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House money effects, risk preferences and the public goods game[☆,☆☆]

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HIGHLIGHTS

- House money effects and not loss aversion is present in the public goods game.
- Risk preferences and contribution in the public goods game are linked.
- Covered loss and Real loss treatments are statistically equivalent.

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ABSTRACT

This paper investigates whether risk preferences inform the decision of how much to put into the public account in the public goods game under the three different frames (the two house money effect frames: the standard and covered-loss frames, as well as the real-loss frame). The main contribution of this paper finds that the covered loss and real loss treatments are statistically equivalent. This assures researchers that just introducing the notion of loss into an experimental treatment without the need for participants to realize a real loss is still a valid experimental instrument. We also find that the house money effect is a better explanation for the difference in contributions between gain and loss framing than loss aversion.

1. Introduction

The problem in distinguishing house money effects versus loss aversion in the traditional public goods game is the inability of experimenters to deliberately place subjects in a true loss setting. Partly it is also the issue of self-selection since participants who sign up who know beforehand of the potential of losing money (ethically responsible protocol) versus those who do not (unethical protocol) may be more risk-loving. This paper presents a public goods experiment using three frames: a gain frame (the normal game), a covered-loss frame (the current norm for a loss frame) and a real-loss frame which is the novelty of this paper. This is not the first paper to use real losses in risky choice experiments (see Etchart-Vincent and L'Haridon (2011); see Harrison (2007)).

Most of the public goods literature has also not considered the role that risk preferences play in this game, though Houser et al. (2010) has examined the effect of risk preferences on the outcome of the trust game. This paper also follows this vein of research by investigating whether peoples' risk preferences inform the decision of *how much* to put into the public goods game under the three different frames (the two house money effect frames: the standard and covered-loss frames, as well as the real-loss frame).

2. Methodology

In order to go about this exercise, we use three framing devices in the public goods game in order to control for possible house money effects which could exacerbate risk loving preferences:

(1) a gain frame (Gain)

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Table 1
Number of participants under each risk profile in the different treatment.

Treatment	IRA									
	1	2	3	4	5	6	7	8	9	10
Gain[a]	0	0	0	0	6	5	5	1	1	2
C-L	1	0	1	2	13	1	2	0	0	0
R-L	1	0	1	2	5	2	1	4	3	1

[a] The two tailed t-test identifies that Gain and C-L are statistically different (p-value $= 0.0004$), Gain and R-L are not (p-value $= 0.586$) and C-L and R-L are statistically different (p-value $= 0.0247$).

(2) a covered loss frame (C-L),
(3) and a real loss frame (R-L).

Conceptually these are all the same game, however it is timing which we vary. In the gain frame, it is the classic public goods game where there is no notion of possible losses and players start with an endowment of 10 yuan; while in both loss frames, the players are told initially that they lose 20 yuan while the public goods game helps to offset their loss. In the covered loss version, players are told from the start that at the end of the experiment, players would be given an additional 30 yuan as a show-up fee for that day's experiment before they are informed of the 20 yuan loss associated with the experiment (there is no opt-out option), while in the real loss version, they are told that they would receive a show-up fee but are not told the exact amount they would receive until the very end of the experiment. This can be also interpreted as a covered loss frame with an uncertain initial endowment. We call this a real loss frame as a description of the state of mind of the decision-maker since he may fully expect to realize a real loss. In order to be ethically responsible, players involved in the real-loss frames who were recruited by emails were told that the game had a possible chance of loss and they were asked to bring 20 yuan (which would be the maximum they could potentially lose) with them but that there would also be a remuneration from the experiment as well as a show-up fee. We expect that this additional piece of information given to those participating in the two loss frame sessions to have self-selection biases.

We therefore use the Holt and Laury (2002) risk assessment protocol prior to participating in the public goods game (in all three frames) in order to be able to ascertain each players' risk preferences which we believe are different due to self-selection biases as a result of our modified call for participation in the real loss frame. Having unequal types of player profiles with different risk preferences in each of our samples does not hinder us from examining whether risk preferences affect giving behavior in the public goods game once we categorize giving behavior by risk profile. We sent emails and recruited from our database of 500 students. We selected the first 30 males and 30 females who replied. The rest who replied were involved in two other different experiments. We restricted each of our three sessions to 20 students (10 males and 10 females).

3. Determining risk profile

We follow the Holt and Laury (2002) test procedure and conduct a binary lottery to ascertain the risk profile of all our participants in each session. Following the literature, participants choose Lottery A over Lottery B over ten choices. Lottery A is usually preferred at the beginning and we look specifically at the switch of choice to lottery B to determine our risk profile. We follow the standard naming convention—Index of Risk Aversion (IRA) to denote the point of switching between Lottery A to Lottery B. Therefore an IRA of 6 means that they switched to Lottery B at choice 6 (see Table 1).

