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Identity and Information  
Diversity in a Leader-member  
Public Goods Experiment**

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# **Revisiting the effects of group identity and information diversity in a leader-member public goods experiment**

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## **Abstract**

We investigate the willingness to cooperate between leaders and members in a repeated public goods experiment, when there is group identity and information diversity between them. The participants who play the role of leader, first decide their contributions to the team project. Subsequently, members also decide their contributions. The results indicate that having the same group identity as the leader has a positive effect on members' intention to fully cooperate with the leader. Additionally, in the case of being in the same group, disclosing information only to members may increase cooperation. Finally, cooperative behavior between members is closely related to the identity of the leader and information diversity.

**Keywords:** Leadership; Beliefs; Group Identity; Information Diversity; Public Goods Experiment

JEL classification: C72, C91, D63

## **1. Introduction**

People believe that, in a group, the behavior of one member is influenced by the leader and other members. People's own behavior largely depends on their beliefs about the way others behave. For example, if leaders and other team members are selfish and willing to accept bribes, the rest will also take it for granted and be more likely to behave in a similar manner. Over time, acceptance of such practices may become part of one's own belief, which will make the whole team enter a vicious cycle. However, if leaders and other members are selfless and fair, a virtuous cycle can be created. Gächter and Renner (2018) and Fisman and Golden (2017) found that the more people believe that others are corrupt, the more widespread the corruption becomes. Cialdini et al. (1990) conducted an experiment in a parking lot. The experiment demonstrated that people were more likely to throw away flyers (posted by the experimenter on their car) in the parking lot itself, if it looked messy, as compared to if the parking lot looked clean.

Kelley and Stahelski (1970) found that people's cooperative behavior is somehow related to others. In fact, it can even be argued that it depends on that of others, i.e., many people are "conditional-cooperators". They cooperate if others cooperate positively. Keser and Van Winden (2000) found that conditional cooperation is a common phenomenon in a public goods game, and that most people choose to cooperate conditionally. Fischbacher et al. (2001) further studied conditional cooperation in public goods games and found that 1/3<sup>rd</sup> of the subjects could be classified as free-riders, while 50% were conditional-cooperators. The behavioral relevance of conditional cooperation has also been demonstrated in field experiments. For example, Croson and Shang (2008) found that by updating social information (i.e., other donors' donations that were higher or lower than the previous years'), they would change their donations along with the social information. When other donors' donations were higher than their previous ones, people increased their own donations, and vice versa. Jack and Recalde (2015) found that voluntary donations increase when local authorities lead by example.

With globalization and diversity, the workforce has become more diverse. Most teams are composed of people of different ages, groups, religious beliefs, and even nationalities. Therefore, it is important to learn how to manage diversity in order to facilitate coordination and cooperation. While diversity in group membership has been found to induce positive outcomes, such as greater caution in decision-making (Nemeth,

1986), expanded access to social networks and resources (Tushman, 1977), and promotion of innovation (Van Der Zee and Paulus, 2008), it can also lead to intergroup bias and conflict among the members (Pelled et al., 1999; Hargreaves Heap et al., 2009). The above-mentioned studies show that while diversity within a group can induce positive outcomes, it might lead to bias. This triggers a thought that if there is an identity difference between the leader and members within a team, will it bring about more positive or negative cooperation behaviors? Will they trust each other more because of their contrasting experiences, or will they distrust each other because of a lack of understanding? In teamwork, leader-member type teams are the most common, so it is necessary to study the willingness to cooperate between leaders and members, when there is identity diversity between them.

To conduct this study, we first create an artificial identity. The use of artificial identity groups to study issues related to discrimination is common in identity economics literature (Eckel and Grossman 2005; Charness et al., 2007; Chen and Li, 2009; Chen and Chen, 2011). In real life, a shared identity is often used to enhance a sense of belonging to a team and encourage team members to work towards a common goal. For example, Nike's founder Phil Knight and many of his employees had the Nike "swoosh" logo tattooed on their left calf as a symbol of group membership (Camerer and Malmendier, 2007). To create a common identity, organizations have experimented with various team-building exercises, such as simulated space missions, where crews work together to overcome malfunctions as they navigate through space (Ball, 1999). Although the standard economic theory does not explain this phenomenon, research on social identity reveals the impact of shared identity on organizational outcomes.

Social psychological research on intergroup relations has found that highlighting and strengthening shared ingroup identities can reduce bias (Dovidio et al., 2009), and enhance cooperation (Dovidio and Gaertner, 2000). For example, students from the same university with different nationalities showed a decrease in their willingness to cooperate, if information about their nationality was emphasized in the experiment; however, there was no significant changes noticed in their willingness to cooperate, if information about their university was emphasized (Chen et al., 2014). Another study emphasized that shared group identity increases satisfaction within colleagues in ethnically diverse work groups (Cunningham, 2005).

Our study adds to previous research on the effects of leaders' beliefs and identities on behavior in public goods games, by addressing the issue of information diversity. Information diversity can change people's behavior during games. Participants who were informed, had a common group identity that increased their cooperation in public goods (Eckel and Grossman, 2005) and prisoner's dilemma games (Goette et al., 2006). We examine how the cooperative behavior of leaders and members with different identities differ in the public goods game. Our sample consisted of student participants from a public university in China who were given group identities at the time of recruitment, and then leaders were randomly selected from among them. We reinforced group identity as the highlighted identity in the experiment, and by controlling variables if-know-id, designed seven experimental sessions. We chose a leader-follower public goods game as our analytical framework, which we have described in detail in the next section.

In this study, we found that group identity has an impact on members' cooperative behavior, and it varies under different session treatments. In addition, we found that preferences for risk, knowledge of economics, and experimental experience also matter.

This study contributes to the literature on social identity in three ways: First, we introduce identity information into a leader-member public goods game and explore the effects of different identities in a led model. Second, we take the approach of inducing group identity in the laboratory rather than studying naturally occurring social identities (e.g., race, religion, gender, etc.), which makes our results purer and does not include other identity elements (religion, gender, age, etc.). For example, some participants may pay more attention to religion than others, while others may not care about gender. This can easily be applied to real-life work settings. We use identity induction techniques from social psychology to manipulate the salience of respective identities, to examine the extent to which evoking different dimensions of these identities affects individuals' choices of coordination and cooperation. Finally, we analyze individual behaviors at a micro level and provide a quantitative categorical classification of each participant's behavior, providing further empirical evidence for the refinement of behavior types in public goods games.

The remainder of this paper is organized as follows: Section 2 describes the experimental design of this study. Section 3 presents our analysis and results. Section 4 discusses the results, and concludes the study.

