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28 February 2014

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MPRA Paper No. 54031, posted 03 Mar 2014 01:14 UTC

Conditional Punishment

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Abstract: We elicit human conditional punishment types by conducting experiments. We find that their punishment decisions to an individual are on average significantly positively proportional to other members' punishment decisions to that individual.

Keywords: cooperation, punishment, experiments

JEL codes: C91, C92, D70, H41

1. Introduction

Cooperation problems are one of the most common and important features of our modern society. During the recent few decades, economists have devoted their efforts to understanding people's cooperation behavior in dilemma situations; and have found that peer-to-peer punishment opportunities can be effective in promoting cooperation under some conditions (e.g., Fehr and Gächter 2000, Nikiforakis and Normann 2008). They have also demonstrated that neither people's cooperation decisions nor punishment decisions are homogeneous. It is now known that there are multiple human types with regards to cooperation and punishment. Regarding cooperative types, it has been known that some people have preferences for cooperation in dilemmas. Moreover, many researchers have proposed that there exist some people that conditionally cooperate dependent upon decisions of others (e.g., Fischbacher *et al.* 2001, Kurzban and Houser 2005). As for punishment types, there are plenty of studies finding various unconditional punishing behaviors. For instance, anti-social punishers impose a fine on cooperators (e.g., Cinyabuguma *et al.* 2006, Hermann *et al.* 2008). However, surprisingly little

attention has been paid to how people's punishment decisions may depend on punishment decisions of others.

Studying people's conditional punishment behaviors is important especially for the following three reasons. First, understanding a person's punishment decisions in relation to others' contributes to an advancement in the economic theory as it gives us more micro-level data regarding people's punishment behaviors. Second, if multiple types of punishers are present, then, incorporating the task of eliciting the punisher types in experiments, likewise cooperative types elicited in other past studies, would allow us to interpret subjects' decisions more easily and precisely (e.g., by studying the relation between conditional punishment types and their institutional choices). Third, providing evidence on the prevalence of heterogeneous conditional punishment types would stimulate both theoretical and experimental research on the roles of conditional punishment types in the evolution of cooperation norms. For instance, Szolnoki and Perc (2013) theoretically show that what they call conditional punishers – those who impose a fine with a strength proportional to the number of punishers in their own groups – can play an important role in promoting cooperation.¹

This paper elicits people's conditional punishment types by conducting experiments using a strategy method. We find that subjects on average punish a non-cooperator at a strength positively proportional to the punishment by other members. We find, however, that subjects' individual conditional punishment decisions are heterogeneous and that around half of the subjects do not punish a person, no matter how many punishment points other members assign to that person. We call this punishment type the free-rider.

The rest of the paper proceeds as follows: Section 2 describes our experimental design. Section 3 reports results, and Section 4 concludes.

2. Experimental Design

The basic game frame we use in the experiment is voluntary contribution mechanism. Each subject is randomly assigned to a group of four, is given an endowment of 10 points, and decides whether they allocate the 10 points to either their private account or public account.

¹ See also Boyd *et al.* (2010).

When a subject allocates it to her private account, she will obtain 10 points as her payoff. By contrast, when the subject allocates it to her group's public account, all group members, including her, obtain 5 points each as their payoffs. In other words, the MPCR (Marginal Per-Capita Return) is 0.5. We call those who allocate their endowment to their public (private) account the cooperators (non-cooperators) in this paper.

Once all subjects make their allocation decisions, they subsequently make conditional punishment decisions. Each subject can assign up to four punishment points to each member. The punishment points must be integer. For each punishment point he assigns to a member, he loses one point from his payoff, and the punished loses three points from her payoff. In the conditional punishment stage, each subject makes 18 ($= 2 \times 9$) decisions, contingent on whether the target is a cooperator or a non-cooperator (2 possibilities), and also on how many punishment points on average the other two members in his group assign to the target ($= \{0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0\}$), of which there are nine possibilities. We refer to this list of 18 punishment decisions as the "conditional punishment schedule." Once all subjects complete their conditional punishment schedules, they move on to the unconditional punishment stage. In this stage, they are informed of the allocation decisions made by the three other members in their groups and then make unconditional punishment decisions to each member. The conditional punishment decision is incentive-compatible as follows: once everyone makes their unconditional punishment decisions, one schedule out of the four in each group is randomly selected to be used as the conditional punishment schedule.² The Instructions are available online as a supplementary content.

Standard theory predictions are straightforward: all allocate their endowments to their private accounts, and no one penalizes others. However, social preference models such as Fehr and Schmidt (1999) predict that some allocate their endowments to the public account, and some punish non-cooperators. Assuming cooperator j is only concerned about the income inequality with non-cooperator i , the income inequality-averse model predicts more punishment from j to i when the other two members punish i less, because otherwise the income inequality between i and j would be large (See Appendix Table B.1).

² This procedure is often used in similar studies including Fischbacher *et al.*

3. Results

We conducted experiments at University of Michigan in February 2014. All experiments were neutrally framed. 52 undergraduate students participated in the experiments. No subject participated in more than one session. The experiments lasted around 45 minutes on average. The average per-subject payment (including a participation fee of \$5) was \$17.35.

Fig.1 reports the total average conditional punishment schedule in our experiment.³ The total average conditional punishment decisions to a non-cooperator are significantly increasing in the amount of the other members' average punishment to the non-cooperator. This pattern cannot be rationalized if we assume that a decision-maker is only concerned about the income inequality between her and the punished (See predictions based on inequality-averse models in Section 2). This instead suggests that (a) she does not care how small a payoff the non-cooperator obtains but (b) she does care about the income inequality between her and other punishers.

Moreover, intriguingly, we find that the total average conditional punishment decisions to a cooperator are also significantly increasing in the others' punishment toward the cooperator, although the strength of punishment is significantly less than that to a non-cooperator. This pattern cannot be explained by reciprocity or income inequality models since the cooperator behaves nicely to his group members and his payoff cannot be any higher than theirs. This pattern can be, however, explained by Levine (1998) which assumes some individuals have spiteful preferences.

Result 1: The total average conditional punishment decisions are positively proportional to the other members' punishment decisions, whether the target of punishment is a cooperator or non-cooperator.

Fig.1 also shows the average conditional punishment schedules for each of cooperators and non-cooperators. The total average punishment schedules of both cooperative types resemble the one of all subjects, but the strength of punishment differs by cooperative type. We find that

³ See Appendix Table B.2(1) for regression results.

on average non-cooperators conditionally punish both cooperative types at a statistically similar strength, whereas cooperators conditionally punish a non-cooperator more strongly.⁴

Result 2: Non-cooperators on average conditionally punish both cooperative types at a statistically similar strength, but cooperators on average conditionally assign significantly larger punishment points to a non-cooperator than to a cooperator.

A closer look at our data reveals that individuals' conditional punishment schedules are heterogeneous. Appendix Fig. B.1 shows individual punishment schedules. The majority of subjects, around 53.8% of them, are free-rider types. This is not surprising because punishment activities fall under a second-order free-riding problem.

The second largest type, which accounts for around 23.1% of the subjects, is the conditional punisher. We define that a subject is a conditional punisher if the Spearman's ρ between his conditional punishment points to a non-cooperator and the remaining others' average punishment points to the non-cooperator is significant at the 5% level. These conditional punishers can be further classified into the "pro-social conditional punishers" (15.4% of the subjects) and the "anti-social conditional punishers" (7.7% of them). The pro-social conditional punishers punish a non-cooperator at a strength positively proportional to the other members' punishment toward the non-cooperator, but do not conditionally punish a cooperator. The anti-social conditional punishers punish non-cooperators in the same manner as the pro-social conditional punishers do, and they also conditionally punish cooperators in some way unlike pro-social conditional punishers.

We also find that four cooperators punish a non-cooperator with a strength significantly negatively proportional to others' punishment toward the non-cooperator. This suggests that some cooperators make their punishment decisions mainly considering the income inequality between themselves and the target.

Result 3: Individual conditional punishment schedules are heterogeneous. 53.8% of subjects are free-riders. The second largest category is the conditional punisher (23.1% of subjects). 66.7%

⁴ See Appendix Table B.2(2).

of the conditional punishers do not conditionally punish cooperators, but 33.3% of them conditionally punish them as well.

4. Conclusion

This paper provides the first classification results regarding people's conditional punishment types. Our evidence has a significant potential in enriching many experimental research areas as people's decisions such as institutional choices might differ by conditional punishment type. In addition to the importance of our study outlined in Section 1, our result has a significant implication for why punishment opportunities can effectively enhance cooperation. Although free-riders are the largest population group, around 23% of the subjects are conditional punishers. The conditional punishers are willing to expend their money to punish a non-cooperator if others do so, and they do not care about how small a payoff the punished receives. The threat of being "severely" punished by coordinated conditional punishers might be an important factor of the observed success of punishing institutions in dilemma situations.