We can see that indeed there are more risk loving players in our pool of players in the two loss frames (IRA between 0 and 4) whereas these players are not present in the gain frame. The presence of more risk loving behavior in the domain of losses is a fairly standard result in the prospect theory literature especially dealing with decision-making under risk (see the seminal paper by Kahneman and Tversky (1979); for experiments dealing with Chinese students on prospect theory, see Sasaki et al. (2008)). There are no highly risk averse players in the C-L frame (IRA between 8 and 10) but there are in both the Gain and R-L samples. The weighted average IRA under the Gain, C-L and R-L frames are 6.6, 4.85 and 6.25 respectively. The literature using the Holt and Laury procedure is common (Eckel and Wilson, 2004; Houser et al., 2010).

4. Framing in the public goods game

In our gain frame, each subject received 10 Yuan at the beginning of the experiment, and s/he should make a decision on how much money (actually from 0 to 10 Yuan) to invest into the public account and then keep the rest as his/her private endowment. Each subject's payment is determined by the following formula:

$$10 - x_i + \frac{1}{N} * 2.4 * \sum_{i=1}^{N} x_i = 10 + \frac{2.4}{N} * \sum_{j \neq i}^{N} x_j - \frac{N - 2.4}{N} * x_i$$

where x_i means the amount of money that the i-th subject put into the public account, and N means the number of subjects in this frame.

In the loss frame, subjects suffer an initial loss of 20 Yuan at the outset of the experiment. Later each subject uses the public account to offset his/her loss. Subjects are shown that the total loss each subject would undertake is determined by the following formula:

$$x_i + \left(20 - \frac{1}{N} * 2.4 * \sum_{i=1}^{N} x_i\right) = 20 - \frac{2.4}{N} * \sum_{j \neq i}^{N} x_j + \frac{N - 2.4}{N} * x_i$$

where x_i means the immediate loss which is the money that the i-th subject puts into the public account from his/her own pocket. N is the same as before. Actually, in both our loss frames, the losses that subjects incur will be offset by the show-up fee which we provide, 30 yuan. So the final payment for each subject is 30 Yuan minus the total loss that s/he undertakes. Conceptually the gain frame and the loss frames are the same in terms of the expected returns.

5. Results

5.1. Mean contribution of each treatment

Table 2 shows us the mean and standard deviation of contributions under each treatment controlling for the risk type of subjects as we add fewer risk-loving players into the pool. This means that we start with the most risk loving players and slowly add into the pool more and more relatively risk averse players. The purpose is to be able to recognize how as we allow more risk averse players into the public good experiment, how much the contribution rate changes since an economy is usually made up of many different risk types.

We can see that in both loss treatments that more risk loving players (IRA $\leq$ 3 and possibly IRA $=$ 4) put low contributions into the group account and highly risk averse players (IRA $\geq$ 8) in the gain and real-loss treatments also put low contributions into the group account since the inclusion of these players reduces the

Table 2
Mean contribution rate & STDEV under each particular risk profile.

IRA	Treatment					
	Gain		Covered-loss		Real-loss	
	Mean	STDEV	Mean	STDEV	Mean	STDEV
≤1	N/A	N/A	0 (1)		0 (1)	
≤2	N/A	N/A	0 (1)		0 (1)	
≤3	N/A	N/A	0.5 (2)	0.71	2.5 (2)	3.54
≤4	N/A	N/A	1 (4)	1.41	4.25 (4)	4.35
≤5	5.67 (6)	3.01	3.65 (17)	2.80	4.56 (9)	3.54
≤6	5.55 (11)	2.38	3.83 (18)	2.83	4.09 (11)	3.45
≤7	5.63 (16)	2.63	4.25 (20)	3.04	4.17 (12)	3.30
≤8	5.29 (17)	2.89	4.25 (20)	3.04	3.88 (16)	3.07
≤9	5.33 (18)	2.81	4.25 (20)	3.04	3.79 (19)	2.97
≤10	4.85 (20)	3.05	4.25 (20)	3.04	3.75 (20)	2.90

N/A refers to the fact that there are no players in our sample which correspond to that particular risk level. For example, row 4 tells us that there are no players of such risk profile in the Gain treatment, while the mean contribution for 4 players in the covered loss of those ≤4 is 1 and that of the real-loss treatment is 4.25. Numbers in brackets represent the number of players of that category.

