GATE
Groupe d'Analyse et de Théorie Économique
UMR 5824 du CNRS

Centre National de la Recherche Scientifique

UNIVERSITÉ LUMIÈRE LYON 2

DOCUMENTS DE TRAVAIL - WORKING PAPERS

W.P. 01-09

Monetary and Non-Monetary Punishment in the Voluntary Contributions Mechanism

David Masclet, Charles Noussair, Steven Tucker, Marie-Claire Villeval

2001

GATE Groupe d'Analyse et de Théorie Économique
UMR 5824 du CNRS
93 chemin des Mouilles – 69130 Écully – France
B.P. 167 – 69131 Écully Cedex
Tél. +33 (0)4 72 86 60 60 – Fax +33 (0)4 72 86 60 90
Messagerie électronique gate@gate.cnrs.fr
Serveur Web : www.gate.cnrs.fr

Monetary and Non-Monetary Punishment in the Voluntary Contributions Mechanism

By

David Masclet, Charles Noussair, Steven Tucker, and Marie-Claire Villeval*

February 12, 2001

Abstract

In this paper we replicate and extend the experiment of Fehr and Gaechter (2000) that analyzes the effect of an opportunity to punish others on the level contributions in the Voluntary Contributions Mechanism. The punishment is costly for both the players distributing and those receiving the punishment. Like Fehr and Gaechter, we find that agents often engage in non-credible costly punishment behavior in order to reduce earnings of others who contribute low amounts to the public good. The availability of punishment increases average contributions sharply. Here, we also introduce a second treatment, identical to the first treatment, except that the "punishment" is non-monetary. The assignment of "non-monetary" punishment points does not reduce the payoff of any agent, but it can be used to register disapproval of others' contribution levels. We find that the existence of the possibility of "non-monetary" punishment alone increases the average level of contributions and earnings, though by less than the monetary punishment. This suggests that the increase in cooperation observed by Fehr and Gaechter is not only due to the possibility of monetary penalties, but also from the opportunity of others to express their disapproval of free riding behavior.

* Masclet and Villeval: GATE, Universite Lumiere Lyon 2, France; Noussair and Tucker: Department of Economics, Krannert School of Management, Purdue University, USA. We thank Romain Zeiliger for developing the computer program used in this study. We also thank Tim Cason, Mark Isaac, Martin Sefton, Vernon Smith, and participants at the Fall 2000 Economic Science Association Meetings in Amsterdam, The Netherlands, for their useful comments.

1. Introduction

One of the most widely studied games in experimental economics is the Voluntary Contributions Mechanism. In this game, each agent receives an initial endowment of money. He can contribute any fraction of the endowment to a group account and keep the remaining fraction for himself. Each agent makes his contribution decision simultaneously. All funds in the group account pay a positive return to each member of the group. In the game, there is a dominant strategy for each agent to contribute nothing to the group account. However, the group optimum, assuming that the marginal per-capita return (the per-capita marginal benefit from additional contribution) is sufficiently high, is for every agent to contribute all of his endowment to the group account. The game receives wide attention in part because it starkly isolates the conflict between self-interest and group interest. This conflict is at the core of many situations in economics, such as the effects of negative externalities, defection from cartels, and team incentive problems, where strategic behavior can adversely affect group welfare. However, the main context in which previous researchers have viewed the voluntary contribution game is the private provision of public goods, where private incentives typically lead to a level of provision below the optimum. Contributing money into the group account constitutes the provision of a public good.[1]

The experimental evidence obtained to date shows that when agents play the game repeatedly, there is initially a positive level of contribution to the group account. This result stands in sharp contrast to the prediction of non-cooperative game theory, which is zero contribution.[2] The level of contribution declines with repetition (Isaac et al.

[1] An interesting experimental literature has focused on public goods with the property that a threshold level of total contribution is required for the public good to be provided. Under that production technology the Voluntary Contributions Mechanism typically has multiple Nash equilibria. Here we confine our attention to public goods with a linear production technology to enable comparisons between our work and the work of Fehr and Gaechter (2000) that we build on with this project. Linear production, also has the advantage that self-interested and group-interested behavior can be more clearly distinguished from each other.

[2] This cooperation has been attributed to other-regarding behavior as well as to decision error. Various researchers have used experiments to uncover the nature of the postulated other-regarding behavior. The existence of players who are conditional cooperators, that is who reciprocate high (low) contributions by others with high (low) contributions of their own (Fischbacher, Gaechter, and Fehr, 2000; Sonnemans, Schram, and Offerman, 1996; Keser and van Winden, 2000) has been identified. The existence of a warm glow effect, in which agents receive utility from the act of contributing, has been identified by Palfrey and Prisbrey (1997). Anderson, Goeree and Holt (1998) find that pure altruism, a preference for others to have a higher payoff, is one of the factors that account for contributions. Bolton et al. (2000) interpret their data as supporting the presence of non-linear distributive preferences.

1985, Andreoni, 1988; Weimann, 1994; Keser, 1996) and readily responds to changes in treatment variables.[3] For example, as the marginal per-capita return increases (Isaac and Walker, 1988b) or if communication between the parties is allowed (Dawes et al, 1977; Marwell and Ames, 1981; Isaac and Walker, 1988a, Ostrom et al, 1992), contribution rates increase. See Ledyard (1993) for a survey and interpretation of previous research in the area.[4]

In a recent paper, Fehr and Gaechter (2000), hereafter FG, consider how the level of contribution responds to the availability of an option for individual agents to punish other agents after they have observed their decisions. They study the following two-stage game. In the first stage, four subjects played the voluntary contributions game described above. In the second stage, each subject, after observing each of the other group members' contribution, has an opportunity to reduce the payoffs of any or all of the other players in his group, at a cost to himself. Players can assign punishment points, which must be paid for from the earnings of the punisher. Each point received by a player reduces his payoff from the first stage of the game by 10 percent.

FG's design varies two factors. One factor is the matching protocol, which takes on one of two levels: partner and stranger. In the *Partner* matching protocol, agents are repeatedly grouped with the same agents, and in the *Stranger* protocol, agents are randomly grouped with other agents rendering the probability of being matched with the same agents in any two consecutive periods very low. In some sessions, ten periods with

---

The decrease in contributions over time is suggestive of a reduction of the incidence of errors in decision-making over time that typically occurs in economic experiments. If the optimal decision is zero contribution, which is at the boundary of the strategy space, the only way confusion and errors can appear in the data is in the form of more cooperation than predicted. Palfrey and Prisbrey (1996) argue that decision error is the main cause of the observed contributions. The role of confusion was studied by Andreoni (1996), who finds that both confusion and intentional contributions are present. (Also see Anderson et al., 1998 and Laury et al., 1999). The contribution rate is also higher than that predicted by non-cooperative game theory when the theoretical prediction is a positive level of contribution (Sefton and Steinberg, 1996; Keser, 1996; Laury et al. 1999).

[3] Marwell and Ames (1981) studied one-shot Voluntary Contribution games and found that agents contributed on average a substantial percentage of their endowment (between 20 and 84 percent, depending on the treatment).

[4] Contribution levels can also be influenced by factors, which are not addressed in traditional economic models. Framing the decision to contribute as inducing a positive externality or as reducing a negative externality influences contribution levels (Andreoni, 1995). The gender of members of the group has complex and subtle effect on contribution (Brown-Kruse and Hummels, 1993). Isaac, Walker and Williams (1994) studied contribution levels in very large groups, and obtained mixed results. A lack of anonymity on the part of the subjects does not account for the higher than predicted contribution rate (Laury et al., 1995).

the punishment phase precede ten periods in which no punishment was possible. In the remainder of the sessions, ten periods of no-punishment precede ten periods with the punishment opportunity.

The results of FG's experiment are striking. In the one-shot conditions present (or approximated) in the stranger treatment, engaging in punishment behavior during the second stage of the game is inconsistent with subgame perfection, since such punishment is costly to the punisher, and thus not credible. By backward induction, the best response in the first stage is to contribute zero to the group account. The same is true in the only subgame perfect equilibrium of the finitely repeated partner treatment. However, under all three matching protocols, they observe that agents exhibit a willingness to punish other members of their group who contributed less than the group average. They also find that the availability of the punishment opportunity increases cooperation markedly. For example, under the partner treatment, in sessions where the ten periods of "no punishment" precede ten periods of "punishment", the mean contribution is 37.5% of the initial endowment in the first ten periods, and 85% in the subsequent ten periods. In period 10, the average contribution is 16% of the initial endowment, but by period 20, it rises to 91%.[5]

There are at least two possible explanations for the increased level of contribution engendered by the presence of the punishment opportunity. The explanations are not mutually exclusive nor are they exhaustive. The first potential explanation is that agents realize, particularly after they have received some punishment points, that a failure to contribute a sufficient amount will result in a reduced monetary payoff from punishment points received, so that free-riding is not profitable. Therefore, subjects contribute more to avoid paying monetary penalties in the current and (in the partner treatment) in future

[5] Sefton, Shupp and Walker (2000) conducted a related experiment in which FG's results were replicated with different parameters. They also added two additional treatments, a Reward treatment and a Combined treatment. In their Reward treatment, agents could, at a cost to themselves, give bonus payments to other agents after observing their contributions. In their Combined treatment, agents could both reward and punish other agents. They found that the presence of both rewards and punishments was most effective in promoting cooperation.

Yamagishi (1986) studied the effect of an exogenous sanctioning mechanism that punished only the lowest contributor. However, the sanctioning system itself had to be funded with voluntary contributions by group members. Yamagishi found that the sanctioning system was indeed funded, particularly by participants who indicated a low trust of other people on surveys. The existence of the system served to increase contribution levels.

periods. We will refer to this explanation, stated more precisely below, as the *Direct Punishment Hypothesis*.

Hypothesis 1: Direct Punishment Hypothesis: The possibility for agents to reduce the monetary payoff of others after observing their decisions increases contribution levels.

A second possible explanation stems from the fact that the opportunity to assign points that indicate disapproval of other agents' decisions *in itself* increases the level of contribution. There are at least three reasons to believe that this might be so. The first reason is that pre-play communication between agents is known to increase the level of contribution and, in a Partner treatment, the assignment of points serves as a type of pre-play communication for future periods. Secondly, in the Partner treatment, the assignment of points can be viewed as indicating the level of disapproval of others' decisions. This expression of a degree of disapproval might have a positive effect on the contributions of other members of the group, if it is believed that such disapproval will translate into lower future contributions. In other words, an agent who assigns points communicates a warning that he will contribute less in the future unless others increase their contribution level. An effect of this nature requires the repeated interaction of the Partner treatment, but does not require the points an agent receives to reduce his payoff directly. A third possibility is that the agent incurs a disutility from receiving an expression of disapproval. The agent increases his contribution to minimize the expected number of disapproval points received. This third effect does not require repeated play and thus would apply to both partner and stranger treatments. We use the term *Indirect Punishment Hypothesis* to collect and describe all of these potential effects.

