Do risk and competition trigger conditional cooperative behavior? Evidence from Public good experiment.

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Abstract

We investigate the effect of intragroup competition and risky marginal per capita returns on subjects' cooperative behavior in a one-shot public good game – following the well-known approach proposed by Fischbacher, Gächter, and Fehr (2001) and extending the Colasante et al. (2019) and Colasante et al. (2018) parametrization. We are aiming to study the interaction between environment and social preferences and test the existence of a causal relationship of risk and competition over cooperative behavior when an individual's benefit of the public good is heterogeneous and uncertain. Our results report experimental evidence about competition fostering cooperative behavior leading a raise contribution for all the subjects regardless of their social preferences. On the contrary, risky has a detrimental effect on cooperative behavior due to encouraging free riding.

Keywords: risk; competition; conditional cooperator; marginal per capita return.

JEL Classification C72; C92; D80; H41.

1. Introduction

In this paper, we study the social dilemma between individual and collective incentives in the provision of public good in two environments, risky and competitive, as well as the role of social preferences. The dominant strategy of the game, under our parametrization, is to act as a free rider, even if the Pareto efficient behavior is to contribute the whole endowment to the public good.

To contribute to the existing literature, we attempt to disentangle the effect of the interaction between environments and social preferences over cooperative behavior. The main goal of our research is to study the influence of risky and competitive environment on cooperative behavior by eliciting subjects' social preferences. On the one hand, we embedded subjects in a competitive and risky scenario, where an individual's earning from the provision of the public good are heterogenous and uncertain. On the other hand, we tested whether the elicitation of cooperation is a matter of social preferences or induction of environments.

Fischbacher, Gäther, and Ferh indicated that most subjects behave as conditional cooperators, moving against the theoretical prediction (Fischbacher et al., 2001). This work has been widely extended to test the robustness of the results for cultural factors (Kocher et al., 2008), in a dyads decision-making environment (Morone and Temerario, 2018), trust (Makowsky et al., 2014) and under punishment constraints (Weber et al., 2018)[1]. Thus, their methodology has been stated as a robust approach to elicit social preferences.

Risk and competition play a crucial role in funding and providing public goods. A large branch of the literature carefully highlights the negative effects of risk (Dickinson, 2005; Levati et al., 2009; Levati and Morone, 2013) and the positive effect of competition (Colasante et al., 2018, 2019; Angelovski et al., 2019) on the cooperative behavior.

Currently, we are living in a heterogeneous and uncertain situation with the world-wide COVID-19 pandemic. In this pandemic situation, there is imperfect information about the evolution of the virus. Additionally, there is competition in the production of a vaccine. We know that during the period with the largest number of infections and deceased, confinement was the most efficient tool for governments. Since the number of contagions rises exponentially with the increase of people's interaction, we are facing a social dilemma. On the one hand, individual selfish behavior to avoid confinement and enjoy the freedom of movement. On the other hand, civic one by respecting the norms by

[1] Thöni and Volk (2018) offer a compressive survey of FGF strategy method.

thinking as a collective. Hence, in this situation, some questions raise in mind as: are subjects social preferences the key to eliciting cooperative behavior? Or maybe, is the context what defines subjects' prosocial behavior?

We elicited subjects' conditional and unconditional contributions in a one-shot public good experiment. We dwell on risky and competitive treatment (Colasante et al. 2018; Colasante et al. 2019). We induced both environments using heterogeneous and uncertain marginal per capita returns (MPCR): high (αH), medium (αM), and low (αL). In risky treatment, subjects' return is randomly assigned. While in the competitive treatment, subjects' MPCR will depend on the individual contribution to the public good.

We have experimental evidence that – in line with the literature – most subjects behave as conditional cooperators independently of the treatment. Additionally, we found that risk has a detrimental effect on contribution, fostering free riding. On the other hand, intra-group competition treatment does not affect preferences but leads to a systemic increase of contribution level regardless of the social preference. Furthermore, we found that a competitive environment seems to be the most effective scenario to trigger contribution.

The paper is organized as follows: Section 2 presents the literature review, Section 3 describes the experimental design, Section 4 outlines data analysis and main results, and Section 5 finally presents our conclusions.

2. Literature review

The social dilemma in the provision of public goods is a well-known black box for economists with so many questions still unsolved. Exist several wide accepted affirmations among scholars: subjects have heterogeneous preferences (Fischbacher et al., 2001); contributions decline over time (Croson et al., 2005), the majority of participants, in an experiment, contribute against the game-theoretical equilibrium of free ride (Colasante et al., 2019); and social preferences are essential to understand the cooperative behavior (Andreoni, 1995).

Fischbacher et al. (2001) developed a very robust technique to elicit social preferences (Thöni and Volk, 2018; Fischbacher et al., 2012; Falluchi et al., 2019). They based this methodology on the work of Selten (1967), where he implemented a variant strategy method. The principal feature is eliciting subjects' social preferences by asking them to indicate for each possible average contribution level of others' group members how much they want to contribute to the public good.

This technique shed light on the predominance of conditional cooperators among the distribution of social preferences confirmed in a wide range of context: cultural factors by three continents[2] (Kocher et al., 2008), and Russian versus Swiss individuals (Herrmann and Thöni, 2009); children sample (Hermes et al.,2019); dyads decision-making (Morone and Temerario, 2018); repeated game (Fischbacher and Gäther, 2010); punishment (Weber et al., 2018); known and unknown probabilities (Fischbacher et al., 2014).

In order to generalize these findings, we embedded the provision of public goods in a risky environment. Indeed, loss-averse individuals (Kahneman and Tversky 1979, Tversky and Kahneman 1991) may consider it more difficult to cooperate in these environments than in others where returns are certain. Many scholars explored the influence of risk on prosocial behavior in different settings such as risk preferences over own and social risk (Harrison et al., 2010); private and public investment dimensions (Freundt and Lange, 2019); ambiguity (Björk et al., 2016); and time preferences (Andersen et al., 2008). The striking point is that risk discourages cooperative behavior.

Kocher et al. (2011) and Fischabacher et al. (2014) studied the effect of risk on prosocial behavior using the FGF strategy method (2001). The former tested the role of beliefs, trust, and risk preferences over subjects' social preferences. They found a positive effect of reciprocity and trust on cooperation. Instead, risk preference seems to do not systematically affect cooperative behavior. The latter introduced heterogeneous and uncertain marginal returns from the public good. They conclude that heterogeneity of reaction is a matter of inequality aversion, and uncertainty scarcely reduces the contribution of conditional cooperators. Additionally, the authors found that MPCR increase also raises average contributions (for both homogenous and heterogenous MPCR), except in the case of heterogeneous and uncertain returns that were detrimental for contributions.

Governments must provide public goods/services in competitive scenarios, as recently happened in the fight for resources as a face mask during the COVID-19 pandemic. Arrow (1986) suggested that competition can correct irrational behavior. The influence of competition on prosocial behavior has been investigated through several approaches: field experiment (Augenblick and Cunha, 2014); minimum effort coordination game (Fatas et al., 2004); and voting competition (Markussen et al., 2013). Results support the idea that competition is a useful tool to trigger cooperative behavior.

[2] The three continents consider in this paper are Austria (Tyrol), Japan (Tokyo), and the United States (North Carolina).

Duffy and Kornienko (2010) dwell on charity fund-raising strategy taking advantage of competition among philanthropists joint a public recognition. They run a sequential dictator game, where they conclude that the tournament raises more donations in altruism context (rank information about the order from the highest to the lowest donation) than selfish (ranked in descending order respect keep from themselves). In the same fashion, Angelovski et al. (2019) induce competition, but in this case to study the provision of impure public goods. They introduce intra-group competition by means of rank-order voluntary contribution mechanism, where the subject with higher contribution relative to other group members obtains the greatest marginal return, so on so far. Their results conclude that the rank-order mechanism is a more efficient tool for fostering cooperation with respect to the randomly assigned rank technique.

Colasante et al. (2018) and Colasante et al. (2019) controlled for risk and competitive environment. They studied a control (fix and homogenous MPCR), a risky (randomly assigned return), and intra-group competitive (by rank-order mechanism) scenarios. Their report experimental evidence that risk has a detrimental effect on cooperation (Colasante et al., 2018), competition has a positive effect on the subjects' willingness to cooperate (Colasante et al., 2019).

In this paper, we used the FGF strategy method to elicit social preferences in a competitive and risky environment. These allow us to study the effect of environments over contributions as well on social preferences, and to test their role in the provision of public goods. Additionally, we analyzed the interaction between social preferences and risk/competition. We addressed the following research questions: how is produce the interaction between social preferences with risky and competitive environments? Is cooperative behavior driven by the environment or social preferences?

3. Experimental design

The experiment is inspired by Fischbacher et al., (2001). We modified the original setting introducing treatments with risk and intra-group competition based on Colasante et al. (2018) and Colasante et a. (2019)[3].

[3] We introduce competition following up the conditions exposed in Colasante et al. (2018, 2019) in the intra-group competition treatment of the low, and the risky environment by Colasante et al. (2018) as well in the low treatment.

The subjects are clustered into three-members'[4] group, randomly selected. Each player has an endowment of 10 ECU[5].

Subjects decide how to allocate their endowment between a private and/or public account. The private account has a return one to one and it is certain for each subject. The public account has a risky MPCR. The individual payoff function is the following:

$$\pi_i = 10 - c_i + \alpha_i \sum_{j=1}^{3} c_i$$

where c_i is the contribution of player *i* to the public account, and α_i is the MPCR of individual *i* for the public project which differs depending on the treatment. In the experiment, subjects perform two tasks: UC and CT tasks. In both tasks, the decision is to indicate an integer number that satisfies $0 \leq c_i \leq 10$.

Furthermore, we give no limit of time for subjects to ensure a careful read of instructions and understanding, when all subjects successfully solved all four control questions the experimental session start. The experiment[6] began with the UC task, subjects are asked to allocate their endowment between the private and the public account without knowing the other members' contribution. After all the subjects take the decisions in the UC task, they must fill the CT, where subjects are asked about how much of their endowment they want to allocate in the public account for each possible average contribution of the other groups' members.