## 2. Experimental design

Our basic design involves a leader-member public goods game. In the experiment, all participants were divided into two roles: role A called “leader” makes an investment decision first in the experiment and role B called “member” makes decision after role A. Each team has one leader and three members. Both the leader and members were endowed with 30 RMB each. The leader was first asked to decide how much money to contribute to the team project, ranging from 0 to 30. Then, after knowing the amount their leader contributed, the members needed to decide how much money to contribute to the team project, which could also range from 0 to 30. The total contribution of the team project is the sum of all contributions from the leader and three members. The payoff for each subject is given by

$$\pi_i = 30 - g_i + 0.5 \sum_{j=1}^4 g_j$$

where subject  $i \in \{1, \dots, 4\}$  is endowed with 30 RMB and decides how much money to contribute to the public good (i.e.,  $g_i$ ) and how much money to keep for themselves (i.e.,  $30 - g_i$ ). Each piece of money allocated to the team project yields a marginal per capita return of 0.5.  $\pi_i$  is the project’s payoff and  $\sum g_i$  is the total investment of the team project.

In the pursuit of profit, both the leader and the member will expect to pay less, and others to pay more. If the leader does not invest any money, the member will not invest any money either. That is, for a rational leader and/or member seeking to maximize their own profit, the choice of the game is clear: the leader chooses to invest 0, and the member also chooses to invest 0. In our game setting, if both the leader and members choose to invest less money, their payoff will converge infinitely to the initial endowment (i.e., 30 RMB). However, with the full cooperation that everyone invests the entire amount (i.e., 30 RMB), everyone earns as much money as his/her initial endowment (i.e., 60 RMB). Therefore, bounded-rational participants in the actual game experiment, will choose to invest a certain amount of money and actively cooperate with the leader or other members to obtain more profits. This is also demonstrated in the actual game experiment, in which both leaders and members choose to pay more than 0. In addition, there is a significant positive correlation between the number of leader investments and member investments. This is significantly different from the theoretical prediction and is due to the existence

of the team project rule, where all participants are likely to be better off if the leader invests more (if he or she trusts the members), and the member also invests more (if he or she trusts the leader). Thus, the amount of the leader and member's contribution, respectively, or the ratio of the member's contribution to the leader's contribution can also be considered as a measure of the leader and member's trust in each other.

When designing the experiment, we wanted to ensure that identity was salient enough to matter. Many experimental studies have addressed the salience of group identity in experimental designs, relying on induced identities such as the color of the group (e.g., Cochard et al., 2019; Currarini and Mengel, 2016). Additionally, Chen and Chen (2011) found that implementing social interactions can increase identity salience. Therefore, at the beginning of the experiment, we introduced a word-chain game to strengthen the sense of identity among the participants.

We conducted the experiment at the Shanghai Lixin University of Accounting and Finance on December 11–12, 2021. A total of 168 students (82 males and 86 females; mean age:20.22 years, standard deviation:1.02 years). Each subject was randomly assigned to WeChat group A (72 students), WeChat group B (72 students), or WeChat group C (24 students), at the time of recruitment. After recruiting participants, we held a word-chain activity in WeChat groups A and B, and participants of the group were rewarded with a certain number of red packets for working together to complete the activity. To avoid the formation of negative social links, word-chains are rather easy, and we allow subjects to discuss or help each other. Every correct word chain is rewarded with a certain payoff to each member of the group. In WeChat group C, the word-chain game was not conducted.

There were seven sessions, each with 24 participants. In the baseline session (session a), all subjects were from WeChat group C. In the six treatment sessions (i.e., sessions b, c, d, e, f, and g), subjects were from either WeChat group A or B. In sessions b and e, the subjects' identities of the WeChat group were common knowledge within each four-player team. In sessions c and f, only the leader was informed of the other participants' identities in each team, while the members were not, and they knew this difference. In sessions d and g, only the members were informed of the other participants' identities in

each team, while the leader was not, and they knew this difference.<sup>1</sup> The seven sessions are summarized in Table 1.

**Table 1. Summary of the seven sessions**

		Leader	Member
<b>Baseline</b>	<i>No identity</i> (Session a)	No group identity.	No group identity.
	<i>ID-Both informed</i> (Session b)	Knows the group of the members and <b>that the members know their group.</b>	Knows the group of the leader and <b>that the leader knows their group.</b>
<b>Same Identity (ID)</b>	<i>ID-Member uninformed</i> (Session c)	Knows the group of the members and <b>that the members do not know their group.</b>	Does not know the group of the leader but <b>is aware that the leader knows their group.</b>
	<i>ID-Leader uninformed</i> (Session d)	Does not know the group of the members <b>but is aware that the members know their group.</b>	Knows the group of the leader and <b>that the leader does not know their group.</b>
<b>Different Identity (ID)</b>	<i>ID-Both informed</i> (Session e)	Knows the group of the members and <b>that the members know their group.</b>	Knows the group of the leader and <b>that the leader knows their group.</b>
	<i>ID-Member uninformed</i> (Session f)	Knows the group of the members and <b>that the members do not know their group.</b>	Does not know the group of the leader <b>but is aware that the leader knows their group.</b>
	<i>ID-Leader uninformed</i> (Session g)	Does not know the group of the members <b>but is aware that the members know their group.</b>	Knows the group of the leader and <b>that the leader does not know his/her group.</b>

Notes: **Same ID**, The leader and members in each four-player team are from the same WeChat group.

**Different ID**: The leader's WeChat group is different from the members' in each four-player team.

<sup>1</sup> Our four-player teams included one leader and three members. The three members are always from the same WeChat-group (i.e., either from WeChat-group-A or B), and the leader may be from the same WeChat-group or a different one.



We randomly selected 18, 18, and 6 leaders from WeChat group A, B, and C, respectively (20 males and 22 females; mean age:19.92 years, standard deviation:0.98 years)<sup>2</sup>. The remaining 126 participants in the WeChat-groups became members during the experiment (62 males and 64 females; mean age:20.30 years, standard deviation:1.01 years). In addition, to maintain anonymity between the leaders and members, they were segregated in different classrooms when they arrived and remained there during the experiment. In each classroom, the subjects received written instructions<sup>3</sup>, a recording sheet, and an investment amount recording sheet. In each classroom, one of the native Chinese experimenters read the instructions to ensure that they understood them.

In each session, when the subjects arrived, they were informed that they would participate in an experiment consisting of ten rounds. In each round, a public good game experiment was conducted. Eighteen members were randomly paired with six leaders. Each leader and member was endowed with 30 RMB (about 4.5 USD, where 1 RMB=0.15 USD). The detailed procedure of the experiment is as follows:

*Step 1.* The leaders in one classroom were asked to decide on the amount to contribute to the team project, predict the average of the team members' contributions, and write them on their recording and investment amount recording sheets, respectively.

