# Supplementary Materials for the Paper:

# Public Goods Provision and Sanctioning

# in Privileged Groups

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**Abstract**

This document contains supplementary materials for the paper Public Goods Provision and Sanctioning in Privileged Groups. It is organized in the following way: Section 1 contains the experimental procedures, Section 2 the instructions given to subjects, Section 3 presents descriptive statistics for each treatment, and in Section 4 a brief description of the accompanying datasets. In addition to this document, we provide the software program used to run the experiment and the data required to replicate the paper's results.

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# 1 Experimental Procedures

The computerized experiment was conducted at the CREED laboratory of the University of Amsterdam. The experiment was programmed with z-Tree (Fischbacher, 2007). In total 81 subjects participated in the experiment. 21 (18) participated in the baseline treatment without (with) punishment and 24 (18) in the privileged group treatment without (with) punishment. This generated between 6 and 8 independent observations per treatment. Each treatment was run in a separate session. About half of the subjects were female and also around half were students of economics (the other half came from various fields such as biology, engineering, political science, and law). A typical experimental session took one hour. On average, subjects were paid out €13.76 (approx. US$17.50).

After arrival in the lab's reception room, each subject drew a card to be randomly assigned to a seat in the laboratory. Once everyone was seated, the instructions for the experiment were read aloud (a translation of the instructions is provided below). In the privileged treatments (with and without punishment), subjects were informed in the instructions whether they would be a high-benefit subject or a low-benefit subject. Thereafter, subjects had to answer a few exercises in order to check their understanding of the game. Next, the subjects played the repeated pubic goods game with or without punishment via the computer. Once the game ended subjects answered a debriefing questionnaire after which they were paid in private and dismissed.

# 2 Experimental Instructions

These are the instructions given to high-benefit subjects in the privileged treatment. The instructions given to low-benefit subjects and to subjects in the baseline treatment are available upon request.

**Introduction**

This experiment is divided into different periods. There will be 10 periods in total. During all 10 periods, the participants are divided into groups of three. Therefore, you will be in a group with 2 other participants. The composition of the groups will remain the same during all of the experiment.

Each period consists of two stages. In the first stage, you have to decide how many tokens you contribute to a group project. In the second stage, you will learn how much the other members of your group contributed to the project.

**The first stage**

At the beginning of each period each participant in your group receives 20 tokens. We will refer to these tokens as the initial endowment.

In the first stage you decide how to use your initial endowment. You have to choose how many tokens you want to contribute to a group project and how many of them to keep for yourself. You can contribute any amount of your initial endowment to the group project. How many tokens you contribute is up to you. Each other group member will also make such a decision. All decisions are made simultaneously. That is, nobody will be informed about the decision of the other group members before everyone made his or her decision.

**Earnings in the first stage**

Your earnings in tokens, in each period, are the sum of two parts:

- The number of tokens that you kept for yourself.

- Your income from the group project. This income equals:

  [multiplication factor] × sum of contributions of all group members to the project

The projects' multiplication factor is determined as follows: in each group, *one of the group members will have a multiplication factor of 1.5* and the other *two group members will have a*

*multiplication factor of 0.5.* Before the experiment started each desk was assigned a multiplication factor equal to either 0.5 or 1.5. Therefore, by randomly assigning the yellow cards, each participant was randomly assigned to one of these values. The multiplication factor will be the same for all the 10 periods. *You will be the group member who has a multiplication factor of 1.5.*

Notice that, for each token which you keep for yourself you earn 1 token. If instead you contribute this token to the group project, then the total contribution to the project will rise by one token. Your income from the group project will rise by 1.5 tokens. Moreover, the other group members' income from the project will rise by 0.5 tokens. Your contribution to the group project therefore also raises the income of the other group members. For each token contributed to the project the total earnings of the group will rise by 2.5 tokens. Note that, you also earn tokens for each token contributed to the group project by the other group members. For each token contributed by any member you earn 1.5 tokens.

In summary, your earnings in tokens at the first stage of a period are equal to:

$$20 - \text{your contribution} + \text{your multiplication factor} \times (\text{sum of contributions})$$

After everyone has made his or her decision the first stage ends.

**Example for the first stage**

Here is an example that illustrates how the earnings in tokens are calculated in the first stage of each period. The numbers used in the example are arbitrarily chosen.

You are in a group with two other participants (group member 1 and group member 2). Each participant's multiplication factor equals: you = 1.5, group member 1 = 0.5, group member 2 = 0.5. Suppose that, you contribute 15 tokens to the group project, group member 1 contributes 5 tokens to the group project, and group member 2 contributes 10 tokens to the group project. The earnings in tokens of each of the participants are given by:

$$20 - \text{tokens contributed} + \text{multiplication factor} \times \text{sum of all contributions}$$

In your case this equals: $20 - 15 + 1.5 \times (15 + 5 + 10) = 50$ tokens.