Acknowledgement: I thank Yan Chen for her hospitality in letting me conduct the experiments at University of Michigan.

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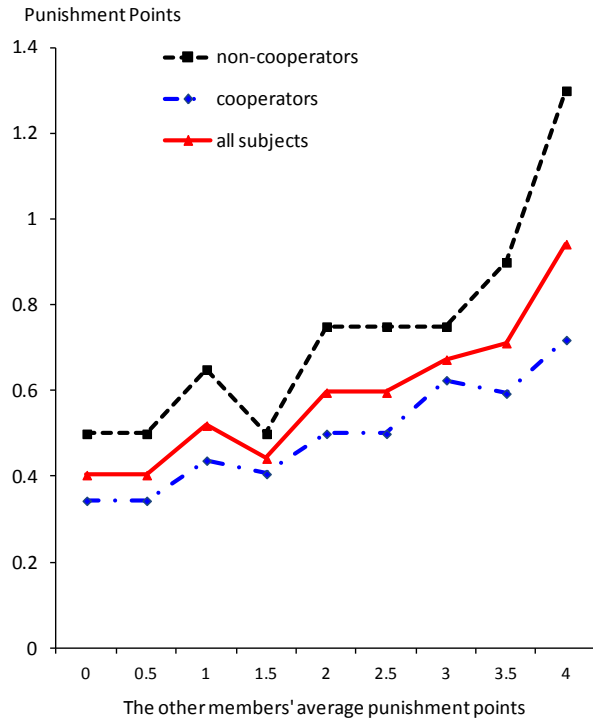
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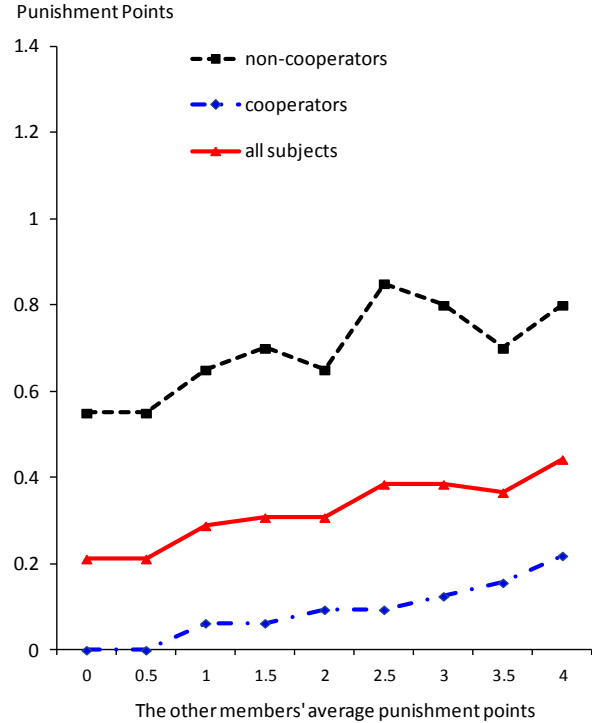
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Fig.1: Average Conditional Punishment Schedules



(a) Conditional Punishment Decisions to a Non-cooperator



(b) Conditional Punishment Decisions to a Cooperator

Table 1: Classification of Conditional Punishment Types

Conditional punishment type	All subjects	Cooperator	Non-cooperator
Free-rider	28 (53.8%)	17 (53.1%)	11 (55.0%)
Conditional punisher	12 (23.1%)	7 (21.9%)	5 (25.0%)
Pro-social conditional punisher	8	5	3
Anti-social conditional punisher	4	2	2
Other	12 (23.1%)	8 (25.0%)	4 (20.0%)
Other pro-social punisher	8	8	0
Other anti-social punisher	4	0	4
Total number of subjects	52	32	20

Notes: Numbers in parentheses are percentages of conditional punishment types in each column category.

Supplementary Online Appendix for Kamei, 2014,

“Conditional Punishment”

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Appendix A: Instructions

Instructions

You are now taking part in a decision-making experiment. Depending on your decisions and the decisions of other participants, you will be able to earn money in addition to the \$5 guaranteed for your participation. Please read the following instructions carefully.

During the experiment you are not allowed to communicate with other participants. If you have questions, raise your hand. One of us will come to answer your question.

During the experiment your earnings will be calculated in points. At the end of the experiment your points will be converted to U.S. dollars at the following rate:

1 point = \$1

(or each point will be exchanged for 1 dollar of real money). At the end of the experiment your total earnings (including the \$5 participation fee) will be paid out to you in cash.

The experiment consists of two phases.

In the experiment, participants are randomly divided into **groups of 4**. This means that you are in a group with 3 other participants. **You will be part of the same group throughout the entire experiment.** No one knows which other participants are in your group, and no one will be informed who was in which group after the experiment.

Phase 1

Each group member, yourself included, will be given an **endowment of 10 points**. In this phase, you and the other 3 group members simultaneously decide how to use the endowment. There are two possibilities:

- 1. You can allocate 10 points to a group account.**
- 2. You can allocate 10 points to a private account.**

Your earnings depend on the total number of points in the group account, and the number of points in your private account.

How to calculate your earnings:

Your earnings from your private account are equal to the number of points you allocated to the private account. That is, if you decide to allocate 10 points to the private account, **you get 10 points as your earnings**. The points you allocate to your private account do not affect the earnings of the other group members.

Your earnings from the group account equal the **sum** of points allocated to the group account by all 4 group members multiplied by 0.5. **When you allocate 10 points to the group account, you and all other group members each get 5 points as earnings**. For example, suppose that two members decide to allocate 10 points to the group account. Then, the sum of points in the group account is 20. The earnings of yours and each of the other group members from the group account are equal to 10 ($= 20 \times 0.5$) points.

In summary, your earnings are calculated with the following formula:

(a) When you allocate 10 points to the private account:

$$10 + 0.5 \times (\text{sum of points allocated by 3 other group members to the group account})$$

(b) When you allocate 10 points to the group account:

$$0 + 0.5 \times (10 + \text{sum of points allocated by 3 other group members to the group account})$$

Note that you get 10 points as earnings when you allocate your endowment to your private account. If you instead allocate 10 points to your group account, your earnings from your allocation is $0.5 \times 10 = 5$ points. However, by allocating 10 points to the group account, the earnings of the other 3 group members also increase by 5 points. Therefore, the total group earnings are $5 \times 4 = 20$ points. Note that you also obtain earnings from points allocated to the group account by other 3 members. You obtain $0.5 \times 10 = 5$ points if another member allocates 10 points to the group account.

Example:

Suppose that you and another member allocate 10 points to the group account, and the two other members of your group each allocate 10 points to the private account. In this case, the sum of the points in the group account is 20 points. You obtain 0 point from the private account, and $0.5 \times 20 = 10$ points from the group account. Therefore, your earnings are $0 + 10 = 10$ points. Another member that allocates 10 points to the group account also obtains 10 points as his or her earnings. The two members that allocate 10 points to the private account each get 10 points from the

private account, and $0.5 \times 20 = 10$ points from the group account; therefore their earnings are each $10 + 10 = 20$ points.

Please note that your earnings may be reduced after you make your allocation decision depending on the other members' decisions. We will explain the reduction procedure more in detail in the instruction of Phase 2.

If you have any questions so far, please raise your hand. When all questions are answered, we will move on to comprehension questions.

Comprehension questions

---Please answer the following questions. Raise your hand if you need help. A member of the experiment team will come to help you and will check your answers when you are done.

1. Suppose all four group members allocate 10 points to the private account.

a) How much do you earn? _____

b) How much do the other group members earn? _____

2. Suppose all four group members allocate 10 points to the group account.

a) How much do you earn? _____

b) How much do the other group members earn? _____

3. Suppose one group member allocate 10 points to the group account and two group members allocate 10 points to the private account. Answer the following:

a) How much do you earn if you allocate 10 points to the private account? _____

b) How much do you earn if you allocate 10 points to the group account? _____

Any questions?

Instructions for Phase 2:

In Phase 2, you will be shown the amount allocated to the group account by each of the other members in your group. In a box set at the right of the allocation information screen, you will be asked to enter an integer that you wish to use to reduce the earnings of the individual who made that allocation decision. Each point you allocate to reduce someone's earnings **reduces your own earnings by 1 point** and **reduces that individual's earnings by 3 points**. You can assign reduction points from {0, 1, 2, 3, 4}. These decisions are unconditional. Your own earnings can be reduced in the same way by the decisions of others in your group. You are free to leave any or all others' earnings unchanged by entering 0's in the relevant boxes.