*Step 2.* The experimenters collected the leaders' transfer amount recording sheets, went to the members' classroom, and wrote the amount of each leader's investment on the recording sheets of the corresponding members.

*Step 3.* After learning about the leader's investment amount, the members decided how much to contribute to the team project, predicted the average of other team members' contributions, and wrote them on their recording and investment-amount recording sheets, respectively.

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<sup>2</sup> We numbered the participants according to the order in which each of them joined the WeChat-group, and then decided who became leaders by randomly selecting the numbers. The participants who were selected as leaders were informed individually, and the others did not know which of them were selected as leaders.

<sup>3</sup> The experimental instructions for leaders and members of the six treatment sessions are almost the same as those in the baseline session, except for the additional information presented in Table 1 being provided in corresponding sessions. The experimental instruction for leaders and members of the baseline session are provided in Appendices A and B, respectively.

*Step 4.* The experimenters collected the members' investment-amount recording sheets and recorded the total investment amount for the team project on the recording sheets of the leader and each member, respectively.

*Step 5.* After all the subjects calculated their payoffs and filled in their recording sheets, the first-round experiment was completed.

The procedure of the remained nine-round experiment was the same as that of the first-round. After ten rounds, all subjects were asked to answer a post-experimental questionnaire, which included questions related to basic individual information (e.g., gender, age, major, hometown, monthly living expenses, and frequency of studying economics), the question evaluating subjects' risk preferences was borrowed from Hsee and Weber (1997), and the widely used General Social Survey (GSS) was utilized to formulate questions about trust, helpfulness, and fairness.<sup>4</sup>

Communication was prohibited during the experiment, with the subjects understanding that the experiment would be terminated immediately if they communicated with one another. There were no show-up fees for our experiments. The total reward for each subject was the sum of the payoffs based on the decisions in two randomly selected rounds. Each session lasted for approximately one hour, and on an average, a leader earned 90.96 RMB (about 13.64 USD, where 1 RMB= 0.15 USD), and a member 86.02 RMB (about 12.90 USD, where 1 RMB= 0.15 USD).

### **3. Results**

#### **3.1 Descriptive evidence**

Table 2 presents descriptive statistics of the participants' experimental performance and basic individual information. There was a good male-to-female ratio, among the participants. Approximately, the ratio of the participants' answering GSS questions regarding trust, helpfulness, and fairness positively, as compared to those answering negatively was about 50%, which suggests that, in general, the participants were relatively neutral in their social preferences.<sup>5</sup> *Risk\_appetite* represents participants' risk

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<sup>4</sup> The post-experimental questionnaire is provided in Appendix C. It is identical in content for both leaders and members.

<sup>5</sup> *GSS\_trust* is defined as 1, if "most people can be trusted" was chosen as the answer to the survey question "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" and 0 otherwise. *GSS\_fairness* is defined as 1 if "most people would try to be fair" was chosen as the answer to the survey question "Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair?" and 0 otherwise. *GSS\_Helpfulness* is defined as 1 if

preferences, which is the number of participants choosing option B in Q11 of the post-experimental questionnaire, provided in Appendix C. The more the participant choose option B, the more is their preference for risk-seeking activities. A 5-point Likert scale was used to measure *Economics\_knowledge* which is the frequency of studying economics, where 1 stood for NEVER and 5 meant ALWAYS. *Experiment\_experience* measured whether the participants had participated in any economics experiments before.

**Table 2. Descriptive statistics**

Variable	No ID	Same ID		Different ID			
	Session	Session	Session	Session	Session	Session	Session
	a	b	c	d	e	f	g
<i>Investment_Leader</i>	19.60	16.60	14.10	12.60	14.90	14.50	14.70
	(9.32)	(7.67)	(10.02)	(9.85)	(9.38)	(9.22)	(6.64)
<i>Investment_Member</i>	14.20	10.80	9.29	9.51	11.40	10.90	9.96
	(11.06)	(8.08)	(9.39)	(9.22)	(9.28)	(7.82)	(8.64)
<i>Payoff_Leader</i>	47.92	43.36	40.37	43.08	44.25	43.30	41.33
	(13.17)	(8.44)	(15.44)	(14.80)	(11.49)	(11.15)	(22.66)
<i>Payoff_Member</i>	47.02	43.68	41.64	40.90	43.14	42.29	42.25
	(10.28)	(8.52)	(9.80)	(9.85)	(9.30)	(8.53)	(9.74)
<i>Male</i>	0.56	0.72	0.28	0.44	0.44	0.61	0.61
	(0.50)	(0.50)	(0.48)	(0.44)	(0.49)	(0.50)	(0.50)
<i>Age</i>	20.11	20.28	20.33	19.94	20.44	20.00	20.00
	(0.92)	(1.11)	(0.89)	(1.35)	(0.83)	(0.86)	(1.20)
<i>Living_expense</i>	4.64	4.58	4.67	4.54	4.42	4.54	4.33
	(1.08)	(1.28)	(1.32)	(1.20)	(0.73)	(0.96)	(1.18)
<i>Economics_knowledge</i>	2.57	2.49	2.48	1.69	1.79	2.00	2.41
	(0.75)	(1.05)	(0.91)	(0.68)	(0.99)	(0.77)	(1.15)
<i>GSS_Trust</i>	2.11	2.61	2.71	2.00	2.67	1.72	1.83
	(1.45)	(1.74)	(1.26)	(1.49)	(0.88)	(1.41)	(1.26)
<i>GSS_Fairness</i>	0.70	0.43	0.63	0.75	0.70	0.43	0.58
	(0.45)	(0.50)	(0.50)	(0.47)	(0.50)	(0.50)	(0.58)

“most of the time people try to be helpful” was chosen as the answer to the survey question “Would you say that most of the time people try to be helpful, or are they mostly just looking out for themselves?” and 0 otherwise.

<i>GSS_Helpfulness</i>	0.35 (0.48)	0.34 (0.46)	0.58 (0.46)	0.34 (0.40)	0.38 (0.47)	0.49 (0.50)	0.60 (0.50)
<i>Risk_appetite</i>	2.21 (0.47)	2.54 (0.50)	2.29 (0.48)	2.30 (0.50)	2.79 (0.49)	2.08 (0.50)	2.19 (0.48)
<i>Experiment_experience</i>	0.95 (0.43)	0.86 (0.24)	0.88 (0.28)	0.95 (0.40)	0.91 (0.35)	0.92 (0.34)	0.94 (0.20)

Notes: Figures with and without parentheses are the standard deviations and mean values, respectively.