Hypothesis 2: Indirect Punishment Hypothesis: The existence of the ability to express disapproval of others' decisions in itself increases cooperation.

The experiment reported here is designed to study the extent that the Direct and Indirect Punishment Hypotheses explain the increase in cooperation that occurs when monetary punishment is allowed. In our first treatment, the Monetary Punishment (MP) treatment, we replicate the procedures of the Partner treatment in the experiment of FG,

and obtain similar results. We find that the existence of the punishment option increases the average contribution. Specifically, we find that an individual tends to contribute more the more he was punished in the previous period. Players are more likely to receive punishment points the further their contribution in the current periods is below the period average, and the more different his contribution is from the punisher. Both the direct and indirect punishment effects are consistent with the results.

We also conduct sessions under a second treatment, the Non-Monetary Punishment Treatment, NP, which is exactly the same as MP, except for one difference. The points assigned to agents affect neither the earnings of the agent who distributes the points nor the agent to whom they are distributed. Subjects are informed at the beginning of the experiment that assigning points to another participant indicates a level of disapproval of that participant's decision. In this treatment, the Indirect Punishment Effect would serve to increase cooperation. However, the Direct Punishment Effect cannot account for an increase in cooperation here because the payment of the agent receiving points is not reduced. In the data from our NP treatment, we also observe an increase in contributions, though not by as much as in the MP treatment. This indicates that part, but not all, of the increase in contributions in the MP treatment is due to the Direct Punishment effect and part is due to the Indirect Punishment Effect.

We then compare the effects of non-monetary sanctions under Partner and under Stranger matching. Several previous studies have explored whether contribution rates are different between Partners or Strangers when no punishment points are available but have not reached a clear consensus. Andreoni (1988) and Palfrey and Prisbrey (1996) find that Strangers contribute more than Partners, while Croson (1996), Keser (1996) and Keser and van Winden (2000) find that Partners contribute more than Strangers, and Weimann (1994) find no difference. See Andreoni and Croson (2000) for a review and survey of previous work in the area. As discussed previously, some of the rationale for the hypothesized effect of the disapproval points on contributions requires repeated interaction. On the other hand, Falk et al. (2000), who study the same game as FG, find that the sanctioning pattern is similar under Partner and Stranger matching, and conclude that the main purpose of the sanctions is non-strategic. Comparing Partner versus Stranger allows us to identify how important repeated interaction is in generating an increase in contributions for non-monetary sanctions. As we report in section three,

contributions are lower in a treatment with non-monetary punishments and stranger matching (NS) than in the NP treatment.

Finally, we turn our attention to whether the NP treatment behaves in a similar manner as the MP treatment in terms of other empirical patterns observed by FG at the individual level. The assignment of points under MP, NP and NS does exhibit some similar patterns. In all of the treatments, agents assign points to those who contribute less than the group average, as well as to those who contribute less than they do. The receipt of points also has a similar effect in all three treatments. The more points received by an agent, the more he contributes in the next period compared to the previous period. The fact that this effect occurs even in the NS treatment is especially striking to us. It indicates that agents increase their contribution if they receive expressions of disapproval from others even when there is no strategic rationale for doing so. The similar behavior of NP and NS is analogous to the results of Falk et al. (2000) for monetary sanctions.

In section 2, the experimental environment is described. Section 3 discusses the procedures of the experiment. The results of the study are presented in section 4, and section 5 contains our concluding remarks.

2. The Experiment

The experiment consisted of eleven sessions and each session consisted of 30 periods.[6] The 30 periods in each session were divided into three segments of 10 periods each.[7] Seven of the sessions were conducted at Purdue University and the other four at the Groupe d'Analyse et de Theorie Economique (GATE), at the Universite Lumiere Lyon II, in Lyon, France.[8] Some information about the sessions is presented in Table 1.

[6] There was one exception. Sessions number 10 was terminated due to a software crash after period 15.
[7] At the beginning of each segment, subjects were given a copy of the instructions for the condition and the experimenter read them aloud. It was made common knowledge that each segment would last ten periods. However, they were not informed during the first or second segments that addition periods were to follow.
[8] A systematic comparison of behavior between the data at Purdue and at Lyon was not one the purposes of this study. The use of two locations is intended to test the robustness of the treatment effects we observe. In general, the evidence that rates of contribution differ in different countries is weak. Yamagishi (1988) found that American subjects cooperated more in the absence of a sanctioning system than did Japanese subjects. However, Brandts, Saijo, and Schram (1997) compared contribution rates in four countries, Japan, The Netherlands, Spain and the United States, and generally found no significant differences between the four countries, with Spain being borderline significantly different from the other three countries. Cason, Saijo, and Yamato (2000), who study a Hawk-Dove game with entry, documented differences between the behavior of American and Japanese subjects. In light of the diverse evidence on international differences, it

The first three columns indicate the number of subjects that took part in the session, the location and the treatment in effect in the session, MP, NP, and NS. The *Matching Protocol* columns indicate whether Partner or Stranger matching was in effect during each of the three ten period segments that made up each session.

[Table 1: About Here]

The subjects were recruited from undergraduate courses in business and economics at both universities. The experiments at Purdue were conducted in English, and the subjects were paid in US dollars. The experiments at GATE were conducted in French, and the subjects were paid in French francs. Some of the subjects had participated in previous experiments, but all of the subjects were inexperienced in this particular type of experiment. No subject participated in more than one session of this study. On average, a session lasted 90 minutes including initial training and payment of subjects. The experiment was computerized using the REGATE program developed at GATE.

All interaction among the subjects was anonymous. The Partner matching protocol was in effect for the first 10 periods of each session, and for the entirety of eight of the eleven sessions. Under the Partner matching protocol, the computer network separated the subjects into groups of size four. Group assignments remained constant for the entire session. The computer terminals comprising a specific group were dispersed throughout the room, and subjects were randomly assigned to a group by their choice of computer terminal upon entering the room for the session. Under the Stranger matching protocol, which was in effect from period 11 on in three of the sessions, participants were re-matched each period in new groups of four in a predetermined manner. It was common information that each subject had a zero probability of being matched with any given other individual for two consecutive periods as well as ever being grouped again with the same three people.

The 30 periods of each session were divided into three 10 period segments. In periods 1-10 and periods 21-30 of each session, there was no punishment available.

is difficult to hypothesize about specific differences in behavior in our game between the American and the French subjects.

Activity in these periods proceeded as follows. At the beginning of each period, each agent was endowed with 20 Experimental Currency Units (ECU's), with each ECU convertible to US dollars at 30 ECU = 1 dollar or to French francs at 5 ECU = 1 franc. Subjects simultaneously chose the portion of their endowment to contribute to a group account. The subjects made this contribution decision by using a scroll bar on their computer screen. Each ECU contributed to the group account yielded a payoff of 0.4 ECU to each of the four members of the group. Each ECU not contributed by the subject was credited to the subject's own earnings.[9] Therefore, the earnings of individual i in a period equal

$$E = 20 - c_i + 0.4 * \sum_{k=1}^{n} c_k$$

where c_i is the contribution of player i.

Once all members of the group made their contribution decision for the period, the computer informed each subject of his initial endowment, his individual contribution, the total group contribution, and his individual earnings. The subjects then manually recorded this data on a separate record sheet. This allowed the subjects additional time to reflect on their decisions and created a backup copy of the data. When all of the subjects completed recording their results, the computer continued to the next period.[10]

Monetary Punishment

In periods 11-20 of the *Monetary Punishment (MP)* sessions, each period consisted of a two-stage game in which the first stage followed exactly the same rules as in periods 1-10. At the beginning of the second stage, subjects were informed of the contribution levels of each of the other members of their group. They could then assign zero to ten punishment points to each of the three other group members. Each point

[9] These parameters were the same used by FG. At the group optimum, each member of the group contributes all 20 ECU, yielding a payoff of 32 ECU per person for the period. However, each individual has a dominant strategy to contribute zero to the group account. If each player follows his dominant strategy, each player receives a payoff of 20 ECU.

[10] The device of an unanticipated restart has been used by Andreoni (1988) and Croson (1996). They observed that contributions in the period immediately following the restart were on average greater than in the last period before the restart. They interpret this increase as providing evidence of strategic behavior being one cause of departures from the dominant strategy of no contribution. If contributions were due to error, then there should be less contribution in later periods, as errors can be expected to decline with repetition of the game, and this process would not be affected by restarting the game.

received by a subject from any other agent reduced the first stage earnings of the subject by 10%, with a maximum reduction of 100%. Subjects observed the total number of points assigned to them, but not how many each individual assigned to them. There was a cost to the agent assigning the points associated with each point allocated. The schedule of costs, denominated in ECU, is given in Table 2.[11] Therefore subject *i*'s earnings equal

$$\left(20 - c_i + 0.4 * \sum_{k=1}^{n} c_k\right) * \frac{\max\left\{0, 10 - \sum_{k \neq i} P_{ki}\right\}}{10} - \sum_{k \neq i} K\left(P_{ik}\right)$$

where P_{ik} is the number of points assigned by i to k, and $K\left(P_{ik}\right)$ is the cost to i of assigning the points.

[Table 2: About Here]

Non-Monetary Punishment

Periods 11-20 of the *Non-Monetary Punishment and Non-Monetary Punishment Stranger (NP and NS)* sessions followed identical rules to periods 11-20 of MP, except that under NP and NS, each point awarded to an agent had no effect on his final earnings and was costless to assign. Each agent had the opportunity to allocate between zero and ten "disapproval" points to each group member. The points represent the level of disapproval of a subject's contribution to the project in the first stage. An allocation of ten points was to be assigned for the highest level of disapproval and zero points for the lowest level of disapproval. The points and their purpose were described to the subjects in the following language:

> "In this stage you have the opportunity to register your **approval** or **disapproval** of each other group member's decision by **distributing points**. **You can award a large number of points to any member of your group if you disapprove of his or her decision (10 points for the most disapproval, 0 points for the least disapproval.)**"

[11] The cost for agent *i* indicated in the table represented the cost of the sum of points assigned to *j* by any one agent. That is, letting P_{ij} equal the points that *i* assigns to *j*, the table indicates $K\left(P_{ij}\right)$, the cost of assigning the points to player *j*. The cost to *i* of assigning points to *j* and *k*, $K\left(P_{ij} + P_{ik}\right) = K\left(P_{ij}\right) + K\left(P_{ik}\right)$.