Finally, when subjects have filled the CT task, they answer the following question about their belief average contribution of the other group members:

"At this point in the experiment, the other two members of the group have indicated their unconditional contribution. How much do you believe, on average, the other two group members have contributed to the project?".

At the very beginning of the experiment, a random mechanism assigns an *id number* to each member of the group. Once, all subjects complete the UC and CT task, one subject

[4] Unlike the FGF (2001) experimental parameters the group size is 3 group members instead of 4 as in the original. We modify the group size to adapt to the Colasante et al. (2018) and Colasante et al., (2019) where the group is conforming to three members to frame risky and competitive environments. Moreover, others' works introduce 3 members per group applying the FGF strategy method without significantly altering the social preference distribution (see Dariel and Nikiforakis, 2014; Kocher et al., 2008).

[5] Another difference in design with respect to FGF strategy-method (2001) is the amount of endowment. In the original, the endowment is 20 ECU instead of 10 ECU as in our case. The reasoning behind this change is to adapt to Colasante et al. (2019) design. They consider 100ECUs (where 10 ECUs=1€), which will be too heavy for the subjects to fill in the Contribution Table. Hence, to avoid the complexity but maintain the same monetary incentive, we decide to implement an endowment of 10 ECU where 1 ECU is equivalent a 1€, the same pecuniary valuation in Colasante et al. (2018) and Colasante et al. (2019). Another's studies applying the FGF strategy method variate to the endowment from 20 ECU to 10 ECU as in our experimental design fact that do not alter the experimental results in terms of social preference distribution (see Aimone et al., 2013; Makowsky et al., 2014).

[6] The English translation of the experiment instructions is reported in Appendix A.

of the group is randomly chosen to receive the payoff, which is determined by her CT relevant decision. The other two members of the group are paid according to their UC. For instance, if subject 1 is selected, she is paid according to her CT decision. Subject 2 and subject 3 is paid according to the UC.

Our experiment is composed of the following three treatments:

- **Control Treatment (T1):** constant and homogenous MPCR α_i for all the group members.
- **Risk Treatment (T2):** heterogeneous and uncertain MPCR (high α_H, medium α_M, and low α_L) randomly assigned (unknown probabilities) among each group member.
- **Competition Treatment (T3):** heterogeneous and uncertain MPCR (high α_H, medium α_M, and low α_L) assigned by rank order mechanism. To be more precise α_H will be assigned to the subject with the highest contribution, α_M will be assigned to the subject second higher contribution, and finally, α_L to the subject with the lowest contribution. The ranking of the subjects is always relative to their group members' contributions. If there is a tie among subjects, each subject will receive the average value of the MPCR. Hence, if the tie is the greatest contribution subjects who coincide will receive $[(\alpha_H+\alpha_M)/2]$; for the lowest contribution $[(\alpha_M+\alpha_L)/2]$; and all contribute the same amount is for each $[(\alpha_H+\alpha_M+\alpha_L)/3]$ (see Colasante et al., 2019).

In Table 1, we depict the values of the MPCR for each treatment. MPCR values differ from the original setting (see, Fischbacher et al., 2001). We followed Colasante et al. (2018) and Colasante et al, (2019) parametrization. The underlining idea is that offering a higher MPCR, how theoretically demonstrated by Anderson et al. (1998), triggers subjects' contribution. The heterogeneous and uncertain MPCR have been already introduced in the FGF strategy method environment in the inquiry of Fischbacher et al. (2014) with known and unknown distribution. However, in this paper, the degree of variability is lower (α_H = 0.5 and α_L=0.3). The authors did not find a significant effect on subjects' preferences distribution with this parametrization in the experimental results. We hypothesize that it is because is needed to increase the variability (degree of risk) to commit subjects' behavior, because of the parameters from a design that have already found an effect in a repeated PGG. Additionally, Kocher et al. (2008) implemented the same *n=3* and MPCR equal 0.6 as in our control treatment in order to confront cultural effects, which results not differ significantly from the social preference distribution found in the literature (see Thöni and Volk, 2018).

Table 1. Values of the MPCR for treatment.

MPCR	T1	T2	T3
α_H	0.60	0.45	0.45
α_M	0.60	0.60	0.60
α_L	0.60	0.75	0.75

There is abundant literature showing that subjects do not behave according to theory (Andreoni, 1995; Ferh and Schmidt, 1999; Fischbacher and Gächter, 2010). As we have already discussed in Section 2, the predominant preference typology among literature is a conditional cooperator. For instance, Fischbacher et al. (2001) categorise subjects as: (i) conditional cooperator (50%), (ii) free-rider (30%) and (iii) hump-shaped (14%). Following the literature, we can state our first research hypothesis.

H1: *Most of the subjects behave as a conditional cooperator, against the theoretical prediction of free riding.*

Additionally, many scholars show that subjects behave differently if the public good is embedded in risky environments arranged in uncertain and heterogenous return distribution (Colasante et al., 2018; Fischbacher et al., 2014; Levati et al., 2009; Levati and Morone, 2013). To be more precise, a negative causal relationship between risk environment and cooperative behavior has been found. Indeed, Fischbacer et al. (2014) found out detrimental significant effect (in the treatment with heterogeneous and uncertain unknown MPCR) on average contribution respect the homogenous MPCR. Nevertheless, natural risk preferences do not play a role in subjects' contributions or social preferences (see Kocher et al., 2011). This leads us to our second research hypothesis.

H2: *Risky heterogeneous and uncertain marginal returns discourage prosocial behavior.*

Moreover, the competitive environment is common in the provision of public goods. Many scholars studied the effect of competitive setting in the provision of public goods and services; and they found a positive effect on prosocial behavior (Andreoni, 1995; Colasante et al., 2018; Colasante et al., 2019; Duffy and Kornienko, 2010). We additionally expect that heterogenous MPCR embedded in a competitive foster the contribution for the positive effect that higher MPCR has on the contribution support by both inequality aversion and reciprocity (see Andreoni et al., 1998). This leads us to our third research hypothesis.

H3: *The competitive environment triggers cooperative behavior, and additionally triggers because of the higher MPCR positive effect on contributions.*

A part of the environment effect on contribution, our focus on interest is social preferences. We pretend in our investigation to answer the following questions: Is the positive effect of competition not altering social preferences or is it a matter to foster altruistic social preferences? Is happening the opposite when we implemented uncertain unknown environments? Which is the role of social preferences?

Respect the implementation of our experiment, we were carried at an experimental lab at the ESSE Laboratory at the University of Bari “Aldo Moro”. We conducted a between-subjects experimental design, with a total of 108 undergraduate students in economics and management from the University of Bari “Aldo Moro”, where 63% were females. The experiment took place in February 2019. We run three sessions (12 subjects per each session) for each of the three treatments (36 subjects per treatment). The experiment was programmed in z-Tree (Fischbacher, 2007).

4. Data analysis and main results

In this section, we proceed to report the descriptive statistics and statistical analysis of the results of our experiment. We will contrast our previous hypothesis with the data diving the study in CT and UC task analysis. In subsection 4.1, we introduce and categorize subjects' preferences, and investigate if the conditional contribution is influenced by social preferences or environments induced. While section 4.2 exhibits the statistical analyses of the unconditional contribution is influenced by beliefs, gender, or treatments.

4.1. Conditional contribution

We tested if social preference distribution is altered by risk and competition. We follow the social preference categorization proposed in Fischbacher et al. (2001). These criteria have been tested in different works. For instance, Thöni and Volk (2018) confronted 17 papers that implement the FGF strategy-method and refine their subjects’ categorization. Fallucchi et al. (2019) analyze six studies and offered a categorization criterion clearer for differentiating among types in terms of strategic behavior and economic feedback. We categorized the subjects’ behavior as follow:

- ***Conditional cooperator (CC)***. Subjects are categorized as conditional cooperators if their willingness to contribute raises as the average contribution of the other group members increases. A "Perfect" conditional cooperator (PCC) is a subject that contributes to the public good the same amount contributed by the other group members. We consider a subject conditional cooperator when the Spearman rank correlation coefficient, among his contribution and the other group members' contribution, is higher or equal to 0.7, and statistically significant at the level of 1 percent[7].

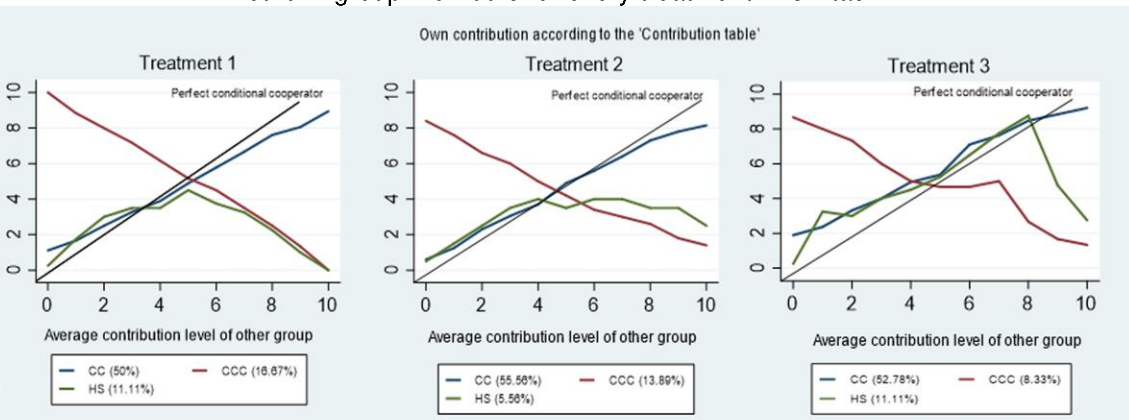
- ***Counter conditional cooperator (CCC)***. It is the inverse behavior of conditional cooperators. The higher is the average contribution of the other group members, the lower is the own willingness to contribute. This category seems to replicate the shape generally found in the literature of repeated games, where subjects decrease their contributions over time. The players are defined as "counter" conditional cooperators when the Spearman rank coefficient is lower or equal to -0.7, and statistically significant at the level of 1 percent[7].
- ***Hump-shaped (HS)***. It refers to an agent whose contribution is monotonically increasing with the others' group member average contribution, until he/she achieves his/her maximum, and then start to decrease monotonically. The hump-shaped subjects are classified by graphical analysis[8].
- ***Free rider***. Subjects who follow selfish theoretical behavior. They behave as a perfect free rider, who will never contribute to the public project, independently of the contribution of the other group members. We categorize a subject as a free rider if its average contribution is statistically less than 2 ECU[9].
- ***Other patterns (OP)***. Subjects whose contribution follows a random walk.[10] Among *OP* we include also subjects who behave as unconditional contributors[11] and those whose preferences' shape does not fall in any of the four categories just described.

