Coalition Formation in Public Goods Games: Experimental Evidence

Sheryl Ball[1], Sudipta Sarangi[2], Sakshi Upadhyay[3]

[1]Department of Economics, 880 West Campus Drive Virginia Tech, Blacksburg, VA, 24061. email: sball@vt.edu

[2]Department of Economics, 880 West Campus Drive Virginia Tech, Blacksburg, VA, 24061. email: ssarangi@vt.edu

[3] Department of Economics, 880 West Campus Drive Virginia Tech, Blacksburg, VA, 24061. email: usakshi@vt.edu

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Abstract

Inclusion of social preferences in coalitions can help explain the existence of large sized coalitions. In this experiment, subject's payoffs are determined by exogenously inducing social preferences, Rawlsian preferences in particular into an individual's utility function. We find that subjects with pro-social preferences have a higher probability of joining the coalition and contributing to the public good. Joining the coalition translates to contributing to the public good. In addition, higher MPCR (Marginal per capita return return from the public good) not only leads to an increase in coalition size, but also

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enhances the chance of more subjects joining the coalition and contributing to the public good. Further, we find that joining and contributing to the public good depend positively on previous periods' payoff of the least well-off person, thus confirming the presence of Rawlsian preferences.

Keywords: Coalition, Social Preference, Public Good

JEL Classification: H4, C7

Introduction

Public goods are characterized by *non-rivalry*, meaning that more than one person can simultaneously benefit from them, and *non-exclusivity*, meaning that it is difficult to prevent any individual from enjoying their benefits. They simultaneously benefit many people and their creation requires the coordinated actions of people who will subsequently enjoy its benefits. Environmental protection, research and innovation, vaccination, health care services, highways, and public parks are just a few important examples. The public goods problem is that it is difficult to decide how much of a public good to produce and how to pay for it. Coalitions, subgroups of individuals who agree to act collectively to produce a public good, represent a possible solution to the public goods problem. International Environment Agreements (IEA) such as United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol are examples of existing coalitions.

In any public good provision problem, Marginal per capita return (MPCR) is an important determinant. MPCR is the ratio of marginal benefit to marginal cost of privately providing a public good. For every dollar a person spends on privately providing the public good, the MPCR measures how much the individual gets back. MPCR is assumed to be less than 1. High marginal per capita return (MPCR) leads to increased cooperation and decreased free riding (Chaudhuri, 2011). However Barrett (1994) and Kolstad (2012) show in their theoretical setup that there is an inverse relationship between equilibrium number of coalition and MPCR. This result is in contrast to recent experimental evidence which suggests the existence of large sized coalitions even in the presence of high MPCR (Burger and Kolstad, 2009; Kosfeld, Okada and Riedl, 2009). Upadhyay 2020 (working paper) provides conditions required to ensure a positive relationship between coalition size and MPCR. In this paper we test theoretical predictions of her paper through a human subjects experiment.

Upadhyay 2020 (working paper) investigates the role of social preferences in a two stage public good game. In the first stage, heterogeneous agents choose whether or not to join a coalition and in the second stage, the coalition votes using a majority voting rule on whether its members will contribute or not. Social preferences are assumed to be Rawlsian where payoffs are strictly increasing in both own earnings and the payoff of the least-well off member of society. The results show that individuals with pro-social preferences are more likely to join the coalition and upon doing so, also vote to contribute to the public good. The likelihood of joining and voting to contribute is also increasing in the return from public good (MPCR).

We use the theoretical model in Upadhyay 2020 (working paper) and test the theoretical predictions of her paper. The experimental setup is used to analyze the decision problem of individuals who have the option of joining coalition. In the experiment preferences are exogenous and are pre-assigned to participants by incorporating preferences into their payoff. Sessions are conducted for both homogeneous and heterogeneous preferences by weighing everyone's social preferences with equal and unique weights respectively.

The main findings from our paper are as follows. Predictions of the theoretical model hold true and individuals with stronger social preferences have a higher probability to join the coalition and contribute to the public good. Individuals who join the coalition have a higher probability to contribute to public good as well. Joining the coalition and contributing to the public good also positively depends on the previous period's payoff of the least well off person in their group.

The primary motivation of our paper originates from the experimental testing of the 'free-rider' hypothesis, which highlights the deviations in behavior of individuals in real life with respect to findings borne from theoretical literature. While public goods theory predicts free riding and inefficient outcomes, experimental results find cooperation towards contributing toward a public good does exist with rates as high as 40-60 percent of the efficient level (Ledyard, 1995). These experimental results motivated research on the importance of mechanisms or institutional environment which can help in achieving the optimal outcome or reduce free riding. Communication between the participants (Isaac and Walker (1988), Ostrom (2000)) and exchange of chat messages between the participants regarding their strategies or intentions (Palfrey, Rosenthal and Roy, 2017) can increase contributions to a public goods game. Chen (1996) and (Kurzban et al., 2001) use "pledge-to-contribute" as a “commitment” mechanism to increase cooperation. Punishment can facilitate higher levels of cooperation by allowing people who contribute to punish “free-riders” (Ostrom et al., 1994). Nikiforakis and Normann (2008) find that contributions to public goods increase monotonically in the effectiveness of punishment (factor by which the punishment reduces the punished player’s income).

Our paper uses coalitions as a commitment mechanism to enhance cooperation (Barrett (1994),Hoel and Schneider (1997)). The standard models of coalition are unable to explain the existence of large-sized IEA. For instance, higher participation is possible if IEAs target lower abatement[1] such that global emissions reduce in equilibrium (Barrett (2002), Finus and Maus (2008)). Other strand of literature studies the relationship between gains from cooperation and coalition size. Thus there exists an inverse relationship between coalition size and gains from cooperation (Komisar, 1969; Barrett, 1994; Kolstad, 2012) [2]. For instance, higher participation was seen in Montreal Protocol (IEA on ozone depletion) where gains to cooperation were very small (Barrett, 2003). Recently researchers have started studying the impact of MPCR on coalition size using laboratory experiments. Large coalitions can exist even with high MPCR ((Burger and Kolstad, 2009),Kosfeld, Okada and Riedl (2009)). However, Dannenberg, Lange and Sturm (2014) in their paper find a trade-off between participation and commitment, where coalitions with voluntary participation are less effective in facilitating cooperation compared to when all players are forced to participate. Our paper shows that existence of large sized coalitions even in presence of high MPCR.

Our paper also focuses on the importance of social preferences in explaining voluntary contributions in a public good game. Existing literature talks about different types of social preferences like reciprocity, where individuals are willing to cooperate provided others in their group also cooperate (Fehr and Fischbacher, 2002; Charness and Rabin, 2002; Rabin, 1993). Individuals are also motivated to

[1]as compared to optimal abatement, which would maximize joint welfare maximization

[2]see Kolstad (2012) for a proof. The proof shows the size of the coalition to be an inverse of MPCR and establishes the essence of inverse relationship between gains from cooperation and coalition size

contribute towards public good because they care for equitable distribution of resources or equal outcomes (Fehr and Schmidt, 1999). To test models of various social preferences, Charness and Rabin (2002) designed a range of experiments and found that people are concerned about increasing social welfare, especially for low-payoff recipients. In their experiment, Engelmann and Strobel (2004) compare a number of social preferences and show that a combination of efficiency concerns and maximin preferences can explain their findings[3]. Motivated by these findings, in her model Upadhyay 2020 (working paper) assumes individuals have Rawlsian preferences, where they care about the payoff of the least well off person[4]. Upadhyay 2020 (working paper) shows that incorporation of social preferences enables conditions under which a large coalition can exist even in the presence of high MPCR.