Once all members of a group made their point allocation decision, the computer displayed the subject's own initial endowment, own earnings from the first stage, own points received, own cost of points allocated (for MP), own overall earnings for both stages, all individuals' contributions, and the total group contribution. The subjects recorded their period results on a separate record sheet before continuing on to the next period. Earnings were calculated in the same manner as when no punishment was in effect

3. Results

The mean individual contribution levels in the MP treatment are shown in Table 3. In the first column, the group number is given. The mean individual contribution levels within each ten period segment are reported for the Purdue and GATE locations in columns 2-7. Figure 1 shows the time series of group contributions for each of the six groups that participated in MP at Purdue, and Figure 2 shows the analogous data at GATE. In the two figures, the bold lines indicate the average group contribution over all sessions in one location.

[Table 3: About Here]

Our findings correspond to those reported by FG. In all but two of the 12 groups, the mean contribution level increases when the monetary punishment is available in periods 11-20 over the level in periods 1-10 in which no punishment is available. Five of the 12 groups attain a contribution level close to the maximum possible of 80 in the later rounds of the second segment. On average, the subjects in periods 11-20 contribute almost twice as much as in periods 1-10. When the possibility of punishment is removed in periods 21-30, the contribution rates fall in a manner consistent with the differences obtained by FG, when punishment opportunities are available in the early periods, but not in the late periods.

[Figures 1 and 2: About Here]

Consider the following linear regression equation,

$$C_{jt} = \beta_0 + \beta_1 t + \beta_2 D + \beta_3 D * (t - 10) \quad (1)$$

where t denotes the time period in the experiment, ranging from 1-30, C_{jt} is the total contribution of group j during period t, and D is a dummy variable if some form of punishment is permitted in the period.

β_1 measures the overall trend in contribution levels over time. Previous studies have documented that there is a tendency for contributions to decline over time, so that if the previous pattern appears in our data, β_1 would be negative. β_2 measures the effect of punishment on contribution, beyond the effect of the overall trend. A significantly positive β_2 is evidence that contributions increased when the punishment opportunity was available and decreased when it was no longer available. Finally, β_3 measures the trend within the ten periods in which a form of punishment is in effect. The variable $(t-10)$ assumes a value equal to 1 in period 11, the first period in which punishment is possible. A significantly positive β_3 means that the rate of decay of contributions in the periods that punishment is possible is less than during the periods when punishment is not possible, and the rate of contributions may even increase over time $(\text{if } \beta_3 > -\beta_1)$.

[Table 4: About Here]

The estimates of regression equation (1) for the monetary partner treatment are given in the column labeled MP of Table 4. The constant term is significant, indicating an initial level of contribution significantly greater than zero. β_1 is significantly less than zero in the Purdue data as well as in the pooled data from the two locations, illustrating a decline in the level of contribution over time. The significantly positive β_2 terms in both locations and in the pooled data indicates that there was a significant jump in contribution levels relative to the overall trend when either form of punishment was introduced, and a decrease when it was removed. The β_3 term is also significant indicating that in addition

to the shift in the level of contributions caused by adding the punishment stage, there was also a shift in the rate of change in contribution level over time. All of the signs of the coefficients are consistent with the data reported by FG.

These results affirm that subjects are willing to engage in costly punishment of their fellow group members even though it is not consistent with subgame perfection, and that this punishment opportunity causes a large increase in contribution levels. If the Direct Punishment Hypothesis is the sole explanation for this increase in contribution levels, then we should observe the same contribution levels in the NP treatment as in a treatment where no type of sanction is available. If the Indirect Punishment Hypothesis is the full explanation, then there should be no difference between MP and NP.

As reported in Result 1 below, the availability of non-monetary disapproval points also has a positive effect on the contribution levels. Nevertheless, contributions in periods 11-20 of the NP sessions are significantly lower than in periods 11-20 of the MP sessions, which means that the both the Direct and Indirect Punishment Hypotheses are supported. The possibility of imposing Monetary Punishment does increase contribution levels, but the ability to express disapproval alone accounts for part of the increase.

Result 1: The Direct and Indirect Punishment Hypotheses are both supported. The availability of non-monetary sanctions increases the contribution levels of subjects, although by an amount less than monetary sanctions do. The increase in contribution resulting from non-monetary sanctions is not as durable as the increase from monetary sanctions.

Support for result 1: We first argue that the non-monetary sanction increased contribution levels. The mean individual contribution levels in the NP treatment are shown in Table 5. Figure 3 shows the time series of group contributions for each group that participated in NP at Purdue, Figure 4 contains the data at GATE, and Figure 5 shows the corresponding data for NS. The mean individual contribution rates in periods 1-10 and 11-20 are 6.55 and 8.97 respectively in NP, out of a maximum possible individual contribution of 20. A t-statistic of 2.48 from a pooled variance t-test shows that

the two means are significantly different at the 5% level.[12] The estimates of regression equation (1) for the non-monetary partner treatment is given in the column labeled NP of Table 4. β_2 is significantly positive which means that the availability of the non-monetary punishment increased the average level of contribution.

Though the non-monetary sanction has a similar effect on the level of contribution as the monetary sanction, the magnitude of the effect is not as large. The mean individual contribution rates in periods 11-20 of MP and NP are 11.11 and 8.97 respectively. The t-statistic from a pooled variance t-test comparing these two mean contribution levels is 3.60, allowing rejection of the hypothesis that the means are equal at the 1% level. The average contribution rates of the MP and NP treatments increase from a similar base. The average contribution rates of the no sanction condition preceding the MP and NP treatments are 6.02 and 6.55 respectively. A pooled variance t-test does not allow for the rejection of the hypothesis that the two means are different (t=0.58).

[Figures 3, 4, 5 and Table 5: About Here]

The effect of the non-monetary sanction on increasing cooperation is not as durable as the monetary sanction. The estimates of the β_3 term of regression equation (1) presented in Table 4 provide evidence. In the NP treatment, β_3 is not significantly negative for the pooled data, which means that the effectiveness of non-monetary punishment decayed at the same rate as no punishment, whereas in the MP treatment, the β_3 term is significantly positive. This means that cooperation in the MP treatment increases over time relative to the trend, whereas it does not in NP. □

Result 2 compares the NP and NS[13] treatment and reveals more cooperation under the Partner than under the Stranger matching rule.[14] This is consistent with the

[12] For all statistical tests, each observation is calculated as the average of all the cohorts within a treatment for a period. This provides 30 observations for each treatment and 10 observations for each treatment segment.

[13] At first glance it may appear from the significantly positive β_2 in the NS treatment that the sanction increased the level of cooperation. However, the negative estimate of β_3 suggests that the increase is merely a restart effect. The increase from the change in treatment is 1.688, but the estimated decline

interpretation that some of the increase in contributions resulting from the non-monetary punishment points are a response to the use of the points as a pre-play communication, and more specifically as a warning of a decrease in future contributions.

Result 2: In the non-monetary sanction treatments, contribution levels are greater under Partner than under Stranger matching.

Support for result 2: The mean individual contribution rates in periods 11-20 of NP and NS are 8.97 and 4.97 respectively, and the average contribution in each period of each session of NS is shown in Figure 5. A Wilcoxon signed-rank test of the two sanction conditions provides a t-statistic of 2.80, and thus can reject the hypothesis at the 1% level that the distributions are the same. Because the average contribution level was not higher over the first 10 periods in NP than NS, the increase from the availability of punishment points was greater in NP than NS. □

In both MP and NP, average earnings increase when the punishment opportunity becomes available. The increase is immediate in NP, but there is an initial decrease in MP, due to the cost of punishment, before the increase occurs. Average earnings in the first five periods of NP are greater than in MP. In the last five periods, monetary sanction yields greater average earnings than non-monetary sanction. Result 5 summarizes this finding.

Result 3: Either type of sanction increases average earnings. In the first five periods that sanctions are available, the average earnings are greater in NP than MP. The opposite is true in the last five periods. After the sanction is no longer available, the average earnings decrease to a similar level in both MP and NP.

---

relative to the trend is .391 per period, so that by period 20, cooperation is lower than it would have been if the data from period 1-10 had been extrapolated until period 20.

[14] A comparison between period 1-10 and 11-20 confounds two factors. Periods 1-10 had no punishment, but also had Partner matching. Periods 11-20 had punishment and Stranger matching. However, the fact that periods 1-10 were identical under MP, NP, and NS, facilitates comparison of the data from periods 11-10 of all three treatments.

Support for result 3: The time series of average per period earnings in MP and NP are shown in Figure 6. The average earnings in periods 1-10 are 23.15 in MP and 23.53 in NP are not significantly different from each other. In periods 11-20 when the sanctions are available, the average per period earnings are 24.41 and 25.03 ECU in MP and NP respectively. The mean earnings of periods 1-10 are significantly less than in periods 11-20 at the 10% level for MP ($t = 1.64$) and 1% level for NP ($t = 2.90$). In periods 11-15, the average earnings are 22.79 and 25.62 ECU per period for MP and NP respectively, a significant increase at the 1% level ($t = 3.15$) for NP and an insignificant decrease in MP. A pooled variance t-test rejects the hypothesis at the 1% level that the earnings are the same in the two treatments in periods 11-15 ($t = 4.28$). In periods 16-20, the average per-period earnings in MP of 26.03 is significantly higher at the 1% level than 24.43 in NP ($t = 4.76$). The t-statistic from a pooled variance t-test comparing the average earnings for MP and NP in periods 16-20 to periods 1-10 are 7.53 and 3.15 respectively, and thus both treatments have significant increase in cooperation at the 1% level. In periods 21-30, earnings average 22.52 and 22.00 in MP and NP respectively, both significant decreases at the 1% level from the contribution rates in periods 11-20 ($t_{MP} = 2.50$ and $t_{NP} = 7.29$). □

[Figure 6: About Here]

Results 4 and 5 concern the dynamics of the interaction of punishment points and cooperation at the individual level. Result 4 focuses on the manner in which points are assigned and identifies those factors that determine the number of points an individual agent receives. In their study, FG document a clear relationship between the negative deviations of an agent's contribution in a period from the group average that period, to the points he receives that period. On the other hand Falk et al. (2000) find that agents give greater (monetary) sanctions, the greater the contributions of the punished subject deviate negatively from those of the punishing subject. Both FG and FFF find the same patterns in the Partner and their Stranger treatments. As we describe in result four, we observe patterns of point assignment consistent with both FG and FFF with both monetary and non-monetary sanctions, and in both our partner and our stranger treatments. Non-monetary punishment points are distributed in the same manner as monetary punishments.

Result 4: The level of both types of sanctions received by an individual is increasing in (a) the negative deviation of the contribution of the punished subject from the average level and (b) the negative deviation of the contribution of the punished subject from the punishing subject.

