2 describes the issues related to the experiment. The results of the experiment are presented in Section 3. Finally, Section 4 discusses the results and suggests several possible directions for future study.

2. Experimental issues

We conducted two ultimatum game experiments at Hiroshima City University. Sixty four students participated in the first experiment (hereinafter, "Experiment 1") in December 2011 and sixty students joined in the second experiment (hereinafter, "Experiment 2") in May 2012. We confirmed in advance that all the subjects participated in Experiment 2 had not participated in Experiment 1 before. In each experiment, subjects were evenly divided into two sessions, which we called one as the cash session and another as the point session. There were six rounds in each session. Each subject was randomly assigned to be a proposer or responder, and a subject played the same role throughout six rounds. To keep anonymity between proposers and responders, they were arranged at different classrooms separately. In each classroom, subjects received written instructions,

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[2] The cost-loss discrepancy suggests that there exists a discrepancy in people's preferences on cost and loss. See Thaler (1980), Smelser and Gerstein (1986), and Tversky and Kahneman (1991) for more detailed discussions on this issue.

[3] One study (i.e., Hoffman et al., 1996) did apply cash in dictator game experiments. However, their design did not allow them to examine how introducing cash into the experiments affects subjects' behaviors, compared to those in the point or token conditions. In addition, several studies investigated the effects of the credit card and cash on spending behavior (e.g., Prelec and Simester, 2001; Raghubir and Srivastava, 2008). They found that credit card payments would increase consumers' purchase likelihood and willingness to pay.

which were first read individually by the subjects and then read aloud by a Japanese-speaking experimenter.

In both sessions of Experiment 1, every proposer was randomly matched with one different responder in each round. In each round of the cash session, the proposer received an envelope containing 1000 JPY in cash (i.e., one 500-yen coin, four 100-yen coins, one 50-yen coin, and five 10-yen coins) and had to decide how much to offer to the responder. After deciding the amount, the proposer was asked to put the offering money in another envelope provided by the experimenter. Then, an experimenter brought these envelopes to responders' classroom and distributed them to the corresponding responders. The responder learned the proposer's offer and could either accept or reject it. In case of acceptance, the responder's payoff in that round was the amount of the offer, and the proposer's payoff in that round was 1000 JPY minus his/her offer. In case of rejection, both subjects earned 0 in that round. The proposers and responders were asked to put the envelopes containing money in their bags if the offer was accepted. In contrast, the experimenters would collect these envelopes if the offer was rejected. The subjects' total payoff in the experiment was the sum of the payoff earned in each round. There was no show-up fee in our experiments.

The experimental procedure of the point session in Experiment 1 was almost the same as that of the cash session except that (i) instead of deciding how much to offer in cash, the proposers in the point session had to decide how many points between 0 to 1000 to offer to the responders;[4] (ii) instead of being paid directly in cash once the proposers' offers were accepted in each round, subjects in the point session would be paid after all the rounds finished; and (iii) there was no any envelope appeared in the point session. Instead, all the decisions of proposers and responders were written in the recording sheets, and an experimenter was in charge of conveying these decisions to the corresponding subjects by filling in their recording sheets.

In Experiment 2, most of proposers' and responders' tasks, experimental procedures, and payment rules remained the same as those in Experiment 1 except that proposers in both cash and point sessions were, unbeknown to responders, given only two options each round to choose from. There were six combinations of options including (900,100) and (100,900), (800,200) and (200,800), (700,300) and (300,700), (900,100) and (500,500), (800,200) and (500,500), and (700,300) and (500,500).[5] Each proposer randomly faced one different combination in each round, and the frequencies of each combination appeared over rounds (i.e., fifteen times) were set up to be same within and between sessions.[6]

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[4] In a manner consistent with that in the cash session, the pie in the point session was 1000 points and proposed divisions were made in units of 10 points (0, 10, 20,…990, 1000). The exchange rate for 10 points was 10 JPY.

[5] The option of (900,100) stands for a proposer keeping 900 and offering 100. The same logic applies in explaining all other options.