An example of your screen:

The screenshot shows a web interface for Phase 2. At the top left, it says "Period 1 out of 1". Below this is a table with three columns: "Player", "Alloc. to group acct.", and "Points for reduction". The table has five rows: "You" with an allocation of 0; "Player 1" with an allocation of 10 and a blue input box for reduction points; "Player 2" with an allocation of 0 and a blue input box; and "Player 4" with an allocation of 10 and a blue input box. At the bottom left, there is a red warning message: "Remember that the earnings of other group members are reduced by 3 times the amounts you enter. To leave an individual's earnings unchanged, enter 0." At the bottom right, there is a "Submit" button.

Player	Alloc. to group acct.	Points for reduction
You	0	
Player 1	10	<input type="text"/>
Player 2	0	<input type="text"/>
Player 4	10	<input type="text"/>

Remember that the earnings of other group members are reduced by 3 times the amounts you enter. To leave an individual's earnings unchanged, enter 0.

Note: Numbers shown are for illustration only.

Your earnings are calculated as:

(i) Your earnings in Phase 1 minus reduction amounts due to your received reduction points

minus

(ii) The reduction points you assign to other members

Here, “the reduction amounts due to your received reduction points” are three times the total reduction points you received from the other three members. In case that your earnings become negative, you will only receive the participation fee of \$5 as your payment today.

There is another decision you are asked to make in this phase. Before you are informed of other members’ allocation decisions and make your reduction decisions for them, you will be asked to enter numbers, from {0, 1, 2, 3, 4}, into a form shown below. This form is called the “conditional reduction schedule.” In this form, you will conditionally indicate how many reduction points you would like to assign to a member, assuming that the two remaining members in your group on average assign the reduction amount shown to that member. For example, in the screen image below in the top-left box, you’ll enter the number of reduction points you would like to assign if two other members do not assign any reduction points to a member (not you) that allocated 10 points to his or her private account; in the bottom-right box, the number of reduction points you want to assign if the other two assign an average of 4 reduction points (thus, 8 points in total) to a member (not you) that allocated 10 points to the group account in the allocation stage.

An example of your screen:

Average assigned reduction points by two other members:	Reduction points you wish to assign if he/she allocated his/her endowment to the private account:	Reduction points you wish to assign if he/she allocated his/her endowment to the group account:
0	<input type="text"/>	<input type="text"/>
0.5	<input type="text"/>	<input type="text"/>
1.0	<input type="text"/>	<input type="text"/>
1.5	<input type="text"/>	<input type="text"/>
2.0	<input type="text"/>	<input type="text"/>
2.5	<input type="text"/>	<input type="text"/>
3.0	<input type="text"/>	<input type="text"/>
3.5	<input type="text"/>	<input type="text"/>
4.0	<input type="text"/>	<input type="text"/>

The reduction amounts you enter in this form will affect your earnings in the following way: at the onset of Phase 2, after you and the others in your group fill in this conditional reduction decision form and click the “Continue” button, you are informed of Phase 1 allocation decisions by other members. Then, all members make unconditional reduction decisions as mentioned above. After that, one out of the four members’ conditional reduction schedules is randomly

selected to be used. The three members' unconditional reduction decisions and the one member's conditional reduction decision will determine their earnings in the way already described.

For example, suppose that you (Subject 1) and Subject 2 allocate 10 points to the group account and that Subjects 3 and 4 in your group allocate 10 points to the private account. Suppose also that you are the group member who is randomly selected as the individual whose conditional reduction schedule is used. Suppose that Subjects 2 and 4 each assign reduction points of 0 point and 2 points, respectively, to Subject 3. Suppose that your conditional reduction schedule says that if other two assign on average reduction points of 1 point to a participant who allocates 10 points to the private account, you will assign 2 reduction points. Then, you shall assign 2 reduction points to Subject 3. As a result, 2 points will be deducted from your earnings, and 6 points ($= 2 \times 3$) will be deducted from the earnings of Subject 3. Together with the reduction points made by subjects 2 and 4 to Subject 3, 12 points will be deducted from the earnings of Subject 3. Your reduction decisions to Subjects 2 and 4 are determined in the same manner.

Comprehension Questions:

1. When you assign 1 reduction point to another member, how many points will be deducted from the member?

[]

2. How many individuals' conditional reduction schedules in a group are randomly selected to be used to determine their reduction decisions?

[]

Any questions? Once all questions are answered, we will move on to the experiment.

Appendix B: Additional Tables and Figures

Table B.1: The Conditional Punishment Decision of Cooperator j to Non-cooperator i , and the Difference in Payoffs between i and j

Others' average punishment points to non-cooperator i	0	.5	1	1.5	2	2.5	3	3.5	4
Punishment points from cooperator j to non-cooperator i									
0	-10	-7	-4	-1	2	5	$\min\{8, 5+5n\}$	$\min\{11, 5+5n\}$	$\min\{14, 5+5n\}$
1	-8	-5	-2	1	4	$\min\{7, 4+5n\}$	$\min\{10, 4+5n\}$	$\min\{13, 4+5n\}$	$4+5n$
2	-6	-3	0	3	$\min\{6, 3+5n\}$	$\min\{9, 3+5n\}$	$\min\{12, 3+5n\}$	$3+5n$	$3+5n$
3	-4	-1	2	$\min\{5, 2+5n\}$	$\min\{8, 2+5n\}$	$\min\{11, 2+5n\}$	$2+5n$	$2+5n$	$2+5n$
4	-2	1	$\min\{4, 1+5n\}$	$\min\{7, 1+5n\}$	$\min\{10, 1+5n\}$	$1+5n$	$1+5n$	$1+5n$	$1+5n$

Notes: Each number in table is the payoff of cooperator j minus that of non-cooperator i , assuming that j does not receive any punishment points from his or her group members. $\min\{a, b\} = a$ (b) if $a \leq b$ ($a > b$). If the number of cooperators except j is $n \in \{0, 1, 2\}$, then, the payoff of j before the punishment stages is $5+5n$ and that of i is $15+5n$. If i receives in total more than $\frac{15+5n}{3}$ punishment points, then, the payoff of i is 0, and the difference in payoffs between i and j becomes $5+5n-c$, where c is the punishment points from j to i .

Remark: The payoff of cooperator j is strictly higher than that of non-cooperator i even if j does not assign any punishment points to i , if the other two members on average assign more than 1.5 punishment points to i .

Table B.2: The Total Average Conditional Punishment Schedules for Each Target (a cooperator or a non-cooperator)

(1) The total average conditional punishment schedules

Independent Variable \ Dependent Variable	Subject j 's conditional punishment decisions to a target $\in \{0, 1, 2, 3, 4\}$			
	(1)	(2)	(3)	(4)
(a) $1_{\{\text{the target is a non-cooperator}\}}$	0.59*** (0.13)	-2.20** (0.88)	0.35** (0.14)	-3.12*** (1.05)
(b) $1_{\{\text{the target is a cooperator}\}}$	0.32*** (0.12)	-4.14*** (1.10)	0.21* (0.11)	-4.78*** (1.34)
(c) Other members' average punishment points to the target $\times 1_{\{\text{the target is a non-cooperator}\}}$	----	----	0.12** (.052)	0.46** (0.21)
(d) Other members' average punishment points to the target $\times 1_{\{\text{the target is a cooperator}\}}$	----	----	0.055* (0.052)	0.33** (0.15)
# of Observations	936	936	936	936
Log Pseudolikelihood	----	-798.4	----	-793.9
F	10.86	7.43	5.78	5.85
Prob > F	.0001	.0006	.0006	.0001
R-squared	.1819	----	.1934	----
Test Results				
F test for $H_0: (a) = (b)$				
F	5.26	8.83	0.87	0.32
p -value	.026**	.0030***	.3567	.5717
F test for $H_0: (c) = (d)$				
F	----	----	1.82	3.56
p -value	----	----	.1837	.0597*

Notes: Linear regressions with no constant terms and with robust standard errors clustered by subject ID in columns (1) and (3), and Tobit regressions with no constant terms and with robust standard errors clustered by subject ID in columns (2) and (4). The numbers of left-(right-) censored observations are 729(41) in columns (2) and (4).

$1_{\{\text{the target is a cooperator}\}} = 1$ if the target of punishment is a cooperator; = 0 otherwise.

$1_{\{\text{the target is a non-cooperator}\}} = 1$ if the target of punishment is a non-cooperator; = 0 otherwise.

*, **, and *** indicate significance at the .10 level, at the 0.05 level and at the .01 level, respectively.

Result: The average strength of conditional punishment to a non-cooperator is significantly stronger than that to a cooperator as shown in columns (1) and (2). The total average conditional punishment decisions to a person are significantly positively increasing in the remaining two members' average punishment to that person, whether the person is a cooperator or a non-cooperator as shown in columns (3) and (4).