Support for result 4: Table 6 contains the estimates from the following regression model:

$$P_{ij} = \beta_0 + \beta_1\left(\max\{0, c_i - c_j\}\right) + \beta_2\left(\max\{0, c_j - c_i\}\right) + \beta_3\left(\max\{0, \bar{c} - c_j\}\right) + \beta_4\left(\max\{0, c_j - \bar{c}\}\right)$$

The β_1 coefficient can be interpreted as the effect of player j contributing less than i on the amount of points that i assigns to j. β_2 is the effect of j contributing more than i. β_3 and β_4 are the effects of j contributing less and more than the overall average respectively. Both β_1 and β_3 are highly significant in MP in both locations. As in FFF, player i sanctions j more the greater the negative deviation of $j's$ contribution is from $i's$. However, there is an additional effect that i sanctions j more, the further below the group average is $j's$ contribution. Both of these effects also carry over to the NP treatment, where the two coefficients are also highly significant. □

[Table 6: About Here]

In MP, the effect of a positive deviation of $j's$ contribution from $i's$, indicated by the positive estimate of β_2 is to increase the amount that i punishes j. However, the negative estimated β_4, i punishes j less, the more that j deviates positively from the group average. This means that agents who contributed low amounts are more likely to punish those who gave higher amounts than other players. A similar pattern is documented by FFF, who interpret this behavior as evidence of spiteful preferences. These are preferences for outcomes that give the punisher a greater share than the punished. These effects do not appear in the pooled data from NP as β_2 and β_4 are not significantly different from zero. This is also consistent with spiteful preferences. If

preferences are spiteful, they should disappear when the relative payoffs cannot be changed in favor of the punisher during the punishment phase, which is the case in the NP treatment.

Result 5 considers whether the assignment of points had the effect for which it was presumably intended, to boost the contribution level of the agent receiving the points in the next period. We find that in all three treatments the assignment of points to an agent does on average increase the contribution level of the agent.

Result 5: The difference in an individual's contribution from period t to period t+1 is positively related to the points the individual received in period t, for the MP, NP and NS treatments.

Support for result 5: Figures 7-9 illustrate the relationship between the points an agent receives and the increase in contribution in the next period. The horizontal axis provides ranges of punishment points received in period t, and the vertical axis presents the average relative contribution level between period $t+1$ and period t, (the average of $c_i^{t+1} - c_i^t$, where c_i^t is individual $i's$ contribution in period t). The number above the data bar in the graph corresponds to the number of observations within that range of punishment points received. The figures show that in MP, agents who receive a positive number of points tend to increase their contribution, while those who receive zero tend to lower it. In NP and NS, agents who receive more than 15 points, an average of five from each person or 50% of the maximum possible, on average raise their contribution in the next period, while those who receive less than 15 points tend to lower it.

[Figures 7-9: About Here]

The correlation coefficient for the points awarded in period t and the difference in contribution levels from period $t+1$ and period t are 0.28 and 0.42 for periods 11-20 of MP and NP treatments respectively. Table 7 provides the estimates from the following regression model:

$$c_i^t - c_i^{t+1} = \beta_0 + \beta_1\left(\sum_k P_{ki}\right) + \beta_2\left(c_i^t - \overline{c^t}\right)$$

The β_1 coefficient is the effect of the aggregate amount of points received by player i from the other members of their group on the change in $i's$ contribution from one period to the next. β_2 is the effect of the difference between individual $i's$ contribution and the mean contribution level of their group in period t on the change in $i's$ contribution from period t to period $t+1$.

[Table 7: About Here]

The estimates in Table 7 show that this relationship between the points received and the change in contribution from one period to the next is not due to a spurious correlation between the negative deviation from the average level of contribution in period t and the change in contribution between periods t and $t+1$. There is a significant negative relation between the deviation from the average and the subsequent change in contribution. Those who make large contributions are more likely to lower them in the next period than those who make low contributions. However, even after this effect is accounted for, the quantity of points awarded has an additional impact.

4. Discussion

This study is an attempt to identify the mechanisms whereby the possibility of punishment increases cooperation within a well-known strategic situation in experimental economics, the Voluntary Contributions Mechanism. We have based our design on that of FG, who clearly documented that even when the threat to punish is not credible, the threat will often be carried out against those who contribute less than the amount viewed as appropriate. Agents know that the threat will be carried out and this leads to increases in contribution to levels much higher than if the punishment opportunity did not exist. The increases are so great that after a few periods earnings are higher than if the punishment opportunity were not available. We replicate all of these findings in our MP treatment. We also find that there is a positive relation between the points received in

period t and the change in contribution between periods t and $t+1$ (the more points an agent receives, the greater is his net increase in contribution next period).

Furthermore, we find that all of the above patterns are also present when the points have neither monetary consequence for the agent who assigns them nor for the agent who receives them. Contribution levels are greater when a non-monetary punishment is available than when it is not; though they are still less than when monetary punishment is available. This indicates the existence of a substantial Direct Punishment Effect. Part of the reason contributions are relatively high in MP is because of the possibility that agents can reduce others earnings.

However, the data also reveal that the Direct Punishment Effect is not the complete explanation for the high contributions in MP, and cooperation can sometimes be achieved purely by non-monetary sanctions. This indicates the existence of the Indirect Punishment Effect. This can be interpreted as a form of peer pressure. In some groups this "peer-pressure" is a powerful mechanism for promoting cooperation, whereas in others it has little effect. The fact that we observe considerable differences between groups suggests that there are sociological or demographic factors that correlate with the ability of non-monetary sanctions to increase cooperation. Identifying such factors is a research agenda that goes far beyond the current project, but would seem to be an intriguing area for future research.

Within the non-monetary sanction treatments, the partner matching protocol has a greater cooperation level than that of the stranger matching protocol. This is consistent with the view that the points can serve as cheap talk signaling future decreases in contribution levels if the free rider does not increase his cooperation soon. This might not be surprising to the reader. However, we observe also that the points are awarded in the same manner in the Stranger as in the Partner treatment, to those who contribute less than the group average. Furthermore, even in the Stranger treatment, agents tend to increase their contribution the more points that they receive. Showing disapproval is effective in boosting contributions but a failure to show it when it is available lowers cooperation. The issue of whether the overall level of contribution is higher in the NS treatment than it would be in a Stranger treatment without the availability of points of disapproval could be studied in future research.

The influence of the non-monetary disapproval points on outcomes in the NS requires a non-strategic explanation. Fehr and Gaechter (1998) postulate that emotions can make non-credible monetary punishments be viewed as credible, and thus increase contributions to avoid punishment. We find the activation of emotions a plausible explanation for the relationship between the number of points received in period t and the change in contribution from period t to $t+1$. When faced with an expression of disapproval from a group of peers, emotions may be activated that induce an increase in contribution. When the peers pass up an opportunity to express their disapproval, other emotions are activated that cause a decrease in contribution.

The net change in contribution between periods t and $t+1$ is greater (a) the greater is $c_i^t - \bar{c}$ and (b) the greater the number of non-monetary punishment points received. This invites an analogy with the work of Kandel and Lazear (1992) on peer pressure. They distinguish between internal peer pressure in the form of *guilt*, and external peer pressure in the form of *shame*. The force of guilt causes an individual to incur disutility from causing harm to others. This internal peer pressure might be important in leading those who contribute less than the average to increase their contribution levels more than others. Shame is a disutility that occurs when others identify you as an offender. External peer pressure appears to be a factor that leads those who receive non-monetary sanctions to contribute more. The difference between a Stranger treatment with and without non-monetary punishment is that external peer pressure can be brought to bear. The experiment supports the assertion that external peer pressure can be a powerful force promoting cooperation.

References

Anderson, S., J. Goeree, and C. Holt. 1998. A theoretical analysis of altruism and decision error in public goods games. *Journal of Public Economics* 70:297-323.

Andreoni, J. 1995. Warm-glow versus cold-pickle: The effects of positive and negative framing on cooperation in experiments. *The Quarterly Journal of Economics* 110:1-21.

_____. 1996. Cooperation in public-goods experiments: Kindness or Confusion? *American Economic Review* 85(4):891-904.

_____. 1988. Why free ride? Strategies and learning in public goods experiments. *Journal of Public Economics* 37:291-304.

Andreoni, J. and R. Croson. 2000. Partners versus strangers: The effect of random rematching in public goods experiments. Forth coming in: C. Plott and V. Smith, eds. *Handbook of Experimental Economics Results*

Bolton, G., J. Brandts, and E. Katok. 2000. How strategy sensitive are contributions? A test of six hypotheses in a two-person dilemma game. *Economic Theory* 15:367-87.

Brandts, J., T. Saijo, and A. Schram. 1997. A four-country comparison of spite and cooperation in voluntary contribution mechanisms. *University of Amsterdam Working Paper.*

Brown-Kruse, J. and D. Hummels. 1993. Gender effects in laboratory public goods contribution. *Journal of Economic Behavior & Organization* 22:255-67.

Cason, T., T. Saijo, and T. Yamato. 2000. Voluntary participation and spite in public good provision experiments: An international comparison. Purdue working paper.

Croson, R. 1996. Partners and strangers revisited. *Economic Letters* 53(1):25-32.

Dawes, R., J. McTavish, and H. Shaklee. 1977. Behavior, communication, and assumptions about other people's behavior in a commons dilemma situation. *Personality and Social Psychology* 35(1):1-11.

Falk, A., Fehr, E. and U. Fischbacher. 2000. Informal sanctions. University of Zurich working paper.

Fehr, E., and S. Gaechter. 1998. Cooperation and punishment in public goods experiments. University of Zurich working paper.

_____. 2000. Cooperation and punishment in public goods experiments. Forthcoming in: *American Economic Review.*

Fischbacher, U., S. Gaechter, and E. Fehr. 2000. Are people conditionally cooperative? Evidence from a public goods experiment. University of Zurich working paper No. 16.

Isaac, R. M., D. McCue, and C. Plott. 1985. Public goods provision in an experimental environment. *Journal of Public Economics* 26:51-74.

Isaac, M., and J. Walker. 1988a. Communication and free-riding behavior: The voluntary contributions mechanism. *Economic Inquiry* 26(4):585-608.

_____. 1988b. Group size effects in public goods provision: The voluntary contributions mechanism. *Quarterly Journal of Economics* 103:179-99.

Isaac, M., J. Walker, and A. Williams. 1994. Group size and the voluntary provision of public goods: Experimental evidence utilizing very large groups. *Journal of Public Economics* 54:1-36.

Kandel, E., and E. Lazear. 1992. Peer pressure and partnership. *Journal of Political Economy* 100:801-817.

Keser, C. 1996. Voluntary contributions to a public good when partial contribution is a dominant strategy. *Economic Letters* 50:359-66.

Keser, C., and F. van Winden. 2000. Conditional cooperation in voluntary contributions to public goods. *Scandinavian Journal of Economics* 102:23-39.