Social preferences have also been used to study how coalitions function. In their empirical analysis Lange, Vogt and Ziegler (2007) show that equity issues are considered highly important in international climate negotiations by using a world wide survey of people involved in international climate policy. Polluter pays rule (rule of equal ratio between abatement costs and emissions) and the accompanying poor losers rule (exempting due to GDP) are the most widely accepted equity principles according to this study. Yu-Hsuan et al. (2018) investigates impact of individual altruistic attitudes on willingness to participate in climate coalition. The theory suggests that strong altruism would lead non-critical players (have a dominant strategy of not-joining) to join a coalition and participation to increase in presence of altruists. The experimental results support this prediction, however the experimental results suggest that when the subject became non critical in the coalition, higher altruistic individuals had lower incentives to join the coalition. Our results show that large sized coalitions can be explained by the presence of individuals who have pro-social preferences.

Our experiment has two parts. In both the parts individuals have an option to either invest their endowment into a private project or a group project (public

[3]Pure Rawlsian social preferences are, interpretable as maximin preferences where utility depends only the welfare of the least well-off member of society.

[4]In her discussion section, she shows the results for other social preferences as well

good in our experiment). The first part involves a usual public goods game. This was done so that subjects understand how a public goods game works. Here an individuals payoff is only dependent on their own earnings both from the private account and group project. For every round in part I, individuals make a choice whether to contribute their endowment to group project or not. In the second part, an individual's payoff is determined both by their earnings as well as the earnings of the least well off person in the group. In the experiment preferences are exogenous and are pre-assigned to participants by incorporating preferences into their payoff. The individuals in second part of the experiment have an option to join the coalition. In every round of the second part individuals make two decisions: 1) whether to join the coalition or not; 2) coalition members vote whether to contribute to the group project. Individuals not in coalition decide independently whether or not to contribute to group project or not. Majority rule among the coalition members determine whether the coalition will contribute to the public good.

We find that higher MPCR has a significant and positive impact on individual's decision to join the coalition and contribute to the public good. Thus large-sized coalitions can exist in presence of high MPCR where individuals with pro-social preferences have a higher probability of joining the coalition as well as contributing to the public good.

Our paper contributes to two strands of literature. First, our paper relates to research on experimental evidence on the relationship between coalition size and MPCR. Experimental evidence on the impact of MPCR on coalition size stands divided. Large coalitions can exist even with high benefits of cooperation (Burger and Kolstad, 2009). However, Dannenberg, Lange and Sturm (2014) in their paper find a trade-off between participation and commitment. Coalitions with voluntary participation are less effective in facilitating cooperation compared to when all players are forced to participate. Their results confirm the pessimistic findings from the coalition formation theory where cooperation is either deep and narrow or shallow and broad (Barrett, 2002). In our results we find that higher MPCR leads to an increase in the probability of joining the coalition and contributing to the public good significantly.

Second, our paper exploits heterogeneity in a society to derive the threshold for individuals to contribute. Heterogeneous preferences can explain variation in cooperation in a society (Gunnthorsdottir, Houser and McCabe, 2007). In their voluntary contribution mechanism (VCM) public goods experiment, authors classify the subjects into 'free riders' (contributes 30 % or less of his/her endowment) and 'cooperators' (contributes more than 30 %) based on their first round contribution. Heterogeneous preferences can also be used to explain the decline in cooperation in these experiments due to the presence of free riders (Fischbacher and Gachter, 2010). Our results show that in a heterogeneous society, if individuals with pro-social preferences are in the majority, then public goods will be provided. In the experiment we exploit group composition in heterogeneous sessions (all types of individuals are present) to study the predictions by these studies. We find that the presence of individuals with pro social preferences ensures large sized coalition as well as contribution to the group project.

The paper is organized as follows: Section I summarizes the theoretical predictions of Upadhyay 2020 (working paper). Section II discusses the experimental design. Section III discusses the descriptive statistics, Section IV discusses the results, Section V concludes.

1 Model

We first define the terminologies used in Upadhyay 2020 (working paper). $N = 1, 2, \cdots, n$ denotes the set of players. Each player has a unit endowment and participates in a two-stage public goods game. In Stage I, each player decides whether to join a coalition or not. Players that chose not to join the coalition are called *fringe members* and denoted by F. Before Stage II begins, size of the coalition is announced. Size of the coalition is denoted by M. In Stage II of the game, using majority voting rule, members of the coalition decide whether or not they will contribute to the public good. The fringe members decide independently if they would like to contribute. Contributions are assumed to be binary, i.e., individuals in the coalition will either contribute their entire endowment or nothing depending on the outcome of the majority voting.

Each individual's payoff is a convex combination of a pecuniary and non-pecuniary component. Let λ_i be the weight of the pecuniary component. λ_i is assumed to be private information and is also uniformly distributed between 0 and 1 [5]. The social preferences are assumed to be Rawlsian in the sense that players care about the player who gets the lowest pecuniary payoff. Action set of a player is denoted by $e_i \in \{0, 1\}$, where $e_i = 1$ implies that the players contribute to public good and $e_i = 0$, implies that they do not. The marginal per capita return (henceforth MPCR) for player i is denoted by $\gamma > 0$.

Non-pecuniary payoff or social preference in the model is represented by pecuniary payoff of the least well off person. When no one is contributing, everyone receives their endowment which is 1, in this case, payoff of the least well off person is also 1. In other scenarios, payoff of the least well off person is the total contributions from public good. The lowest pecuniary payoff of any $i \in N$ is given by γQ, i.e., individuals for whom $e_i = 1$. e_i denotes the strategy of player i and e_{-i} the strategy of the remaining players. Then the payoff of a player i is given by (Upadhyay (2020) :equation 1):

$$\pi_i(e_i, e_{-i}) = \begin{cases} \lambda_i(\gamma Q) + (1 - \lambda_i)\gamma Q = \gamma Q & \text{for } e_i = 1, Q > 1 \\ \lambda_i(1 + \gamma Q) + (1 - \lambda_i)\gamma Q & \text{for } e_i = 0, Q > 1 \end{cases} \tag{1}$$

The first term in each expression is the weighted pecuniary payoff and the second term is the non-pecuniary payoff.

The solution is arrived using backward induction. The paper first solves for Stage II: decision to contribute. Coalition members decide to contribute using majority rule whereas fringe members decide independently. The action set of coalition members when they are voting is given by $v_i \in \{0, 1\}$ where $v_i = 1$ implies $i \in M$ votes to contribute to public good and $v_i = 0$ implies $i \in M$ does not vote. Comparing the payoff of coalition members when they vote to contribute v/s the payoff when they do not vote to contribute leads to Proposition 1(a). Similarly comparing the payoff of fringe members when they contribute v/s the when they

[5] The results are robust to specification for any distribution as discussed in her paper

do not contribute leads to Proposition 1(b)

Proposition I: Assume that M is known.

a)If $\lambda_i \leq \hat{\lambda}$, where $\hat{\lambda} = \gamma M$, then $v_i = 1 \ \forall i \in M$.If $\lambda_i > \hat{\lambda}$ then $v_i = 0 \ \forall i \in M$.

b)If $\lambda_i \leq \hat{\lambda}$, where $\hat{\lambda} = \gamma$, then $e_i = 1 \ \forall i \in F$. If $\lambda_i > \hat{\lambda}$, then $e_i = 0 \ \forall i \in F$.