[6] A note on the reason of conducting Experiment 2 is that the rejection rates in both sessions of Experiment 1 were so low (5/96 in the cash session and 10/96 in the point session) that some

Including payment, each session of both two experiments lasted for about 90 minutes, and participants earned, on average, 2582 JPY (about 32.28 USD if 1 USD = 80 JPY). The average payoffs of proposers and responders differed a little across sessions and experiments, due to the differences in proposers' offer and responders' rejection rate between the cash and point sessions.[7]

3. Results

Tables 1a and 1b describe proposer and responder behavior aggregating across rounds in Experiment 1 and Experiment 2, respectively. Table 1a can be read as: consider the offer range 210 – 300, which signifies proposer offered responder between 21% and 30% of the pie. In the cash session, 14.58% (14/96) of all offers were in this range, and 7.14% (1/14) of these offers were rejected. Similarly, offers in this range accounted for 28.13% (27/96) of the offer in the point session, and 7.41% (2/27) of these offers were rejected. In addition, Table 1b can be read as: consider the offer 300, which means proposer chose the option of (700, 300) when also given another option as (300, 700) or (500, 500) to be chosen. 16.67% (15/90) and 21.11% (19/90) of all offers were this amount in the cash session and point session, respectively. The rejection rates on this offer were 20% (3/15) and 31.58% (6/19) in the cash session and point session, respectively.

3.1. Proposer behavior

To understand the results in Tables 1a and 1b more visually, we present proposer behavior in Figures 1a and 1b. From the figures, we can find out that in both experiments, high offers (i.e., more than or equal to half of the pie) appear more frequently in the cash session than in the point session. In contrast, the frequency of extremely low offers (i.e., no more than 100 in Experiment 1 and 100 in Experiment 2) is relatively lower in the cash session than in the point session.

In Experiment 1, average offers over rounds are 404 and 323 in the cash and point sessions, respectively. Both one-tailed t test ($t = 4.802$, $p = 0.000$) and Wilcoxon rank sum test ($z = 4.962$, $p = 0.000$) suggest that proposers offer more in the cash session than in the point session. In addition, in Experiment 2, the proportion of proposers offering 500 or more increases from 46.67% in the point session to 53.33% in the cash session. One-tailed proportion test indicates that this increase is marginally significant ($z = 1.329$, $p = 0.092$).

The second and third columns from the left side of Table 2 report the results of regressions of

scholars may doubt the power of the cash effect found in the current study. For detailed results and discussions, see the next section.

[7] Proposers/responders earned, on average, 3334/2353 JPY and 2747/2247 JPY in the cash sessions of Experiments 1 and 2, and 3569/1784 JPY and 2547/2027 JPY in the point sessions of Experiments 1 and 2, respectively.

offers in Experiments 1 and 2. The dependent variables are the shares of proposers' offer in Experiment 1 and a dummy variable defined as 1 for offers no more than 300 and 0 otherwise in Experiment 2, respectively.[8] The common independent variables in both regressions are *Cash Session* (i.e., a dummy variable equals 1 if the subjects participated in the cash session and 0 if the subjects participated in the point session) and *Round* (i.e., equals 1 for round 1, equals 2 for round 2, and so on). Additional two independent variables in the regression of Experiment 2 are *Option_500* (i.e., a dummy variable equals 1 if another option of offers faced by the proposer was (500,500) and 0 otherwise) and *Cash*Option_500* (i.e., an interaction term of *Cash Session* and *Option_500*). As shown in the columns, given the condition that proposers could offer any amount from 0 to 1000 in unites of 10 (i.e., Experiment 1), the proposers in the cash session significantly offer more than those in the point session. However, this effect is not significantly found under the environment of Experiment 2 that proposers were asked to choose the offer from two options. We doubt that this is due to first, the difference in proposers' offering rules between Experiments 1 and 2, and second, the offer ratios no more than 300 in the two sessions of Experiment 2 differed marginally (42/90 in the cash session and 48/90 in the point session).

