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Framing effects in public good games: Choices or externalities?

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Abstract

We disentangle the effects of choice (give vs. take) and externality (positive vs. negative) framing of decisions in isomorphic and payoff-equivalent experimental public good games. We find that, at the aggregate level, neither frame affects group contributions. At the individual level, the Take choice frame leads to greater free-riding, and also to somewhat higher contributions, i.e., to more extreme contribution behaviour.

Keywords: isomorphic; public goods; experiment; cooperation; choice frame; externality frame

JEL codes: C72, C91, C92, D02, H41

1. Introduction

A large literature has looked at framing effects in public good games (see Cox and Stoddard 2015 for a review). The precise size, nature and cause of framing effects remain, however, an open question.

Andreoni (1995) argued that there is a *positive-negative externality framing effect*. This posits that contributions are higher if the positive externality of contributing to the group is emphasised rather than the negative externality of not contributing to the group. Follow up studies by Park (2000) and Fujimoto and Park (2010) support this view. The main body of literature, however, has focussed on a *give-take choice framing effect*. The ‘consensus view’ is that contributions are higher when individuals are asked to contribute to the group rather than given the opportunity to take away from the group (Cox 2015, Khadjavi and Lange 2015, Gächter, Kölle and Quercia 2017). Results, however, are mixed with many studies finding no significant effect on aggregate contributions (e.g. Cox and Stoddard 2015, Cox et al. 2018) and some the reverse effect (Fosgaard, Hansen and Wengström 2014).

Cartwright (2016) points out that the mixed results concerning a give-take choice effect may result from a confound with the positive-negative externality effect (see also Böhm and Theelen 2016). In particular, the externality and choice dimensions are distinct and so one can have give-positive, take-positive, give-negative and take-negative frames. Existing studies have not always controlled for this and so evidence of a choice effect may merely be picking up an externality effect, or vice-versa. In this paper we report on an experiment that explicitly separates choice and externality dimensions with the objective of disentangling these two framing effects. We find no evidence of a framing effect on overall contributions (with the possible exception of a choice effect in the negative externality domain) but evidence of a choice framing effect on the distribution of individual contributions.

2. Experiment design

We employed a between subject 2×2 design with give-positive, take-positive, give-negative and take-negative treatments. In all treatments subjects played a strategically identical, linear public good game with group size four and marginal per capita return of 0.5. Specifically, payoffs were

determined by the allocation of Tokens between Individual Projects and a Group Project. Each Token in a subject's Individual Project yielded payoff 1 to that subject alone. Each Token in the Group Project yielded a payoff of 0.5 to each of the four members of the group. Subjects were in fixed groups for 20 rounds and only exposed to one treatment.

In the give treatments subjects are given an endowment of 20 Tokens in an 'Individual Project' and told: 'The task of each group member is to decide how many Tokens, if any, they would like to move from their Individual Project and contribute to the Group Project.' (The full instructions are available in supplementary information.) In the take treatments subjects are given an endowment of 80 Tokens in the Group Project and told: 'The task of each group member is to decide how many Tokens, if any, they would like to withdraw from the initial Group Project and move to their Individual Project.' Here, the instructions emphasise the difference between contributing to (give) and extracting from (take) a public good.

In the positive treatments subjects were told: 'For each Token you contribute to [do not withdraw from] the Group Project, your earnings from the Group Project will increase by 0.5 Tokens. Each of the other three people in your group will also see an increase in earnings of 0.5 Tokens.' In the negative treatments subjects were told: 'For each Token you do not contribute to [withdraw from] the Group Project, your earnings from the Group Project will decrease by 0.5 Tokens. Each of the other three people in your group will also see a decrease in earnings of 0.5 Tokens.' We see here the distinction between instructions that emphasise the positive externality of Tokens in the Group Project versus the negative externality of Tokens in the Individual Project (Andreoni 1995).

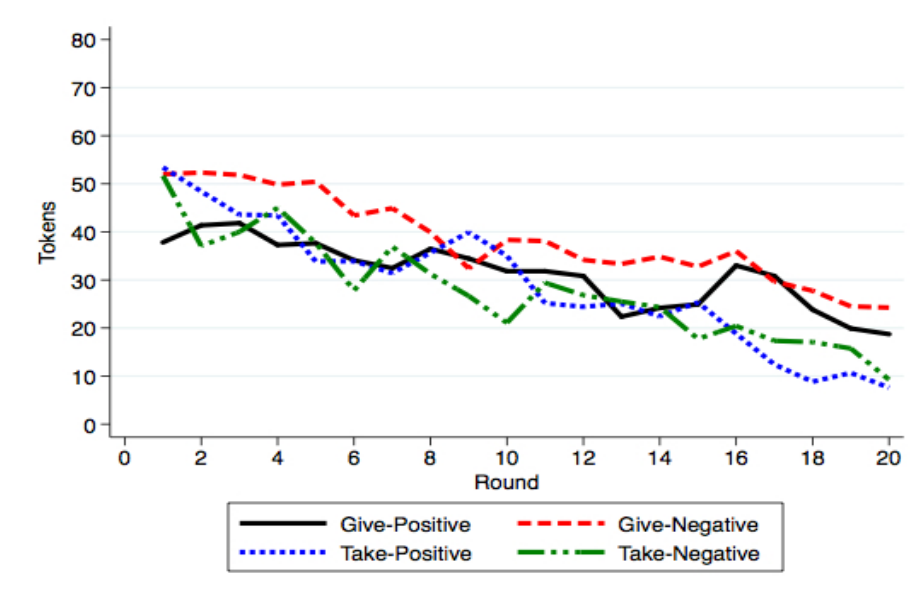
Based on the previous literature we expected to observe an externality effect on overall contributions (Andreoni 1995, Park 2000). So, contributions to be higher in give-positive than give negative and in take-positive than take-negative. We did not expect to see a choice effect on overall contributions (Cox and Stoddard 2015, Cartwright 2016). So, average contributions to be similar in give-positive and take-positive and in give-negative and take-negative. But we could expect to observe a choice effect on the distribution of contributions with more extreme behaviour in the take treatments (Cox and Stoddard 2015, Gächter et al. 2017).