The mean investment and payoff for both, leaders and members in the baseline session (session a) were higher than those in the other 6 sessions. In addition to the effect of group identity, this may also be related to the fact that their knowledge of economics and experimental experience is more. Moreover, the participants in session a, had a higher cost of living and a higher number of participants who believed that giving was rewarded (*GSS\_Fairness*:0.70) among all participants.

### 3.2 Regression analysis of members' investment behavior

Table 3 lists the regression results of the random-effects Tobit model for members' investment decisions<sup>6</sup>. The dependent variable in this model is the investment of the members. The session dummies *SameGroup\_Bothknow*, *SameGroup\_Leaderknow*, *SameGroup\_Memberknow*, *DifferentGroup\_Bothknow*, *DifferentGroup\_Leaderknow*, and *DifferentGroup\_Memberknow* are included as the independent variables, with the baseline session (session a) being used as the reference. In addition, the independent variable *Investment\_Leader* is the investment of the paired leader, decided prior to members making decisions, and *L.Investment\_Member* is the average investment of the other two paired members in the previous round. *L.Investment\_Average* is the average investment of one paired leader and two paired members.

As shown in the table, none of the variables related to the treatment session were significant. Chi-squared tests were conducted to investigate whether the coefficients of these treatment sessions were equal. The results are also not significant, which indicates that group identity and information diversity do not seem to affect members' investment

<sup>6</sup> Our main purpose in the current paper is to investigate the investment behavior of members in a leader-member public goods game. Therefore, we present the regression results for the leader's investment decision in Appendix D.

decisions. However, *Transfer\_leader* and *L.Transfer\_Member* are estimated to be significantly positive, implying that members' investment is somewhat conditional on others' past behavior. We further analyze members' investment behaviors individually in the next subsection.

With respect to the effects of other independent variables, *Age*, *Male*, *GSS\_Fairness*, *GSS\_Helpfulness*, *Living\_expense*, and *Experiemnt\_experience* were not statistically significant. *Risk\_appetite* and *GSS\_Trust* were found to affect investment significantly and positively, while *Economics\_knowledge* had the opposite effect. The coefficient of *Round* is significantly negative, which is consistent with the findings of previous literature on public goods experiments.

**Table 3. Tobit regressions of the members' investment**

VARIABLES	Member
<i>SameGroup_Bothknow (Session b)</i>	1.182 (1.494)
<i>SameGroup_Leaderknow (Session c)</i>	-1.266 (1.530)
<i>SameGroup_Memberknow (Session d)</i>	-1.000 (1.527)
<i>DifferentGroup_Bothknow (Session e)</i>	0.032 (1.486)
<i>DifferentGroup_Leaderknow (Session f)</i>	0.634 (1.509)
<i>DifferentGroup_Memberknow (Session g)</i>	1.048 (1.465)
<i>Round</i>	-0.903*** (0.105)
<i>Investment_Leader</i>	0.469*** (0.036)
<i>L.Investment_Member</i>	0.235*** (0.044)
<i>L.Return_Average</i>	0.160*** (0.044)
<i>Risk_appetite</i>	0.486** (0.293)

<i>Male</i>	0.965 (0.848)
<i>GSS_Trust</i>	1.540* (0.878)
<i>GSS_Fairness</i>	0.276 (0.906)
<i>GSS_Helpfulness</i>	0.102 (0.845)
<i>Economics_knowledge</i>	-1.115** (0.482)
<i>Living_expense</i>	0.029 (0.348)
<i>Experiment_experience</i>	1.490 (1.159)
<i>Age</i>	0.287 (0.389)
<i>Constant</i>	-3.063 (7.893)

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Notes: Standard errors clustered by subject are in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10% levels of confidence, respectively.

### 3.3 Categorizing members by their investment behavior

Since the Tobit regression results indicate that the investment amounts of both the leader and the other two members in the team, affect the corresponding member's investment decisions, we use two ratios to categorize the members. One is the ratio of the member's investment to the leaders', in the same round (hereinafter, *by leader*), and the other is the ratio of the member's investment to the average of the other two members' in the previous round (hereinafter, *by member*). As a result, 126 members were categorized into the four types listed below:

- ◆ **Full-Cooperator:** We categorized members with the above-mentioned ratio above 1.0, in at least 60% of the rounds, into this type. As a result, 35 (i.e.,28%) and 22 subjects (i.e.,17%) fell into this category *by leaders* and *members*, respectively. These are those subjects, who are more willing to cooperate. They invest more than the leader or other members in more than 60% of the rounds. They are more resolute

in their beliefs about cooperation and are typically altruistic.

- ◆ **Conditional-Cooperator:** We categorized members with the above-mentioned ratio between 0.6 and 1.0 in at least 60% of the rounds into this type. As a result, 62 (i.e.,49%) and 57 subjects (i.e.,45%) fell into this category *by leaders* and *members*, respectively. These subjects always want to be fully aligned with the contributions of others. They also revise their own investments with reference to others. Their cooperation is conditional and not entirely selfless. Therefore, this behavior can simply be described as "conditional cooperation with self-serving bias".
- ◆ **Free-Rider:** We categorized members with the above-mentioned ratio being lower than 0.6 in at least 60% of the rounds, into this type. As a result, 23 (i.e.,18%) and 40 subjects (i.e.,32%) fell into this category *by leader* and *member*, respectively. These subjects always want to get something for nothing and are not willing to co-operate. Therefore, they seem purely selfish or lack altruistic motives.
- ◆ **Others:** We categorized members with the above-mentioned ratio being irregular into this type. In other words, their ratio can neither be categorized as “Full-Cooperator,” nor “Conditional -Cooperator” nor “Free-rider.” As a result, 6 (i.e.,5%) and 7 subjects (i.e.,6%) fell into this category *by leader* and *by member*, respectively. These subjects always behave randomly.

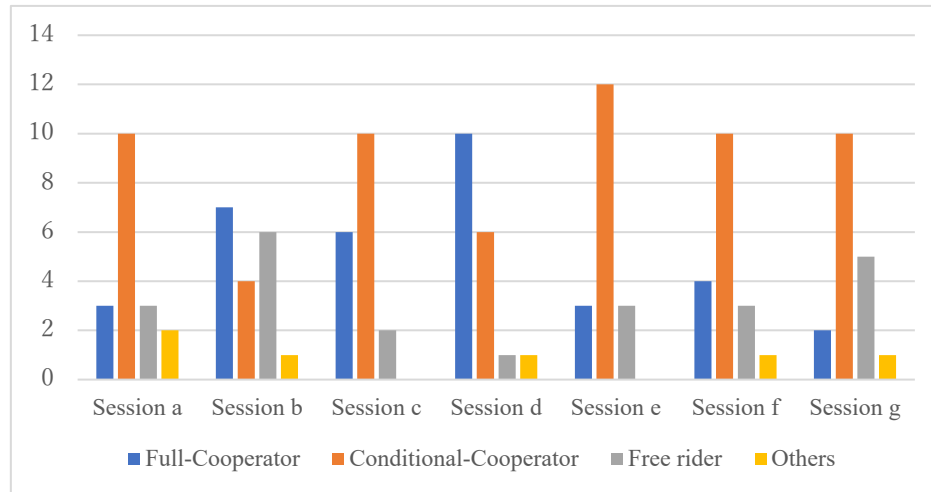
The above- mentioned information can be seen in Figures 1 and 2. From the figures, we can see that by both *leader* and *member*, nearly 50% of the subjects are conditional co-operators, which is consistent with the findings of Fischbacher et al. (2001). The second most frequent type, *by leader* was full-cooperator (28%), and *by member* was free rider (32%).