(2) The average conditional punishment schedules by cooperative type (a cooperator or a non-cooperator)

Independent Variable \ Dependent variable	Subject j 's conditional punishment decisions to a target			
	(1)	(2)	(3)	(4)
(a) $I_{\{\text{the target is a non-cooperator and subject } j \text{ is a non-cooperator}\}}$	0.73*** (0.25)	-1.59 (1.09)	0.41 (0.27)	-2.83** (1.39)
(b) $I_{\{\text{the target is a non-cooperator and subject } j \text{ is a cooperator}\}}$	0.50*** (0.13)	-2.30** (0.93)	0.32** (0.16)	-2.93*** (1.08)
(c) $I_{\{\text{the target is a cooperator and subject } j \text{ is a non-cooperator}\}}$	0.69** (0.27)	-1.91* (1.13)	0.57** (0.27)	-2.32** (1.17)
(d) $I_{\{\text{the target is a cooperator and subject } j \text{ is a cooperator}\}}$	0.090 (0.064)	-6.17*** (1.81)	-0.0097 (0.0074)	-7.68 (1.84)
Other members' average punishment points to the target \times variable (a)	----	----	0.16** (.069)	0.60** (0.27)
Other members' average punishment points to the target \times variable (b)	----	----	0.091 (0.073)	0.33 (0.29)
Other members' average punishment points to the target \times variable (c)	----	----	0.063 (0.053)	0.22 (0.17)
Other members' average punishment points to the target \times variable (d)	----	----	0.050 (0.036)	0.71** (0.15)
# of Observations	936	936	936	936
Log Pseudolikelihood	----	-767.7	----	-761.8
F	6.14	3.20	3.63	6.13
Prob > F	.0004	.0127	.0021	.0000
R-squared	.2223	----	.2346	----
Test Results				
F test for $H_0: (a) = (b)$				
F	0.69	0.37	----	----
p-value	.4093	.5410	----	----
F test for $H_0: (c) = (d)$				
F	4.70	5.06	----	----
p-value	.0349***	.0248**	----	----
F test for $H_0: (a) = (c)$				
F	0.03	0.14	----	----
p-value	.8631	.7100	----	----

F test for $H_0: (a) = (c)$				
F	11.79	8.78	----	----
p-value	.0012***	.0031***	----	----

Notes: Linear regressions with no constant terms and with robust standard errors clustered by subject ID in columns (1) and (3), and Tobit regressions with no constant terms and with robust standard errors clustered by subject ID in columns (2) and (4). The numbers of left-(right-) censored observations are 729(41) in columns (2) and (4).

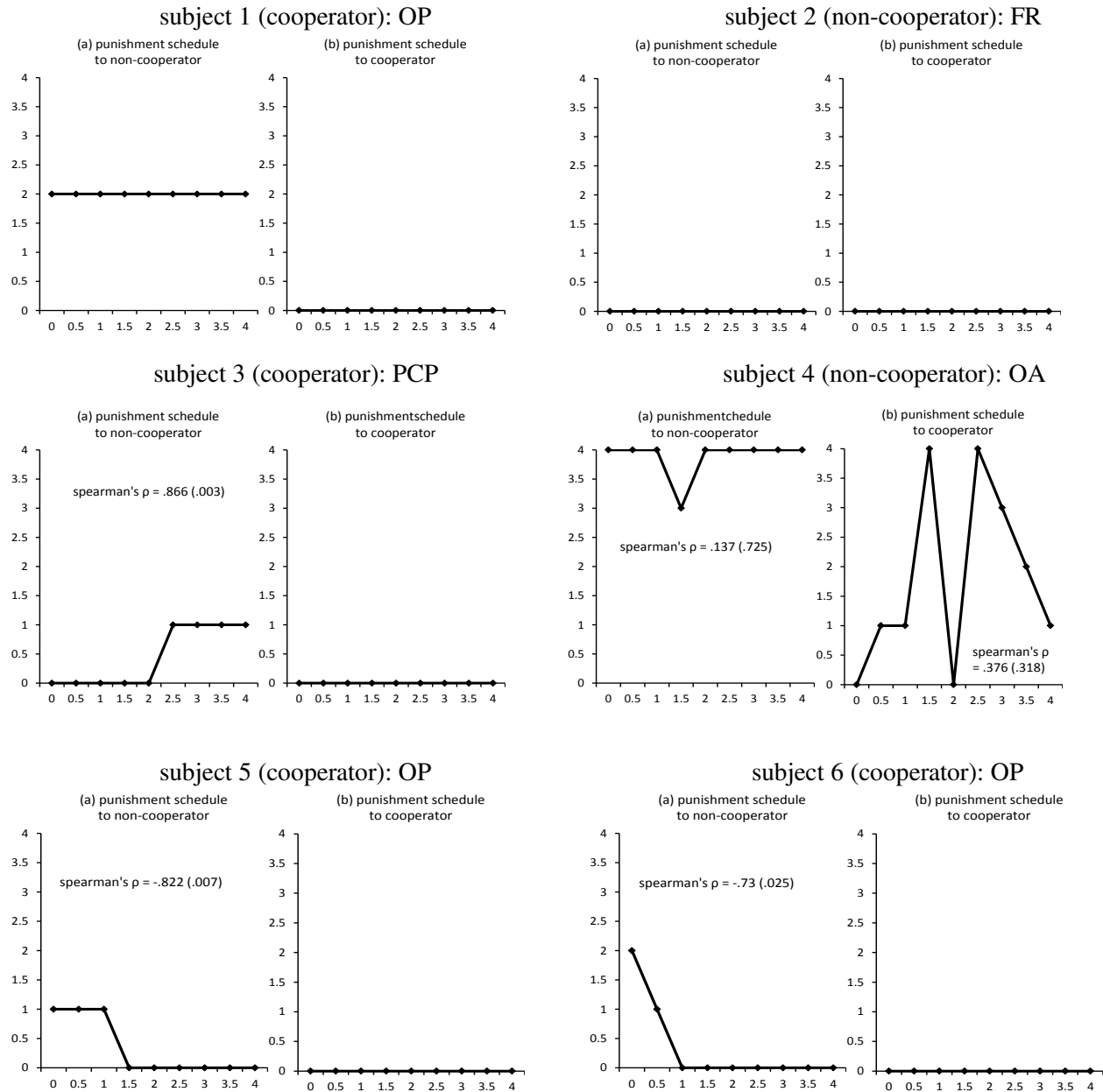
$1_{\{\text{the target is a non-cooperator and subject } j \text{ is a non-cooperator}\}} = 1$ if the target of punishment is a non-cooperator and j is a non-cooperator; = 0 otherwise. $1_{\{\text{the target is a non-cooperator and subject } j \text{ is a cooperater}\}} = 1$ if the target of punishment is a non-cooperator and j is a cooperater; = 0 otherwise. $1_{\{\text{the target is a cooperater and subject } j \text{ is a non-cooperator}\}} = 1$ if the target of punishment is a cooperater and j is a non-cooperator; = 0 otherwise. $1_{\{\text{the target is a cooperater and subject } j \text{ is a cooperater}\}} = 1$ if the target of punishment is a cooperater and j is a cooperater; = 0 otherwise.

*, **, and *** indicate significance at the .10 level, at the 0.05 level and at the .01 level, respectively.

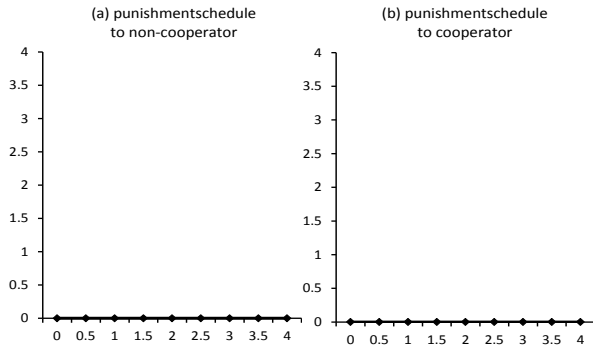
Result: The cooperators on average conditionally assign significantly larger punishment points to a non-cooperator than to a cooperater. The average strength of conditional punishment points assigned by cooperators to a non-cooperator is statistically similar to the average strength of conditional punishment points assigned by non-cooperators to a non-cooperator. The non-cooperators on average assign punishment points both to a non-cooperator and to a cooperater at a statistically similar strength.