Laury, S., J. Walker, and A. Williams. 1995. Anonymity and the voluntary provision of public goods. *Journal of Economic Behavior & Organization* 27:365-80.

_____. 1999. The voluntary provision of a pure public good with diminishing marginal returns. *Public Choice* 99:139-60.

Ledyard, J. 1993. Public goods: A survey of experimental research, in: J. Kagel and R. Roth, eds., *Handbook Of Experimental Economics*, Princeton University Press, Princeton, NJ.

Marwell, G., and R. Ames. 1981. Economists free ride, does anyone else? Experiments on the provision of public goods, IV. *Journal of Public Economics* 15:295-310.

Ostrom, E., J. Walker, and R. Gardner. 1992. Covenants with and without a sword: Self-governance is possible. *The American Political Science Review* 86(2):404-17.

Palfrey, T., and J. Prisbrey. 1997. Anomalous behavior in linear public goods experiments: How much and why? *American Economic Review* 87(5):829-46.

_____. 1996. Altruism, reputation and noise in linear public goods experiments. *Journal of Public Economics* 61:409-27.

Sefton, M., R. Shupp, and J. Walker. 2000. The effect of rewards and sanctions in provision of public goods. Indiana University working paper.

Sefton, M., and R. Steinberg. 1996. Reward structures in public good experiments. *Journal of Public Economics* 61:263-87.

Sonnemans, J., Schram, A., and T. Offerman. 1996. Strategic behavior in public good games: When partners really become strangers. University of Amsterdam working paper.

Weimann, J. 1994. Individual behavior in a free riding experiment. *Journal of Public Economics* 54:185-200.

Yamagishi, T. 1988. The provision of a sanctioning system in the United States and Japan. *Journal of Personality and Social Psychology* 51(3):265-71.

_____. 1986. The provision of a sanctioning system as a public good. *Journal of Personality and Social Psychology* 51(1):110-16.

Table 1: Characteristics of the Experimental Sessions

Session Number	Number of Subjects	Location	Treatment	Matching Protocol		
				Periods 1-10	Periods 11-20	Periods 21-30
1	12	Purdue	MP	Partner	Partner	Partner
2	12	Purdue	MP	Partner	Partner	Partner
3	12	GATE	MP	Partner	Partner	Partner
4	12	GATE	MP	Partner	Partner	Partner
5	16	Purdue	NP	Partner	Partner	Partner
6	8	Purdue	NP	Partner	Partner	Partner
7	12	GATE	NP	Partner	Partner	Partner
8	8	GATE	NP	Partner	Partner	Partner
9	16	Purdue	NS	Partner	Stranger	Stranger
10	16	Purdue	NS	Partner	Stranger Periods 11-15	N/A
11	16	Purdue	NS	Partner	Stranger	Stranger

Table 2: Levels of Punishment and Associated Costs for the Punishing Subject

Punishment Points	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Cost of Punishment	**0**	**1**	**2**	**4**	**6**	**9**	**12**	**16**	**20**	**25**	**30**

Table 3: Mean Individual Contribution Levels in the Monetary Sanction Treatment

	Partner Purdue Monetary Sanction			**Partner GATE Monetary Sanction**		
Groups	No Sanction Periods 1-10	Monetary Sanction Periods 11-20	No Sanction Periods 21-30	No Sanction Periods 1-10	Monetary Sanction Periods 11-20	No Sanction Periods 21-30
1	4.20	2.73	1.50	6.63	18.83	10.63
	(3.74)	(2.69)	(2.12)	(4.72)	(2.83)	(7.16)
2	7.15	7.33	4.28	5.33	2.33	1.35
	(6.29)	(4.69)	(4.66)	(4.96)	(3.18)	(1.59)
3	9.68	15.89	7.05	5.50	12.68	5.25
	(8.01)	(7.41)	(8.78)	(4.62)	(3.45)	(3.73)
4	6.00	19.05	3.85	6.05	6.73	4.33
	(6.14)	(3.19)	(5.63)	(6.30)	(6.25)	(5.42)
5	4.20	9.28	0.75	7.20	9.48	6.63
	(5.76)	(2.16)	(1.98)	(4.97)	(4.34)	(4.05)
6	3.05	16.35	7.09	7.35	13.03	5.44
	(3.37)	(5.62)	(5.74)	(4.82)	(6.38)	(6.13)
Avg.	5.71	11.77	4.09	6.34	10.51	5.60
Std. Dev.	(6.13)	(7.37)	(5.63)	(5.10)	(6.94)	(5.75)

Standard Deviations are in parenthesis

Table 4: Contribution Regressions Results

	Purdue		GATE	
	MP	NP	MP	NP
Constant (β_0)	26.191***	28.007***	27.562***	34.927***
	(2.937)	(2.761)	(2.824)	(2.000)
Period (β_1)	-0.466***	-0.431***	-0.172	-0.880***
	(0.157)	(0.148)	(0.151)	(0.107)
Sanction Dummy (β_2)	15.725***	20.451***	7.594*	15.184***
	(5.348)	(5.012)	(5.128)	(3.632)
Period x Dummy (β_3)	2.261***	0.109	1.736**	-1.500***
	(0.821)	(0.772)	(0.790)	(0.560)
R Square	0.389	0.289	0.203	0.405
F Statistic	37.120	23.802	14.965	33.082
Observations	179	180	180	150

	Pooled Data		
	MP	NP	NS
Constant (β_0)	26.854***	31.153***	9.294***
	(2.058)	(1.842)	(0.348)
Period (β_1)	-0.317***	-0.640***	-0.270***
	(0.110)	(0.099)	(0.021)
Sanction Dummy (β_2)	11.638***	18.057***	1.688***
	(3.742)	(3.344)	(0.644)
Period x Dummy (β_3)	1.998***	-0.620	-0.391***
	(0.575)	(0.515)	(0.107)
R Square	0.292	0.263	0.424
F Statistic	48.759	38.699	72.127
Observations	359	330	298

*** 1% significance level, ** 5% significance level, * 10% significance level
Standard Deviations are in parenthesis

Table 5: Mean Individual Contribution Levels in the Non-Monetary Sanction Treatment

	Partner Purdue Non-Monetary Sanction			Partner GATE Non-Monetary Sanction		
Groups	No Sanction Periods 1-10	Non-Monetary Sanction Periods 11-20	No Sanction Periods 21-30	No Sanction Periods 1-10	Non-Monetary Sanction Periods 11-20	No Sanction Periods 21-30
1	3.98	10.90	3.30	7.08	7.70	5.33
	(4.37)	(4.72)	(3.35)	(6.45)	(7.14)	(6.20)
2	5.25	3.50	1.38	8.60	6.60	4.80
	(5.91)	(3.75)	(2.19)	(5.09)	(5.48)	(5.07)
3	6.05	7.25	5.68	7.08	5.63	3.30
	(4.68)	(4.07)	(6.05)	(6.01)	(5.52)	(3.61)
4	3.85	17.68	3.55	6.20	5.83	2.10
	(4.12)	(5.15)	(6.26)	(4.78)	(3.67)	(2.48)
5	5.95	10.15	2.30	6.38	9.55	2.35
	(5.53)	(8.51)	(3.81)	(4.68)	(4.22)	(2.59)
6	11.60	13.90	4.79			
	(6.49)	(6.98)	(7.84)			
Avg.	6.11	10.56	3.50	7.07	7.06	3.58
Std. Dev.	(5.81)	(7.30)	(6.06)	(5.46)	(4.17)	(4.39)

Standard Deviations are in parenthesis

Table 6: The Relation of Sanctioning Behavior to Contribution Levels

	Purdue		GATE	
	MP	NP	MP	NP
Constant (β_0)	0.019	1.554**	0.053	3.239**
	(0.029)	(0.197)	(0.038)	(0.216)
Negative Deviation from i's Own Contribution (β_1)	0.039**	0.244**	0.076**	0.166**
	(0.001)	(0.043)	(0.011)	(0.047)
Positive Deviation from i's Own Contribution (β_2)	0.030**	0.165**	0.046**	-0.098**
	(0.009)	(0.032)	(0.013)	(0.034)
Negative Deviation from Average (β_3)	0.111**	0.368**	0.368**	0.676**
	(.0161)	(.0669)	(.0669)	(.0767)
Positive Deviation from Average (β_4)	-0.013	-0.247**	-0.247**	0.001*
	(0.015)	(0.062)	(0.062)	(0.002)
R Squared	0.36	0.41	0.27	0.39
	Pooled Data			
	MP	NP	NS	
Constant (β_0)	0.046*	2.267	4.99	
	(0.024)	(0.145)	(0.179)	
Negative Deviation from i's Own Contribution (β_1)	0.059**	0.209**	0.144	
	(0.008)	(0.034)	(0.032)	
Positive Deviation from i's Own Contribution (β_2)	0.037**	0.002	-0.066	
	(0.008)	(0.022)	(0.053)	
Negative Deviation from Average (β_3)	0.099**	0.507**	0.318	
	(0.012)	(0.053)	(0.067)	
Positive Deviation from Average (β_4)	-0.027*	-0.000	-0.231	
	(0.013)	(0.002)	(0.076)	
R Squared	0.29	0.35	0.21	

*** 1% significance level, ** 5% significance level, * 10% significance level
Standard Deviations are in parenthesis

Table 7: Effect of Negative Deviation and Points Received on Change in Contribution

Dependent variable: the difference in contribution between periods t and t+1

	Monetary Partner	Non-Monetary Partner	Non-Monetary Stranger
Constant (β_0)	-1.241***	-3.245***	-4.306***
	(0.272)	(0.422)	(0.636)
Points (β_1)	0.123	0.189***	0.156***
	(0.172)	(0.037)	(0.037)
Deviation from the Average (β_2)	-0.723***	-0.506***	-0.851***
	(0.133)	(0.122)	(0.148)
R Square	0.116	0.224	0.182
F Statistic	31.082	63.202	41.450
Observations	476	440	376