In Figure 1, we report the average contribution of the other group members with respect to the own contribution to a public project, for each treatment and preferences categories. We do not present free-rider preferences, because in our experiment are just found on T2. The fact of the small number of free riders could be as Brandt and Charness (2011) suggested because of the fewer contingent decision seems to be more likely to reduce free riders. For all treatments, the CC subjects are close to behaving as PCC with a bit of noise. Nevertheless, CCC and HS subjects' categories have a distortion of their shaping among treatment. Indeed, we suspect that the distortion in social preference

[7] See Appendix B Tables B.1, B.2, and B.3.
[8] See Appendix B Figures B.1, B.2, and B.3.
[9] See Appendix B Tables B.4, B.5, and B.6.
[10] See Appendix B Tables B.7, B.8, and B.9.
[11]Unconditional contributor subjects are considered those whose contribution to the public project is constant and higher than 2, indifferently of the other group members' contribution.

distribution respect the original is maybe because of two reasoning: mainly for the effect of risky and competitive environment; or cultural influence.

Figure 1. Own average willingness to contribute depending on the average contribution level of others' group members for every treatment in CT task.



In Table 2, we report a summary of the distribution of the preferences' categories for all the treatments. We can claim that most of the agents behave as a CC in all the treatments, which represent around 50 percent of subjects. It confirms our first hypothesis, *H1*. According to our study, there is no evidence against the fact that Fischbacher et al. (2001)'s results are robust for risk and competition. Furthermore, this result is as well consistent with 17 papers in the review of Thöni and Volk (2018). We can summarize our first result as follow:

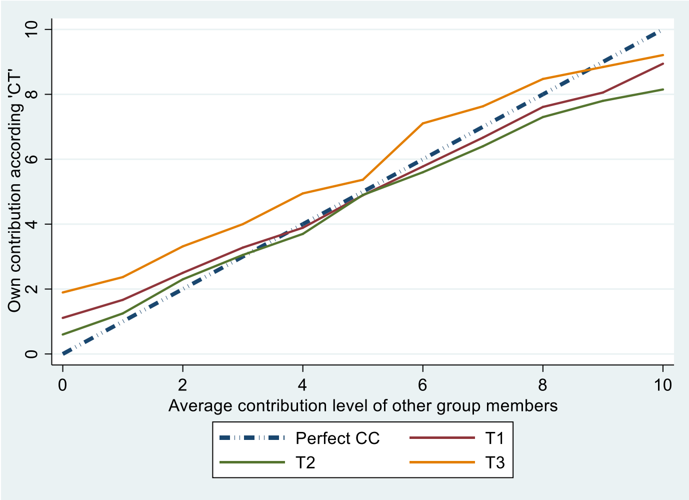
R1: *Most of the subjects behave as CC against theory conclusions. Therefore, Fischbacher et al. (2001) results are robust for risk and competition scenarios.*

Table 2. Preferences classification for all treatments

Treatment	CC	CCC	HS	OP	FR	Total subject
T1	50% (18)	16.67% (6)	11.11% (4)	22.22% (8)	0% (0)	36
T2	55.56% (20)	13.89% (5)	5.56% (2)	13.89% (5)	11.11% (4)	36
T3	52.78% (19)	8,33% (3)	11.11% (4)	27.78% (10)	0% (0)	36

Because CC is the predominant category, we are interested in confronting the CC in every treatment to test environmental influence. Figure 2 exhibits this contrast. We can observe that conditional cooperators in T1 and T2 do not behave differently, and there is no significant difference between both scenarios (the p-value is 0.356; two-sided Wilcoxon rank-sum test). We observed a statistically significant difference between the mean contribution in T3 and T1 (the p-value is 0.010; two-sided Wilcoxon rank-sum test) and T2 (the p-value is 0.000; two-sided Wilcoxon rank-sum test). Additionally, we observe that the contribution of CC in T3 is higher than the average contribution of others' group members. Therefore, the possibility of intra-group competition to contributing more obtain a greater MPCR is a consistent incentive to trigger a greater contribution to CC subjects.

Figure 2. Conditional cooperator subjects for all the treatments.



Note: The Perfect CC are subjects who contribute the same amount respect the average contribution of others' group members.

For a deeper investigation of conditional contribution, we focus on all the subjects (Model 1) and conditional cooperators (Model 2). To study if cooperative behavior is adjusted by environment elicitation; belief and the real average contribution of others' group members; and if exist any gender effect. To study these causal relationships, we estimate by OLS the regression model and depict it in Table 3. We pretend to test the previous intuition in a more powerful statistical analysis.

Table 3. OLS regression on CT task (conditional contribution).

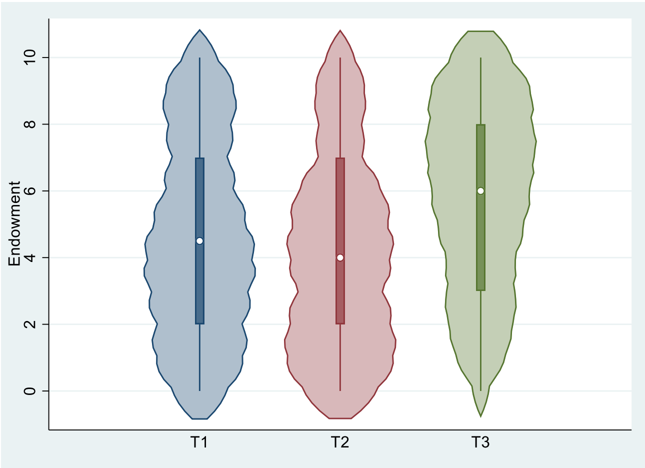
Dependent variable CT	*Model 1 All subjects*	*Model 2 CC*
T2	-0.186*	-0.118
	(0.111)	(0.151)
T3	0.241***	0.184**
	(0.055)	(0.077)
Beliefs about others' contribution	0.298***	0.310***
	(0.050)	(0.076)
Average contribution of other group members	0.212***	0.129**
	(0.045)	(0.064)
Female	0.177	0.098
	(0.188)	(0.256)
Constant	3.390***	4.108***
	(0.292)	(0.440)
Observations	1188	627
R^2	0.056	0.030

Note: The variables T2 and T3 takes the value 1 if refer to this treatment and 0 otherwise, related to control T1. The variable Female is equal to 1 if is a woman and 0 in case of man. Robust standard errors in parentheses ****p<0.01, **p<0.05, *p<0.1.*

Risk treatment (T2) decreases conditional contribution for all the subjects by 0.186, which in line with the detrimental effect of risky environments on subjects' cooperative behavior. Hence, confirms our hypothesis *H2*. While T2 has no significant effect on conditional cooperator. We suspect this result is led by the fact that we just find free-rider subjects on T2. Hence, the detrimental effect of risk treatment seems to be driven by the elicitation of free riding, not by reducing the contribution of other typologies of preferences. Which lead us to the second result:

R2. *The risky environment has a detrimental effect on cooperative behavior by fostering free riding.*

Figure 3. Violin plot according to the CT task for all the treatments.



On the other hand, competition treatment (T3) raise conditional contribution 0.241 for all the subject and 0.184 for CC. Figure 3 reports the Violin plot, which suggests that conditional contribution distribution is concentrated in the higher values of the endowment in T3 respect other treatments. Therefore, it confirms *H3*. These results conduce to the following:

R3. *Heterogenous and uncertain MPCR trigger a greater conditional contribution for all the subjects embedded by the rank-order mechanism for a twofold reason: competition and possibility of a greater MPCR.*

Moreover, the beliefs about others' group members' contributions have a positive causal relationship on conditional contribution. The conditional cooperators are as expected more influence in their beliefs than the subjects in its entirety, but both raise CT contribution. The gender effect in the CT task is not found in our inquiry.

4.2. Unconditional contribution and beliefs

In our investigation, we are also interested to study the unconditional contribution and beliefs about the average contribution of others' group members that are influenced by risky and competitive environments. We summaries the descriptive statistics of both in Table 4. For unconditional contribution has not been found a significant difference across treatments. While beliefs just have a significant difference between T2 and T3 where heterogeneous and uncertain MPCR is introduced.

Table 4. Descriptive statistics for UC and Beliefs of the average contribution of others' group members.

	Descriptive statistics		Wilcoxon	
Treatment	*Mean*	*SD*	*Z*	*p*
Unconditional Contribution				
T1	5.470	3.050		
T2	5.580	1.990	0.234	0.815
T3	6.000	2.550	-0.58	0.562
T2 vs T3			-1.198	0.230
Beliefs about the average contribution of others' group members				
T1	5.440	2.530		
T2	5.110	1.540	0.853	0.394
T3	6.250	1.730	-1.335	0.182
T2 vs T3			-2.975	0.003***

Note. The Wilcoxon test allows comparing between the T1 (control treatment) respect T2 (risk treatment) and T3 (competition treatment). The last line T2 vs T3 refers to the contrast between T2 and T3 distributions. Robust standard errors in parentheses ****p<0.01, **p<0.05, *p<0.1.*

In addition, we check whether there are significant differences between the UC and the belief about others' group members. The aim is to test whether subjects behave strategically in the two tasks. For instance, the free-rider subjects are assigning a lower UC with respect to their belief average contribution (of the others' group member) to get the advantage of the subjects in his/her group. The Hotelling test cannot reject the null hypothesis (Prob>F=0.1317) of not statistically significant differences of mean contribution between unconditional decision and belief choice for all treatments.