Fig. B.1: Individual Conditional Punishment Schedules and Classification Results

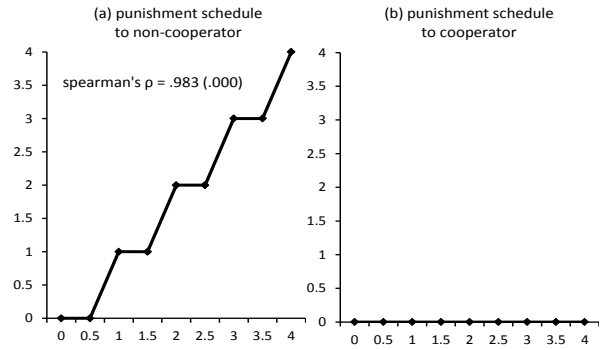
We define a free-rider as a subject who does not punish a person, no matter how many punishment points the other two members assign to that person. We define a pro-social (anti-social) conditional punisher as a subject whose Spearman's ρ between his conditional punishment points to a non-cooperator and the remaining members' average punishment points to the non-cooperator is significantly positive at the 5% level and whose conditional punishment decisions to a cooperator are (are not) always 0. As for the rest of subjects, we define an other pro-social (anti-social) punisher as a subject who conditionally punishes a non-cooperator but whose Spearman's ρ is not significantly positive at the 5% level unlike conditional punishers and whose conditional punishment decisions to a cooperator are (are not) always 0.