The experiment was run at the University of Essex using z-Tree (Fischbacher 2007). A total of 188 subjects took part in the experiment with 11 groups in the give-positive treatment and 12 groups in each of the other three treatments. Subjects were paid their total earnings from all 20 rounds (60 Tokens = £1) at the end of the session plus a £2 show-up fee. A session lasted about 45 minutes on average, and the average payment was £11.69.

3. Results

Figure 1 plots average group contributions by treatment and round. In all treatments, we observe the usual decline in contributions over time. Table 1 provides the average group contribution by treatment. A Kruskal Wallis test for differences in distribution of group contributions across treatments shows no significant difference ($p = 0.22$). The only marginally significant pairwise differences using a two-sided rank sum test are give-negative is higher than take-positive ($p = 0.065$) and take-negative ($p = 0.083$).¹ In Appendix B1, we report panel random effects regressions of group contributions that control for time trends. The regression results support the results reported here. We see, therefore, no compelling evidence of any framing effect in overall group contributions (with the possible exception of a choice framing effect in the negative domain).

Figure 1. Average group contributions over time



¹ The unit of observation is a group's total contribution averaged over all 20 rounds.

Table 1. Summary statistics on contributions and the proportion of free-riders and full cooperators

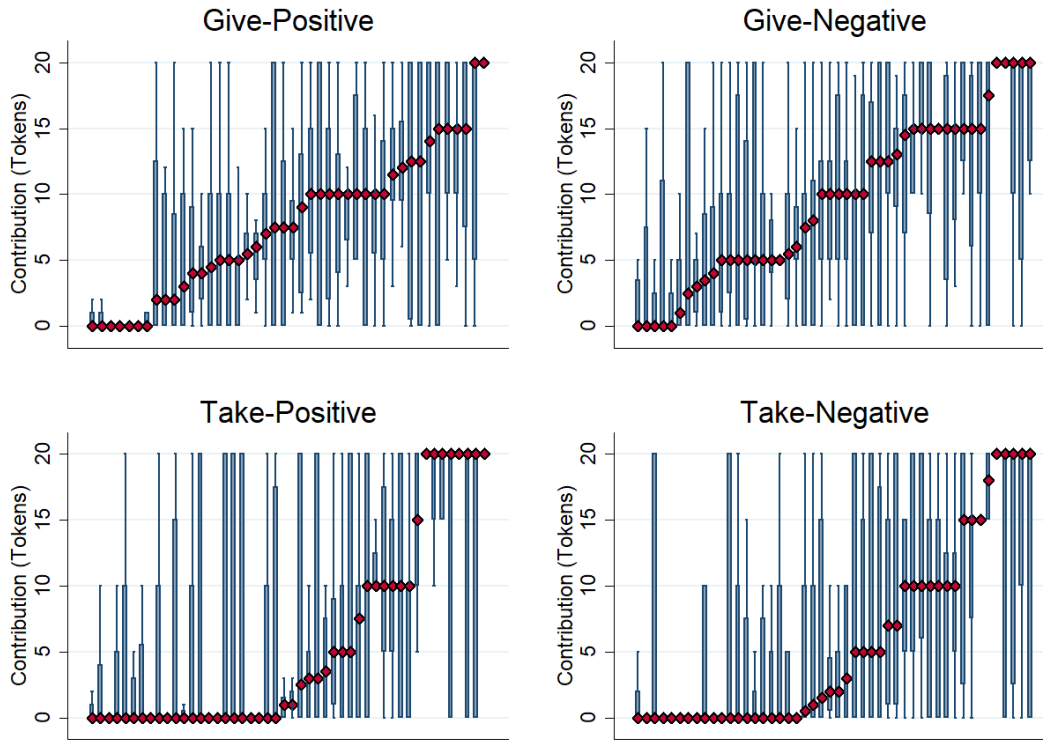
Treatment	Obs.	Group contributions	Proportion of	
			Free-riders	Full cooperators
Give - Positive	11	31.28 (15.51)	0.28 (0.25)	0.15 (0.19)
Give-Negative	12	38.54 (14.26)	0.23 (0.16)	0.22 (0.19)
Take-Positive	12	28.97 (11.91)	0.49 (0.14)	0.27 (0.16)
Take-Negative	12	27.94 (16.18)	0.48 (0.23)	0.19 (0.18)

Figures in parentheses are standard deviations.

Figure 2 plots the distribution of individual contributions by treatment. Figure 2 suggests that there are more individuals with median contributions of zero in the Take treatments than in the Give treatments. Figure 3 (a) provides more evidence by plotting the average proportion of subjects in a group contributing zero by treatment and round. Table 1 presents summary statistics on the proportion of free-riders in groups. The differences across treatments are significant (Kruskal Wallis test on proportion of free-riders in the group, $p = 0.0021$). Pairwise, we find no difference between the two Give treatments ($p = 0.76$) or Take treatments ($p = 0.73$) and so no evidence of an externality effect. We do find a difference between the two positive treatments (Give-Pos vs. Take-Pos: $p = 0.0106$) and negative treatments (Give-Neg vs. Take-Neg; $p = 0.0086$). So, there is evidence of a choice framing effect.²

² Probit and logit regressions (reported in Appendix B) provide additional support for these findings.