*** 1% significance level, ** 5% significance level, * 10% significance level
Standard Deviations are in parenthesis

Figure 1: Group Contribution Level for Each Monetary Sanction Cohort at Purdue

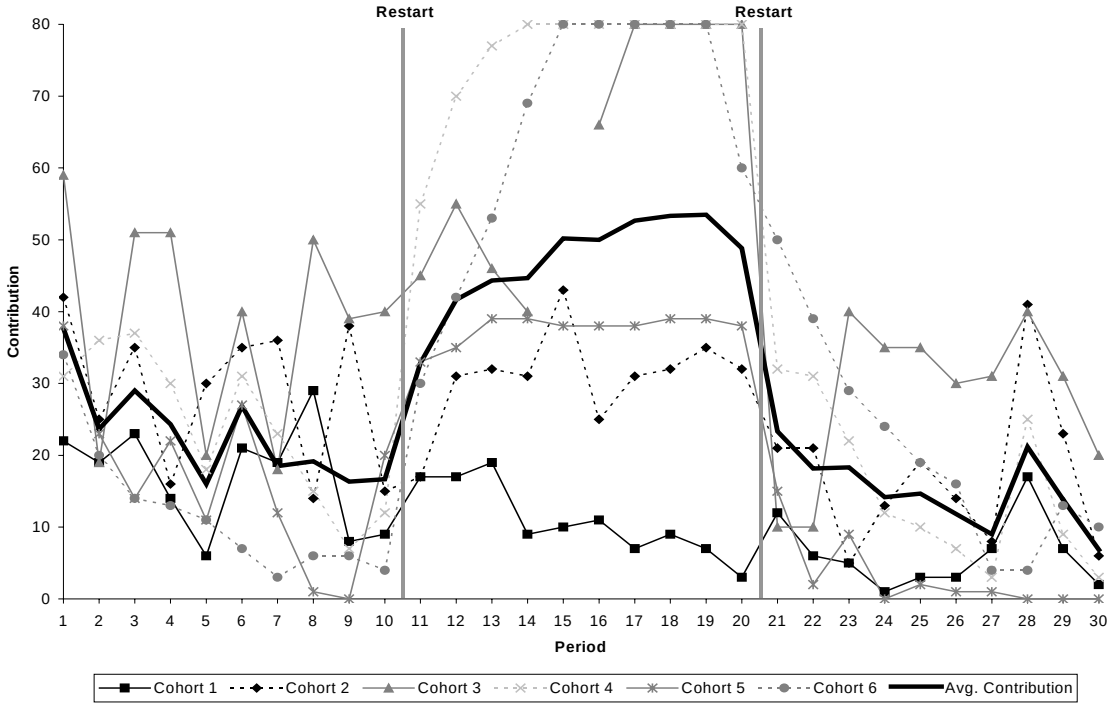


Figure 2: Group Contribution level for Each Monetary Sanction Cohort at GATE

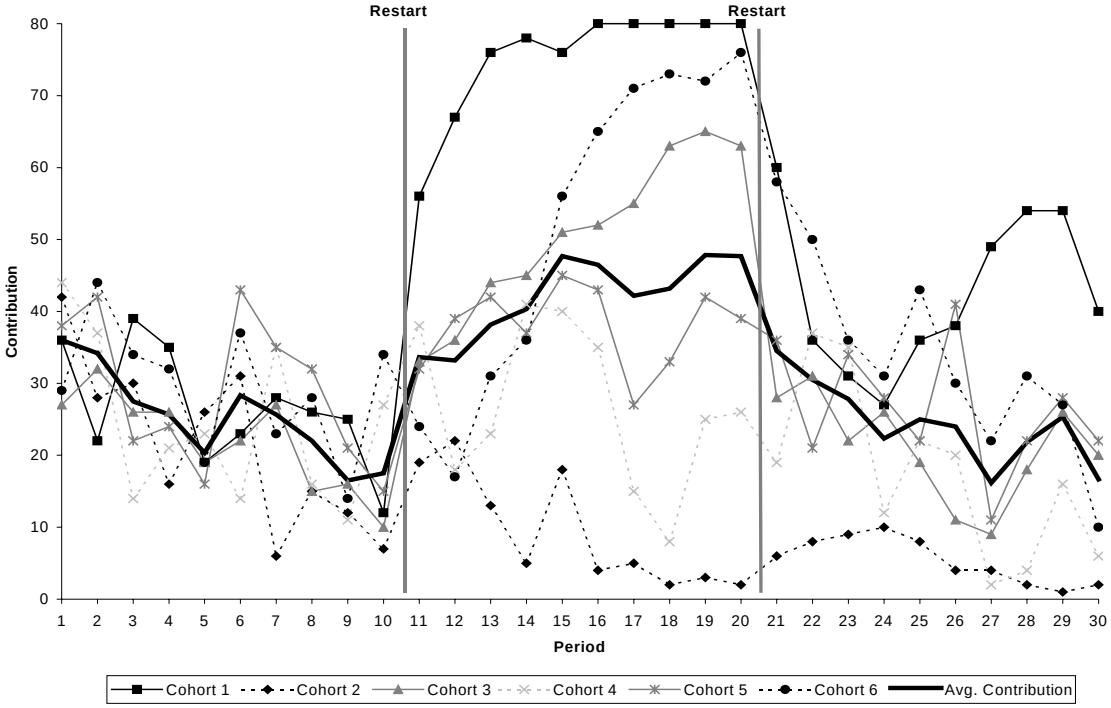


Figure 3: Group Contribution Levels for Each Non-Monetary Sanction Cohort at Purdue

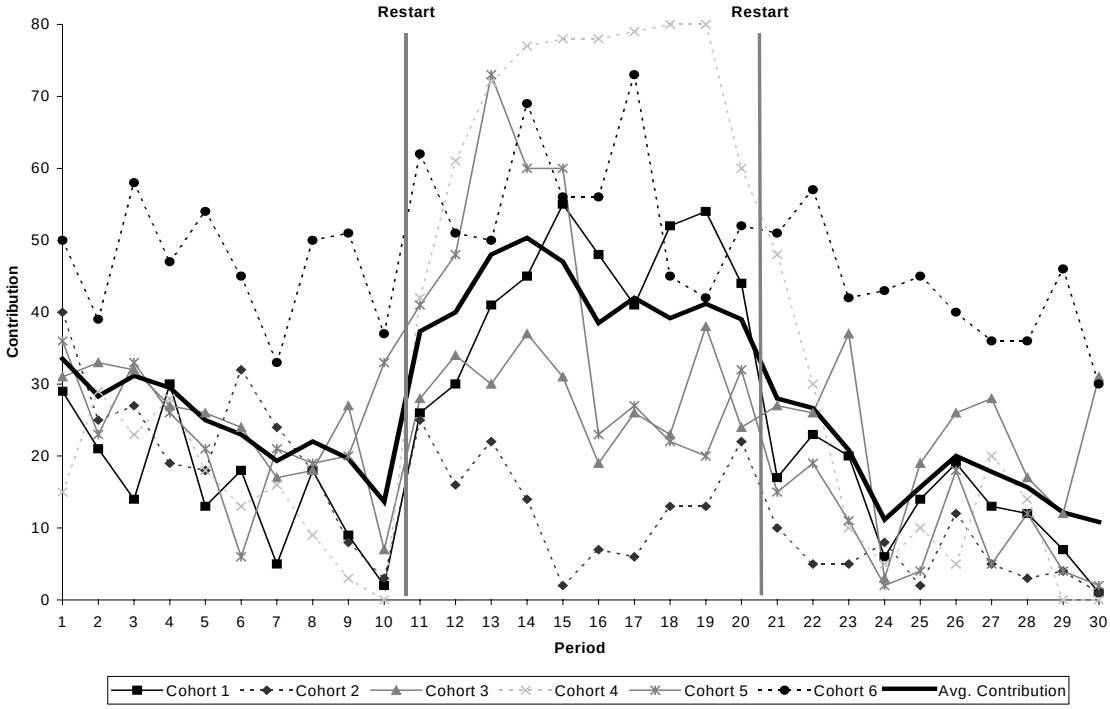


Figure 4: Group Contribution Levels for Each Non-Monetary Sanction Cohort at GATE