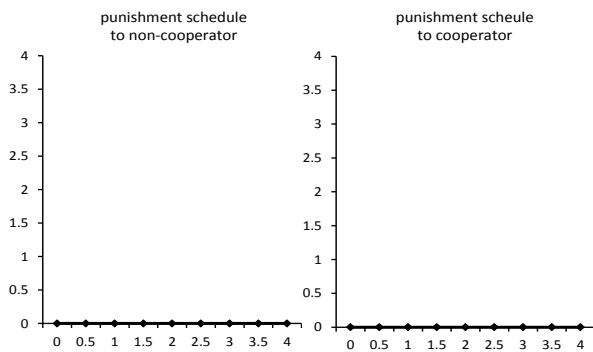
subject 7 (non-cooperator): FR



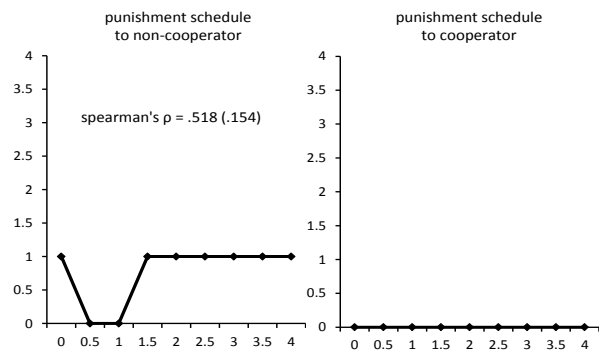
subject 8 (cooperator): PCP



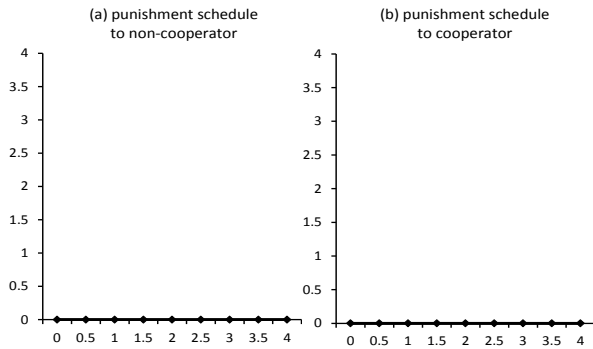
subject 9 (cooperator): FR



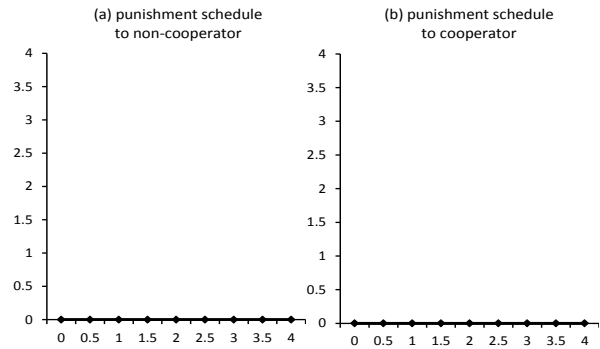
subject 10 (cooperator): OP



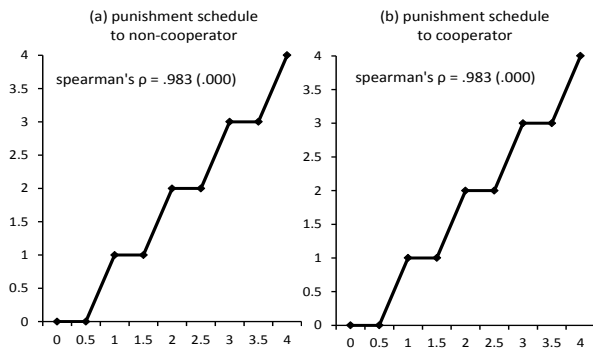
subject 11 (cooperator): FR



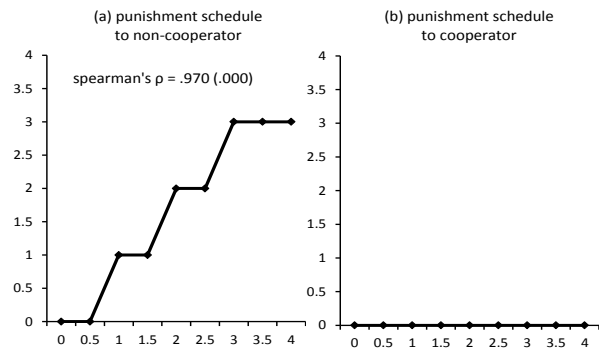
subject 12 (cooperator): FR



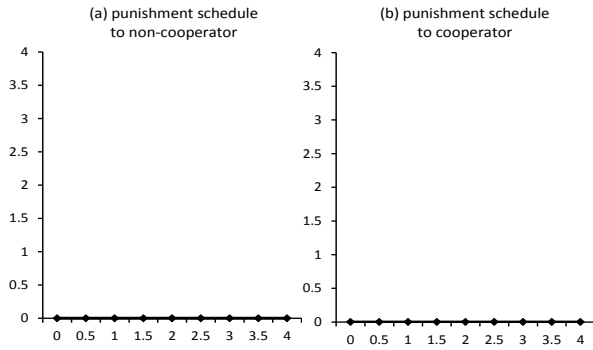
subject 13 (cooperator): ACP



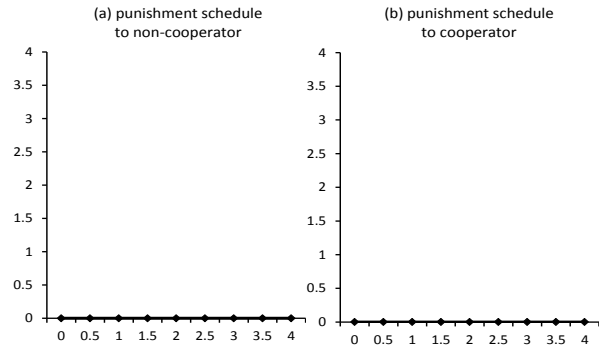
subject 14 (cooperator): PCP



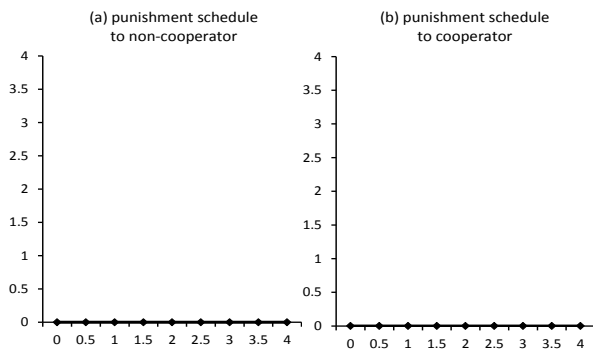
subject 15 (cooperator): FR



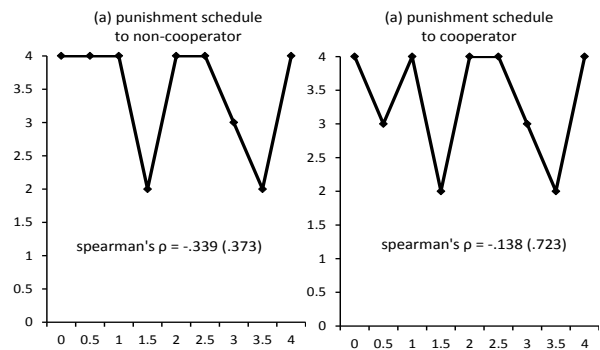
subject 16 (non-cooperator): FR



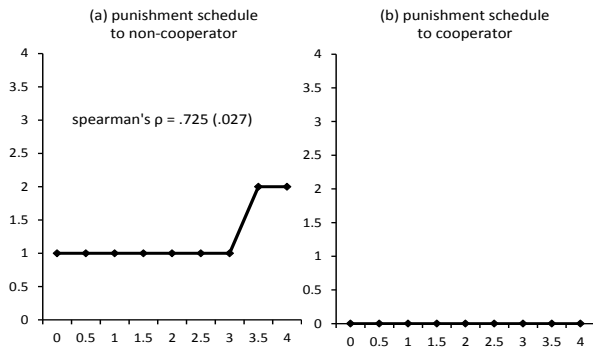
subject 17 (non-cooperator): FR



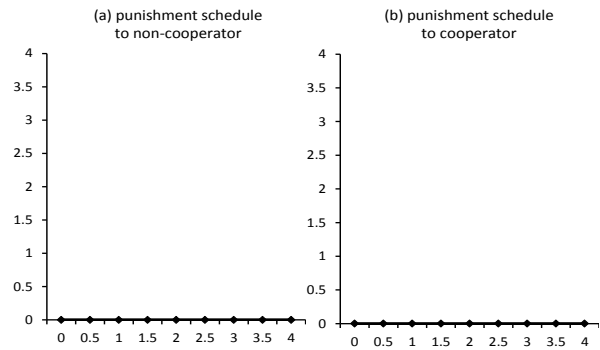
subject 18 (non-cooperator): OA



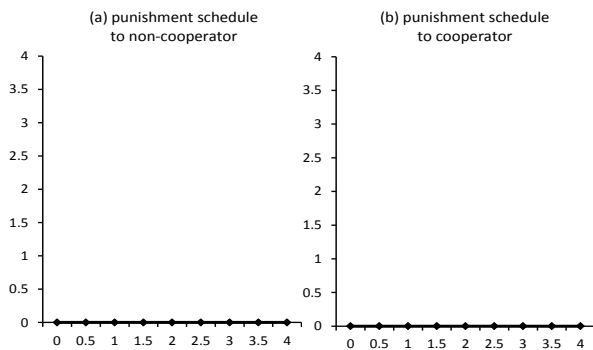
subject 19 (non-cooperator): PCP



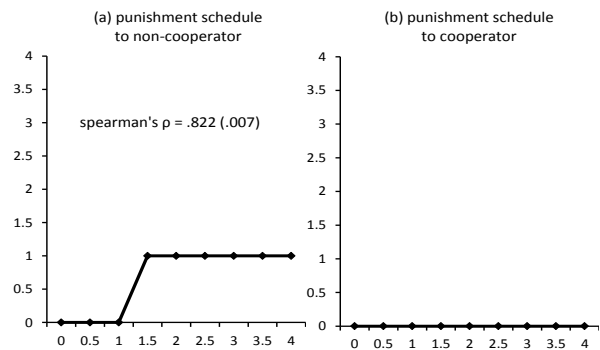
subject 20 (non-cooperator): FR



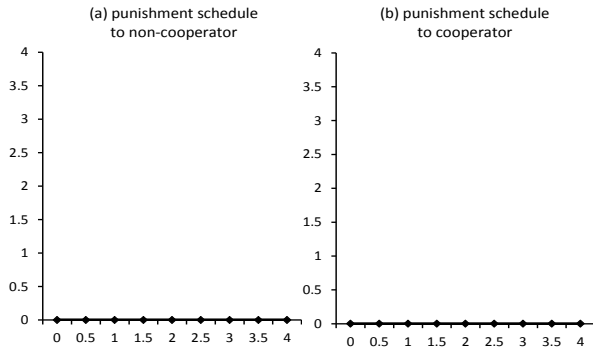
subject 21 (non-cooperator): FR



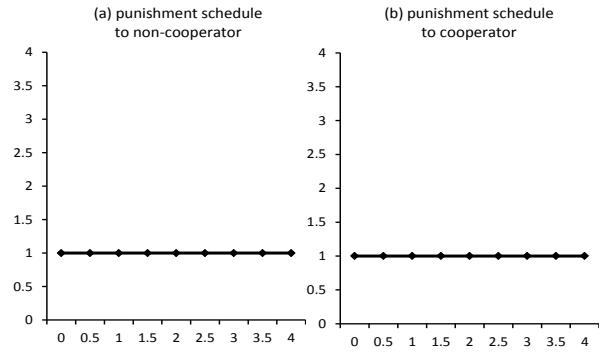
subject 22 (cooperator): PCP



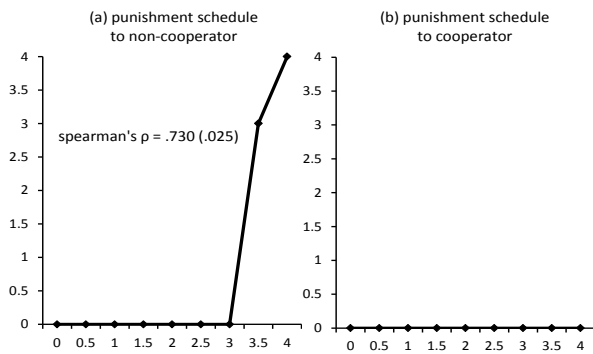
subject 23 (non-cooperator): FR