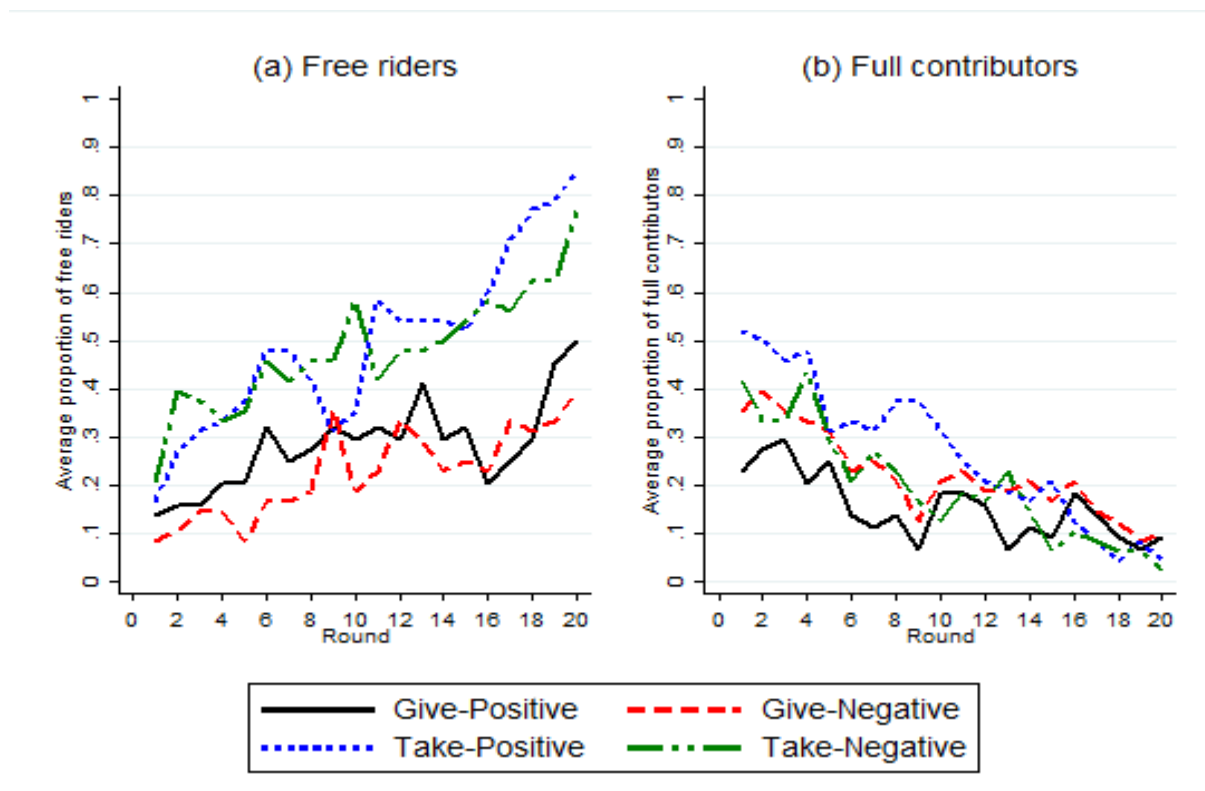
Figure 2. Distributions/spread of individual contributions



Note: Each vertical line presents an individual's contributions. Diamonds indicate the median contribution for each individual. The thicker portion of each bar indicates the inter-quartile range of that individual's contributions. Individuals are arranged in ascending order of median contributions. Individuals are *not* grouped.

If we observe no choice framing effect on average contributions and yet do see an effect on free-riding then there must be a counter-weighting effect on higher contributions. In other words the distribution of contributions becomes more extreme in the Take treatments (Cox and Stoddard 2015). Figure 2 also suggests that there are more individuals with median contribution of 20 Tokens in Take-Positive than in Give-Positive. Figure 3 (b) presents the average proportion of full contributors in a group by treatment and round. Table 1 presents summary statistics on the proportion of full contributors in groups. The differences across treatments are not significant (Kruskal Wallis test on proportion of full contributors in the group, $p = 0.1101$). We see a statistically significant increase in the average proportion of subjects with contributions of 20 Tokens in the Take choice frame in the positive treatments (Give-Pos vs. Take-Pos: $p = 0.0266$), but do not find a significant difference between choice frames in the negative treatments (Give-Neg vs. Take-Neg: $p > 0.10$).

Figure 3. Average proportion of free riders (contribute 0) and full contributors (contribute 20) in group



4. Conclusion

We report on an experiment designed to disentangle externality and choice framing effects in repeated public good games. We find no compelling evidence of a framing effect on overall contributions. There is evidence of a choice framing effect in terms of the distribution of contributions, with more extreme behavior in the take treatments.

Our results are relatively easy to interpret in terms of the choice dimension. In particular, our results are consistent with recent studies showing that a give-take framing effect influences the distribution of contributions without having any significant effect on overall contributions (Cox and Stoddard 2015, Cox et al. 2018). Gächter, Kölle and Quercia (2017) argue there is a give-take framing effect on overall contributions but random variation means this effect does not always show up. Our results support this view to some extent in that we see a significant increase in free-

riding, in the take treatments, but a weaker increase in full cooperation. Even so, the accumulated evidence appears to suggest that if a give-take framing effect exists then it is small.