An interesting result is obtained from the Logit regression in Experiment 2. When another option that proposers faced is (500,500), a wholly equal option to both proposers and responders, the probability that they offer no more than 300 will be decreased in both sessions. Furthermore, this decrease may be stronger in the cash session. Our data revealed that in the cash session, the numbers of offering 100, 200, and 300 without and with another option of (500,500) decreased from 10/15, 12/15, and 11/15 to 2/15, 3/15,and 4/15, respectively, while in the point session the corresponding numbers decreased from 11/15, 10/15, and 12/15 to 4/15, 4/15, and 7/15, respectively. It is to say that proposers' choices of (900,100) or (800,200) or (700,300) were influenced by combining these options with an option of the equal split (500,500), compared to the conditions that another alternative was (100,900) or (200,800) or (300,700).[9]

3.2. Responder behavior

Figures 2a and 2b provide visual descriptions of rejection behaviors on the offers no more than 400.[10] As shown in the figures, smaller offers are more likely to be rejected in both sessions and

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[8] The regression of offers in Experiment 1 is a Tobit regression because the offer ratio is bounded between 0 and 1, and the regression of offers in Experiment 2 is a Logit regression.

[9] This evidence partly supports the result of Falk et al. (2003), which reported that proposers offered (8,2) only a third of the time when the alternative was the equal-split (5,5) and offered (8,2) most of the time in the other conditions such as (2,8) or (10,0).

[10] There were three unusual rejections occurred in the experiments. One was in the cash session of Experiment 1 by one subject for offer of 510 and the other two were in the point session of Experiment 2 by another subject for offers of 900 and 500. Both subjects expressed clearly in a

offers more than 300 are never rejected in the cash session but are rejected 10.53% (4/38) of the time in the point session of Experiment 1.

Over all offers, in Experiment 1 the rejection rate decreases from 10.42% in the point session to 5.21% in the cash session, while in Experiment 2 the same decreasing tendency is observed (i.e., from 24.44% in the point session to 16.67% in the cash session). One-tailed proportion test marginally supports these evidences (in Experiment 1: $z = 1.345$, $p = 0.089$; in Experiment 2: $z = 1.291$, $p = 0.098$).

The column from the right side of Table 2 presents the results of the Logit regression of rejection behavior in Experiments. The dependent variable in the regression is a dummy variable that equals 1 if the proposer's offer was rejected and 0 otherwise. The definitions of *Cash session* and *Round* are the same as in the regression of proposer behavior. *Offer300* is a dummy variable defined as 1 for proposers' offers no more than 300 and 0 otherwise. *Cash*Offer300* is an interaction term of *Cash Session* and *Offer300*, and *Experiment 2* is a dummy variable equaling to 1 for Experiment 2 and 0 for Experiment 1. As show in the column, *Cash Session* is estimated with significant and negative sign, which indicates that although marginally the responders in the cash session significantly reject less than those in the point session. In addition, the significantly positive estimate of *Offer300* and insignificant estimate of *Cash*Offer300* suggest that offers no more than 30% of the pie would be likely to be rejected and this is not differential between the cash and point sessions. Combining the latter evidence with the result of *Cash Session* just described above, we may make a conjecture that the cash effect influences responders' behavior most likely in the situation that they face offers above 30% of the pie. Finally, *Experiment 2* is estimated with significant and positive sign, implying that the probability of rejection is higher in Experiment 2. This result reflects the fact observed from the raw data that rejection rates are 7.81% (15/192) in Experiment 1 and 20.56% (37/180) in Experiment 2.

4. Discussion

In the current paper, we conducted two experiments in Japan to examine how introducing cash into the ultimatum game experiments affects both proposers' and responders' experimental behavior. We found that in our experiments, the proposers offered more in the cash sessions than those in the non-cash sessions. Meanwhile, compared to those under the non-cash environment, the responders rejected less when they faced offers in cash. In our view, these evidences could be explained by the cost-loss discrepancy discussed in Thaler (1980), Smelser and Gerstein (1986), and Tversky and

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post-experiment questionnaire that their reason rejecting these offers was due to dislike earning more upon the loss of their partners, therefore, we did not treat these data as missed. It should be noted that dropping these data does not have any essential influences on the reported results of statistical tests and regression.

Kahneman (1991). It is to say that relative to considering a loss as the *Cost,* a loss regarded as the *Loss* leads people to feel more disappointed. Thus, both proposers and responders would be more cautious in making decisions under the cash environment.