Table 5. OLS regression for unconditional contribution.

Dependent variable *Unconditional Contribution*	Model 1 *All subjects*	Model 2 *T1*	Model 3 *T2*	Model 4 *T3*
T2	0.341*** (0.065)			
T3	-0.031 (0.029)			
CC	0.037** (0.017)	-0.318 (1.044)	1.342 (1.443)	1.419 (1.057)
CCC			0.472 (1.477)	
HS		-2.120 (1.592)		-0.550 (1.406)
OP		-0.478 (1.307)	0.517 (1.603)	0.919 (1.424)
Beliefs about others' contribution	1.007*** (0.028)	0.904*** (0.133)	0.741*** (0.196)	0.850*** (0.274)
Female	-0.905*** (0.119)	-1.166* (0.667)	-1.551** (0.662)	-0.336 (0.853)
Constant	0.546** (0.255)	1.862 (1.685)	1.864 (2.155)	-0.099 (1.891)
Observations	627	36	36	36
R^2	0.722	0.701	0.542	0.461

Note: The variables T2 and T3 takes the value 1 if refer to this treatment and 0 otherwise, related to control T1. Then, the variable Female is equal to 1 if is a woman and 0 in case of man. Robust standard errors in parentheses ****p<0.01, **p<0.05, *p<0.1.*

We also conducted a regression analyzing estimating OLS model in Table 5 to study the causal-relationship of unconditional contributions respect induced environments (respect all the subjects in Model 1 and by the specific effect inside the treatment for Model 2, 3 and 4); social preferences (e.g. given the features of CC maybe are as well more cooperative in their UC); beliefs (extend the study of the strategic decisions); and gender effect. The aim is to confront the intuition from the descriptive statistics by a more robust econometric analysis. We observe that for all the subjects the unconditional contribution has a detrimental effect of 0.031 in the risky environment. The result is in line with the outcome found in CT, and the literature. Moreover, CC subjects contribute more to the unconditional decision in 0.037, which is reasonable as a prosocial feature of this typology of subjects. Subjects' beliefs increase by 1.007. Effectively, subjects behave strategically between both decisions in all the treatments showing a positive relationship.

In the case of unconditional contribution, gender effect is found, woman contributes 0.905 less than man when they are facing decisions unconditioned by other group members' behavior. It is consistent not just for all the subjects, also, in every treatment. This result is compatible with literature, exists a gender effect in risk attitude, where females are more risk-averse fact that conduces a lower contribution in the literature (Greig and Bohnet, 2009; Halko et al., 2012; Jianakoplos and Bernasek, 1995; Nelson, 2015).

5. Conclusions

This study aims to detect the interaction between risk and competition on subjects' social preferences. The evidence found is in line with Fischbacher et al. (2001) by showing that most of the subjects behave as CC (around 50%) regardless of the environment.

The causal relationship of risk (Dickinson, 2005; Levati et al., 2009; Levati and Morone, 2013) with the prosocial behavior and competition (Colasante, et al., 2019; Angelovski, et al., 2019; Colasante et al., 2018) in relation with cooperative patterns, is found in line with the relevant literature.

A negative causal relationship between risk and cooperative behavior emerges from the experimental data. Additionally, the risky treatment fosters the selfish behavior of the subjects against the collective interest, by triggering free ridding.

In the case of competition, a positive causal effect is observed by the elicitation of a higher level of contributions. Henceforth in the competition treatment seems to be the environment the key to foster contributions. In line with our expectations, heterogenous MPCR leads to a positive relationship between returns and cooperation, and uncertainty by herself seems to not alter cooperation.

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Appendix A: **Instructions** (translated from the original in Italian)

Treatment 1 (Control Treatment)

You are now taking part in an experiment. If you read the following instructions carefully, you can earn a considerable amount of money.

During the experiment is prohibited to communicate with the other participants, under penalty of exclusion from the experiment and final payment. The instructions which we have distributed to you, are solely for your private information. Should you have any questions please ask us.

During the experiment, we will not speak of Euros but rather of Experimental Currency Units (ECU). At the end of the experiment, your entire earnings will be calculated in ECU. Also, the total amount of ECUs you have earned will be converted to Euros at the following rate:

1 ECU = 1€

All participants will be divided into groups of three members. The subjects will be assigned a number (1, 2 o 3) for each group. Except for us, the experimenters, nobody knows who is in which group.

The decision situation

Each member has to decide on the division of 10 ECUs. You can put these 10 ECUs on a private account, or you can invest them fully or partially into a project. Each ECU you do not invest in the project will automatically be transferred to your private account.

Your income from the private account

For each ECU you put on your private account you will earn exactly one point. For example, if you put 10 ECUs on your private account (which implies that you do not invest anything into the project), you will earn exactly 10 ECUs from the private account. If you put 4 ECUs into the public account (then, 6 ECUs in the private account), you will receive an income of 6 ECUs from the private account. Nobody except you earns something from your private account.

Your income from the project

From the ECU amount you invest in the project, each group member will get the same payoff, Marginal per capita return (MPCR) α_i equal 0.6.

[*Treatment 2:* each ECU you invest in the project, each group member will receive a different MPCR 0.45, 0.6, or 0.75 randomly assigned.]

[*Treatment 3:* each group member will receive MPCR base on the rank order with the following returns: low is 0.45, medium 0.6, or high 0.75 assigned depending on their contribution to the public project].

Of course, you will also get a payoff from the ECUs the other group members invest in the project. For each group member the income from the project will be determined as follows:

Income from the project = sum of contributions to the project × α_i

The multiplier α_i is equal to 0.6.
[*Treatment 2 and 3:* the multiplier α_i can be either 0.45 or 0.6 or 0.75]
Where α_i refers to the return of the project (MPCR) for i player, taking into consideration i=(1, 2, 3). For instance, if the sum of all contributions to the project is 20 ECUs. Then, you have contributed 10 ECUs, and all other two group members 8 and 2 ECUs. Hence, all the members of the group will get a payoff of 20 x 0.6= 12 ECUs for the project. If the sum of contribution three group members is 10 ECUs, you and all others will get a payoff of 10 x 0.6=6 ECUs for the project.

[*Treatment 2:* 20xα_i (0.45; 0.6; 0.75) ECUs for the project depending on the MPCR randomly assigned. If the three group members together contribute 10 ECUs to the project, you and the two other members of the group will get a payoff of 10 x αi (0.45; 0.6; 0.75) ECUs for the project depending on the MPCR randomly assigned.]

[*Treatment 3:* you have made the highest contribution for the rank order you will receive the high return, then you earn from the public project is 20x0.75=15 ECUs. The agent who has to contribute 8 ECUs has the medium contribution and the agent who has to contribute 2 ECUs the lowest, then, they will earn form the public account 20x0.6=12 ECUs and 20x0.45=9 ECUs respectively. If the other two group members together contribute 10 ECUs to the project, 5 ECUs ahead. Your earning from the project, given that as before you made the greatest contribution, will be the same 20x0.75=15 ECUs. The other two members have the same contribution comparatively lower respect you, then both will earn 20 x ((0.6+0.45)/2) =10.5 ECUs].

At the end of the experiment, you will receive information about the contribution of your partners and your corresponding earnings. Before the experiment starts, you will have to answer some control questions to verify your understanding of the rules of the experiment. Please remain seated quietly until the experiment starts. If you have any questions, please raise your hand.

Your total income

Your total income results from the summation of your income from the private account and your income from the project. The total income is calculated following this function:

Total Income= Income from the private account (= 10 - Your contribution to the project) + Income from the project (α_i × Sum of contributions to the project)

The multiplier α_i is equal to 0.6.

[*Treatment 2 and 3:* the multiplier α_i can be either 0.45 or 0.6 or 0.75]

Control questions

Their purpose is to make you familiar with the calculation mechanism of the total profits before the experiment starts. Read accurately the questions and answers, please.

1. Each group member has 10 ECUs at his or her disposal. Assume that none of the two group members (including you) contributes anything to the project.
    a. What will your total income be?
    b. What is the total income of the other group members?

2. Each group member has 10 ECUs at his or her disposal. Assume that you invest 10 ECUs into the project and each of the other group members also invests 10 ECUs.
    a. What will be your total income?
    b. What is the total income of the other group member?

3. Each group member has 10 ECUs at his or her disposal. Assume that the other group member contributes 5 ECUs to the project.
    a. What is your total income if you contribute 0 ECUs to the project?
    b. What is your income if you contribute 8 ECUs to the project?
    c. What is your income if you contribute 10 ECUs to the project?

4. Each group member has 10 ECUs at his or her disposal. Assume that you invest 8 ECUs in the project.
    a. What is your total income if the other group members - in addition to your 8 ECUs the other group members invest in average 3 ECUs to the project?
    b. What is your total income if the other group members - in addition to your 8 ECUs the other group members invest in average 8 ECUs to the project?

c. What is your income if the other group members - in addition to your 8 ECUs the other group members invest in average 10 ECUs to the project?

If you finish these questions before the others, we advise you to think about additional examples to further familiarize yourself with the decision situation.

The Experiment structures

The experiment contains the decision situation that we have just described to you. At the end of the experiment, you will get paid according to the decisions you make in this experiment. The experiment will only be conducted once.

As you know, you will have 10 ECUs at your disposal. You can put them into a private account, or you can invest them in a project. In this experiment, each subject has to make two types of decisions. You must put an integer number. In the following, we will call them “unconditional contribution” and “contribution table”.

a) “*Unconditional contribution*”: With the unconditional contribution to the project you have to decide how many of the 10 ECU, you want to invest in the project. After you have determined your unconditional contribution, inserting the amount in the box, you press the "OK"- button.

b) Your second task is to fill out a “*Contribution table*”: each subject will indicate their conditional contribution, for every possible contribution made for the average contribution of others’ group members, you have to assign among of ECUs that you would like to invest in the public account.