The more surprising result is the fact we do not observe an externality framing effect. This is inconsistent with Cartwright (2016) and would seem to go against the results of Andreoni (1995) and Park (2000). We suggest, therefore, that this is an area which warrants further study. Our instructions repeatedly emphasised the positive versus negative externality and so it would seem hard to argue our framing approach was simply too subtle. Instead, it seems that subjects did not respond to the difference in framing. One plausible reason is that our instructions were long and detailed enough to improve comprehension (Fosgaard, Hansen and Wengström 2017, Freeman et al. 2018, Ramalingam, Morales and Walker 2018) and thus influence the ‘gut’ instinct that drives warm glow versus cold prickle. Another possibility is that the externality effect only shows up in certain contexts. For instance, Böhm and Theelen (2016) observe an externality effect, but only in a setting with negative outcome valence and not (similar to us) in a setting with positive outcome valence.

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SUPPLEMENTARY MATERIAL

Framing effects in public goods games: Choices or externalities?

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Appendix A. Experimental Analysis

A1. Give-Positive

Thank you for coming! This is an experiment about decision-making. You will receive £2 for your participation. If you follow the instructions carefully, you can earn more money depending both on your own decisions and on the decisions of others.

These instructions and your decisions in this experiment are solely your private information. During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

Your decisions will be recorded privately at your computer terminal. Your identity will never be disclosed to other participants. You will be paid individually and privately in cash at the end of the experiment.

During the experiment all decisions are made in Tokens (more details below). Your total earnings will also be calculated in Tokens and, at the end of the experiment will be converted to Pounds at the following rate:

$$\mathbf{60\ Tokens = \pounds 1}$$

The experiment consists of twenty (20) consecutive decision rounds.

At the beginning of the experiment, participants will be randomly divided into groups of four (4) individuals. The composition of the groups will remain the same in each round. This means that you will interact with the same people in your group throughout the experiment.

You are a member of a group of four participants. Each of you will have an Individual Project and your group of four will have a Group Project. At the beginning of each round, each group of four begins with 0 Tokens placed in their initial Group Project. Each Token in the Group Project is worth 2 Tokens to the group. Thus, each group begins with an initial Group Project worth 0 Tokens. Each person begins with 20 Tokens placed in his/her initial Individual Project.

The task of each group member is to decide how many Tokens, if any, they would like to move from their Individual Project and contribute to the Group Project. Each group member may move a maximum of 20 Tokens from their Individual Project to the Group Project. Each Token not contributed to the Group Project will automatically remain in their Individual Project. Your total earnings from the round include earnings from both your Individual Project and the Group Project.

All participants in your group will simultaneously face the same decision situation.

Your earnings from the Individual Project in each round

Each Token you leave in your Individual Project increases the value of your Individual Project by 1 Token. **Thus, you will earn one (1) Token for each Token remaining in your Individual Project.** No other member in your group will earn from your Individual Project.

Your earnings from the Group Project in each round

For each Token you **contribute to the Group Project, your earnings from the Group Project will increase** by 0.5 Tokens. Each of the other three people in your group will **also see an increase in earnings** of 0.5 Tokens. Your final earnings from the Group Project are based on the **total number** of Tokens **contributed to** the Group Project after all members in your group have made their decisions. Each member's earnings will increase equally from the amount contributed to the Group Project. For each Token contributed to the Group Project, each group member's earnings will increase by 0.5 Tokens regardless of who made the decision to contribute it. Therefore, **if you contribute one Token more to the Group Project, the earnings from the Group Project received by the whole group together increases by 2 Tokens.** It is also true that your earning increases by 0.5 Tokens if another group member contributes one Token more to the Group Project.

Your total earnings in each round

Your total earnings consist of earnings from your Individual Project *and* the earnings from the Group Project.

Your earnings from the round = Earnings from your Individual Project + Earnings from the Group Project

The following examples are for illustrative purposes only.

Example 1. Assume that you have contributed 0 Tokens to the Group Project. Suppose that each of the other group members has also contributed 0 Tokens to the Group Project. Thus, the total number of Tokens contributed to the Group Project in your group is 0. Your earnings from this round will be 20 Tokens (20 Tokens from your Individual Project and 0 Tokens from the Group Project). The earnings of the other group members in this round will be 20 Tokens each.

Example 2. Assume that you have contributed 10 Tokens to the Group Project. Suppose that each of the other group members has contributed 0 Tokens to the Group Project. Thus, the total number of Tokens contributed to the Group Project in your group is 10. Your earnings from this round will be 15 Tokens (= 10 Tokens from your Individual Project and $10 \times 0.5 = 5$ Tokens from the Group Project). The earnings of

the other group members from this round will be 25 Tokens each (= 20 Tokens from the Individual Project + $10 \times 0.5 = 5$ Tokens from the Group Project).

Example 3. Assume that you have contributed 20 Tokens to the Group Project. Suppose that each of the other group members has also contributed 20 Tokens to the Group Project. Thus, the total number of Tokens contributed to the Group Project in your group is 80. Your earnings from this round will be 40 Tokens (= 0 Tokens from your Individual Project and $80 \times 0.5 = 40$ Tokens from the Group Project). The earnings of the other group members in this round will similarly be 40 Tokens each.

Recall that, as mentioned above, for each Token you **contribute to the Group Project, your earnings from the Group Project will increase** by 0.5 Tokens. Each of the other three people in your group will **also see an increase in earnings** of 0.5 Tokens.