In part a of the proposition, if the given cutoff is satisfied, the individual will vote yes to contribute to the public good. The cutoff $\lambda_i \leq \gamma M$ can be interpreted as the probability $i \in M$ will vote yes to contribute to the public good. The probability is increasing in both γ and M. The cutoff $\lambda_i \leq \gamma$ in part b can be interpreted as the probability $i \in F$ will contribute to the public good. As γ increases, the cutoff will increase.

Using the results from Stage I, the paper arrives at cutoff for joining the coalition. Action set of player when they are deciding to join the coalition is represented by $j_i \in \{0, 1\}$ where $j_i = 1$ implies $i \in M$ decides to join the coalition and $j_i = 0$ implies $i \in M$ does not join the coalition. Comparing the payoff from joining the coalition and the payoff from not joining the coalition leads us to Proposition II in the paper.

Proposition II:In the subgame perfect Nash equilibrium, if $\lambda_i \leq \gamma$ then $j_i = 1$. If $\lambda_i > \gamma$ then $j_i = 0$.

Proposition II, shows that individuals with relatively lower weight on pecuniary payoff ($\lambda_i \leq \gamma$) will join the coalition and individuals with higher weight on pecuniary payoff will not join the coalition. As γ increases, more individuals satisfy the cutoff ($\lambda_i \leq \gamma$), thus leading to more people joining the coalition. Higher γ also leads to an increase in the cutoff of the people who will vote yes to contribute to public good in Stage II ($\lambda_i \leq \gamma M$). Thus an increase in γ or higher benefits of cooperation can increase the size of a coalition and also increase the likelihood by which an existing coalition will contribute to the public good. Hence the model is able to show that an increase in the benefits of cooperation i.e. MPCR leads to a bigger coalition size which also has a higher likelihood to contribute to the public good.

In our paper, we will test for Proposition I and II from Upadhyay 2020 (working paper). We now will describe our experimental design

2 Experiment Design

The experiment was divided into two parts and in each round participants were in a group of 6 different people. These groups were changed after every period. The participants were paid for one random round in each part. Participants in Part I, played a public goods game for 8 rounds. In each round everyone in the group was given 10 points[6]. Each group member has to decide on how to invest their 10 points in each round. They had option to invest all 10 points into their private account, or all 10 points into a group project. The points cannot be split between private account and the group project. Payoffs for participants is calculated using equation 1, with $\lambda_i = 0$ and $e_i = 10$ if individuals contribute to the public good and $e_i = 0$ otherwise. At the end of each round, subjects were informed about their earnings from both group project and private project in each round.

After Part I was completed, participants were given separate instructions for Part II and then played 12 rounds of public goods game. In part II individuals had the option to join the coalition and the payoffs incorporated the social preference. In our experiment, each individual received one of the three weights:$\lambda_i = 0.2$ or $\lambda_i = 0.5$ or $\lambda_i = 0.8$. These values of λ_i help us cover the possible range of how much an individual cares about the least well off person. An individual with $\lambda_i = 0.2$, places 0.2 weight on his /her own earnings and 0.8 weight on earning of the least well off person, meaning they care more for the least well off person's earning. An individual with $\lambda_i = 0.5$, places 0.5 weight on his /her own earnings and 0.5 weight on earning of the least well off person, meaning they care equally for the earnings of the least well off person's and their own earning . An individual with $\lambda_i = 0.8$, places 0.8 weight on his /her own earnings and 0.2 weight on earning of the least well off person, meaning they care more for their own earning.

We had both heterogeneous sessions and homogeneous session. In heterogeneous sessions, subjects were assigned weights on their social preference randomly by the computer in a manner that all the three types were equally represented in each

[6]The theoretical model has an endowment of 1 unit, however here we use 10 points in order to make the calculation easier for participants to calculate their payoffs.

heterogeneous session. Whereas in homogeneous session, all the participants had the same weights. The participants were not informed about the weights other individuals had on their social preferences. The details of the sessions are shown in Table 1.

Table 1: **Session Details**

Session Type	Number of Sessions	Number of Subjects
Heterogeneous	3	12
Homogeneous (All 0.2)	2	12
Homogeneous (All 0.5)	2	12
Homogeneous (All 0.8)	2	12
Total	9	108

As explained in the Model, in Part II, participants will make two decisions. They first decide whether to join the coalition or not and then decide whether to contribute to the public good. As described in Figure 1, participants have the following two decision:

1. Stage I: Participants decide to join the coalition.

2. Stage II: The coalition members vote to contribute to the group project. If majority of the participants vote to contribute, then the coalition contributes to the group project. Participants who are not in the coalition decide independently whether to contribute to the group project or not.

Figure 1, uses the same terminologies as in model of Upadhyay 2020 (working paper). As in part I of the experiment, in each round everyone in the group was given 10 points. Each group member has to decide on how to invest their 10 points in each round. They had option to invest all 10 points into their private account, or all 10 points into a group project. For the coalition members if the majority was satisfied ($\geq m'$), everyone in the coalition invests in group projects. After participants decide to join the coalition or not, everyone in the group was informed about the size of the coalition. Payoffs for participants is calculated using

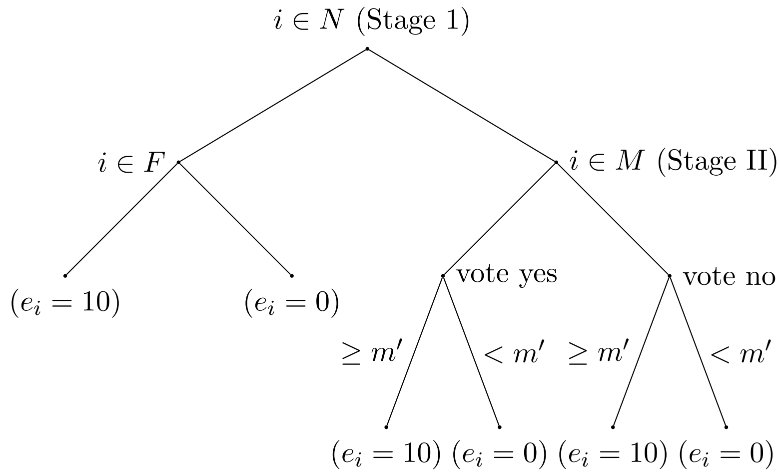

Figure 1: Game Tree: Stage I participants decide to join the coalition or not. In Stage II, participants in a coalition vote to contribute and if majority is satisfied, coalition contributes to public good. Fringe members decide to contribute independently. N: Total subjects in a group, F:Fringe members in the group, M: size of the coalition, m': majority in a coalition

equation 1, with $\lambda_i = 0.2$ or $\lambda_i = 0.5$ or $\lambda_i = 0.8$ depending on the weight assigned to individuals. Also, $e_i = 10$ if individuals contribute to the public good and $e_i = 0$ otherwise. After coalition members vote to contribute and fringe members decide to contribute to the public good, participants were informed about their earnings from the project, earnings from the group project, their total earnings and earnings of the least well off person.

The instructions for the experiment are in the appendix. The experiment was programmed using z-Tree. Subject pool consisted mainly of undergraduate students at Virginia Tech recruited through SONA. Subjects were paid $10 show up fee and earned money from one of the either rounds. On an average subjects received $20 from this experiment

3 Descriptive Statistics

Effect of MPCR on joining the coalition: Figure 2 reports that probability to join the coalition is higher when we have high MPCR [7].

[7]Individuals have the option to join the coalition only in Part II which begins from Round 9

Effect of MPCR on contributing to public good: As we can see in Figure 3, probability of contributing to public good is higher when we have higher MPCR. The probability of contributing to the public good is almost as high as 1, when we have higher MPCR.