In each input box, you can insert all integer numbers from 0 to 10. The numbers next to the input boxes are the possible (rounded) contributions of the other group members to the project. You simply have to insert into each input box how many ECUs you will contribute to the project - conditional on the indicated contribution of the other group member. You have to make an entry into each input box. For instance, you will have to indicate how much you contribute to the project if the others contribute 0 ECU to the project? how much you contribute if the others contribute 10 ECUs? etc. If you have made an entry in each input box, press the OK button.

After all participants of the experiment have made an unconditional contribution and have filled out their contribution table, in each group a random mechanism will select a group member. For the randomly determined subject, only the contribution table will be the payoff-relevant decision. For the other group member that is not selected by the random mechanism, only the unconditional contribution will be the payoff-relevant decision. Therefore, you will have to think carefully about both types of decisions because both can become relevant for you. Two examples should make that clear.

- **EXAMPLE 1**: Assume that you have been selected by the random mechanism. This implies that your relevant decision will be your contribution table. For the other group member, the unconditional contribution is the relevant decision. Assume they have made average contributions of 2 ECUs. If you have indicated in your contribution table that you will contribute 3 ECU when the other members contribute to average 2 and 1 ECU each one. Then, the total contribution is given by 3+1+1=5 ECUs. All group members earn 0.6 x 5= 3 ECUs from the public project

[*Treatment 2:* Therefore, the total contribution for the public account will depend on return (α_i) of the projects assigned randomly, where α_i=(0.45, 0.6, 0.75). Thus, the return for the public project is α_i (0.45, 0.6, 0.75) x 5 ECU.]

[*Treatment 3:* Therefore, the profit of the project will depend on their previous rank order based on their contribution. You have contributed with the highest contribution who has to contribute 3 ECUs, will earn 5x0.75=3.75 ECU. The other group members that have to contribute 1 ECU will earn from the project 5x ((0.6+0.45)/2) = 2.652 ECUs because have the relatively minor contribution] points from the project plus their respective income from the private account.

- **EXAMPLE 2:** Assume that you have not been selected by the random mechanism which implies that for you the unconditional contribution is taken as the payoff-relevant decision. Imagine that your unconditional contribution is 6 ECUs, and another subject of the group with unconditional contribution as relevant choice contributes 10 ECUs. Then, they contribute 8 ECUs on average. The member of the group selected as the contribution table relevant choice by the random mechanism indicates he/she will contribute 1 ECU if the other group member contributes on average 8 ECUs. Therefore, the total contribution of the group to the project is given by 6+10+1=17 ECUs. All group members will earn 17x0.6=10.2 ECUs.

  [*Treatment 2:* The profit from the project will depend on the MPCR randomly assigned, where α_i = (0.45, 0.6, 0.75). Thus, the return for the public project is α_i (0.45, 0.6, 0.75) x 17 ECUs.]

  [*Treatment 3:* The earning from the project will depend on the rank order base on contribution. Then, the subject who contribute 10 ECUs have contributed the highest amount with and he/she will earn 17x0.75=12.75 ECUs from the project. You have the medium contribution with 6 ECUs, you will win from the project 17x0.6=10.20 ECUs. While the other player selected by the contribution table contributes 1 ECU, the lowest contribution. Thus, he/she will gain 17x0.45=7.65 ECUs from the public account.] points from the project plus their respective income from the private account.

The random selection of the participants will be implemented as follows. Each group member is assigned a number between 1 or 2, randomly assigned. When, all the members had filled both step decision-making about the contribution, a participant - draw at the begging of the experiment- throw a coin. Where face is equal to 1 and the cross will be 2. Therefore, this number represents the subject relevant decision on contribution.

Appendix B

Table B.1, B.2, and B.3 report the results of Spearman's and Kendall's correlation test subject by subject in T1, T2, and T3 respectively.

Table B.1 Spearman test by subject p-value 0.001 in the T1, CT task.

Subject	rho	p-value	Subject	rho	p-value
1	0.9608***	0.0000	19	0.8367***	0.0013
2	-1.0000***	0.0000	20	0.8897***	0.0002
3	0.9954***	0.0000	21	-0.4165	0.2026
4	-1.0000***	0.0000	22	0.9909***	0.0000
5	-1.0000***	0.0000	23	0.9535***	0.0000
6	0.9954***	0.0000	24	0.9653***	0.0000
7	0.9487***	0.0000	25	-0.9543***	0.0000
8	-0.3014	0.3678	26	-0.3280	0.3247
9	-0.0282	0.9344	27	-0.1098	0.7478
10	0.0000	1.0000	28	0.7626***	0.0064
11	0.0972	0.7761	29	0.2360	0.4848
12	0.9886***	0.0000	30	0.9977***	0.0000
13	1.0000***	0.0000	31	-0.5467*	0.0818
14	0.5070	0.1115	32	0.9909***	0.0000
15	-1.0000***	0.0000	33	0.9794***	0.0000
16	0.7620***	0.0064	34	0.9863***	0.0000
17	0.2462	0.4655	35	0.6329**	0.0366
18	0.9700***	0.0000	36	-0.9886***	0.0000

Note: ***, ** and * denotes statistical significance at the 1, 5 and 10 level, respectively.

Table B.2 Spearman test by subject p-value 0.001 CT task T2.

Subject	rho	p-value	Subject	rho	p-value
1	1.0000***	0.0000	19	0.9863***	0.0000
2	0.9863***	0.0000	20	-1.0000***	0.0000
3	1.0000***	0.0000	21	0.8660***	0.0006
4	0.9439***	0.0000	22	0.9702***	0.0000
5	-0.9170***	0.0001	23	-0.1122	0.7426
6	0.4139	0.2058	24	0.9439***	0.0000
7	0.4780	0.1370	25	0.6214**	0.0413
8	0.5885*	0.0568	26	-0.8660***	0.0006
9	0.9170***	0.0001	27	0.9977***	0.0000
10	-0.6091	0.0467	28	0.9170***	0.0001
11	0.9770***	0.0000	29	0.9977***	0.0000
12	0.8634***	0.0006	30	-0.9932***	0.0000
13	0.5753*	0.0640	31	-0.8903***	0.0002
14	0.7173**	0.0130	32	-1.0000***	0.0000
15	0.0372	0.9135	33	0.9977***	0.0000
16	-0.4009	0.2217	34	0.9840***	0.0000
17	0.9954***	0.0000	35	0.4311	0.1856
18	0.9793***	0.0000	36	0.9863***	0.0000

Note: ***, ** and * denotes statistical significance at the 1, 5 and 10 level, respectively.

Table B.3 Spearman test by subject p-value 0.001 in the T3 CT task.

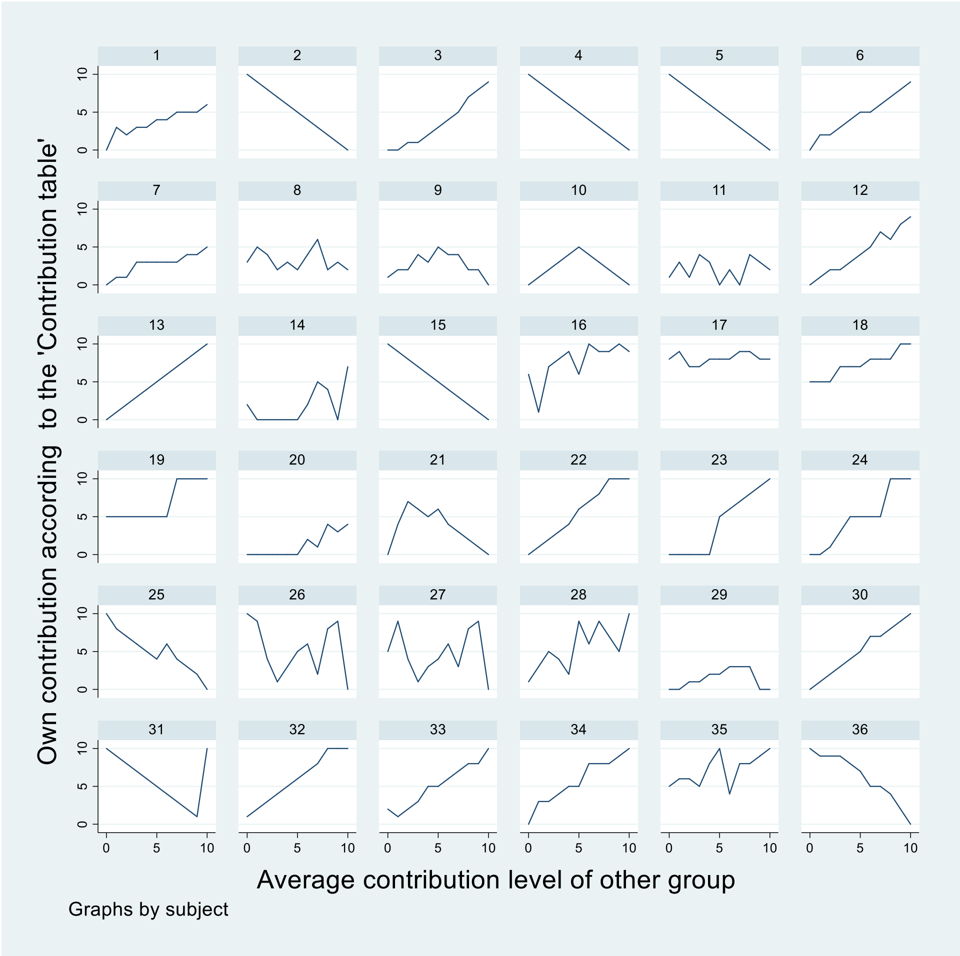
Subject	rho	p-value	Subject	rho	p-value
1	0.9249***	0.0000	19	0.9256***	0.0000
2	0.9977***	0.0000	20	0.9632***	0.0000
3	0.9954***	0.0000	21	-0.0047	0.9891
4	0.8833***	0.0003	22	1.0000***	0.0000
5	0.5550*	0.0764	23	0.4943	0.1222
6	0.6299**	0.0378	24	0.3272	0.3260
7	0.3327	0.3174	25	0.9932***	0.0000
8	0.9817***	0.0000	26	-1.000***	0.0000
9	0.9909***	0.0000	27	-0.6333**	0.0365
10	0.3908	0.2347	28	0.7420***	0.0089
11	-0.0324	0.9246	29	0.0415	0.9036
12	0.9747***	0.0000	30	0.8660***	0.0006
13	0.9863***	0.0000	31	-0.2636	0.4334
14	0.9954***	0.0000	32	-0.9487***	0.0000
15	0.5467*	0.0818	33	0.6287**	0.0383
16	-0.2636	0.4334	34	0.9700***	0.0000
17	0.9045***	0.0001	35	0.8794***	0.0004
18	0.7964***	0.0034	36	-0.7311**	0.0106

Note: ***, ** and * denotes statistical significance at the 1, 5 and 10 level, respectively.