Investigating the influence of cash on subjects' behavior gives us a fresh insight not only into the ultimatum game experiment but also into other economic experiments such as Prisoners' Dilemma experiment, Public Goods experiment, and Auction experiment. Considering that if the cash effect is a universal phenomenon in economic experiments, shall we start to introduce cash into the procedures of future experiments from now on? Of course, we cannot draw such a conclusion without examining whether a cash effect exists in other experiments. Hence, we leave this question open and welcome any efforts to further explore this issue at much deeper extent.

Acknowledgements

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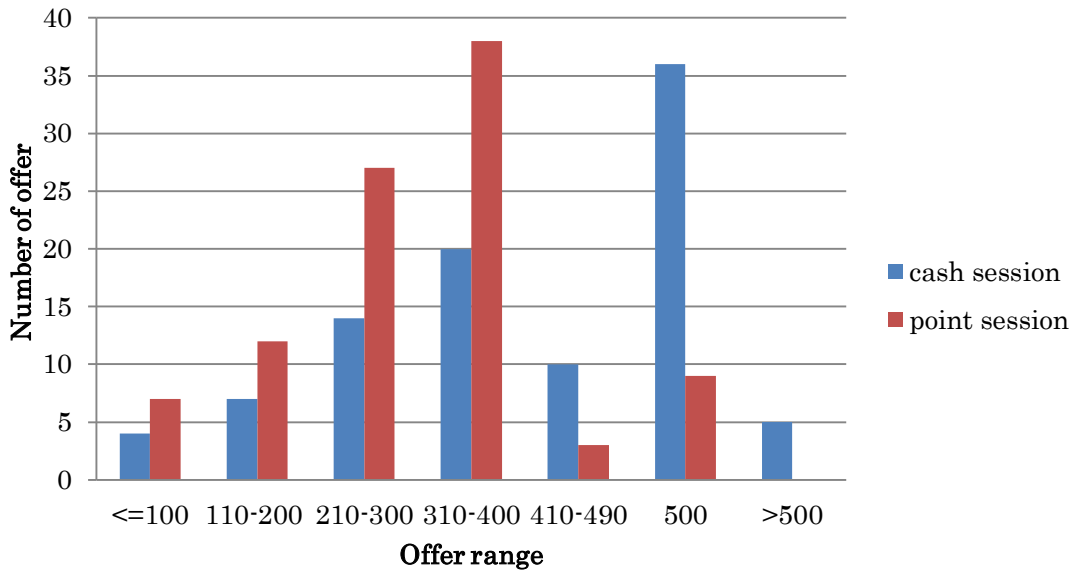Figure 1a. Proposer behavior in Experiment 1 (total observation = 96)