Contributing to the public goods in Part I and Part II: We now see how the contribution to public good differs in Part I and Part II. In Figure 4, contributions are high in the start, however they decline as the experiment progresses over periods. This is in line with the result from previous public goods experiment. This trend is observed in Part 1(till period 8) and Part II. However, the contribution in Part II, always stays higher than contributions in Part I. The decline in contribution is steeper in Part I, however in Part II the decline stabilizes over later periods.

Contributing to the public goods based on joining the coalition : Figure 5 shows that, individuals who join the coalition contribute to the public good. This provides evidence for our theoretical prediction that individuals who join the coalition also vote to contribute to public good. The probability of joining the coalition is as high 1 in some periods.

Table 2 denotes the differences in mean for various variables and also tests for statistical significant difference in the means under these two scenarios. The results point to the fact that probability of joining coalition, contributing to public good are higher under high MPCR. The table also reports that payoff of the group members and least well off person are highly significant when we have high MPCR [8]. Coalition size is also highly significant with higher MPCR. This confirms that high MPCR promotes cooperation.

[8]Higher MPCR should result in higher payoff by calculation as well. However, the difference is higher than expected, meaning more people contribute to public good and care for the least well off person in presence of higher MPCR. Thus resulting in higher payoff for least well off person and payoff for members inc coalition.

3.1 Regression Results

3.1.1 Dependent Variable

We want to measure the outcome of the following variables.

- Joining the coalition: This variable is only defined for Part II of the experiment. The variable takes value “1” when individual chooses to join the coalition and “0” when individual decides to not join the coalition.

- Contributing to the public good (coalition): This variable is also only defined for Part II of the experiment. The variable takes value “1” when individual contributes and “0” when individual does not contribute.

- Contributing to public good : The variable takes value “1” when individual contributes and “0” when individual does not contribute.

- Number of contributors(coalition) : This variable counts the number of contributors in Part II

- Number of contributors : This variable counts the number of contributors

3.1.2 Independent variables

We want to estimate impact of following variables on our dependent variables.

- Type of individuals: To test the predictions of our model , we have divided individuals into three types: with weight as 0.2 , 0.5 and 0.8. The analysis treats weight of 0.2 as a base.

- MPCR: Low MPCR takes value of 0.3 and high MPCR takes value of 0.7. Low MPCR is treated as the base in analysis.

- Lagged variables: Lag of payoff, lag of payoff of least well off person, lag of coalition size, lag of number of contributors are taken in order to analyse the impact of last period’s outcome on dependent varaible.

4 Results

We first analyze how probability of joining the coalition and contributing to public good is dependent upon other factors. Since the decision to join the coalition/contribute to public good is binary (1 for yes, 0 for no), we use Probit to estimate our results.

Table 3 shows the effect of independent variables on joining the coalition. Model 1 and Model 3 are for both type of sessions (homogeneous and heterogeneous), whereas Model 2 and 4 is for homogeneous session. This was done because the homogeneous sessions, did not have much difference in outcomes due to type of individuals (based on the weights assigned to them). We will later provide an explanation for this.

From Table 3 we can see, there is a positive marginal effect when the weight on pecuniary preference switches from 0.2 to 0.5(Model 1 and 3). High MPCR also has a positive and significant marginal effect on joining coalition. For instance, a switch from low MPCR to high MPCR increases the probability of joining the coalition. Last period's payoff received in coalition has a negative and significant impact on the decision to join coalition this period. Higher payoff in the last period reduces the incentive to join coalition. Last period's payoff of least well off person (for Model 2 and Model 4, homogeneous sessions) has a positive and significant impact on joining the coalition. Higher payoff received by the least well off person in your group incentivises individuals to join the coalition in next period, thereby also showing presence of Rawlsian prefernces in our model. Number of contributors in last period (Model 2) has a positive and significant marginal effect on joining coalition. Coalition size in last period has no significant marginal effect on joining coalition. [9]

Table 4 shows the effect of independent variables on contributing to the public good. Model 1 and Model 3 are for both type of sessions (homogeneous and heterogeneous), whereas Model 2 and 4 is for homogeneous session. There is a positive

[9]Coalition size and number of contributors are highly correlated and hence we have two different models to analyze.

marginal effect when the weight on pecuniary preference switches from 0.2 to 0.5 (Model 2) and a negative marginal effect when the weight on pecuniary preference switches from 0.2 to 0.8 (Model 2 and Model 4). High MPCR also has a positive and significant marginal effect on joining coalition. Last period's payoff has a significant negative marginal effect on joining coalition. Last period payoff of the least well off person has a significant positive effect on contributing to public good (Model 2). Last period's coalition size has a significant positive effect on the decision to contribute this period. Thus, last period's coalition size effects the decision to contribute to public good but not decision to join the coalition.

Table 5 shows the effect of independent variables on number of contributors. Model 1 is for both type of sessions (homogeneous and heterogeneous), whereas Model 2 is for homogeneous session. Number of contributors are significantly higher in Homogeneous session. There is a positive effect when the weight on pecuniary preference switches from 0.2 to 0.5 and a negative effect when the weight on pecuniary payoff switches from 0.2 to 0.8. Thus number of contributors are higher in presence of pro-social preferences. High MPCR also has a positive and significant effect on number of contributors. Last period's payoff received has a significant negative effect on number of contributors. Last period's coalition size has a significant positive effect on number of contributors.

Table 6 shows the effect of independent variables on decision to contribute and number of contributors for both part I and part II. Contribute-1 and Contributors-1 is for both type of sessions (homogeneous and heterogeneous), whereas Contribute-2 and Contributors-2 is for homogeneous session. Contribution and number of contributors are significantly higher in homogeneous sessions. There is a positive marginal effect(for decision to contribute) and positive effect(for contributors) when we switch from Part I to Part II, thereby confirming the fact that presence of social preferences and coalition increases contribution/contributors. High MPCR also has a positive marginal effect(for decision to contribute) and positive effect(for contributors). Last period's payoff received has a negative marginal effect on decision to contribute and negative effect on number of contributors. Last period's number of contributors has a significant positive marginal effect on contributing to public good.

In summary, the results show that higher MPCR leads to increase in the coalition size. With high return from public good, probability of joining the coalition is significantly higher. As the theory model predicts, individuals who join the coalition also contribute to public good. Higher payoff in the last period reduces the incentive to join the coalition, however higher payoff of the least well off person in last period increases the probability of joining the coalition. This result suggest subjects in in the study care about the least well off person. The results also show that individuals with lower weight on pecuniary payoff (weights: 0.2 and 0.5) are likely to join the coalition as compared to individuals with higher weight on pecuniary payoff[10] .

4.1 Effect of group composition on decision to join the coalition and contribute

As we mentioned before, in our heterogeneous sessions, there is not much difference in outcomes based on the type of preference assigned to the participant. This could be due to heterogeneity of preferences. Presence of free riders can lead to reduced cooperation from conditional cooperators as well (Gunnthorsdottir, Houser and McCabe (2007)). To analyse this we test how group composition in heterogeneous sessions impacts the decision to join the coalition and contribute to public good. Group composition ranged from 1 to 4 members for each of the three types in a group

In order to derive the group composition we count the number of individuals with $\lambda_i = 0.2$, $\lambda = 0.5$ and $\lambda = 0.8$ in each unique group. Table 7 measures the impact of group composition along-with other control variables on decision to join the coalition and contribute to public good[11]. Higher MPCR still plays a role in decision to join the coalition and contribute. Last period's payoff negatively effects decision to join coalition and contribute to public good. Majority of type 1 (4 individuals) in a group positively and significantly effects decision to join the coalition and contribute to

[10]In some models,probability of joining coalition increases when we switch the type of person from 0.2 to 0.5. This requires further analysis of our data

[11]Type 3 was dropped because number in type 3=6-number in type 1-number in type 2

public good. We also have a similar result when we include type 1 and type 3 group composition (Table 8). Majority of type 1 (4 individuals) in a group positively and significantly effects decision to join the coalition, however has no effect on decision to contribute to public good. This maybe because individuals who join the coalition will definitely contribute as seen in previous results[12].