The subjects are categorized as CC if the Spearman test gives a coefficient higher or equal to 0.7 and statistically significant at the level of 1 percent. Subjects are considered as CCC if the Spearman test has a coefficient lower or equal to -0.7 and statistically significant a level of 1 percent.

Figures B.1, B.2, and B.3 have reported the average contribution by subject in T1, T2, and T3 respectively.

Figure B.1 Contribution schedules per subject in the T1.



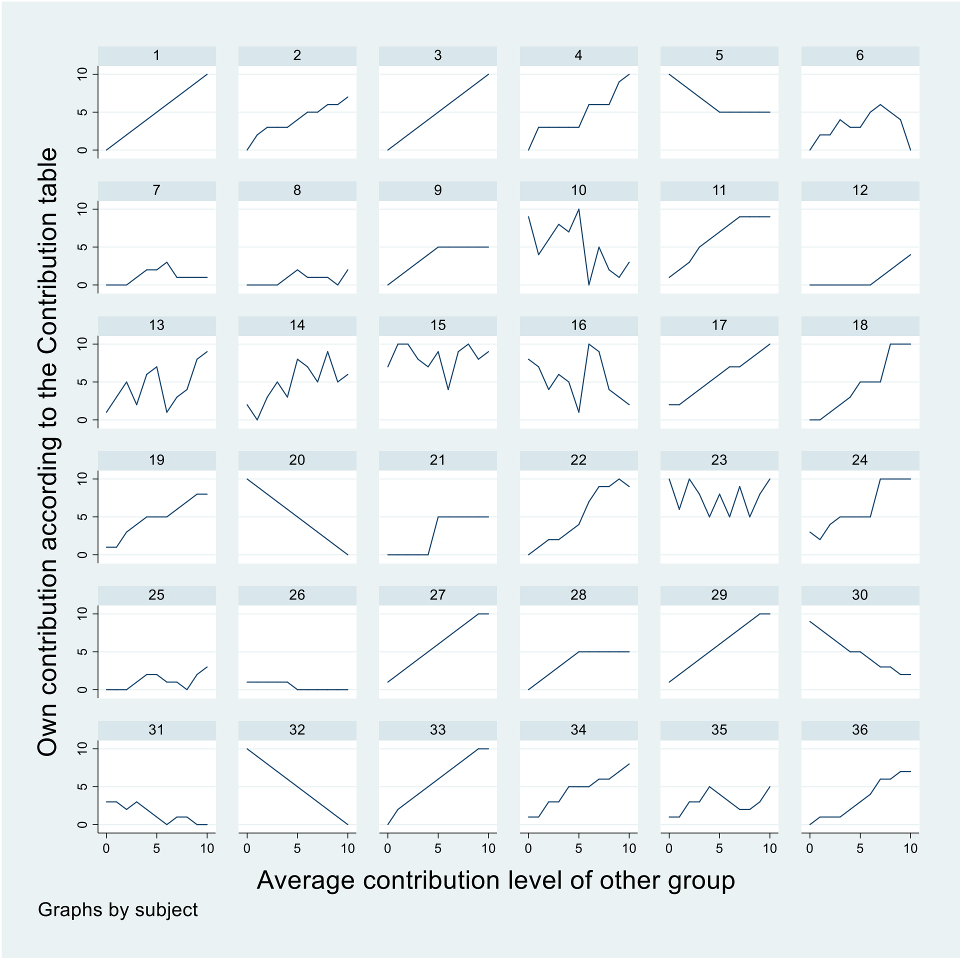
Preferences classification In T1:[12]

- **Conditional cooperator (**18/36=50%**):** 1, 3, 6, 7, 12, 13* 16, 18, 19, 20, 22, 23, 24,28, 30,32, 33, 34
- **Counter conditional cooperator (**6/36=16.67%**):** 2*, 4*, 5*, 15*, 25, 36
- **Hump-shaped**[13] **(**4/36=11.11%**):** 9, 10, 21, 29
- **Others pattern (**8/36=22.22%**):** 8, 11, 26, 27, 31, 14, 17, 35
- **Free rider (**0/36=0%**).**

As in Fischbacher et al. (2001), the result is that most subjects behave as CC (50%). The second category with a higher number of subjects is "other pattern" (22.22%) but this is followed closely by CCC (16.67%). Surprisingly and against game theorist prediction, there are not subjects' behaving as a free rider.

[12] The subjects number followed by an asterisk (*) means that the agent behaves as a perfect free rider, CC, or CCC depending on which of this classification belongs.
[13] Hump-shaped subjects are graphically classified as subjects whose contribution increase monotonically with the other group members' average contributions until reaching his/her maximum contribution and then, starts to fall.

Figure B.2 Contribution schedules per subject in the T2.

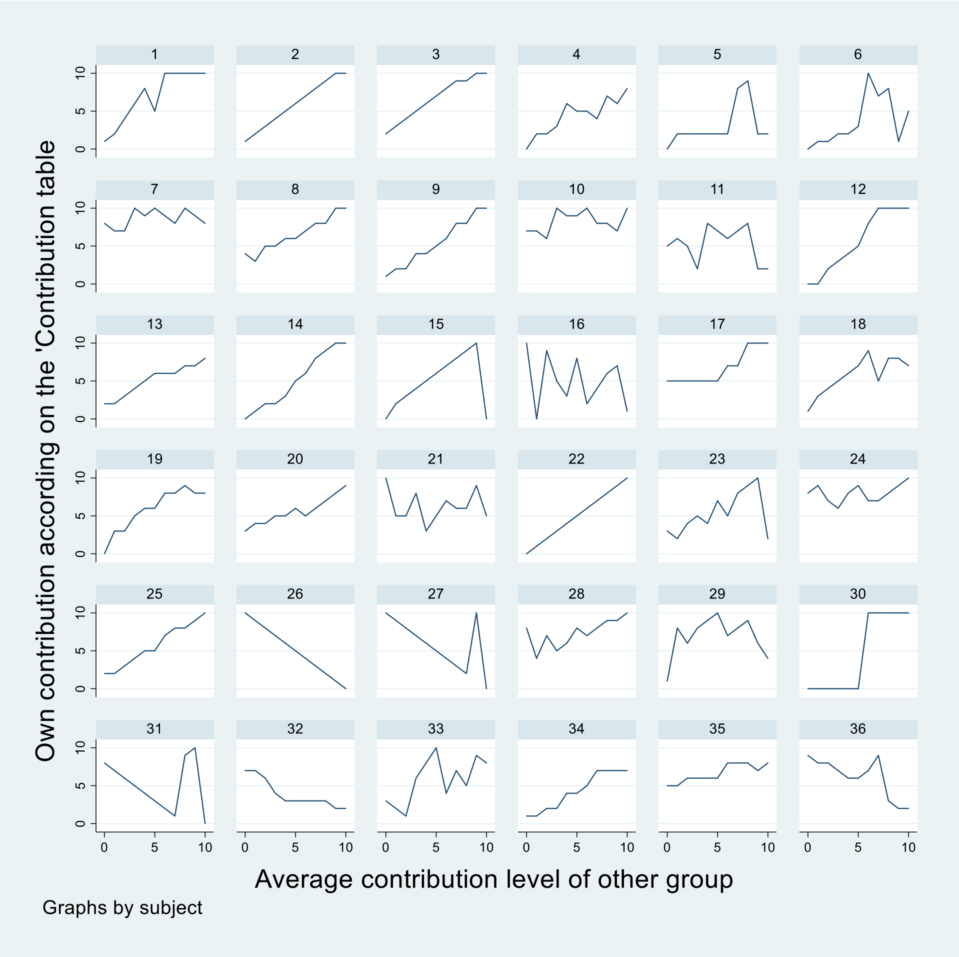


Preferences classification:

- **Conditional cooperator (**20/36=55.56%**):** 1*, 2, 3*, 4, 9, 11, 12, 14, 17, 18, 19, 21, 22, 24, 27, 28, 29, 33, 34, 36.
- **Counter conditional cooperator (**5/36=13.89%**):** 5, 20, 30, 31, 32*
- **Hump-shaped (**2/36=5.56%**):** 6, 35
- **Other pattern (**5/36=13.89%**):** 10, 13, 15, 16, 23
- **Free rider[14] (**4/36=11.11%**):** 7_2, 8_2, 25_2, 26_1

[14] We will indicate by subscript if the subject on the t-test has been classified as free-rider because of his/her mean contribution was equal or minor to 1 (subscript is 1) or instead of equal or minor to 2 (subscript is 2).

Figure B.3 Contribution schedules per subject in the T3.



Preference classification:

- **Conditional cooperator (**19/36=52.78%**):** 1, 2, 3, 4, 8, 9, 12, 13, 14, 17, 18, 19, 20, 22*, 25, 28, 30, 34, 35
- **Counter conditional cooperator (**3/36=8.33%**):** 26*, 32, 36
- **Hump-shaped (**4/36=11.11%**):** 5, 6, 15, 29
- **Other pattern (**10/36=27.78%**):** 7, 10, 11, 16, 21, 23, 24, 27, 31, 33
- **Free rider (**0/36=0%**).**

Figures B.4, B.5, and B.6 report the results from the t-test to select the free-rider category by subject in T1, T2, and T3 respectively.