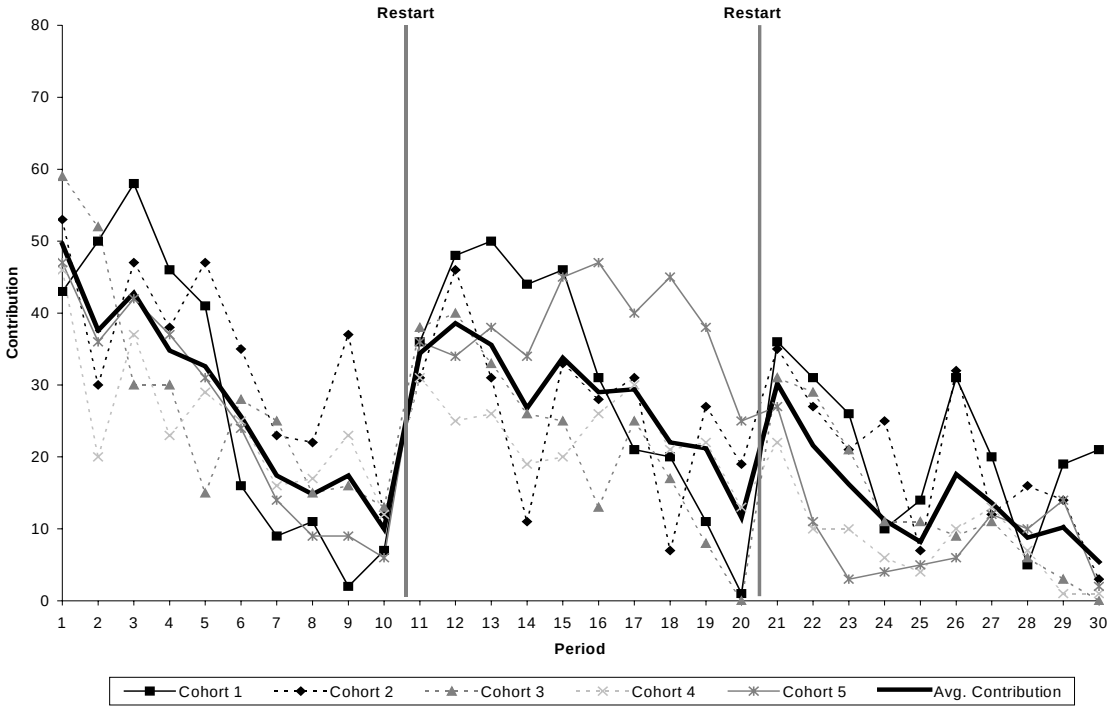


Figure 5: Group Contribution Level for Each Non-Monetary Stranger Session

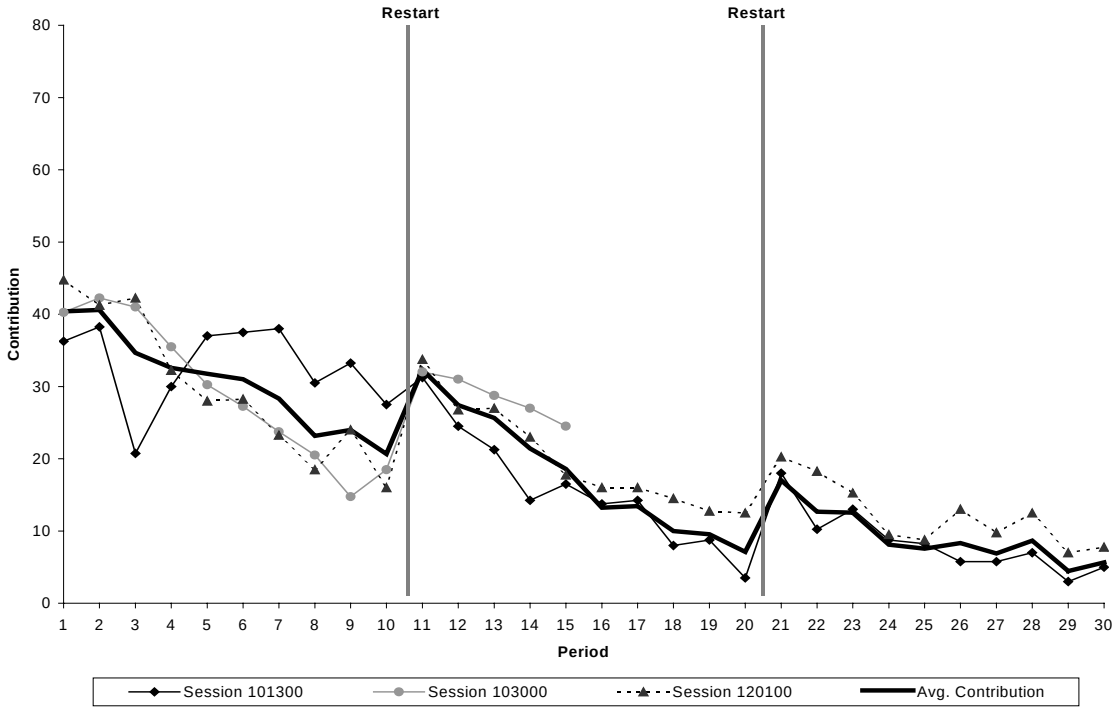


Figure 6: Average Per Period Earnings in MP and NP

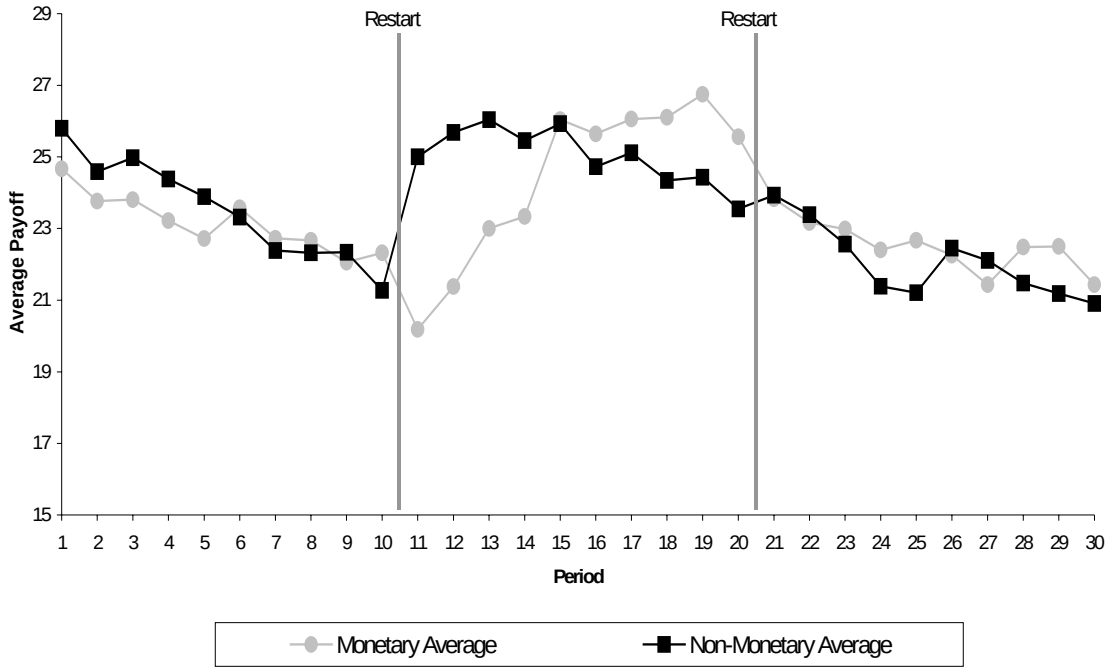


Figure 7: Relative Contribution Between Period t+1 and Period t for Received Monetary Punishment Points in Period t of Partner Matching Protocol

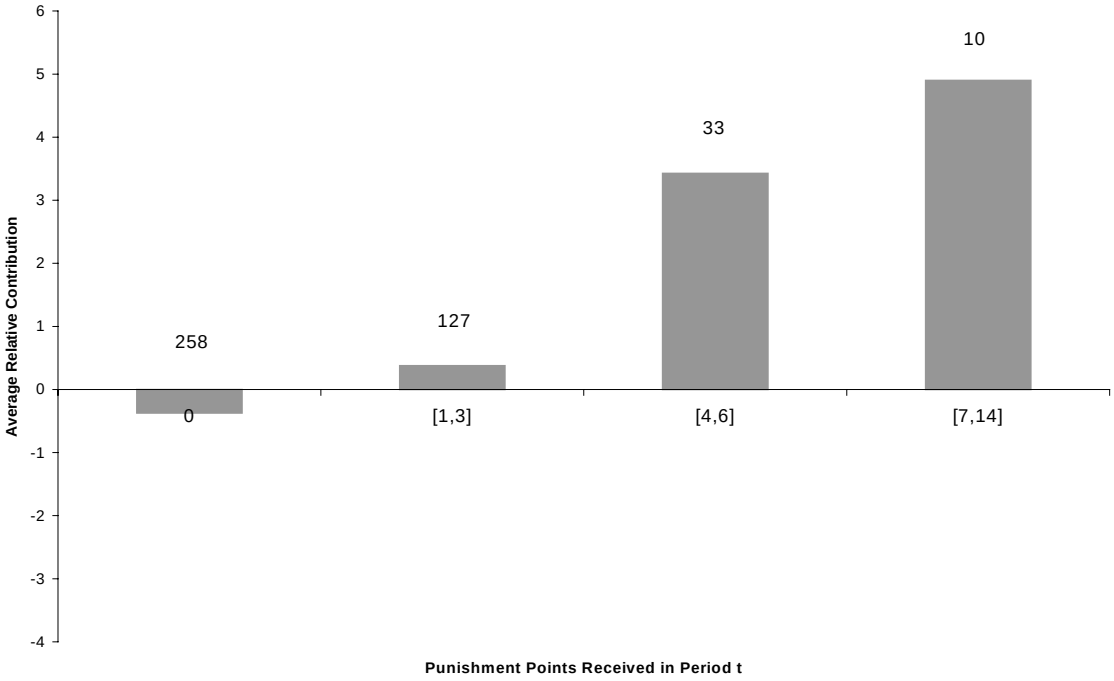


Figure 8: Relative Contribution Between Period t+1 and Period t for Received Non-Monetary Punishment Points in Period t of Partner Matching Protocol

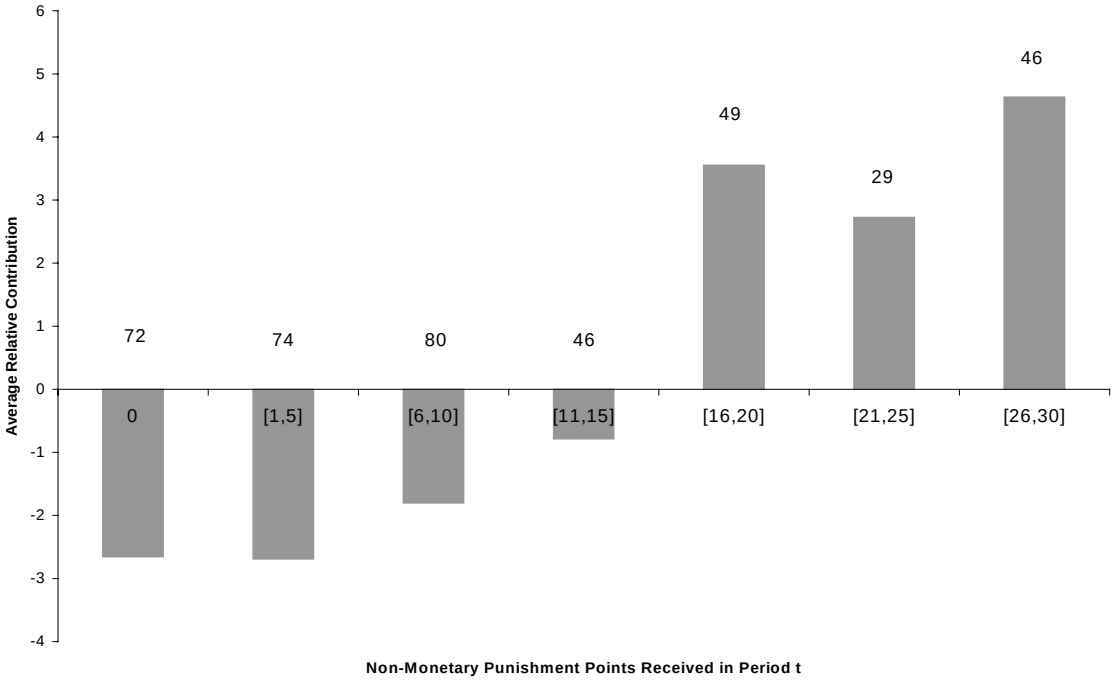
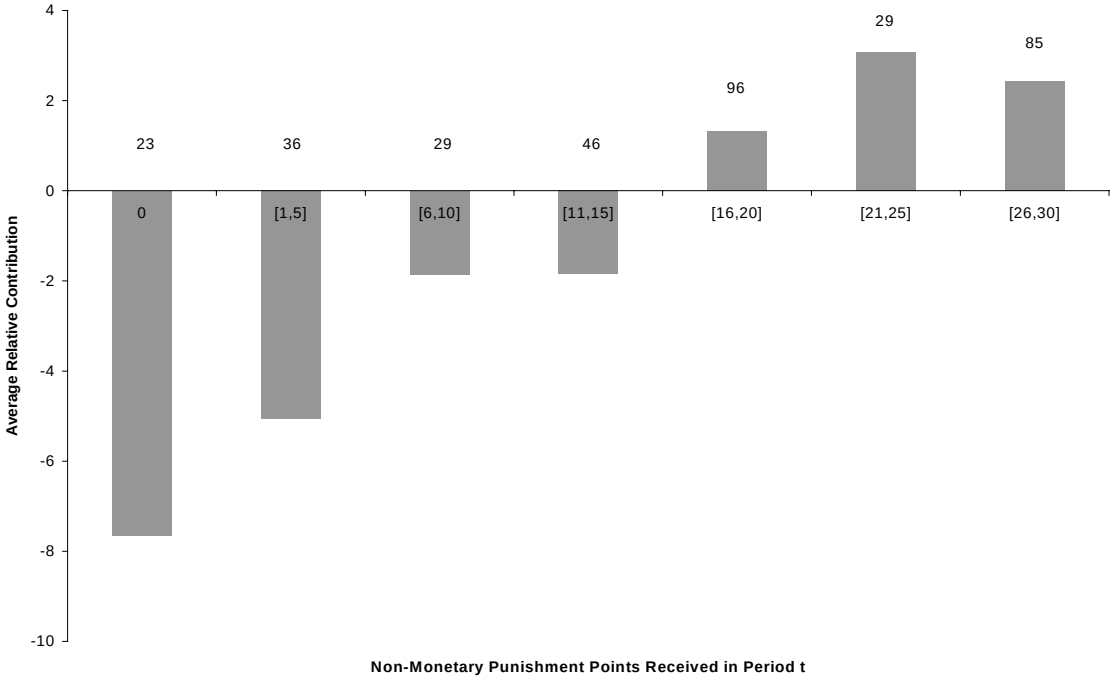


Figure 9: Relative Contribution Between Period t+1 and Period t for Received Non-Monetary Punishment Points in Period t of Stranger Matching Protocol



Instructions for Experiment

General instructions (Monetary Punishment Treatment)

You are now taking part in an economic experiment. If you read the following instructions carefully, you can, depending on your decisions and the decisions of others, earn a considerable amount of money. It is therefore very important that you read these instructions with care.