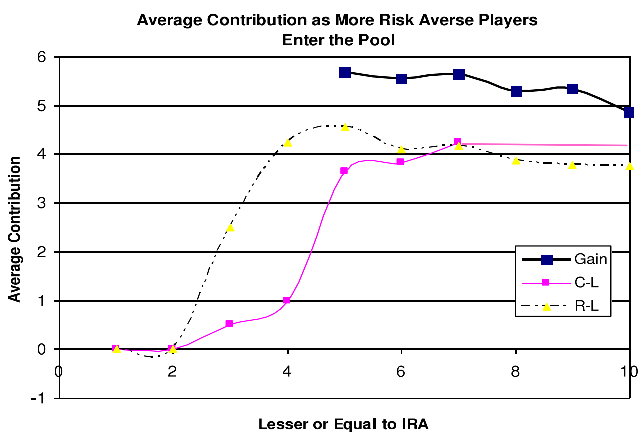

Fig. 1. Average contribution as we include more and more risk-averse players.

group's average contributions. It is also noted that those who are more risk neutral in all three treatments tend to give the most.

We can see from Fig. 1 that the gain frame results in higher contributions (controlling for risk profile) compared with the C-L and R-L treatments which suggests that house money effects are present especially for players who are more risk averse (IRA above and equal to 5).[1]

What is interesting though is the existence of risk loving players in the C-L and R-L treatments. For IRA levels between 1 and 3, we can see that those in the real loss treatment tend to contribute a lot less than in the covered loss treatment. In general, risk loving players seem to free ride (as per game theoretical predictions) in order to earn more. In the Gain and R-L treatments we can see that from IRA 8 to 10, the addition of more and more severely risk-averse players leads to declining average contribution rates.

5.2. Comparing between the C-L, R-L and gain treatments controlling for risk profile

Table 3 presents the difference of mean contributions comparing all treatments and looking at the Mann–Whitney U test statistics with the inclusion of more and more risk averse players. From Table 3 we can see that the p-value of the difference between R-L and C-L is very high, which means that there is no significant difference between C-L and R-L treatments. This gives added evidence

Table 3
Absolute contribution difference & P-values after controlling the risk profile.

Treatment		IRA				
		≤6	≤7	≤8	≤9	≤10
C-L-R-L	Diff.	−0.2576	0.8333	0.375	0.4605	0.5
	P-value	0.4910	0.4077	0.3052	0.2729	0.2538
Gain-R-L	Diff.	1.4545	1.4583	1.4191	1.5439	1.1
	P-value	0.1392	0.0929	0.0723	0.0390	0.0839
Gain-C-L	Diff.	1.7121	1.375	1.0441	1.0833	0.6
	P-value	0.0632	0.0737	[a]	[a]	[a]

[a] No C-L players of IRA 8, 9 or 10.

that covered loss frames give us essentially the same outcomes as a real loss treatment. Hence experimental methodology does not have to worry about a house money effect as a consequence of giving people house money in a loss frame.

Comparing the contributions between the Gain and R-L treatments, we can see that the p-values are generally below 10% as we include more and more risk averse players and include all but the most risk averse players, the p-value is 0.039. Comparing the Gain and C-L treatments, for players whose IRA is below or equal to 6 and 7, the p-values are significant. As an added robustness check, we redo another C-L treatment (a further 20 players) in order to obtain highly risk averse players in our sample which are not reported in this paper. The difference between the Gain and new C-L treatment is more pronounced and significant while the R-L and new C-L treatment remains statistically indistinguishable from one another. Therefore the results affirm our present findings.

We wish to highlight the significant positive contribution rates between gain and loss frames in the public goods game as evidenced in Table 3. For example the average difference between the Gain and R-L mean contribution rate is 1.1 yuan and the average difference between the Gain and C-L mean contribution rate is 0.6 yuan. We cannot attribute this difference to loss aversion since players who know they have lost and desire to lessen their loss through participation in the public goods game do not make higher contributions than those in the gain frame. In prospect theory, players tend to make risk loving choices in the domain of losses but our results show contrary results. This lends more support to the belief that house money effects are significant when players participate in the gain frame than in the loss frame. The biggest take-home from Table 3 shows us that there is little to statistically distinguish between both the covered loss and real loss frames. This is an important result for experimenters who may not have the ability to account for self-selection biases in their data and yet need to introduce notions of loss into their treatments. This paper gives assurance to such researchers that as long as they can limit self-selection biases in their recruitment protocol, a covered loss frame serves just as well as a real loss frame.

6. Conclusion

The pattern of contribution in the public goods game has many key features that can be dissected. This paper shows that risk profiles and contribution rates in the public goods game can be linked and are experienced differently depending on whether the subject sees a gain frame, covered-loss frame or real-loss frame. The main contribution of this paper shows the public goods game in two types of loss domains and shows that a covered loss and real loss treatment are statistically equivalent. This is a significant finding for researchers who may not have the opportunity to introduce real loss frames in their experimental design. This paper also shows that the public goods game framed in the gains domain leads participants to contribute significantly more than in a loss domain, suggesting that house money effects rather than loss aversion is the primary reason for the difference even when risk preferences are accounted for.

[1] Since we do not have any risk loving players in our sample, we cannot make any comment for IRA 1–4 in the gain frame.

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