5 Conclusion

In this paper, we test the theoretical predictions of Upadhyay 2020 (working paper). We find that theoretical predictions of the model hold true. Our experimental analysis provides further insights which underscores the formation of coalitions which in turn leads to the contribution to a public good

In our experiment, subjects payoff is determined by exogenously inducing social preferences into an individuals utility function. The experiment consists of two parts: voluntary contributions public goods game (part 1) and the same public goods game with coalition in presence of social preferences (part 2).

The results suggest that individuals with pro social preferences (who care more about the least well off person) have a higher probability to join the coalition. In addition, individuals who join the coalition also contribute to the public good. Higher MPCR ensures more individuals to join the coalition and contribute to public good. Our experimental findings establish a positive relationship between coalition size and MPCR. Additionally, the probability of joining the coalition and contributing to public good are also increasing in last period's payoff of the least well off person, coalition size and number of contributors in a group. The result suggests that Rawlsian preferences motivate individuals to contribute to the public good over time even when the groups are changed in each round. Our experimental results also point to the importance of heterogeneous preferences in our society. Presence of individuals who care more about the least well off person (in majority) in a group leads to higher probability of individuals joining the coalition and contributing to

[12]Including type 2 and type 3, excluding type 1 had no significant result, hence not included in the analysis

the public good. In another experiment, we allow endogenous social preferences to validate the positive relation between MPCR and size of the coalition[13].