After all individuals have made their decisions in the round, you will be informed of the total contribution to the Group Project in your group, and your earnings from the round. You will also be informed of the individual contribution decisions of each group member, ranked from top to bottom. Individuals in your group will NOT be identified in anyway. Thus, information about individual contributions will be completely anonymous.

The same process will be repeated for a total of 20 rounds. Your earnings from earlier rounds cannot be used in the following rounds. You will begin each round with 20 Tokens placed in your initial Individual Project.

Questions to help you better understand the decision tasks

When everyone has finished reading the instructions, and before the experiment begins, we will ask you a few questions regarding the decisions you will make in the experiment. The questions will help you understand the calculation of your earnings and ensure that you have understood the instructions.

Please answer these questions on your computer terminal. Please type your answer in the box next to the corresponding question. Once everyone has answered all questions correctly we will begin the experiment.

A2. Give-Negative

Thank you for coming! This is an experiment about decision-making. You will receive £2 for your participation. If you follow the instructions carefully, you can earn more money depending both on your own decisions and on the decisions of others.

These instructions and your decisions in this experiment are solely your private information. During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

Your decisions will be recorded privately at your computer terminal. Your identity will never be disclosed to other participants. You will be paid individually and privately in cash at the end of the experiment.

During the experiment all decisions are made in Tokens (more details below). Your total earnings will also be calculated in Tokens and, at the end of the experiment will be converted to Pounds at the following rate:

$$\mathbf{60\ Tokens = \pounds 1}$$

The experiment consists of twenty (20) consecutive decision rounds.

At the beginning of the experiment, participants will be randomly divided into groups of four (4) individuals. The composition of the groups will remain the same in each round. This means that you will interact with the same people in your group throughout the experiment.

You are a member of a group of four participants. Each of you will have an Individual Project and your group of four will have a Group Project. At the beginning of each round, each group of four begins with 0 Tokens placed in their initial Group Project. Each Token in the Group Project is worth 2 Tokens to the group. Thus, each group begins with an initial Group Project worth 0 Tokens. Each person begins with 20 Tokens placed in his/her initial Individual Project.

The task of each group member is to decide how many Tokens, if any, they would like to move from their Individual Project and contribute to the Group Project. Each group member may move a maximum of 20 Tokens from their Individual Project to the Group Project. Each Token not contributed to the Group Project will automatically remain in their Individual Project. Your total earnings from the round include earnings from both your Individual Project and the Group Project.

All participants in your group will simultaneously face the same decision situation.

Your earnings from the Individual Project in each round

Each Token you leave in your Individual Project increases the value of your Individual Project by 1 Token. **Thus, you will earn one (1) Token for each Token left in your Individual Project.** No other member in your group will earn from your Individual Project.

Your earnings from the Group Project in each round

The maximum possible contribution to the Group Project in your group by all members is 80 Tokens. This would give you, and each other member of the group, maximum earnings from the Group Project of 40 Tokens. That is, for each of the 80 Tokens in the Group Project, each of you receives 0.5 tokens. For each Token you **do not contribute to the Group Project, your earnings from the Group Project will decrease** by 0.5 Tokens. Each of the other three people in your group will **also see a decrease in earnings** of 0.5 Tokens. Your final earnings from the Group Project are based on the **total number** of Tokens **not contributed to** the Group Project after all members in your group have made their decisions. Each member's earnings will decrease equally from the amount not contributed to the Group Project. For each Token not contributed to the Group Project, each group member's earnings will decrease by 0.5 Tokens regardless of who made the decision to not contribute it. Therefore, **if you contribute one Token less to the Group Project, the earnings from the Group Project received by the whole group together decreases by 2 Tokens.** It is also true that your earning decreases by 0.5 Tokens if another group member contributes one Token less to the Group Project.

Your total earnings in each round

Your total earnings consist of earnings from your Individual Project *and* the earnings from the Group Project.

Your earnings from the round = Earnings from your Individual Project + Earnings from the Group Project

The following examples are for illustrative purposes only.

Example 1. Assume that you have contributed 0 Tokens to the Group Project. Suppose that each of the other group members has also contributed 0 Tokens to the Group Project. Thus, the total number of Tokens not contributed to the Group Project in your group is 80. Your earnings from this round will be 20 Tokens (20 Tokens from your Individual Project and $[40 - (80 \times 0.5) = 40 - 40] = 0$ Tokens from the Group Project). The earnings of the other group members in this round will be 20 Tokens each.

Example 2. Assume that you have contributed 10 Tokens to the Group Project. Suppose that each of the other group members has contributed 0 Tokens to the Group Project. Thus, the total number of Tokens not

contributed to the Group Project in your group is 70. Your earnings from this round will be 15 Tokens (= 10 Tokens from your Individual Project and $[40 - (70 \times 0.5) = 40 - 35] = 5$ Tokens from the Group Project). The earnings of the other group members from this round will be 25 Tokens each (= 20 Tokens from the Individual Project + $[40 - (70 \times 0.5) = 40 - 35] = 5$ Tokens from the Group Project).

Example 3. Assume that you have contributed 20 Tokens to the Group Project. Suppose that each of the other group members has also contributed 20 Tokens to the Group Project. Thus, the total number of Tokens not contributed to the Group Project in your group is 0. Your earnings from this round will be 40 Tokens (= 0 Tokens from your Individual Project and $[40 - (0 \times 0.5)] = 40$ Tokens from the Group Project). The earnings of the other group members in this round will similarly be 40 Tokens each.

Recall that, as mentioned above, for each Token you **do not contribute to the Group Project, your earnings from the Group Project will decrease** by 0.5 Tokens. Each of the other three people in your group will **also see a decrease in earnings** of 0.5 Tokens.