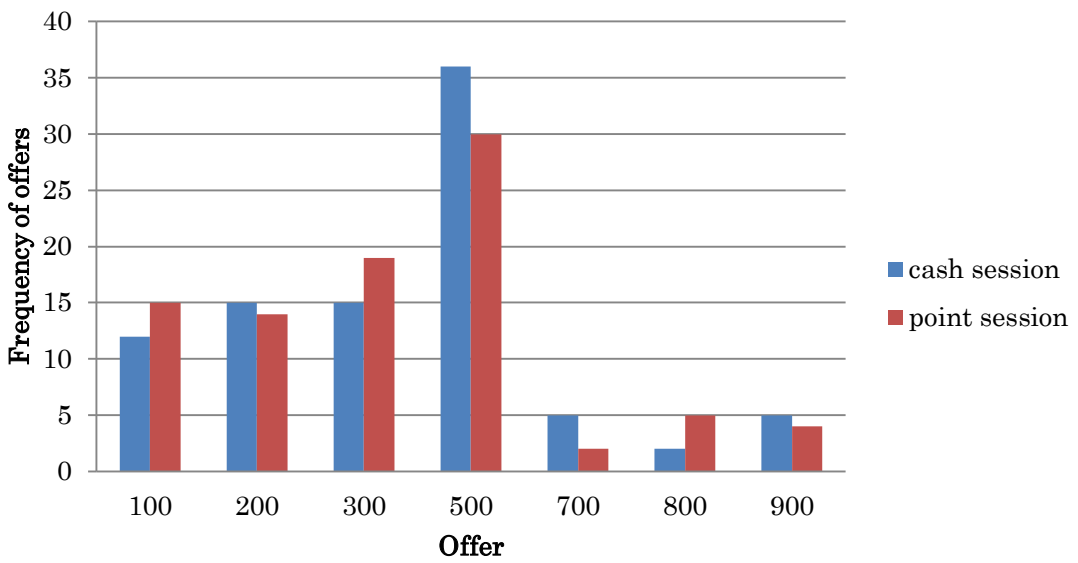Figure 1b. Proposer behavior in Experiment 2 (total observation = 90)
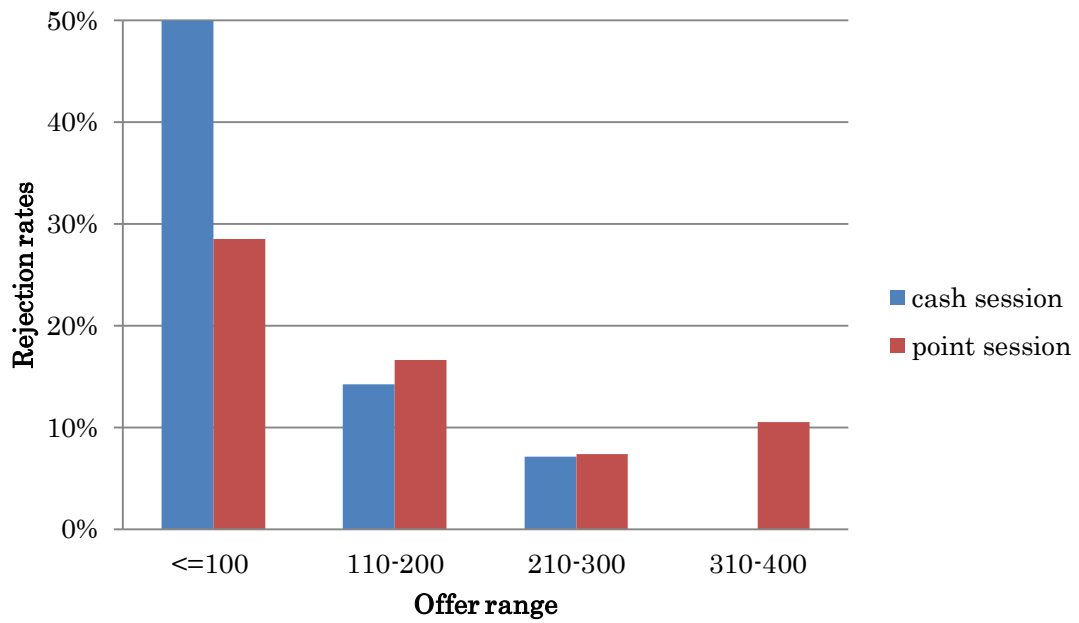
Figure 2a. Rejection rates in Experiment 1

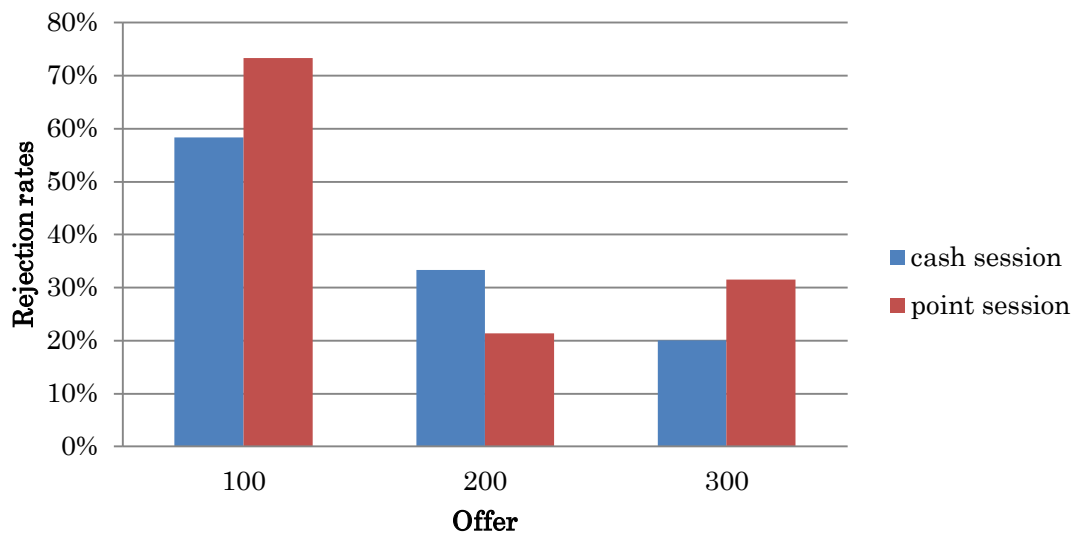Figure 2b. Rejection rates in Experiment 2