Table B.4 T-test to mean contribution to be equal to 1 or 2 according to the CT task in the T1.

	p-value				*p-value*		
Subject	mean(diff)<1	mean(diff)≠1	mean(diff)>1	Subject	mean(diff)<1	mean(diff)≠1	mean(diff)>1
1	0.9998	0.0004	0.0002	19	1.0000	0.0000	0.0000
2	0.9987	0.0250	0.0013	20	0.6991	0.6018	0.3009
3	0.9889	0.0222	0.0111	21	0.9960	0.0080	0.0040
4	0.9987	0.0025	0.0013	22	0.9988	0.0024	0.0012
5	0.9987	0.0025	0.0013	23	0.9837	0.0326	0.0163
6	0.9993	0.0014	0.0007	24	0.9966	0.0067	0.0034
7	0.9984	0.0032	0.0016	25	0.9996	0.0009	0.0004
8	0.9999	0.0002	0.0001	26	0.9987	0.0026	0.0013
9	0.9976	0.0047	0.0024	27	0.9989	0.0022	0.0011
10	0.9847	0.0307	0.0153	28	0.9998	0.0005	0.0002
11	0.9843	0.0313	0.0157	29	0.8147	0.3705	0.1853
12	0.9978	0.0044	0.0022	30	0.9988	0.0024	0.0012
13	0.9987	0.0025	0.0013	31	0.9998	0.0004	0.0002
14	0.8500	0.3000	0.1500	32	0.9997	0.0005	0.0003
15	0.9987	0.0025	0.0013	33	0.9996	0.0008	0.0004
16	1.0000	0.0000	0.0000	34	0.9998	0.0005	0.0002
17	1.0000	0.0000	0.0000	35	1.0000	0.0000	0.0000
18	1.0000	0.0000	0.0000	36	0.9998	0.0004	0.0002
	p-value				*p-value*		
Subject	mean(diff)<2	mean(diff)≠2	mean(diff)>2	Subject	mean(diff)<2	mean(diff)≠2	mean(diff)>2
1	0.9954	0.0093	0.0046	19	1.0000	0.0000	0.0000
2	0.9933	0.0133	0.0067	20	0.0907	0.1813	0.9093
3	0.9379	0.1242	0.0621	21	0.9606	0.0787	0.0394
4	0.9933	0.0133	0.0067	22	0.9947	0.0106	0.0053
5	0.9933	0.0133	0.0067	23	0.9378	0.1244	0.0622
6	0.9949	0.0102	0.0051	24	0.9852	0.0296	0.0148
7	0.9318	0.1364	0.0682	25	0.9972	0.0056	0.0028
8	0.9947	0.0107	0.0053	26	0.9936	0.0128	0.0064
9	0.9049	0.1901	0.0951	27	0.9931	0.0138	0.0069
10	0.6991	0.6018	0.3009	28	0.9986	0.0027	0.0014
11	0.5805	0.8390	0.4195	29	0.0659	0.1319	0.9341
12	0.9853	0.0294	0.0147	30	0.9939	0.0122	0.0061
13	0.9933	0.0133	0.0067	31	0.9989	0.0022	0.0011
14	0.4065	0.8130	0.5935	32	0.9988	0.0024	0.0012
15	0.9933	0.0133	0.0067	33	0.9976	0.0048	0.0024
16	1.0000	0.0000	0.0000	34	0.9987	0.0026	0.0013
17	1.0000	0.0000	0.0000	35	1.0000	0.0000	0.0000
18	1.0000	0.0000	0.0000	36	0.9992	0.0016	0.0008

Table B.5 T-test to mean contribution be equal to 1 or 2 according to the CT task in the T2.

		p-value				*p-value*	
Subject	mean(diff)<1	mean(diff)≠1	mean(diff)>1	Subject	mean(diff)<1	mean(diff)≠1	mean(diff)>1
1	0.9987	0.0025	0.0013	19	0.9998	0.0004	0.0002
2	0.9997	0.0007	0.0003	20	0.9987	0.0025	0.0013
3	0.9987	0.0025	0.0013	21	0.9735	0.0530	0.0265
4	0.9990	0.0019	0.0010	22	0.9976	0.0047	0.0024
5	1.0000	0.0000	0.0000	23	1.0000	0.0000	0.0000
6	0.9972	0.0056	0.0028	24	0.9999	0.0002	0.0001
7	0.6220	0.7560	0.9780	25	0.6106	0.7787	0.3894
8	0.1384	0.2767	0.8616	26	0.0030	0.0061	0.9970
9	0.9996	0.0008	0.0004	27	0.9998	0.0004	0.0002
10	0.9987	0.0025	0.0013	28	0.9996	0.0008	0.0004
11	0.9999	0.0002	0.0001	29	0.9998	0.0004	0.0002
12	0.4195	0.8390	0.5805	30	0.9999	0.0003	0.0001
13	0.9990	0.0020	0.0010	31	0.8788	0.2425	0.1212
14	0.9996	0.0008	0.0004	32	0.9987	0.0025	0.0013
15	1.0000	0.0000	0.0000	33	0.9996	0.0005	0.0002
16	0.9997	0.0006	0.0003	34	0.9998	0.0005	0.0002
17	0.9999	0.0002	0.0001	35	0.9995	0.0010	0.0005
18	0.9943	0.0115	0.0057	36	0.9940	0.0120	0.0060
		p-value				*p-value*	
Subject	mean(diff)<2	mean(diff)≠2	mean(diff)>2	Subject	mean(diff)<2	mean(diff)≠2	mean(diff)>2
1	0.9933	0.0133	0.0067	19	0.9983	0.0033	0.0017
2	0.9955	0.0089	0.0045	20	0.9933	0.0133	0.0067
3	0.9933	0.0133	0.0067	21	0.8113	0.3774	0.1887
4	0.9938	0.0123	0.0062	22	0.9894	0.0212	0.0106
5	1.0000	0.0000	0.0000	23	0.9378	0.1244	0.0622
6	0.9517	0.0965	0.0483	24	0.9852	0.0296	0.0148
7	0.0048	0.0096	0.9952	25	0.9972	0.0056	0.0028
8	0.0002	0.0003	0.9998	26	0.9936	0.0128	0.0064
9	0.9923	0.0153	0.0077	27	0.9931	0.0138	0.0069
10	0.9933	0.0133	0.0067	28	0.9986	0.0027	0.0014
11	0.9995	0.0010	0.0005	29	0.0659	0.1319	0.9341
12	0.0157	0.0313	0.9843	30	0.9939	0.0122	0.0061
13	0.9926	0.0148	0.0074	31	0.9989	0.0022	0.0011
14	0.9971	0.0058	0.0029	32	0.9988	0.0024	0.0012
15	1.0000	0.0000	0.0000	33	0.9976	0.0048	0.0024
16	0.9984	0.0033	0.0016	34	0.9987	0.0026	0.0013
17	0.9994	0.0012	0.0006	35	1.0000	0.0000	0.0000
18	0.9754	0.0491	0.0246	36	0.9992	0.0016	0.0008

Table B.6 T-test to mean contribution to be equal to 1 or 2 according to the CT task in the T3.

	p-value				*p-value*		
Subject	mean(diff)<1	mean(diff)≠1	mean(diff)>1	Subject	mean(diff)<1	mean(diff)≠1	mean(diff)>1
1	0.9999	0.0002	0.0001	19	0.9999	0.0002	0.0001
2	0.9998	0.0004	0.0002	20	1.0000	0.0000	0.0000
3	1.0000	0.0000	0.0000	21	1.0000	0.0000	0.0000
4	0.9995	0.0010	0.0005	22	0.9987	0.0025	0.0013
5	0.9805	0.0389	0.0195	23	0.9998	0.0004	0.0002
6	0.9869	0.0262	0.0131	24	1.0000	0.0000	0.0000
7	1.0000	0.0000	0.0000	25	0.9999	0.0002	0.0001
8	1.0000	0.0000	0.0000	26	0.9987	0.0025	0.0013
9	0.9995	0.0010	0.0005	27	0.9996	0.0007	0.0004
10	1.0000	0.0000	0.0000	28	1.0000	0.0000	0.0000
11	0.9999	0..0001	0.0000	29	1.0000	0.0000	0.0000
12	0.9981	0.0038	0.0019	30	0.9760	0.0480	0.0240
13	1.0000	0.0001	0.0000	31	0.9987	0.0025	0.0013
14	0.9977	0.0045	0.0023	32	0.9998	0.0004	0.0002
15	0.9981	0.0037	0.0019	33	0.9998	0.0004	0.0002
16	0.9987	0.0025	0.0013	34	0.9993	0.0014	0.0007
17	1.0000	0.0000	0.0000	35	1.0000	0.0000	0.0000
18	1.0000	0.0000	0.0000	36	1.0000	0.0001	0.0000

	p-value				*p-value*		
Subject	mean(diff)<2	mean(diff)≠2	mean(diff)>2	Subject	mean(diff)<2	mean(diff)≠2	mean(diff)>2
1	0.9996	0.0009	0.0004	19	0.9994	0.0012	0.0006
2	0.9989	0.0022	0.0011	20	1.0000	0.0001	0.0000
3	0.9999	0.0003	0.0001	21	1.0000	0.0000	0.0000
4	0.9956	0.0089	0.0044	22	0.9933	0.0133	0.0067
5	0.8688	0.2625	0.1312	23	0.9988	0.0024	0.0012
6	0.9316	0.1368	0.0684	24	1.0000	0.0000	0.0000
7	1.0000	0.0000	0.0000	25	0.9993	0.0014	0.0007
8	1.0000	0.0001	0.0000	26	0.9933	0.0133	0.0067
9	0.9975	0.0051	0.0025	27	0.9982	0..0035	0.0018
10	1.0000	0.0000	0.0000	28	1.0000	0.0000	0.0000
11	0.9996	0.0009	0.0004	29	1.0000	0.0001	0.0000
12	0.9926	0.0148	0.0074	30	0.9315	0.1370	0.0685
13	0.9997	0.0006	0.0003	31	0.9933	0.0133	0.0067
14	0.9898	0.2050	0.0102	32	0.9966	0.0069	0.0034
15	0.9906	0.0189	0.0094	33	0.9990	0.0019	0.0010
16	0.9933	0.0133	0.0067	34	0.9936	0.0128	0.0064
17	1.0000	0.0000	0.0000	35	1.0000	0.0000	0.0000
18	0.9998	0.0004	0.0002	36	0.9998	0.0004	0.0002

Table B.7, B.8, and B.9 report the estimated coefficients of an Ordinary Least Squares (OLS), where the dependent variable is the average contribution of the other group members (from 0 to 10 ECUs), and the independent variable is the own choice made in the CT task for T1, T2, and T3 respectively.