After all individuals have made their decisions in the round, you will be informed of the total number of tokens not contributed to the Group Project, and your earnings from the round. You will also be informed of the individual contribution decisions of each group member, ranked from top to bottom. Individuals in your group will NOT be identified in anyway. Thus, information about individual contributions will be completely anonymous.

The same process will be repeated for a total of 20 rounds. Your earnings from earlier rounds cannot be used in the following rounds. You will begin each round with 20 Tokens placed in your initial Individual Project.

Questions to help you better understand the decision tasks

When everyone has finished reading the instructions, and before the experiment begins, we will ask you a few questions regarding the decisions you will make in the experiment. The questions will help you understand the calculation of your earnings and ensure that you have understood the instructions.

Please answer these questions on your computer terminal. Please type your answer in the box next to the corresponding question. Once everyone has answered all questions correctly, we will begin the experiment.

A3. Take-Positive

Thank you for coming! This is an experiment about decision-making. You will receive £2 for your participation. If you follow the instructions carefully, you can earn more money depending both on your own decisions and on the decisions of others.

These instructions and your decisions in this experiment are solely your private information. During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

Your decisions will be recorded privately at your computer terminal. Your identity will never be disclosed to other participants. You will be paid individually and privately in cash at the end of the experiment.

During the experiment all decisions are made in Tokens (more details below). Your total earnings will also be calculated in Tokens and, at the end of the experiment will be converted to Pounds at the following rate:

$$\mathbf{60\ Tokens = \pounds 1}$$

The experiment consists of twenty (20) consecutive decision rounds.

At the beginning of the experiment, participants will be randomly divided into groups of four (4) individuals. The composition of the groups will remain the same in each round. This means that you will interact with the same people in your group throughout the experiment.

You are a member of a group of four participants. Each of you will have an Individual Project and your group of four will have a Group Project. At the beginning of each round, each group of four begins with 80 Tokens placed in their initial Group Project. Each Token in the Group Project is worth 2 Tokens to the group. Thus, each group begins with an initial Group Project worth 160 Tokens. Each person begins with 0 Tokens placed in his/her initial Individual Project.

The task of each group member is to decide how many Tokens, if any, they would like to withdraw from the initial Group Project and move to their Individual Project. Each group member may move a maximum of 20 Tokens from the Group Project to their Individual Project. Each Token not withdrawn and moved to their Individual Project will automatically remain in the Group Project. Your total earnings from the round include earnings from both your Individual Project and the Group Project.

All participants in your group will simultaneously face the same decision situation.

Your earnings from the Individual Project in each round

Each Token you withdraw from the Group Project and move to your Individual Project increases the value of your Individual Project by 1 Token. **Thus, you will earn one (1) Token for each Token moved to your Individual Project.** No other member in your group will earn from your Individual Project.

Your earnings from the Group Project in each round

For each Token you **do not withdraw from the Group Project, your earnings from the Group Project will increase** by 0.5 Tokens. Each of the other three people in your group will **also see an increase in earnings** of 0.5 Tokens. Your final earnings from the Group Project are based on the **total number** of Tokens **not withdrawn from** the Group Project after all members in your group have made their decisions. Each member's earnings will increase equally from the amount not withdrawn from the Group Project. For each Token not withdrawn from the Group Project, each group member's earnings will increase by 0.5 Tokens regardless of who made the decision to not withdraw it. Therefore, **if you withdraw one Token less from the Group Project, the earnings from the Group Project received by the whole group together increases by 2 Tokens.** It is also true that your earning increases by 0.5 Tokens if another group member withdraws one Token less from the Group Project.

Your total earnings in each round

Your total earnings consist of earnings from your Individual Project *and* the earnings from the Group Project.

Your earnings in the round = Earnings from your Individual Project + Earnings from the Group Project

The following examples are for illustrative purposes only.

Example 1. Assume that you have withdrawn 20 Tokens from the Group Project to your Individual Project. Suppose that each of the other group members has also withdrawn 20 Tokens from the Group Project to their Individual Projects. Thus, the total number of Tokens not withdrawn from the Group Project in your group is 0. Your earnings from this round will be 20 Tokens (20 Tokens from your Individual Project and 0 Tokens from the Group Project). The earnings of the other group members in this round will be 20 Tokens each.

Example 2. Assume that you have withdrawn 10 Tokens from the Group Project to your Individual Project. Suppose that each of the other group members has withdrawn 20 Tokens from the Group Project to their Individual Projects. Thus, the total number of Tokens not withdrawn from the Group Project in your group is 10. Your earnings from this round will be 15 Tokens (= 10 Tokens from your Individual Project and 10

$\times 0.5 = 5$ Tokens from the Group Project). The earnings of the other group members from this round will be 25 Tokens each ($= 20$ Tokens from the Individual Project $+ 10 \times 0.5 = 5$ Tokens from the Group Project).

Example 3. Assume that you have withdrawn 0 Tokens from the Group Project to your Individual Project. Suppose that each of the other group members has also withdrawn 0 Tokens to their Individual Projects. Thus, the total number of Tokens not withdrawn from the Group Project in your group is 80. Your earnings from this round will be 40 Tokens ($= 0$ Tokens from your Individual Project and $80 \times 0.5 = 40$ Tokens from the Group Project). The earnings of the other group members in this round will similarly be 40 Tokens each.

Recall that, as mentioned above, for each Token you **do not withdraw from the Group Project, your earnings from the Group Project will increase** by 0.5 Tokens. Each of the other three people in your group will **also see an increase in earnings** of 0.5 Tokens.