[13] data collection in process

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Appendix

Appendix for Experimental results

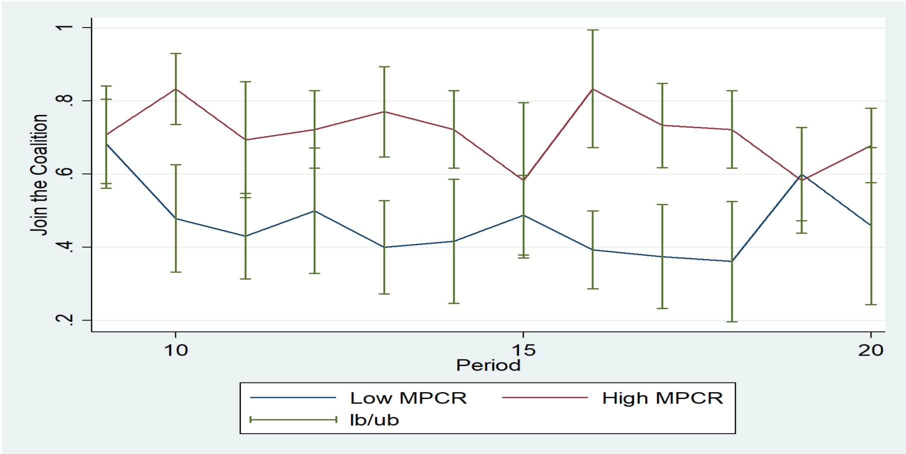

Figure 2: Time trends:Joining the coalition with respect to MPCR

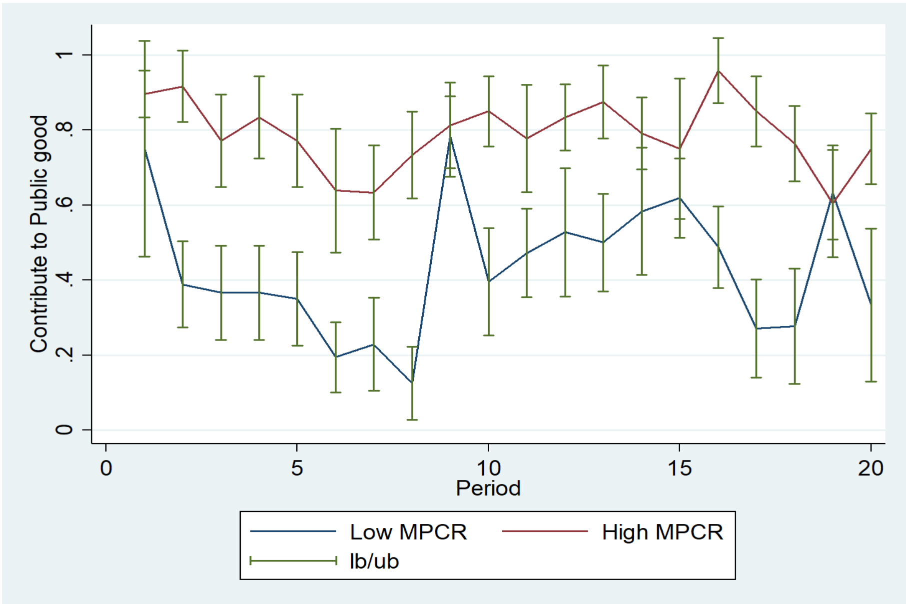

Figure 3: Time trends:Contribute to Public Good with respect to MPCR

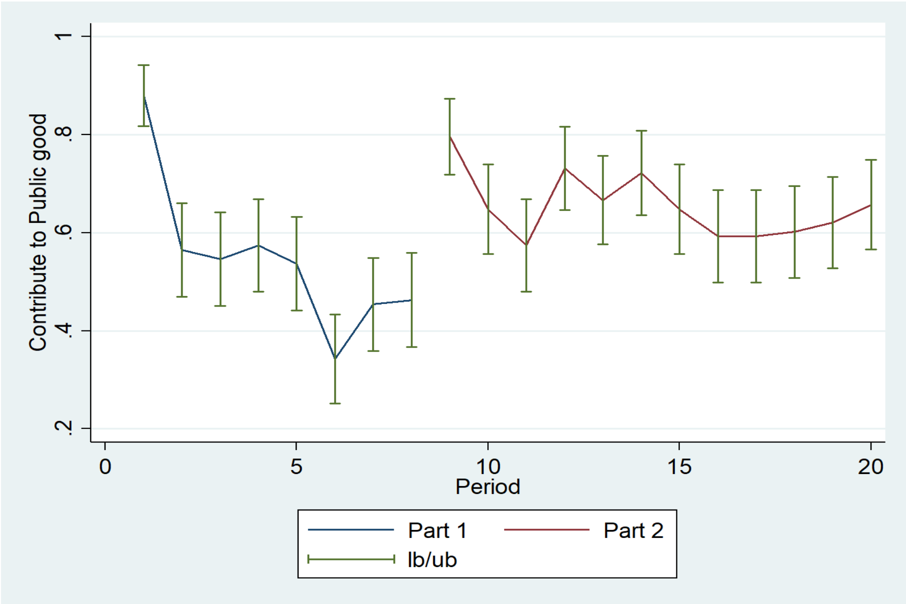

Figure 4: Time trends:Contribute to Public Good with respect to rounds

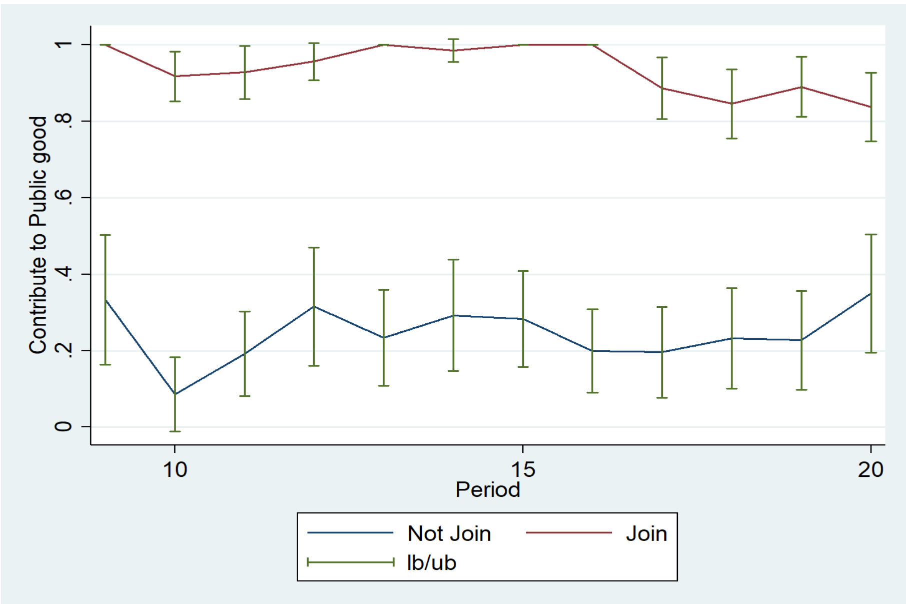

Figure 5: Time trends:Contribute to Public Good with respect to Join

Table 2: Descriptive Statistics with low and high MPCR

	Low MPCR	High MPCR	Difference
Join the Coalition	0.469	0.718	-0.248***
			(0.0264)
Contribute to Public good	0.512	0.796	-0.284***
			(0.0252)
Contribute to Public good (Coalition)	0.512	0.796	-0.284***
			(0.0252)
Contribute to Public good(Part 1)	0.308	0.782	-0.475***
			(0.0298)
Payoff in Coalition	12.22	34.62	-22.40***
			(0.335)
Payoff of least well off person	10.24	33.54	-23.30***
			(0.372)
Coalition Size	2.815	4.306	-1.491***
			(0.0707)

Notes: Standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 3: Joining the Coalition

	(1)	(2)	(3)	(4)
	Model_1	Model_2	Model_3	Model_4
type 2(0.5) (type 1 as base)	0.120*	0.123	0.117*	0.120
	(0.0602)	(0.0712)	(0.0596)	(0.0711)
type 3(0.8) (type 1 as base)	-0.0751	-0.105	-0.0766	-0.118
	(0.0657)	(0.0799)	(0.0655)	(0.0794)
High MPCR (low MPCR as base)	0.281***	0.308***	0.285***	0.305***
	(0.0340)	(0.0433)	(0.0341)	(0.0431)
Lag of Payoff in Coalition	-0.0181*	-0.0272**	-0.0176*	-0.0267**
	(0.00728)	(0.00927)	(0.00735)	(0.00948)
Lag of Payoff of least well off person	0.0122	0.0195*	0.0117	0.0195*
	(0.00721)	(0.00927)	(0.00748)	(0.00990)
Lag of Number of Contributors(Coalition)	0.0258	0.0424*		
	(0.0146)	(0.0178)		
Lag of Coalition Size			0.0314	0.0403
			(0.0175)	(0.0258)
Control for session type	Y		Y	
Observations	1188	792	1188	792

Standard errors in parentheses and clustered at subject level, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

All predictors at their mean value. Dependent: Join(1:Join, 0:Not Join)

Model 1 and 3 for both sessions, Model 2 and 4 for Homogeneous sessions

Table 4: Contribute to Public Good (Coalition)

	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4
type 2(0.5) (type 1 as base)	0.0932	0.123*	0.0885	0.111
	(0.0491)	(0.0581)	(0.0488)	(0.0589)
type 3(0.8) (type 1 as base)	-0.110	-0.191**	-0.110	-0.185**
	(0.0564)	(0.0703)	(0.0566)	(0.0691)
High MPCR (low MPCR as base)	0.323***	0.295***	0.325***	0.290***
	(0.0288)	(0.0344)	(0.0289)	(0.0341)
Lag of Payoff in Coalition	-0.0178**	-0.0225**	-0.0168*	-0.0216**
	(0.00658)	(0.00741)	(0.00659)	(0.00762)
Lag of Payoff of least well off person	0.0122	0.0156*	0.0105	0.0123
	(0.00654)	(0.00736)	(0.00667)	(0.00769)
Lag of Number of Contributors(Coalition)	0.0205	0.0170		
	(0.0124)	(0.0166)		
Lag of Coalition Size			0.0338*	0.0461*
			(0.0147)	(0.0222)
Control for session type	Y		Y	
Observations	1188	792	1188	792

Standard errors in parentheses and clustered at subject level, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

All predictors at their mean value. Dependent: Contribute(1:Yes, 0:No)

Model 1 and 3 for both sessions, Model 2 and 4 for Homogeneous sessions

Table 5: Number of Contributors

	(1) Model1	(2) Model2
type 2(0.5) (type 1 as base)	0.390***	0.554***
	(0.112)	(0.149)
type 3(0.8) (type 1 as base)	-0.620***	-1.021***
	(0.137)	(0.153)
High MPCR (Low MPCR s base)	1.832***	1.578***
	(0.0985)	(0.111)
Homogeneous (Heterogeneous sessions as base)	0.236*	
	(0.113)	
Lag of Payoff in Coalition	-0.0635***	-0.0624***
	(0.0182)	(0.0180)
Lag of Payoff of least well off person	0.0319	0.0175
	(0.0179)	(0.0183)
Lag of Coalition Size	0.240***	0.286***
	(0.0445)	(0.0595)
Constant	2.768***	3.335***
	(0.142)	(0.134)
Observations	1188	792

Standard errors in parentheses and clustered at subject level, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

OLS, dependent variable: Number of contributors

Model 1 for both the sessions, Model 2 for Homogeneous sessions

Table 6: Full sample(Contribute and Contributors)

	(1)	(2)	(3)	(4)
	Contribute_1	Contribute_2	Contributors_1	Contributors_2
Part 2 (Part 1 as base)	0.101***	0.104**	0.731***	0.771***
	(0.0264)	(0.0349)	(0.0946)	(0.134)
High MPCR (Low MPCR as base)	0.377***	0.355***	2.188***	2.011***
	(0.0264)	(0.0312)	(0.0703)	(0.0808)
Homogeneous (Heterogeneous Sessions as base)	0.0386		0.242*	
	(0.0447)		(0.106)	
Lag of Payoff for subjects	-0.00729***	-0.00829***	-0.00137	-0.00730*
	(0.00144)	(0.00186)	(0.00255)	(0.00285)
Lag of Number of Contributors	0.0615***	0.0618***		
	(0.0109)	(0.0141)		
Constant			1.883***	2.325***
			(0.135)	(0.0984)
Observations	1944	1296	1944	1296

Standard errors in parentheses and clustered at subject level, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Model 1 and Model 2(All predictors at their mean value). Dependent: Contribute(1:Yes, 0:No)

Model 3 and Model 4(OLS). Dependent: Number of Contributors

Model 1 and 3 for both the sessions, Model 2 and Model 4 for Homogeneous sessions