Table B.7 Regression estimated by OLS average contribution of other group members as the dependent variable and own contribution according to the CT task in the T1.

Subject	Constant	CT	R^2	Subject	Constant	CT	R^2
1	-1.624 (1.1658)	1.8216*** (0.2638)	0.86	19	-2.5000 (1.782)	1.1000*** (0.2079)	0.70
2	10.0000	-1.0000	1.00	20	2.8322*** (0.7562)	1.7032*** (0.2891)	0.74
3	1.3478*** (0.3974)	1.0043*** (0.067)	0.95	21	6.9341** (2.5632)	-0.5599 (0.5055)	0.17
4	10.0000	-1.0000	1.00	22	0.1531 (0.1676)	0.874*** (0.0510)	0.97
5	10.0000	-1.0000	1.00	23	1.8883** (0.6653)	0.7606*** (0.0869)	0.89
6	-0.5119 (0.3299)	1.1888*** (0.0504)	0.98	24	0.9008** (0.3837)	0.8350*** (0.0675)	0.91
7	-0.6557 (0.4624)	2.0738*** (0.1514)	0.86	25	10.5625*** (0.4869)	-1.1125*** (0.0826)	0.90
8	6.8000** (2.8169)	-0.5500 (0.8107)	0.05	26	6.4058*** (1.8125)	-0.2713 (0.3505)	0.08
9	5.4677* (2.9092)	-0.1774 (0.7862)	0.00	27	5.3077** (2.1807)	-0.0651 (0.4295)	0.00
10	5.0000* (2.5211)	0.0000 (0.7035)	0.00	28	0.4375 (1.3268)	0.8227*** (0.2004)	0.54
11	4.5000** (1.6289)	0.2391 (0.6202)	0.01	29	4.0934* (2.1246)	0.6648 (0.8787)	0.06
12	0.3000 (0.2360)	1.1000*** (0.0536)	0.97	30	-0.0048 (0.0373)	0.9831 (0.01999)	0.99
13	0.0000	1.0000	1.00	31	8.5135*** (1.4162)	-0.5946 (0.3684)	0.32
14	3.5546** (1.1402)	0.7949*** (0.2327)	0.35	32	-1.0000*** (0.253)	1.0000*** (0.0579)	0.98
15	10.0000	-1.0000	1.00	33	-0.7484 (0.5745)	1.1093*** (0.0833)	0.95
16	-1.6843 (2.1437)	0.8753*** (0.2586)	0.47	34	-0.9546 (0.5939)	1.0396*** (0.0908)	0.94
17	-4.8889 (9.6297)	1.2222 (1.2251)	0.06	35	-2.4062 (3.7252)	1.0312* (0.4808)	0.42
18	-7.8813*** (1.1133)	1.7712*** (0.1447)	0.91	36	11.0861*** (0.6415)	-0.9845*** (0.1003)	0.93

Note: ***, ** and * denotes statistical significance at the 1, 5 and 10 level, respectively

Subjects 26 and 31 are classified as other patterns

Table B.8 Regression estimated by OLS average contribution of other group members as the dependent variable and own contribution according to the CT task in T2.

Subject	Constant	CT	R^2	Subject	Constant	CT	R^2
1	0.0000***	1.0000***	1.00	19	-1.3826** (0.5534)	1.3247*** (0.0931)	0.95
2	-1.2857 (0.812)	1.5714*** (0.1583)	0.94	20	10.0000***	-1.0000***	1.00
3	0.0000***	1.0000***	1.00	21	2.0000** (0.6992)	1.1000*** (0.2081)	0.75
4	0.068 (0.6622)	1.0433*** (0.0857)	0.87	22	0.6645 (0.3737)	0.8516*** (0.0777)	0.93
5	15.1315*** (1.7158)	-1.5921*** (0.2108)	0.80	23	5.8974 (3.8488)	-0.1175 (0.5485)	0.01
6	3.1729 (2.9197)	0.5911 (0.6903)	0.12	24	-1.1956 (0.9036)	0.9877*** (0.1261)	0.85
7	3.4081** (1.4345)	1.4591 (0.7959)	0.17	25	2.8000* (1.4237)	2.0167** (0.8127)	0.40
8	3.2352** (1.4185)	2.4264* (1.2482)	0.33	26	7.5000*** (0.7708)	-5.5000*** (1.0407)	0.75
9	-0.7894 (0.5386)	1.5921*** (0.2108)	0.80	27	-1.1486*** (0.1416)	1.0405*** (0.0368)	0.99
10	8.0454*** (1.4898)	-0.6091** (0.2416)	0.37	28	-0.7895 (0.5386)	1.5921*** (0.2108)	0.80
11	-1.4762*** (0.4322)	1.0476*** (0.0949)	0.01	29	-1.1486*** (0.1416)	1.0405*** (0.0368)	0.99
12	3.2609*** (0.7917)	1.913*** (0.3015)	0.70	30	11.7284*** (0.4801)	-1.3706*** (0.0818)	0.97
13	1.8649 (1.7296)	0.7038** (0.2846)	0.35	31	8.556*** (0.8634)	-2.4444*** (0.4239)	0.80
14	0.8299 (1.0505)	0.8655*** (0.2016)	0.49	32	10.0000***	-1.0000***	1.00
15	4.7429 (3.7253)	0.031 (0.4662)	0.00	33	-0.7328* (0.3603)	0.9853*** (0.0574)	0.99
16	7.2204*** (2.0596)	-0.4139 (0.3670)	0.13	34	-1.3793** (0.4958)	1.403*** (0.090)	0.94
17	-1.8413*** (0.3082)	1.1945*** (0.0436)	0.99	35	1.7692 (2.2775)	1.1106 (0.7052)	0.21
18	1.2008** (0.3793)	0.8194*** (0.0738)	0.93	36	0.7995 (0.4382)	1.2159*** (0.0938)	0.95

Note: ***, ** and * denotes statistical significance at the 1, 5 and 10 level, respectively.

Table B.9 Regression estimated by OLS average contribution of other group members as the dependent variable and own contribution according to the CT task in the T3.

Subject	Constant	CT	R^2	Subject	Constant	CT	R^2
1	-1.0000 (0.5502)	0.8684*** (0.1002)	0.83	19	-1.2831 (0.8668)	1.0799*** (0.1529)	0.84
2	-1.1486*** (0.1416)	1.0405*** (0.0368)	0.99	20	-4.8715*** (0.8866)	1.7514*** (0.1389)	0.91
3	-2.6625*** (0.3264)	1.1546*** (0.0637)	0.98	21	5.8922 (3.7011)	-0.1422 (0.6073)	0.01
4	-0.3664 (0.5184)	1.2298*** (0.1328)	0.81	22	0.0000***	1.0000***	1.00
5	3.3461** (1.4541)	0.5513** (0.1968)	0.22	23	1.5665 (2.9071)	0.6401 (0.3894)	0.29
6	2.9321* (1.4542)	0.5686* (0.2603)	0.33	24	-3.0000 (5.6141)	1.0000 (0.7408)	0.13
7	-3.9493 (6.8699)	1.0362 (0.7597)	0.12	25	-1.6428*** (0.3364)	1.1598*** (0.0478)	0.98
8	-4.1862*** (0.9713)	1.4034*** (0.1291)	0.94	26	10.0000***	-1.0000***	1.00
9	-0.5752 (0.3321)	1.0221*** (0.0545)	0.98	27	8.8567*** (1.1474)	-0.6628* (0.311)	0.45
10	-2.3784 (6.0339)	0.8919 (0.6969)	0.15	28	-4.7291** (1.5649)	1.3212*** (0.2476)	0.52
11	6.3624* (2.8968)	-0.2584 (0.4609)	0.03	29	3.5543 (3.9589)	0.2092 (0.483)	0.03
12	0.5857* (0.2741)	0.7832*** (0.0709)	0.94	30	2.5000** (0.7708)	0.5500*** (0.1041)	0.75
13	-2.9491*** (0.4976)	1.5614*** (0.0994)	0.95	31	6.3182*** (1.6497)	-0.2636 (0.3946)	0.07
14	0.5287 (0.3142)	0.8783*** (0.0491)	0.97	32	11.2708*** (1.0634)	-1.6042*** (0.1884)	0.82
15	2.5229 (2.6751)	0.5046 (0.3767)	0.28	33	0.9082 (1.4758)	0.7144** (0.2554)	0.41
16	6.3182** (2.3442)	-0.2636 (0.3848)	0.07	34	-0.4971 (0.4587)	1.2865*** (0.1242)	0.94
17	-3.8478** (1.6161)	1.3152*** (0.1943)	0.79	35	-10.9687*** (2.3097)	2.4062*** (0.3779)	0.77
18	-1.3984 (1.0541)	1.1172*** (0.2156)	0.66	36	11.0989*** (1.1075)	-1.0013*** (0.2681)	0.63

Note: ***, ** and * denotes statistical significance at the 1, 5 and 10 level, respectively.