After all individuals have made their decisions in the round, you will be informed of the total number of Tokens not withdrawn from the Group Project in your group, and your earnings from the round. You will also be informed of the individual withdrawal decisions of each group member, ranked from top to bottom. Individuals in your group will NOT be identified in anyway. Thus, information about individual withdrawals will be completely anonymous.

The same process will be repeated for a total of 20 rounds. Your earnings from earlier rounds cannot be used in the following rounds. Your group will begin each round with 80 Tokens placed in your initial Group Project.

Questions to help you better understand the decision tasks

When everyone has finished reading the instructions, and before the experiment begins, we will ask you a few questions regarding the decisions you will make in the experiment. The questions will help you understand the calculation of your earnings and ensure that you have understood the instructions.

Please answer these questions on your computer terminal. Please type your answer in the box next to the corresponding question. Once everyone has answered all questions correctly we will begin the experiment.

A4. Take-Negative

Thank you for coming! This is an experiment about decision-making. You will receive £2 for your participation. If you follow the instructions carefully, you can earn more money depending both on your own decisions and on the decisions of others.

These instructions and your decisions in this experiment are solely your private information. During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

Your decisions will be recorded privately at your computer terminal. Your identity will never be disclosed to other participants. You will be paid individually and privately in cash at the end of the experiment.

During the experiment all decisions are made in Tokens (more details below). Your total earnings will also be calculated in Tokens and, at the end of the experiment will be converted to Pounds at the following rate:

$$\mathbf{60\ Tokens = \pounds 1}$$

The experiment consists of twenty (20) consecutive decision rounds.

At the beginning of the experiment, participants will be randomly divided into groups of four (4) individuals. The composition of the groups will remain the same in each round. This means that you will interact with the same people in your group throughout the experiment.

You are a member of a group of four participants. Each of you will have an Individual Project and your group of four will have a Group Project. At the beginning of each round, each group of four begins with 80 Tokens placed in their initial Group Project. Each Token in the Group Project is worth 2 Tokens to the group. Thus, each group begins with an initial Group Project worth 160 Tokens. Each person begins with 0 Tokens placed in his/her initial Individual Project.

The task of each group member is to decide how many Tokens, if any, they would like to withdraw from the initial Group Project and move to their Individual Project. Each group member may move a maximum of 20 Tokens from the Group Project to their Individual Project. Each Token not withdrawn and moved to their Individual Project will automatically remain in the Group Project. Your total earnings from the round include earnings from both your Individual Project and the Group Project.

All participants in your group will simultaneously face the same decision situation.

Your earnings from the Individual Project in each round

Each Token you withdraw from the Group Project and move to your Individual Project increases the value of your Individual Project by 1 Token. **Thus, you will earn one (1) Token for each Token moved to your Individual Project.** No other member in your group will earn from your Individual Project.

Your earnings from the Group Project in each round

The 80 Tokens initially placed in the Group Project would give you, and each other member of the group, initial earnings from the Group Project of 40 Tokens. That is, for each of the 80 Tokens in the Group Project, each of you receives 0.5 tokens. For each Token you **withdraw from the Group Project, your earnings from the Group Project will decrease by 0.5 Tokens.** Each of the other three people in your group will **also see a decrease in earnings** of 0.5 Tokens. Your final earnings from the Group Project are based on the **total number** of Tokens **withdrawn from** the Group Project after all members in your group have made their decisions. Each member's earnings will decrease equally from the amount withdrawn from the Group Project. For each Token withdrawn from the Group Project, each group member's earnings will decrease by 0.5 Tokens regardless of who made the decision to withdraw it. Therefore, **if you withdraw one Token more from the Group Project, the earnings from the Group Project received by the whole group together decreases by 2 Tokens.** It is also true that your earning decreases by 0.5 Tokens if another group member withdraws one Token more from the Group Project.

Your total earnings in each round

Your total earnings consist of earnings from your Individual Project *and* the earnings from the Group Project.

Your earnings in the round = Earnings from your Individual Project + Earnings from the Group Project

The following examples are for illustrative purposes only.

Example 1. Assume that you have withdrawn 20 Tokens from the Group Project to your Individual Project. Suppose that each of the other group members has also withdrawn 20 Tokens from the Group Project to their Individual Projects. Thus, the total number of tokens withdrawn from the Group Project is 80. Your earnings from this round will be 20 Tokens (20 Tokens from your Individual Project and $[40 - (80 \times 0.5) = 40 - 40] = 0$ Tokens from the Group Project). The earnings of the other group members in this round will be 20 Tokens each.

Example 2. Assume that you have withdrawn 10 Tokens from the Group Project to your Individual Project. Suppose that each of the other group members has withdrawn 20 Tokens from the Group Project to their

Individual Projects. Thus, the total number of Tokens withdrawn from the Group Project is 70. Your earnings from this round will be 15 Tokens ($= 10$ Tokens from your Individual Project and $[40 - (70 \times 0.5) = 40 - 35] = 5$ Tokens from the Group Project). The earnings of the other group members from this round will be 25 Tokens each ($= 20$ Tokens from the Individual Project $[40 - (70 \times 0.5) = 40 - 35] = 5$ Tokens from the Group Project).

Example 3. Assume that you have withdrawn 0 Tokens from the Group Project to your Individual Project. Suppose that each of the other group members has also withdrawn 0 Tokens to their Individual Projects. Thus, the total number of Tokens withdrawn from the Group Project is 0. Your earnings from this round will be 40 Tokens ($= 0$ Tokens from your Individual Project and $[40 - (0 \times 0.5)] = 40$ Tokens from the Group Project). The earnings of the other group members in this round will similarly be 40 Tokens each.