Figures 3 and 4 show the ratio of the treatment sessions to the baseline session (session a). To see the results more visually, we divided the number of subjects of each type in the treatment sessions by those of the corresponding type in the control session (Session a) and presented the ratios in Figures 3 and 4.<sup>7</sup> As shown in the figures, the composition of the co-operator types in each session differed from that in the control session. For example, compared to the baseline session, the number of full-cooperators

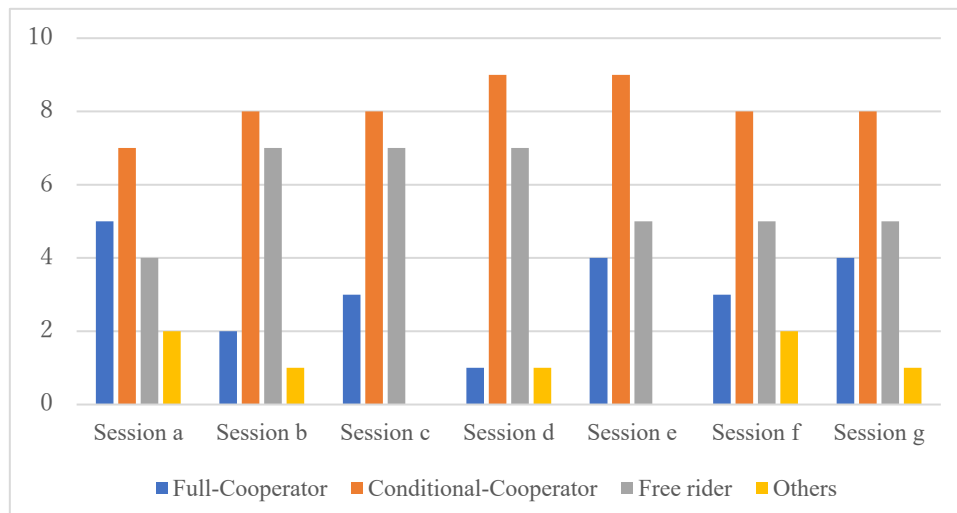
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<sup>7</sup> For example, as we can see in Figure 1, the number of full-cooperator in the baseline session (session a) is 3 and that in session f is 4, so the ratio of the number of full-cooperator in session f to session a is 1.33 (in Figure 3).

(categorized *by leader*) is much higher in the same ID sessions (i.e., sessions b, c, and d). However, the number of free-riders (categorized *by members*) is higher in all treatment sessions than in the baseline session. To investigate how group identity and information diversity affect member types, we conducted a multinomial logit regression. The results are presented in the following sub-section.

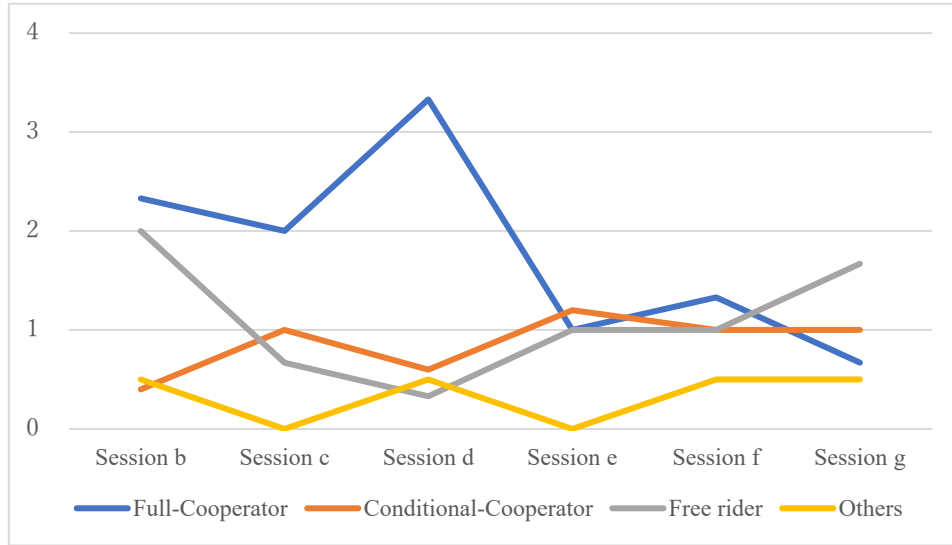


**Figure 1. Types of members in each session (*by leader*)**

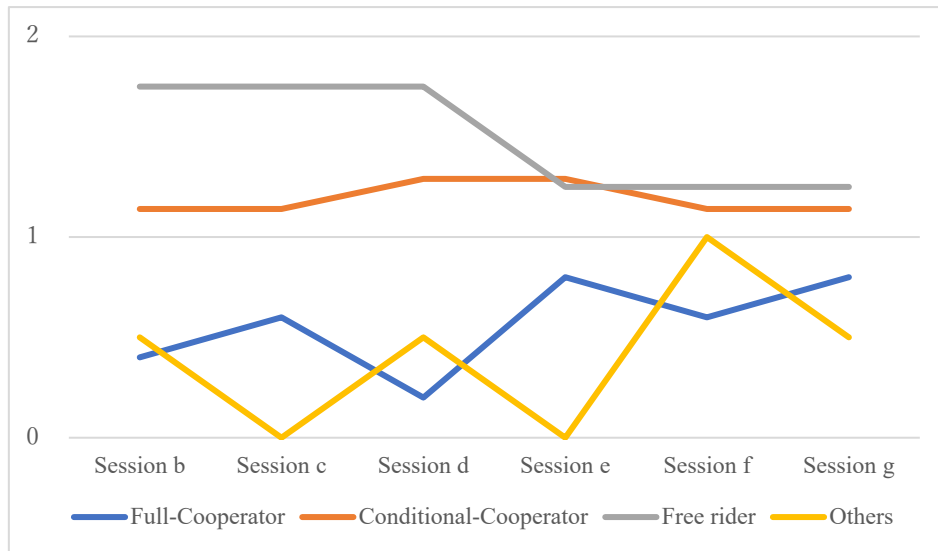


**Figure 2. Types of members in each session (*by member*)**





**Figure 3. The ratio of the numbers of subjects of each type in treatment sessions compared to those in the baseline session (*by leader*).**