Table 7: Joining the coalition:group composition-Type 1 and Type 2

	(1)	(2)
	Join	Contribute
Type1comp=1	0	0
	(.)	(.)
Type1comp=2	0.104	0.0938
	(0.0723)	(0.0704)
Type1comp=3	0.0872	0.0891
	(0.0689)	(0.0689)
Type1comp=4	0.282**	0.242*
	(0.0921)	(0.100)
Type2comp=1	0	0
	(.)	(.)
Type2comp=2	-0.0155	-0.0170
	(0.0721)	(0.0717)
Type2comp=3	0.0466	0.0483
	(0.0854)	(0.0846)
Type2comp=4	0.00265	-0.00185
	(0.0792)	(0.0783)
Low MPCR	0	0
	(.)	(.)
High MPCR	0.218***	0.233***
	(0.0564)	(0.0568)
Lag of Payoff in Coalition	-0.0275*	-0.0255*
	(0.0119)	(0.0116)
Lag of Payoff of least well off person	0.0220	0.0187
	(0.0123)	(0.0112)
Lag of Number of Contributors(Coalition)	0.0168	
	(0.0292)	
Lag of Coalition Size		0.0451
		(0.0285)
Observations	378	378

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

All predictors at their mean value. Dependent: Join(1:Yes, 0:No)

Table 8: Joining the coalition:group composition-Type 1 and Type 3

	(1)	(2)
	Join	Contribute
Type1comp=1	0	0
	(.)	(.)
Type1comp=2	0.0668	0.0653
	(0.0794)	(0.0777)
Type1comp=3	-0.00439	-0.00470
	(0.0781)	(0.0761)
Type1comp=4	0.227*	0.178
	(0.0914)	(0.0956)
Type3comp=1	0	0
	(.)	(.)
Type3comp=2	-0.0107	-0.0427
	(0.0717)	(0.0680)
Type3comp=3	-0.0675	-0.0682
	(0.0835)	(0.0816)
Type3comp=4	0.0165	-0.00855
	(0.203)	(0.209)
Low MPCR	0	0
	(.)	(.)
High MPCR	0.244***	0.256***
	(0.0579)	(0.0576)
Lag of Payoff in Coalition	-0.0242	-0.0223
	(0.0126)	(0.0123)
Lag of Payoff of least well off person	0.0199	0.0159
	(0.0129)	(0.0119)
Lag of Number of Contributers(Coalition)	0.0139	
	(0.0298)	
Lag of Coalition Size		0.0447
		(0.0320)
Observations	366	366

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

All predictors at their mean value. Dependent: Join(1:Yes, 0:No)

Instructions

Page 1: Instructions

Welcome to the experimental session. You will be paid $10 for participating, you may earn additional money based on the decisions you make in the experiment. Your earnings will be paid in cash at the end of the session. You will complete a number of rounds in the experiment and your earnings from two randomly determined rounds will be paid to you. **You are not allowed to communicate with others during the experiment.**

Violation of this rule will lead to the exclusion from the experiment and all payments. If you have questions, please raise your hand. A member of the experimenter team will come to you and answer them in private. Cell phones are not allowed during the experiment.

Page 2: Instructions

We will not speak of Dollars during the experiment, but rather of points. Your whole income will first be calculated in points. At the end of the experiment, the total amount of points you earned will be converted to Dollars. Each 4 points is worth $1. So, if you earn 40 points you will receive $10 in addition to the $10 you get for participating.

The experiment consists of 2 parts and in each part there will be a number of rounds. You will be paid for one random rounds in each part. We will start by explaining the first part. You will receive separate instructions for part 2 after you have finished part 1.

Page 3: Instructions for **Part I**

This part will have 8 rounds, and, in each round, you will be required to make a decision.

The decision situation.

You will be a member of a group consisting of **6 people**. In each round everyone in your group will be given 10 points. Each group member has to decide on how to invest their 10 points in each round. You can invest all 10 points into your **private account**, or all 10 points into a **group project**. The points cannot be split between private account and the group project.

Page 4: Instructions for Part I

Your earnings from your **private account**. **You will earn one point for each point you put into your private account**. You can either put 0 points or 10 points into your private account. For example, if you put 10 points into your private account (and therefore do not invest in the group project), your earnings from private account will amount to exactly 10 points. If you put 0 points into your private account, your earnings from private account will be 0 points. No one except you earns something from your private account.

Page 5: Instructions for Part I

Here is information about your earnings from the group project. Both group members who do put their points in the group project and those who do not put their points in the group project will receive an equal number of points from the group project.

The earnings for each group member will be determined through a conversion rate. There will be two conversion rates in the experiment as described below.

Case 1) Earnings from the project = 30% multiplied by the sum of all contributions. Example 1: If everyone in your group of 6 participants contributes 10 points then, the sum of all contributions to the project is 60 points. Here the conversion rate is 30%. You and the other members of your group will each earn 30% (0.3) multiplied by 60, which is18 points (30% of 60 points $= 0.3x60 = 18$).

Example 2: If four members of the group contribute 10 points each, then sum of contributions is 40 points. You and everyone in your group each earn 30% of the total contributions of 40, which is 12 points.

Case 2) Earnings from the project = 70% (0.7) multiplied by the sum of all contributions.

Example 1: If everyone in your group contributes 10 points then, the sum of all contributions to the project is 60 points. Here the conversion rate is 70%. You and the other members of your group will each earn 70% of the total contribution (60 points), which is 42 points (0.7x60).

Example 2: If four members of the group contribute 10 points each, then the sum of contributions is 40 points. You and everyone in your group each earn 70% of the total contributions (40 points), which is 28 points.

Remember that you also get earnings from your private account, so in any round Total Earnings = earnings from your private account + earnings from the group project

Page 6: Instructions for Part I

Points to remember

Case 1 (30% earnings from the group project) and Case 2 (70% earnings from the group project) will occur in random order for the 8 rounds. Please pay attention to the amount of earnings from the group project in each round.

Your total earning: Your total earnings is the sum of your earnings from your private account and that from the project.

If you contribute to the project: In this case, you would have invested nothing in your private account and your earnings will solely depend on the earnings from the group project. Example 1: Total earnings= Earnings from your private account (0 points) + Earnings from the project (30%of sum of all contributions). Example 2: Total earnings= Earnings from your private account (0 points) +Earnings from the project (70% of sum of all contributions).

If you do not contribute to the project: In this case, you would have invested the 10 points in your private account and your earnings will include that 10 points in addition to the earnings from the groups project.

Example 1: Total earnings= Earnings from your private account (10 points) +Earnings from the project (30%of sum of all contributions). Example 2: Total earnings = Earnings from your private account (10 points) +Earnings from the project (70%of sum of all contributions).

To reiterate, income from the project goes up if more people contribute to the project. On the other hand, Income from your private account is only dependent on your contribution. At the end of each round, you will be informed about your earnings and how many people contributed to the project.

Page 7: Instructions for Part II

We now move to Part II of our experiment. In the previous part of the experiment, you were making choices independently. There are two differences in Part II of the experiment compared to Part I:

1. group members can join a coalition, and
2. your earnings will be calculated differently

Let's discuss coalitions first.

In this part, you all will have an option to join a coalition which decides together whether every coalition member will contribute to the group project or not. In each round of Part 1 you had only one decision to make in each round, but in Part II you will make two decisions in each round.

As in Part 1, you will be a member of a group consisting of 6 members. Part II will have 12 rounds with two stages in each round.