Recall that, as mentioned above, for each Token you **withdraw from the Group Project, your earnings from the Group Project will decrease by 0.5 Tokens**. Each of the other three people in your group will **also see a decrease in earnings** of 0.5 Tokens.

After all individuals have made their decisions in the round, you will be informed of the total number of Tokens withdrawn from the Group Project in your group, and your earnings from the round. You will also be informed of the individual withdrawal decisions of each group member, ranked from top to bottom. Individuals in your group will NOT be identified in anyway. Thus, information about individual withdrawals will be completely anonymous.

The same process will be repeated for a total of 20 rounds. Your earnings from earlier rounds cannot be used in the following rounds. Your group will begin each round with 80 Tokens placed in your initial Group Project.

Questions to help you better understand the decision tasks

When everyone has finished reading the instructions, and before the experiment begins, we will ask you a few questions regarding the decisions you will make in the experiment. The questions will help you understand the calculation of your earnings and ensure that you have understood the instructions.

Please answer these questions on your computer terminal. Please type your answer in the box next to the corresponding question. Once everyone has answered all questions correctly we will begin the experiment.

Appendix B. Additional Analysis

B1. Regressions on group contributions

Figure 1 in the main text shows that there are time trends in group contributions. In particular, group contributions decline over time. To account for these, we estimate two panel random effects of group contributions. The dependent variable in each regression is a group's contribution in a round. The regressors in the first regression are treatment dummies (excluded category is *Give-Positive*) and round dummies. The second regression includes lagged group contributions as an additional regressor. We report robust standard errors clustered on independent groups. Table B1 presents the regression estimates.

Table B1. Group level regressions of contributions

	(1)	(2)
<i>Give-Negative</i> dummy	7.260 (6.086)	1.376 (1.553)
<i>Take-Positive</i> dummy	-2.311 (5.669)	-1.867 (1.454)
<i>Take-Negative</i> dummy	-3.336 (6.458)	-1.978 (1.681)
Lagged group contribution	-	0.751*** (0.038)
Constant	48.55*** (4.531)	8.742*** (3.233)
Observations	940	893

*, **, *** - significant at 10%, 5%, and 1% respectively. Dep. variable: Group contribution in a round. Std. errors clustered on independent groups in parentheses. Includes round dummies (not reported). Excluded treatment is *Give-Positive*.

Post-regression Wald tests after regression (1) show that, as with the ranksum test, the estimate of the *Give-Negative* dummy is only marginally significantly different from the *Take-Negative* dummy ($p = 0.0822$). The p-value after the second regression is 0.0418, i.e., the difference is marginally significant at the 5% level. Further, even this marginal significance is achieved only after controlling for past behaviour. The regressions thus provide support for the conclusion on group contributions stated in the text, i.e., that group contributions in *Give-Negative* are only marginally significantly different from those in *Take-Negative*.

B2. Individual regressions on free-riding behaviour

Rather than aggregate data at the group level, we use individual decisions in each round to examine differences in complete free-riding (zero contributions) across treatment. We estimate probit and logit regressions where the dependent variable is 1 if the individual contributes zero in a round, and is 0 otherwise. The independent variables are a dummy for zero contribution in the previous round, the individual's one-period lagged deviation of his/her contribution from the average contribution of the others in the group, treatment dummies (excluded treatment: Give-Positive), a gender dummy (= 1 if female and = 0 otherwise) and round dummies (not reported for brevity). We estimate separate regressions for when individuals were below-average contributors in the previous round (negative lagged deviations) and when they were (weakly) above-average contributors. The estimates are presented in Table B2.

Table B2. Individual regressions – complete free riding

	Probit		Logit	
	Lagged Negative deviations	Lagged Non-neg deviations	Lagged Negative deviations	Lagged Non-neg deviations
Dummy for free rider in previous round	1.244*** (0.153)	1.859*** (0.206)	2.086*** (0.271)	3.099*** (0.362)
Lagged absolute deviation	-0.030*** (0.010)	0.049*** (0.009)	-0.051*** (0.018)	0.082*** (0.016)
<i>Give-Negative</i>	-0.045 (0.178)	-0.186 (0.219)	-0.093 (0.306)	-0.309 (0.378)
<i>Take-Positive</i>	0.632*** (0.172)	0.137 (0.204)	1.047*** (0.291)	0.232 (0.344)
<i>Take-Negative</i>	0.403** (0.173)	0.298 (0.226)	0.649** (0.297)	0.518 (0.376)
Female dummy	-0.213** (0.099)	0.028 (0.117)	-0.367** (0.167)	0.065 (0.203)
Constant	-0.978*** (0.255)	-1.273*** (0.257)	-1.583*** (0.424)	-2.102*** (0.439)
Observations	1712	1860	1712	1860

*, **, *** - significant at 10%, 5%, and 1% respectively. Dep. Variable = 1 if individual contribution in the round is zero Tokens, and = 0 otherwise. Std. errors clustered on independent groups in parentheses. Includes round dummies (not reported).

Both probit and logit regressions show that, for below-average contributors, the likelihood of complete free-riding is significantly higher in both Take treatments than in Give-Positive. Post-regression tests show that this is also the case relative to Give-Negative ($p < 0.00001$ and $p = 0.0019$ for the probit regression, and $p < 0.00001$ and $p = 0.0026$ for the logit regression). There are no significant differences in the likelihood of complete free-riding within the Give treatments or within the Take treatments.