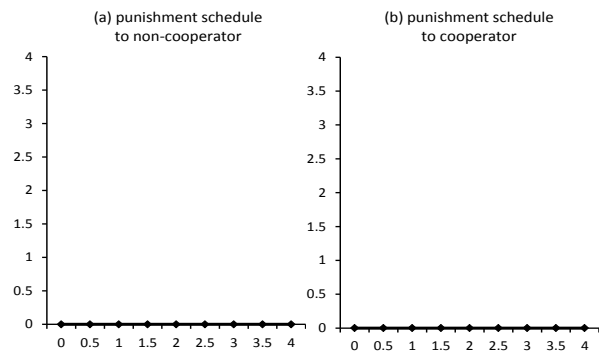
subject 24 (non-cooperator): OA



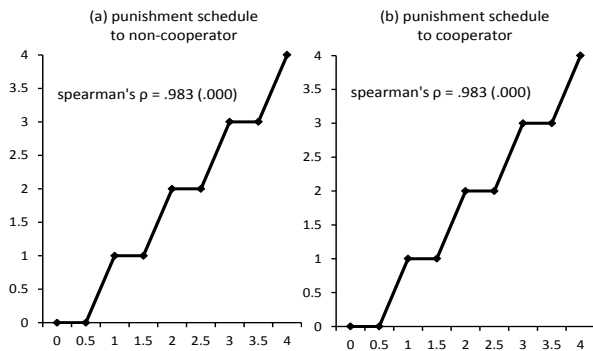
subject 25 (non-cooperator): PCP



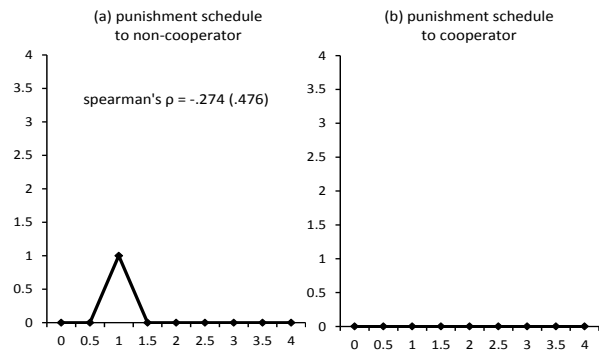
subject 26 (cooperator): FR



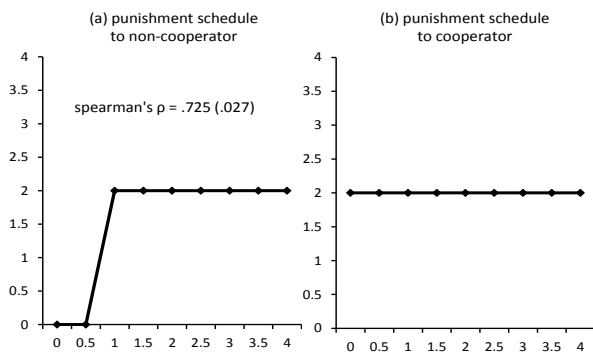
subject 27 (non-cooperator): ACP



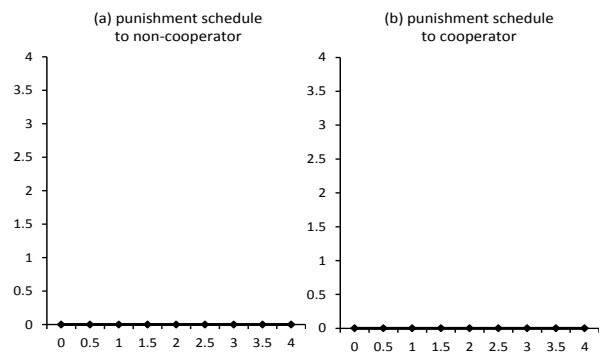
subject 28 (cooperator): OP



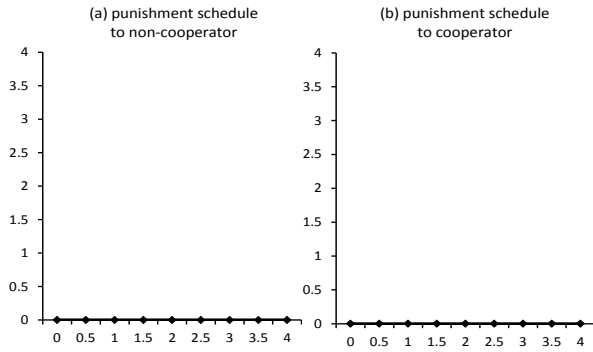
subject 29 (non-cooperator): ACP



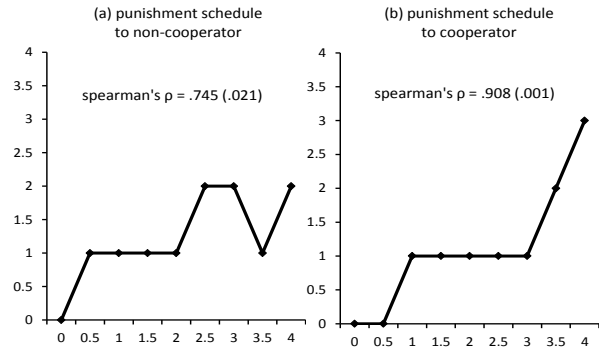
subject 30 (non-cooperator): FR



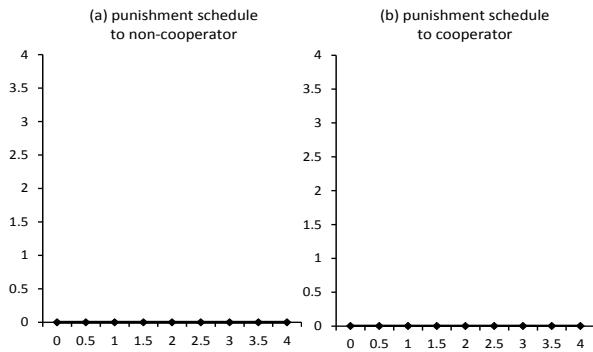
subject 31 (cooperator): FR



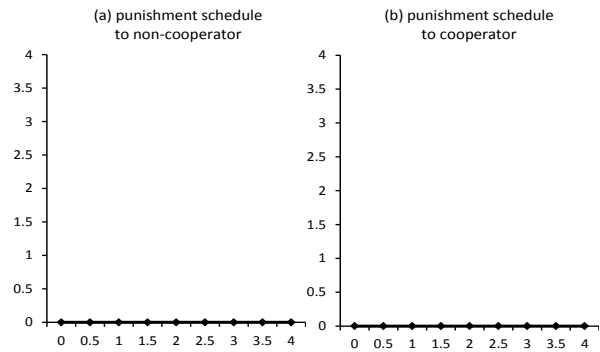
subject 32 (cooperator): ACP



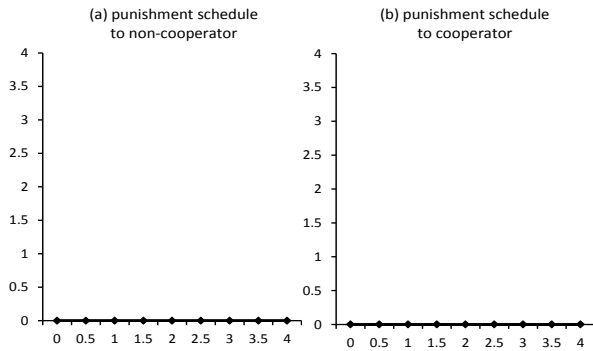
subject 33 (cooperator): FR



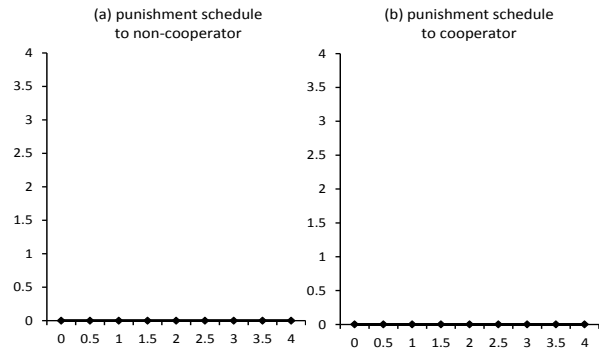
subject 34 (non-cooperator): FR



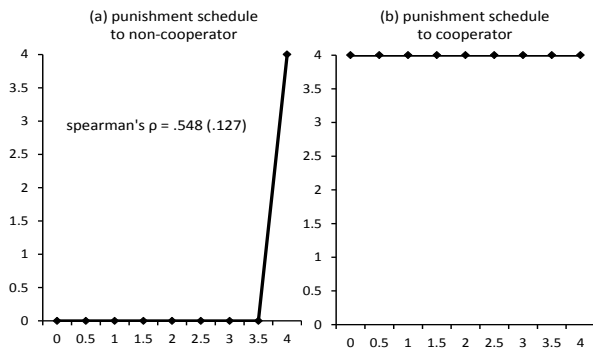
subject 35 (cooperator): FR



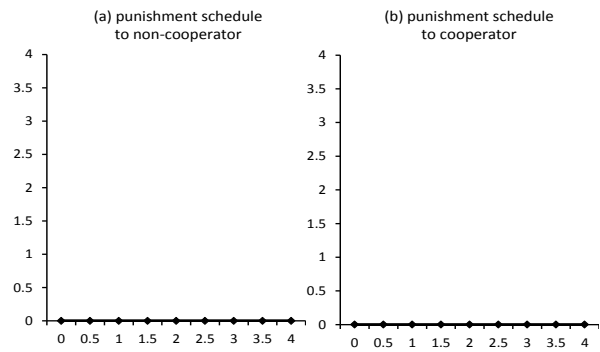
subject 36 (cooperator): FR



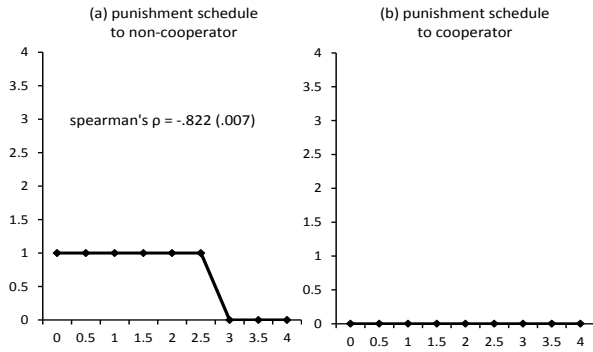
subject 37 (non-cooperator): OA



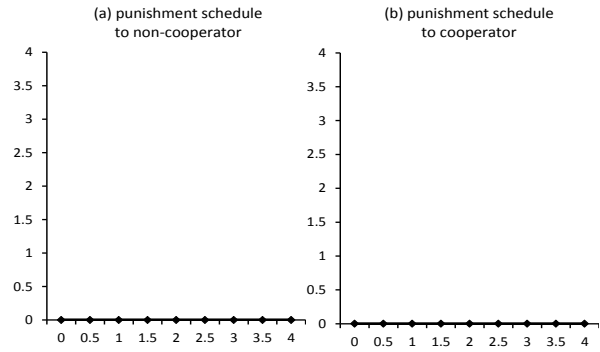
subject 38 (cooperator): FR



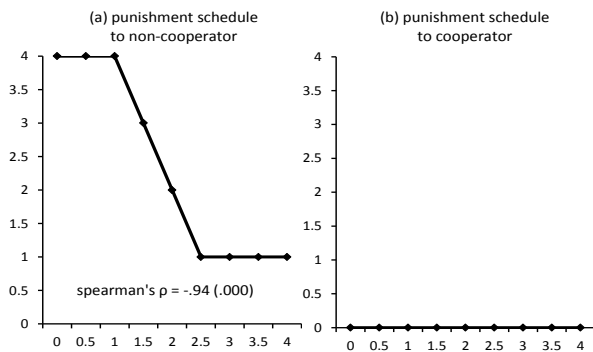
subject 39 (cooperator): OP



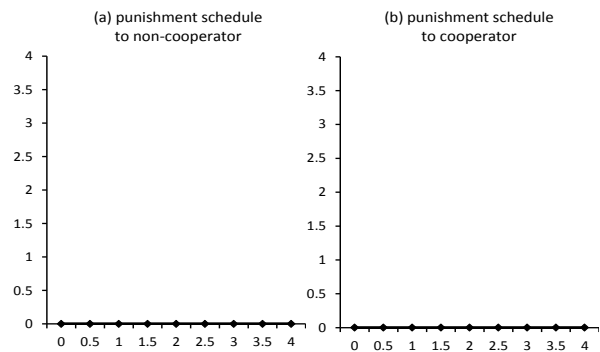
subject 40 (non-cooperator): FR