**Figure 4. The ratio of the numbers of subjects of each type in treatment sessions compared to those in the baseline session (*by member*).**

### 3.4 Regression analysis of members' types

Tables 4 and 5 present the results of the multinomial logit regression on member types, categorized *by leader* and member, respectively. First, we examine the results in Table 4. When both leader and members know they belong to the same WeChat group (i.e., Session b), the probability of being a ‘conditional co-operator’ decreases

significantly (-0.411), while the probabilities of being a ‘full-cooperator’ (+0.123), ‘free-rider’ (+0.181) and ‘others’ (+0.102) are all estimated to be significantly positive. In other words, under the condition that every role knows that they belong to the same group, members are significantly less influenced by the leaders' behavior (conditional co-operator decreases significantly) and tend to act more according to their own characteristics (the other 3 types increase). In the condition that only the leader knows that the members and they belong to the same WeChatgroup, (i.e., Session c), the probability of being a ‘conditional co-operator’ decreases (-0.167), and the probabilities of being a ‘free-rider’ (+0.104) and ‘others’ (+0.094) increase significantly. When only members know that the leader and they come from the same WeChat group (i.e., Session d), the probabilities of being a ‘full-cooperator’ (+0.322) and ‘others’ (+0.137) increase significantly, while the probabilities of being a ‘conditional-cooperator’ (-0.312) and ‘free-rider’ (-0.145) decrease significantly. In the conditions when the leader and members come from different WeChat groups (i.e., Sessions e, f, and g), the probability of being ‘others’ increase significantly, but the probability of being a free-rider in Session e (-0.045) and Session f (-0.066) decreases, and the other types are not significant. For other independent variables, people with a high-risk appetite have a higher probability of being full-cooperators, and those with positive attitudes towards trust and fairness have a lower probability of being free-riders. Interestingly, members with more economic knowledge are less likely to be full-cooperators.

**Table 4. Multinomial Logit regressions on the cooperative type of members (by leader)**

VARIABLES	Full-Cooperator	Conditional-Cooperator	Free-Rider	Others
<i>SameGroup_Bothknow</i> (Session b)	0.128***	-0.411***	0.181***	0.102***
<i>SameGroup_Leaderknow</i> (Session c)	-0.031	-0.167***	0.104**	0.094***
<i>SameGroup_Memberknow</i> (Session d)	0.322***	-0.312***	-0.145***	0.137***
<i>DifferentGroup_Bothknow</i> (Session e)	-0.058	0.054	-0.045*	0.049**

<i>DifferentGroup_Leaderknow</i> (Session f)	0.013	-0.07	-0.066**	0.123***
<i>DifferentGroup_Memberknow</i> (Session g)	-0.038	-0.045	-0.045	0.128***
<i>Economics_Knowlegde</i>	-0.039**	0.049	-0.035**	-0.045
<i>Experiment_Knowlegde</i>	0.059	0.071**	-0.049	-0.085***
<i>Male</i>	0.016	-0.003	-0.021	-0.002
<i>Age</i>	-0.001	0.038	0.158	-0.053***
<i>Living_expense</i>	0.001	-0.042***	-0.001	0.034***
<i>GSS_Trust</i>	0.003	-0.032	-0.084***	0.122***
<i>GSS_Fairness</i>	-0.021	0.077	-0.083**	0.112***
<i>GSS_Helpfulness</i>	-0.017*	0.024	-0.074	0.067**
<i>Risk_appetite</i>	0.033**	-0.006	-0.003	-0.024**

Notes: The figures represent marginal effects. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10% levels of confidence, respectively.

With respect to the results in Table 5, overall, compared to the baseline session, in all the treatment sessions the probability of being a ‘full-cooperator’ decreases significantly, and that of being ‘others’ increase significantly. However, the decrease in the probability of being a full-cooperator differs in the degree among sessions. In cases where the leader and members come from the same WeChat groups (i.e., Sessions b, c, and d), the probability of being a ‘full-cooperator’ decreases more when the members know this information (i.e., Sessions b and d) than when they do not know (i.e., Session c). In contrast, in cases where the leader and members come from different WeChat groups (i.e., Sessions e, f, and g), the probability of being a ‘full-cooperator’ declines less when members know this information (i.e., Sessions e and g) than when they do not know (i.e., Session f).

For other independent variables, men are more inclined to be full-cooperators. People with a high-risk appetite and those who have participated in similar experiments are also be more inclined to be full-cooperators. In addition, members with more economic knowledge are more likely to be a ‘free rider’, while those with positive attitudes towards trust, fairness, and helpfulness have a lower probability.

**Table 5. Multinomial Logit regressions on the cooperative type of members (*by member*)**

VARIABLES	Full- Cooperator	Conditional- Cooperator	Free-Rider	Others
<i>SameGroup_Bothknow</i> (Session b)	-0.240***	-0.022	0.129**	0.109**
<i>SameGroup_Leaderknow</i> (Session c)	-0.204***	0.001	0.080*	0.123***
<i>SameGroup_Memberknow</i> (Session d)	-0.275***	0.027	0.070	0.179***
<i>DifferentGroup_Bothknow</i> (Session e)	-0.132***	0.027	0.039	0.066
<i>DifferentGroup_Leaderknow</i> (Session f)	-0.215***	0.045	-0.046	0.216***
<i>DifferentGroup_Memberknow</i> (Session g)	-0.136***	0.097**	0.041	0.081*
<i>Economics_Knowledge</i>	0.025	-0.015	0.043***	-0.053***
<i>Experiment_Knowledge</i>	0.018	0.052	-0.038	-0.032
<i>Male</i>	0.005	-0.082***	0.041	0.036*
<i>Age</i>	0.016	0.017	0.011	-0.044***
<i>Living_expense</i>	-0.010	-0.05	-0.011	0.026***
<i>GSS_Trust</i>	0.003	-0.051*	-0.108***	0.156***
<i>GSS_Fairness</i>	0.028	0.001	-0.056*	0.028
<i>GSS_Helpfulness</i>	-0.035	0.028	-0.037	0.043**
<i>Risk_appetite</i>	0.049***	-0.004	0.010	-0.035***

Notes: The figures represent marginal effects. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10% levels of confidence, respectively.