Table 1a. Summary of Ultimatum Game – Experiment 1

Offer Ranges (pie = 1000 JPY)	Cash Session		Point Session	
	% Offer	% Rejected	% Offer	% Rejected
> 500	5.21	20.00	0.00	0.00
	(5)	(1)	(0)	(0)
= 500	37.50	0.00	9.38	0.00
	(36)	(0)	(9)	(0)
410 – 490	10.42	0.00	3.13	0.00
	(10)	(0)	(3)	(0)
310 – 400	20.83	0.00	39.58	10.53
	(20)	(0)	(38)	(4)
210 – 300	14.58	12.50	28.13	7.41
	(14)	(1)	(27)	(2)
110 – 200	7.29	14.29	12.50	16.67
	(7)	(1)	(12)	(2)
<= 100	4.17	50.00	7.29	28.57
	(4)	(2)	(7)	(2)
All Offers	100.00	5.21	100.00	10.42
	(96)	(5)	(96)	(10)
Offers < 500	57.29	7.27	90.63	11.49
	(55)	(4)	(87)	(10)
Average Offer	404		323	

Notes: The number in parentheses below each % offer is the number of offers made in the range and the number in parentheses below % rejected is the number of offers rejected in the range.

Table 1b. Summary of Ultimatum game – Experiment 2

Offers (pie = 1000 JPY)	Cash Session		Point Session	
	% Offer	% Rejected	% Offer	% Rejected
900	5.55	0.00	4.44	25.00
	(5)	(0)	(4)	(1)
800	2.22	0.00	5.55	0.00
	(2)	(0)	(5)	(0)
700	5.55	0.00	3.33	0.00
	(5)	(0)	(3)	(0)
500	40.00	0.00	33.33	3.33
	(36)	(0)	(30)	(1)
300	16.67	20.00	21.11	31.58
	(15)	(3)	(19)	(6)
200	16.67	33.33	15.56	21.43
	(15)	(5)	(14)	(3)
100	13.33	58.33	16.67	73.33
	(12)	(7)	(15)	(11)
All Offers	100.00	16.67	100.00	24.44
	(90)	(15)	(90)	(22)
Offers < =300	46.67	35.71	53.33	41.67
	(42)	(15)	(48)	(20)
Average Offer	403		386	

Notes: The number in parentheses below each % offer is the number of offers made for the amount and the number in parentheses below % rejected is the number of offers rejected for the amount. Average offer in each session is calculated as the expectation value of the offer.

Table 2. Regression Results of Proposer and Responder Behaviors

	Proposer Behavior			Responder Behavior	
	Experiment 1	Experiment 2			
Constant	0.344***	1.186	*Constant*		−3.583***
Cash session	0.081**	−0.108	*Cash session*		−2.014*
Round	−0.006**	0.095	*Offer300*		2.251***
Option_500		−2.523***	*Cash*Offer300*		1.885
*Cash*Option_500*		−3.478***	*Experiment 2*		1.005*
			Round		−0.124
Wald chi2	10.000(2)***	33.780(4)***	Wald chi2		28.390(5)***
Observations	192	180	Observations		372

Notes: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.