For group member 1 this equals: $20 - 5 + 0.5 \times (15 + 5 + 10) = 30$ tokens.

For group member 2 this equals: $20 - 10 + 0.5 \times (15 + 5 + 10) = 25$ tokens.

**The second stage**

At the beginning of the second stage, everyone in the group will see how much each of the other group members contributed to the project as well as their earnings from the first stage. The decision each group member has to make in the second stage is to either reduce or leave equal

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the earnings of each other group member. Reducing other group members' earnings can be done by spending tokens. The other group members can also reduce your earnings if they wish to. All decisions are made simultaneously. That is, nobody will be informed about the decision of the other group members before everyone made his or her decision.

More concisely, in this stage, you must decide whether and if yes how many tokens you want to spend to reduce the earnings of the other two group members. If you want to reduce another member's earnings, you do that by allocating deduction points. For each deduction point that you allocate to another group member his or her earnings are reduced by 3 tokens and your own earnings are reduced by 1 token. If you do not wish to change the earnings of another group member then you must allocate 0 deduction points to him or her. Note, that you will not be allowed to reduce the earnings of a group member to less than zero.

Remember that, for every deduction point you receive from other group members, your earnings will be reduced by 3 tokens (but never below zero). Every participant can spend up to a maximum of 10 tokens (i.e. allocate 10 deduction points) on each group member in each period.

After everyone has made a decision, you will be informed how many deduction points you received from the other group members and also what your total earnings in tokens for that period are. Note that you do not get to know how individual group members spend their deduction points. In other words, you will only be informed of the total amount of deduction points allocated to you by the other two group members. You will not know how many deduction points each individual group member allocated to you.

**Examples for the second stage**
Here are some arbitrarily chosen examples that illustrate how your final earnings are calculated. You, group member 1 and group member 2 are all members of the same group.

*Example 1*: Suppose that after the first stage you have earnings that are equal to 30 tokens. In the second stage you decide to allocate 3 deduction points to group member 1 (this reduces group member 1's earnings by 9 tokens) and 0 deduction points to group member 2 (this does not change group member 2's earnings). After all have made their decision, you learn that the others allocated you a total of 4 deduction points. In this case, your total earnings in tokens in this period are given by:

$$\text{(Your first stage earnings - 3} \times \text{deduction points allocated to you)*}$$
$$\text{- deduction points you allocated}$$

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\* If the number between brackets is negative then replace it with zero.

In this example, your earnings are equal to: $(30 - 3 \times 4) - 3 = 18 - 3 = 15$ tokens.

*Example 2*: Suppose that after the first stage you have earnings that are equal to 18 tokens. In the second stage you decide to allocate 4 deduction points to group member 1 (this reduces group member 1's earnings by 12 tokens) and 6 deduction points to group member 2 (this reduces group member 2's earnings by 18 tokens). After all have made their decision, you learn that the others allocated you a total of 8 deduction points.

In this case, your earnings are equal to: $(18 - 3 \times 8) - 10 = 0 - 10 = -10$ tokens.

Note that $18 - 3 \times 8 = -6$, since this is a negative number it is replaced by zero.

**Negative earnings**

It is, in principle, possible that you make negative earnings in a period. However, you can always avoid this by not spending any tokens in the second stage (that is, by not allocating any deduction points to the other members). Hence, you can always avoid negative earnings with certainty through your own choices.

**Summary**

In summary, your earnings in tokens in each period are equal to:

(Your initial endowment - your contribution to the project

+ 0.5 × (sum of contributions)

- 3 × total deduction points received from others)\*

- amount of deductions points you allocated to others

\* If your earnings up to this point are negative then replace them with zero

# 3   Descriptive Statistics

Table 1 summarizes the average amount contributed to the public good per period. Table 2 summarizes the average amount contributed to the public good per period by low-benefit an high-benefit subjects in privileged groups.

Table 1: Mean contributions by group type and treatment

| Period \ Group | Baseline Treatment | | | | Punishment Treatment | | | |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| | Normal | | Privileged | | Normal | | Privileged | |
| 1 | 10.67 | (7.79) | 11.96 | (6.99) | 12.83 | (5.97) | 10.44 | (7.15) |
| 2 | 9.05 | (7.24) | 11.67 | (7.25) | 13.94 | (6.22) | 12.89 | (7.11) |
| 3 | 5.14 | (5.33) | 9.25 | (7.61) | 15.94 | (4.92) | 10.67 | (8.10) |
| 4 | 3.10 | (3.60) | 7.92 | (7.61) | 15.39 | (6.02) | 10.89 | (7.27) |
| 5 | 3.00 | (3.48) | 8.46 | (8.16) | 17.28 | (3.46) | 13.17 | (7.69) |
| 6 | 2.52 | (3.70) | 8.46 | (7.68) | 17.50 | (3.49) | 14.06 | (7.91) |
| 7 | 2.71 | (4.01) | 6.88 | (7.64) | 15.83 | (6.61) | 14.11 | (7.03) |
| 8 | 2.67 | (3.32) | 8.25 | (8.52) | 16.83 | (4.58) | 11.94 | (8.56) |
| 9 | 2.24 | (3.19) | 7.13 | (8.82) | 16.83 | (4.97) | 12.28 | (8.78) |
| 10 | 1.00 | (2.47) | 6.79 | (9.56) | 14.89 | (6.91) | 13.11 | (8.85) |
| Total | 4.21 | (5.52) | 8.68 | (8.05) | 15.73 | (5.49) | 12.36 | (7.78) |

*Note:* Numbers between brackets are standard deviations.