In **stage 1**, you will decide whether or not to join a coalition. In **stage 2**, your decision will depend on whether you decided to join the coalition or not. **If you do not join the coalition**, your decision is exactly the same as in Part 1: you decide independently whether to invest 10 points in your private account or the group project. **If you do join the coalition**, then members of the coalition collectively decide whether all members will contribute or not contribute to the group project.

Page 8: Instructions for Part II

Remember that in stage 1 every group member decides whether or not to join the coalition. At the end of stage 1, you will know how many members in the group of 6 participants have decided to join the coalition.

How do coalitions make decisions in stage 2?

Every group member who joins the coalition, will vote on whether members of the coalition will invest all 10 points in the group project or not. **If half or more than half the people in the coalition vote to put "points in the group project" then everyone's points in the coalition go into the group project**.

Example 1: If the coalition consists of 5 members and 3 of them vote to contribute their 10 points, then each of the 5 members will put 10 points in the group project.

Example 2: If the coalition consists of 4 members and 2 of them vote to contribute their 10 points, then each of the 4 members will put 10 points in the group project.

Once you join the coalition, you remain in it until the round ends. You are free to make a different decision in each round about whether to join the coalition.

Stage 2 instructions

Page 9: Instructions for Part II

As in Part I, your earnings depend on how much you put in your private account and how much you contribute to the group project. As a reminder: You will earn one point for each point you put into your private account . No one except you earns something from your private account. Each group member will profit equally from the amount you put into the project. The earnings from the group project for each group member will be determined through a conversion rate as before (30%or 70%). Recall the earnings from the project can be determined in the following ways:

Case 1) Earnings from the group project = 30% multiplied by the sum of all contributions=0.3x sum of all contributions. Case 2) Earnings from the group project =30% multiplied by the sum of all contributions=0.7x sum of all contributions.

Case 1 (30% earnings from the group project) and Case 2 (70% earnings from the group project) will occur in random order for the 8 rounds. Please pay attention to the amount of earnings from the group project in each round.

Page 10: Instructions for Part II

The second difference in Part II compared to Part I, is the earning calculation. In Part II, your total earnings in a round are based on

1) A percentage of your earnings from your private account,

2) A percentage of your earnings from the group project and

3) A percentage of the earnings of the person in your group **who earns the least** in that round of the experiment.

Here is how to analyze who earns the least in your group a. If everyone in the group puts all of their points in their private account, then everyone is tied for lowest earner in the group b. If everyone in the group puts all of their points in the group account, then everyone is tied for lowest earner in the group c. If some people put all of their points in their private account, and some put all of their points in the group account, then the people who put their points in their private account earn more. That means that all of the people who put their points in the group account are tied for lowest earner in the group

The percentages you use to calculate your total earnings for the round will remain the same throughout Part II of the experiment. Other members in your group may or may not have the same percentages as you. **You will not be informed about the percentages other participants use to calculate their total earnings**.

Page 11: Instructions for Part II

To illustrate this earnings calculation, let's assume that the percentage of the earnings you receive from both your private account and the group project is 20% (0.2) and the percentage of the earnings you receive based on the earnings of the least well-off person in your group is 80% (0.8).

The formula for calculating your earnings for a round is: .2x(earnings from private account) + .2x(earnings from group project) + .8x(earnings of the least well off person in your group)

Now suppose the group project's conversion rate is 30%.

If you contribute to the project then your earnings for the round will be .2x(Earnings from your private account or 0 points) + .2x(Earnings from the group project or 30% of the sum of everyone's contributions) + .8x(the earnings of the least well-off person)

Remember that when you contribute to the project; your total earnings will be the same as the earnings of the least well-off person who is also contributing to the project. **Thus, when you contribute to the group project, your earnings for the round turn out to be the same as in Part 1 of the experiment**.

If you do not contribute to the project then your earnings for the round will be .2x(Earnings from your private account or 10 points) + .2x(Earnings from the group project or 30% of the sum of everyone's contributions) + .8x(the earnings of the least well-off person)

Remember, when you do not contribute to the project, your total earnings will not be the same as earnings of the least well-off person who is contributing to the project. **Thus, when you do not contribute to the group project, your earnings for the round will not be the same as in Part 1 of the experiment**.

Page 12: Instructions for Part II

Let's give you some scenarios as examples and your earnings in each one of them.

Suppose that the group project's conversion rate is 30%.

Suppose the percentage of the earnings you receive from both your private account and the group project is 20% (0.2) and the percentage of the earnings you receive based on the income of the least well-off person in your group is 80% (0.8).

Also, suppose three people in the group join the coalition and that two out of these three people vote to contribute to the group project. In this case, **everyone in the coalition contributes their 10 points to the group project**.

Last, suppose that 2 out of the remaining 3 people the group who are not in the coalition also contribute to the group project. Thus, there are now 5 people contributing to the group project. The sum of everyone's contributions is 50 (5 multiplied by 10=5x10).

Scenario 1: you are a member of the coalition of 3 people that collectively decided to contribute to the group project.

Since you contributed to the project, your earnings for the round will be .2x(Earnings from your private account = 0 points) + .2x(Earnings from the group project or 30% of the sum of everyone's contributions=0.3x50) + .8x(the earnings of the least well-off person=0.3x50) **Earnings for the round**=0.2x(0) +0.2x(15) +0.8x(15) =15 points

Suppose you **do not join the coalition** and there are four members in your group (other than you) who are contributing to the project. If you **decide to contribute** to the project, **there are now 5 people contributing to the group project**. The sum of everyone's contributions is 50 (5 multiplied by 10=5x10). In this scenario your calculation for **Earnings for the round will exactly be the same as above**.

Recall when you contribute to the group project, your earnings for the round turn out to be the same as in Part 1 of the experiment.

Page 13: Instructions for Part II

- **Suppose three people in a group join the coalition including you** . Suppose only 1 out of the 3 people in your coalition votes to contribute to the group project, **in this case the coalition of 3 people will not contribute to the group project**.

- Also, suppose 2 out of the remaining 3 people in your group who are not in the coalition also contribute to the group project. Thus, **there are now 2 people contributing to the group project**. Sum of everyone's contributions is 20 (2 multiplied by 10=2x10).

Since you do not contribute to the project, your earnings for the round will be .2x(Earnings from your private account =10 points) + .2x(Earnings from the group project or 30% of the sum of everyone's contributions=0.3x20) + .8x(the earnings of the least well-off person=0.3x20)

Earnings for the round=0.2x(10) +0.2x(6) +0.8x(6) =3.2+4.8=8 points

Suppose you **do not join the coalition** and there are two members in your group (other than you) who are contributing to the project. Now you decide not to contribute to the project, **there are now 2 people contributing to the group project**. Sum of everyone's contributions is 20 (2 multiplied by 10=2x10). In this scenario your calculation for **Earnings for the round will exactly be the same as above**.

Recall when you do not contribute to the group project, your earnings for the round will not be the same as in Part 1 of the experiment.

Page 14: Points to remember

Summary of the changes in from Part 1 to Part 2:

1. In each round you have the option to join a coalition. The coalition decides together whether to contribute to the group project or not. **If half or more than half the people in the coalition vote to put "points in the group project" then everyone's points in the coalition go into the group project**.

2. In Part II, your total earnings in a round are based on 1) A percentage of your earnings from your private account, 2) A percentage of your earnings from the group project and 3) A percentage of the earnings of the person in your group **who earns the least**in that round of the experiment. This percentage will be fixed for you until the end of the experiment. You will not be informed about the percentage other participants have attached to their total earnings and earnings of the least well-off person.

3. **At the end of each round, you will be informed about your earning and how many people contributed to the project**.

Participants play a quiz before they began to play the game in Part II