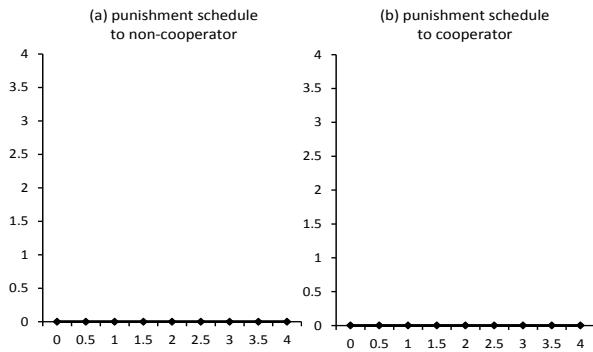
subject 41 (cooperator): OP



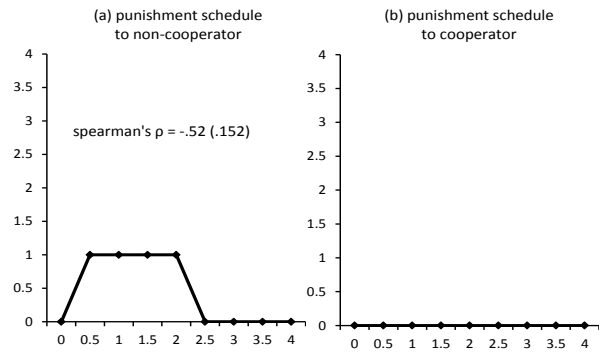
subject 42 (cooperator): FR



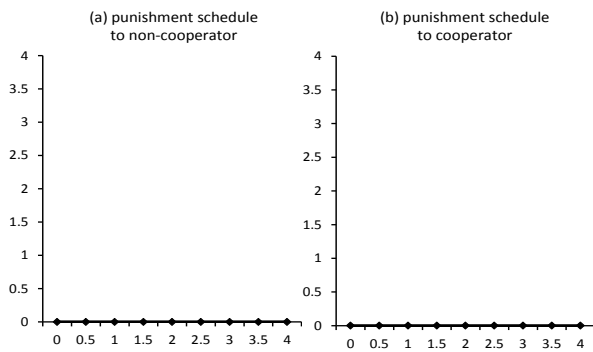
subject 43 (cooperator): FR



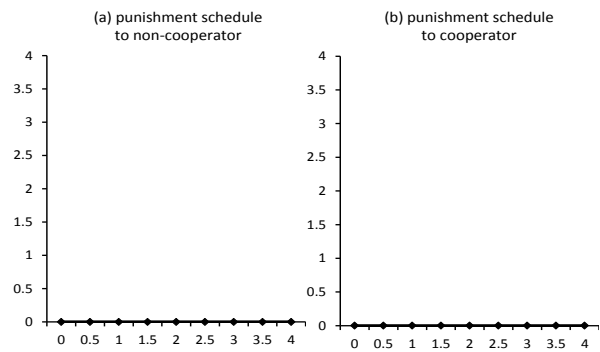
subject 44 (cooperator): OP



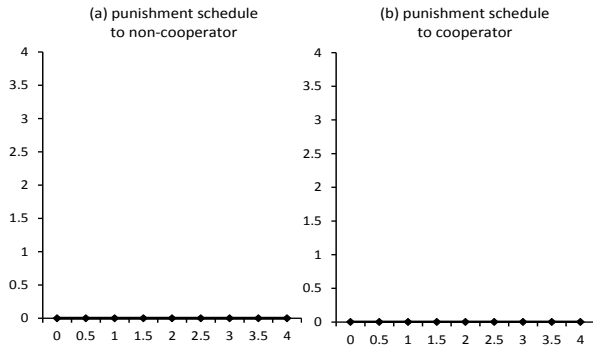
subject 45 (cooperator): FR



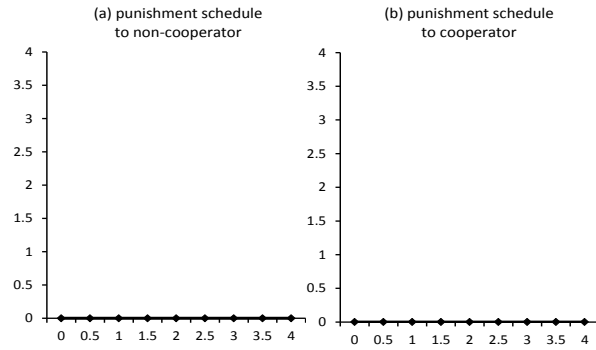
subject 46 (cooperator): FR



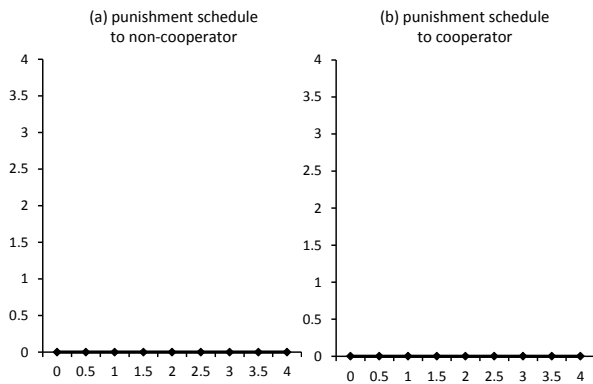
subject 47 (cooperator): FR



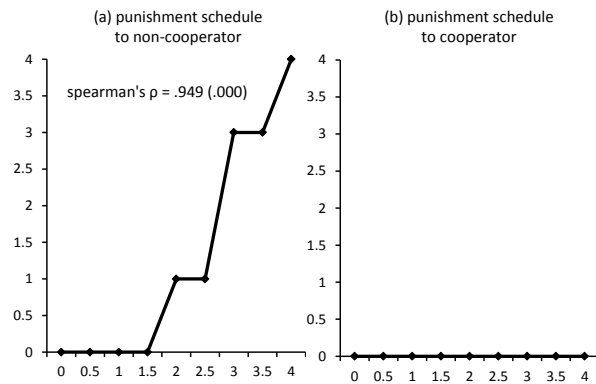
subject 48 (cooperator): FR



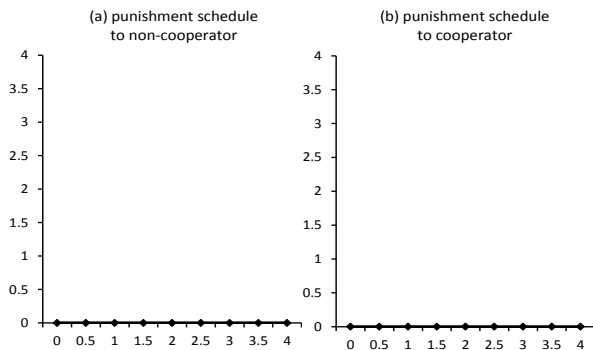
subject 49 (cooperator): FR



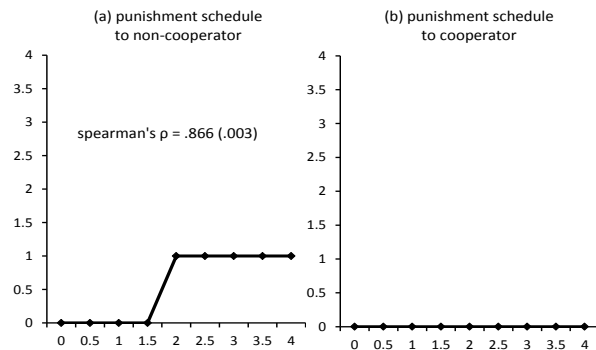
subject 50 (cooperator): PCP



subject 51 (non-cooperator): FR



subject 52 (non-cooperator): PCP



Classification Results:

- (a) FR (Free-rider: 53.8%): subjects 2, 7, 9, 11, 12, 15, 16, 17, 20, 21, 23, 26, 30, 31, 33, 34, 35, 36, 38, 40, 42, 43, 45, 46, 47, 48, 49, 51
- (b) PCP (Pro-social conditional punisher: 15.4%): subjects 3, 8, 14, 19, 22, 25, 50, 52
- (c) ACP (Anti-social conditional punisher: 7.7%): subjects 13, 27, 29, 32
- (d) OP (Other pro-social punisher: 15.4%): subject 1, 5, 6, 10, 28, 39, 41, 44
- (e) OA (Other anti-social punisher: 7.7%): subjects 4, 18, 24, 37