Table 2: Mean contributions in privileged groups by subject type and treatment

| Period \ Treatment | Low-benefit Subjects | | | | High-benefit Subjects | | | |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| | Baseline | | Punishment | | Baseline | | Punishment | |
| 1 | 8.63 | (5.80) | 6.50 | (4.83) | 18.63 | (3.5) | 18.33 | (3.20) |
| 2 | 8.13 | (5.88) | 10.08 | (6.80) | 18.75 | (3.54) | 18.50 | (3.67) |
| 3 | 5.63 | (4.72) | 8.50 | (7.35) | 16.50 | (7.23) | 15.00 | (8.37) |
| 4 | 4.38 | (4.32) | 7.83 | (6.41) | 15.00 | (8.02) | 17.00 | (4.69) |
| 5 | 3.75 | (4.71) | 9.83 | (7.42) | 17.88 | (4.36) | 19.83 | (0.41) |
| 6 | 4.88 | (4.95) | 11.17 | (8.33) | 15.63 | (7.29) | 19.83 | (0.41) |
| 7 | 3.56 | (3.74) | 11.25 | (7.03) | 13.50 | (9.30) | 19.83 | (0.41) |
| 8 | 4.56 | (6.03) | 8.33 | (8.29) | 15.63 | (8.21) | 19.17 | (2.04) |
| 9 | 1.31 | (2.33) | 10.00 | (8.64) | 18.75 | (3.54) | 16.83 | (7.76) |
| 10 | 0.19 | (0.75) | 9.67 | (9.07) | 20.00 | (-) | 20.00 | (-) |
| Total | 4.50 | (5.12) | 9.32 | (7.36) | 17.02 | (6.13) | 18.43 | (4.23) |

*Note:* Numbers between brackets are standard deviations.

# 4    Datasets Description

This document is accompanied by two datasets. The first dataset consists one record for each subject and each period. It includes the data of all treatments. The second dataset contains two records per subject and period. It contains data only from the punishment treatments. With the first dataset most of the papers results can be replicated. It has the following data: contribution decisions, profits, and total punishment received and given. The second dataset can be used to replicate the results related to individual punishment decisions. Each of the two records per subject and period correspond to the subject's decision to punish each of the two other members of his/her group. Datasets are provided in CSV and STATA formats (the STATA files include variable descriptions). Below is the list of included variables and a brief description of each.

**First Dataset**

treatment: Treatment (0=baseline, 1=punishment)
grouptype: Type of group (0=normal, 1=privileged)
subject: Subject ID
group: Group ID
MPCR: Subject's marginal per capita return
period: Period number
periodlast: Dummy variable for last period
high: Dummy variable for high-benefit subject
cont: Subject's contribution to the public good
changecont: Difference in contribution to the public good between next and current period
contgroup: Sum of group's contribution to the public good
contothers: Sum of other group members' contribution to the public good
contmedian: Contribution to the public good by the group's median contributor
Dcontmedian: Difference in contributions between own and the median contribution
Dconthigh: Difference in contributions between own and the high-benefit subject
Dcontlow: Difference in contributions between own and the other low-benefit subject
pungiven: Sum of tokens spent on punishment
punreceive: Sum of tokens lost for receiving punishment
punreceive_d: Dummy variable indicating whether the subject received positive punishment
profit: Subject's earnings

**Second Dataset**

grouptype: Type of group (0=normal, 1=privileged)

subject: Subject ID

group: Group ID

MPCR: Subject's marginal per capita return

period: Period number

periodlast: Dummy variable for last period

high: Dummy variable for high-benefit subject

highj: Dummy variable indicating whether target subject is a high-benefit subject

cont: Subject's contribution to the public good

contj: Target subject's contribution to the public good

contk: Contribution to the public good by the third subject in the group

contgroup: Sum of group's contribution to the public good

contgroup_d: Dummy variable idicating whether everyone in the group contributed fully

pungiven: Punishment points assigned to target subject

pungivenk: Punishment points assigned to third subject in the group

punreceive: Sum of tokens lost for receiving punishment

profit: Subject's earnings

# References

Fischbacher, U. (2007). z-tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, 10:171–178.