#### 4. Discussion and conclusion

This study examined the effects of group identity and information diversity on types of people who co-operate, in a leader-member public goods game experiment. Three main results were highlighted. First, with respect to members' investment, based on the leader's, as shown in Table 4, we found that when members know that they have the same group identity as the leader, they are more likely to be "full-cooperators" than when they know that the leader's group identity is different from theirs (0.128 versus -0.058 in sessions b and e; 0.322 versus - 0.038 in sessions d and g). This suggests that if the team leader has

the same identity as majority of the team (e.g., nationality and faith), most members will prefer to behave cooperatively, and the overall benefits of teamwork are likely to be maximized. Moreover, to have a better collaborative effect, the leader should be a role model upholding high moral standards.

Second, we found that when only members know they have the same identity as their leader (categorized *by leader*), members were 2.5 times (0.322 versus 0.128) more likely to be “full-cooperators” than “free-riders” as compared to when both are aware of their identity (see Table 4). In other words, if every role knows that they belong to the same group, members are significantly less influenced by the leaders' behavior and tend to behave according to their own characteristics. However, there were no significant differences in the case of different identities. This indicates that disclosing information about being in the same group as the leader only to members, may promote more cooperation.

Third, regarding members' investment in response to other members', as shown in Table 5, we found that when members know they have the same identity as their leader, the probability of being a "full-cooperator" decreases more, while members know they have the different identity as their leader, the probability of being a "full-cooperator" decreases less (-0.240 versus -0.132 in sessions b and e; -0.275 versus -0.136 in sessions d and g). This implies that cooperative behavior between members is closely related to the group identity of the leader and information diversity.

There are also issues that require further investigation. First, although creating an artificial identity (id) group setting by the WeChat group makes id-diversity purer and excludes the influence of other potential identities (e.g., age, gender), the word-chain game aimed at strengthening the sense of identity among the participants may not be salient enough to matter. Instead, more difficult but high-reward mini-games can be conducted to strengthen the sense of group identity. Second, providing excessive information (e.g., the role of leader and member, whether the leader and members belong to the same group, and their group identities are known to others or not) to the participants may burden their comprehension; therefore, the information diversity that we tried to investigate could be manipulated more purely in future studies.

## **Acknowledgement**

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## **Appendices**

### **A. Experimental instruction for leaders in the baseline session (originally written in Chinese)**

#### **Start**

Welcome to the current experiment. It will be divided into ten rounds. The reward that you receive in the experiment is determined by the sum of those you obtain over the ten rounds, and we will randomly select two decisions to determine your reward. Finally, a post-experimental questionnaire will be distributed to you for completion and will be collected individually. Payment will be made individually upon the completion of the questionnaire. Your experimental ID number, in this experiment, is the one you were provided by the experimenter when you signed in, and it should match the number on your seat. Please place your cell phone in your bag before the experiment begins and refrain from using it until the end. Use of cell phones is prohibited during the experiment.

#### **The experiment**

The procedure of the experiment is described below:

In the experiment, you make decisions about the money you have. You will receive 30 RMB.

There will be two roles (leader or member) in this round, and your role is of the leader during the ten rounds. You will be randomly paired with three member participants in another classroom, playing role B. There will be only 1 leader(you), i.e., after pairing, you and the other 3 experiment participants will form a 4-person team consisting of 1 leader and 3 members. The roles (leader or member) and composition of the team will



not change during the 10 rounds of the experiment. The pairing of leaders and members will be randomized by the experiment implementer.

Let us now consider the specific experimental procedure.

The person in the role of the leader will first invest an arbitrary integer amount (which can also be zero) from their 30 RMB to the team project. After knowing the amount invested by the leader, the other 3 participants in the member role of the team will simultaneously decide to invest an arbitrary integer amount (which can also be zero) from their 30 RMB to the team project.

Your payoff (as leader) = 30 RMB - the amount you invest in the team project +  $0.5 \times$  team project (invested by all 4 people).

〈Example〉 Suppose you decide to invest 10 RMB to the team project, and the 3 people in the role of members decided to invest 10RMB, 10RMB, and 20RMB, respectively (i.e., the total amount invested by all 4 people is 50 yuan). After the investment, you will have 45RMB ( $= 30 - 10 + 0.5 \times 50$ ), so the payoff for you for that round of the experiment will be 45 RMB.

In this round, you will use two types of sheets: one is the "Investment Recording Sheet," and the other is the "Sheet for the leader."

Before using both sheets, please fill in your experimental ID number in the blanks where "Your experimental ID number" is listed in both sheets.

First, please look at the "Investment Recording Sheet." It will be used to record your investment, and at each round, the experimenter will take away the "Investment Recording Sheet" after you fill it in and inform the three members of your investment. Next, please look at the "Sheet for the leader." It is used to record the amount of investment. For each round of the experiment, the experimenter will retrieve the "Investment Recording Sheet" and calculate the total amount invested by all 4 people of your team and publish it to your team.

In each round of the experiment, when you decide on your investment amount, please fill in this amount in the "Your Investment Amount A" column in the "Leader Recording Sheet" and "Sheet for leader." The experimenter will collect the "Investment Recording Sheet". Then, you will be asked to predict the most likely average investment of the other three members of your team (excluding you) and fill in the column "Your predicted investment amount (average) of the other members X" in the "Sheet for leader." Finally,

after the experimenter enters the total amount invested by your team in the "Total amount invested by all team members (including you and the leader) B" column of the " Sheet for leader," please calculate the final amount of money and fill it in the "Final amount of money you have" column of the " Sheet for leader. " The " Sheet for leader " will be collected by the experiment conductor at the end of Round 10.

If you have any questions about the above experimental instructions, you can raise your hand now and the experimenter will answer your questions.

The experiment will begin with the confirmation that all participants have understood the experimental description.

Please remember that you cannot speak to other participants during the experiment. If communication such as talking occurs, the experiment will be aborted at that point. If you have any questions, please raise your hand.

## **B. Experimental instruction for members in the baseline session (originally written in Chinese)**

### **Start**

Welcome to the current experiment. It will be divided into ten rounds. The reward that you will receive in the experiment is determined by the sum of those you obtain over the ten rounds, and we will randomly select two decisions to determine your reward. Finally, a post-experimental questionnaire will be distributed to you for completion and will be collected individually. Payment will be made individually upon the completion of the questionnaire. Your experimental ID number in this experiment is the one you were provided by the experimenter when you signed in, and it should match the number on your seat. Please place your cell phone in your bag before the experiment begins and refrain from using it until the end. Use of cell phones is prohibited during the experiment.

### **The experiment**

The procedure of the experiment is described below:

In the experiment, you make decisions about the money you have. You will receive 30 RMB.

There will be two roles (leader or member) in this round, and your role is of a member during the ten rounds. You will be randomly paired with one leader (in another classroom) and two members. There will be only 1 leader, i.e., after pairing you, and the other 3

experimental participants will form a 4-person team consisting of 1 leader and 3 members. The roles (leader or member) and composition of the team will not change during the 10 rounds of the experiment. The pairing of leaders and members will be randomized by the experiment implementer.

Let us now consider the specific experimental procedure.

The person in the role of the leader will first invest an arbitrary integer amount (which can also be zero) from their 30 RMB, to the team project. After knowing the amount invested by the leader, the other 3 people in the role of team members will simultaneously decide to invest an arbitrary integer amount (which can also be zero) from their 30 RMB to the team project.

Your payoff (as a member) = 30 RMB - the amount you invested in the team project +  $0.5 \times$  team project (invested by all 4 people).

〈Example〉 Suppose the person in the role of leader decides to invest 10 RMB to the team project, you(member) decided to invest 10RMB, other 2 members decided to invest 10RMB and 20RMB, respectively (i.e., the total amount invested by all 4 people is 50 yuan), After the investment, you will have 45RMB ( $= 30 - 10 + 0.5 \times 50$ ), so the payoff for you for that round of the experiment will be 45 RMB.

In this round, you will use two types of sheets: one is the "Investment Recording Sheet," and the other is the "Sheet for member."

Before using both the sheets, please fill in your experimental ID number in the blanks where "Your experimental ID number" is listed within both sheets.

First, please look at the "Investment Recording Sheet." It is for recording the amount of your investment. For each round of the experiment, the experimenter will retrieve the "Investment Recording Sheet" and calculate the total amount invested by all 4 participants of your team and publish it to your team.

In each round of the experiment, the experimenter will fill in the "Leader's Investment Amount Y" column of the "Sheet for member" with the investment amount of the leader of their team before the members decide how much to invest, and then you make your decision. When you have decided, please fill in this amount in the "Your Investment Amount A" column of the 'Sheet for member' and the "Investment Recording Sheet." The experimenter will collect the "Investment Recording Sheet." Then, you will be asked to predict the most likely average investment of the other two members of your

team (excluding you and the leader) and fill in the column "Your predicted investment amount (average) of the other members X" in the " Sheet for member." Finally, after the experimenter enters the total amount invested by your team in the "Total amount invested by all team members (including you and the leader) B" column of the " Sheet for member," please calculate your final amount of money and fill it in the "Final amount of money you have" column of the " Sheet for member." The " Sheet for member " will be collected by the experiment conductor at the end of Round 10.

If you have any questions about the above experimental instructions, you can raise your hand now and the experimenter will answer your questions.

The experiment will begin with the confirmation that all participants have understood the experimental description.

Please remember that you cannot speak to other participants during the experiment. If communication such as talking occurs, the experiment will be aborted at that point. If you have any questions, please raise your hand.

### **C. Post-experimental questionnaire (originally written in Chinese)**

Q1. Your year of birth. Please fill in a specific year in the parentheses.

(       ) Year

Q2. Your gender. Please check the appropriate answer.

1. Male
2. Female

Q3. What is your major? Please fill in the specific major in the parentheses.

(       )

Q4. Where is your hometown? Please fill in a specific province in the parentheses.

(       )

Q5. Where was high school attended? Please fill in a specific province in the parentheses.

(       )

Q6. Your monthly living expenses. Please check the corresponding answer.

1. Less than 500 RMB per month
2. Between 500 RMB and 999 RMB per month
3. Between 1000 RMB and 1499 RMB per month
4. Between 1500 RMB and 1999 RMB per month
5. Between 2000 RMB and 2499 RMB per month
6. Between 2500 RMB and 2999 RMB per month
7. More than 3000 RMB per month

Q7. Frequency of studying economics and/or reading books on economics. Please refer to the corresponding answers.

1. Never
2. Rarely
3. Occasionally
4. Often
5. Always

Q8. Generally speaking, do you think most people can be trusted or that you need to be very careful in dealing with people? Please check the appropriate answer.

1. Most people can be trusted
2. You need be very careful in dealing with people

Q9. Generally speaking, do you think most people would try to take advantage of you if they got a chance or would they try to be fair? Please check the appropriate answer.

1. Most people would try to be fair
2. Most people would try to take advantage of you if they got a chance

Q10. Generally speaking, do you think people try to be helpful most of the time or are they mostly just looking out for themselves? Please check the appropriate answer.

1. Most of the time people try to be helpful
2. People are mostly just looking out for themselves

Q11. Have you ever participated in any economic experiment before?

1. Yes
2. No

Q12. Suppose you bought a lottery ticket a week ago, and now you are told that you have won and have two options to receive the prize: Option A is to receive the lottery prize amount directly, and Option B is to flip a coin and receive 10000 RMB if the coin is heads or 0 RMB if it is tails. What option will you choose based on your lottery prize amount listed below.

A. Lottery Prize Amount	B. Coin Flip	Your Choice of A or B
2000 RMB	10000 RMB or 0	
3000 RMB	10000 RMB or 0	
4000 RMB	10000 RMB or 0	
5000 RMB	10000 RMB or 0	
6000 RMB	10000 RMB or 0	
7000 RMB	10000 RMB or 0	
8000 RMB	10000 RMB or 0	

#### D. Tobit regressions for the leader's investment

VARIABLES	Leader
<i>SameGroup_Bothknow (Session b)</i>	-2.244 (2.666)
<i>SameGroup_Leaderknow (Session c)</i>	-3.862 (2.895)
<i>SameGroup_Memberknow (Session d)</i>	-4.837* (2.591)
<i>DifferentGroup_Bothknow (Session e)</i>	-1.720 (2.423)
<i>DifferentGroup_Leaderknow (Session f)</i>	-5.392** (2.509)
<i>DifferentGroup_Memberknow (Session g)</i>	-1.809 (2.777)

<i>Round</i>	-0.0224 (0.187)
<i>L.Investment_Leader</i>	0.0594 (0.0859)
<i>L.Investment_Member</i>	0.537*** (0.108)
<i>Risk_appetite</i>	-1.008** (0.606)
<i>Male</i>	-0.984* (2.050)
<i>GSS_Trust</i>	-0.301 (1.457)
<i>GSS_Fairness</i>	-0.813 (1.511)
<i>GSS_Helpfulness</i>	-0.134 (1.952)
<i>Economic_knowledge</i>	-0.439 (0.840)
<i>Living_expense</i>	1.290 (0.769)
<i>Experiment_knowledge</i>	10.53* (5.647)
<i>Age</i>	0.760 (1.072)
<i>Constant</i>	-14.33 (22.91)

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Notes: Standard errors clustered by subject are in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10% levels of confidence, respectively. The independent variables *L.Transfer\_Leader* and *L.Transfer\_Member* are the investment of the paired leader and the average investment of the other two paired members in the previous round, respectively.