The instructions we have distributed to you are solely for your private information**. It is prohibited to communicate with the other participants during the experiment.** Should you have any questions please ask us. If you violate this rule, we shall have to exclude you from the experiment and from all payments

During the experiment your entire earnings will be calculated in ECU (Experimental Currency Units). At the end of the experiment the total amount of ECU you have earned will be converted to ECU at the following rate:

30 ECU=$1

Each participant receives a lump sum payment of ___ ECU at the beginning of the experiment. At the end of the experiment your entire earnings from the experiment will be immediately paid to you in cash.

The experiment is divided into periods. In each period the participants are divided into groups of four. You will therefore be in a group with 3 other participants.

Detailed instructions for periods 1-10

At the beginning of each period each participant receives 20 ECU. In the following we call this his or her endowment. Your task is to decide how to use your endowment. You have to decide how many of the 20 ECU you want to contribute to a project and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your endowment in each period is 20 ECU. You have to decide how many ECU to contribute to the project by choosing a number between 0 and 20. After choosing your contribution you must press the ok button. Once you have done this, your decision can no longer be revised.

After all members of your group have made their decision then your screen will show you the total amount of ECU contributed to the project by each of the four group members (including your contribution). This screen shows you how many ECU you have earned.

Your income consist of two parts:
1) the ECU, which you have kept for yourself
2) the income from the project = 40 percent of the total contribution of all 4 group members to the project (the total includes your own contribution)

Your income in ECU in each period is therefore: (20-your contribution to the project)+0.4*(total contributions to the project)

The income of each group member from the project is calculated in the same way, this means that each group member receives the same income from the project.

For example, suppose the total of the contributions of all group members is 60 ECU. In this case each member of the group receives an income from the project of 0.4*60=24 ECU. If the total contribution to the project is 9 ECU, then each member of the group receives an income of 0.4*9=3.6 ECU from the project.

For each ECU that you keep for yourself you earn an income of 1 ECU. For every ECU you contribute to the project instead, the total contribution rises by one ECU. Your income from the project would rise by 0.4*1=0.4 ECU. However the income of the other group members would also rise by 0.4 ECU each, so that the total income of the group from the project would rise by 1.6 ECU. Your contribution to the project therefore also raises the income of the other group members. On the other hand you earn an income for each ECU contributed by the other members to the project. For each ECU contributed by any member you earn 0.4*1=0.4 ECU.

To check your understanding of the experiment, please answer the following questions:
1) Suppose each group member has an endowment of 20 ECU. Nobody (including yourself) contributes any ECU to the project. How high is:
   a) Your income for the period? _____
   b) The income of the other group members for the period? _____
2) Suppose each group member has an endowment of 20 ECU. You contribute 20 ECU to the project. All other group members contribute 20 ECU to the project. What is:
   a) Your income for the period? _____
   b) The income of the other group members for the period? _____
3) Suppose each group member has an endowment of 20 ECU. The other three group members contribute a total of 30 ECU to the project.
   a) What is your income if you contribute 0 ECU to the project? _____
   b) What is your income if you contribute 15 ECU to the project? _____
4) Suppose each group member has an endowment of 20 ECU. You contribute 8 ECU to the project.
   a) What is your income if the other group members together contribute a total of 7 ECU to the project? _____
   b) What is your income if the other group members together contribute a total of 22 ECU to the project? _____

Detailed instructions for periods 11-20

Each period consists of two stages. In the first stage you have to decide how many ECU you would like to contribute to a project. In the second stage you are informed on the contributions of the three other group members to the project. You can decide whether or not to reduce their earnings from the first stage by distributing points to them. The following sections describe the activity in detail.

The first stage

The first stage is identical to the first ten periods. At the beginning of each period each participant receives 20 ECU. In the following we call this his or her endowment. Your task is to decide how to use your endowment. You have to decide how many of the 20 ECU you want to contribute to a project and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your endowment in each period is 20 ECU. You have to decide how many ECU to contribute to the project by choosing a number between 0 and 20. After choosing your contribution you must press the ok button. Once you have done this, your decision can no longer be revised.

After all members of your group have made their decision then your screen will show you the total amount of ECU contributed to the project by each of the four group members (including your contribution). This screen shows you how many ECU you have earned.

Your income consists of two parts:
1) the ECU which you have kept for yourself
2) the income from the project = 40 percent of the total contribution of all 4 group members to the project (the total includes your own contribution)

Your income in ECU in each period is therefore: (20-your contribution to the project)+0.4*(total contributions to the project)

The income of each group member from the project is calculated in the same way, this means that each group member receives the same income from the project.

For example, suppose the total of the contributions of all group members is 60 ECU. In this case each member of the group receives an income from the project of 0.4*60=24 ECU. If the total contribution to the project is 9 ECU, then each member of the group receives an income of 0.4*9=3.6 ECU from the project.

For each ECU that you keep for yourself you earn an income of 1 ECU. For every ECU you contribute to the project instead, the total contribution rises by one ECU. Your income from the project would rise by 0.4*1=0.4 ECU. However the income of the other group members would also rise by 0.4 ECU each, so that the total income of the group from the project would rise by 1.6 ECU. Your contribution to the project therefore also

raises the income of the other group members. On the other hand you earn an income for each ECU contributed by the other members to the project. For each ECU contributed by any member you earn 0.4*1=0.4 ECU.

The second stage

At the beginning of the second stage, your screen shows you how much each of your group members contributed to the project. In this stage you have the opportunity to **reduce or leave equal** the income of **each** group member by **distributing points**. **You can award a large number of points to any member of your group if you disapprove of his or her decision (10 points for the most disapproval. 0 points for the least disapproval. Each point you distribute to a particular player lowers his or her payment by 10%.)**

The other group members can also reduce your income if they wish to. This is apparent from the input screen at the second stage. On the screen, you can see how much each group member contributed to the project at the first stage. Please recall that the same three people will be in your group for the entire experiment.

You must decide how many points to give to each of the other three group members. If you do not wish to change the income of a specific group member then you must enter 0. If you distribute points, you have costs in ECU which depend on the amount of points you distribute. You can distribute between 0 and 10 points to each group member. The more points you give to any group member, the higher your costs. Your total costs are equal to the sum of the costs of distributing points to each of the other three group members. The following table illustrates the relation between distributed points to each group member and the cost of doing so in ECU.

points	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
cost of these points	0	1	2	4	6	9	12	16	20	25	30

Suppose for example that you give 2 points to one member. This costs you 2 ECU. If you give 9 points to another member this costs you an additional 25 ECU; and if you give the last group member 0 points this has no cost for you. In this case your total costs of distributing points would be 27 ECU (2+25+0). Your total cost of distributing points is displayed on the input screen. As long as you have not pressed the ok button you can revise your decision.

If you choose 0 points for a particular group member, you do not change his or her income. However if you give a member 1 point (by choosing 1) you reduce his or her income by 10 percent, etc. The amount of points you distribute to each member determines therefore how much you reduce their income from the first stage.
Whether or by how much the income from the first stage is totally reduced depends on the total of the received points. If somebody received a total of 3 points (from all other group members in this period) his or her income would be reduced by 30 percent. If somebody received a total of 4 points his or her income would be reduced by 40 percent.

If anybody receives **10 or more** points their income from the first stage will be reduced by 100 percent. The income from the first stage for this member would in this case be reduced to zero. Your total income from the two stages is therefore calculated as follows:

Your total payoff for the period (in ECU)

If you **receive** less than 10 points:

= [(income from the 1st stage)*(10-received points)/10]-cost to you of points you distribute

If you **receive** 10 or more points:

= - cost to you of points you distribute

Please note that your income in ECU at the end of the second stage can be negative, if the costs of the points you distribute exceeds your income from the first stage. You can however avoid such losses with certainty through you own decisions by not distributing any points.

After all participants have made their decisions, your income from the period will be displayed on your screen:

To check your understanding of the experiment, please answer the following questions:

5) Suppose in the second stage of a period, you distribute the following amounts of points to the other three group members: 9, 5, and 0. What is the total cost of the points you distribute? _____
6) What are your costs if you distribute a total of 0 points? _____
7) By how many percent will your income from the first stage be reduced, when you receive a total of 0 points from the other group members? _____
8) By how many percent will your income from the first stage be reduced, when you receive a total of 4 points from the other group members? _____
9) By how many percent will your income from the first stage be reduced, when you receive a total of 15 points from the other group members? _____

Detailed Instructions for periods 21-30
In the next ten periods, each period will follow the same rules as periods 1-10.

General instructions (Non-monetary Punishment Partner)

You are now taking part in an economic experiment. If you read the following instructions carefully, you can, depending on your decisions and the decisions of others, earn a considerable amount of money. It is therefore very important that you read these instructions with care.

The instructions we have distributed to you are solely for your private information**. It is prohibited to communicate with the other participants during the experiment.** Should you have any questions please ask us. If you violate this rule, we shall have to exclude you from the experiment and from all payments

During the experiment your entire earnings will be calculated in ECU (Experimental Currency Units). At the end of the experiment the total amount of ECU you have earned will be converted to ECU at the following rate:

30 ECU=$1

Each participant receives a lump sum payment of ___ ECU at the beginning of the experiment. At the end of the experiment your entire earnings from the experiment will be immediately paid to you in cash.

The experiment is divided into periods. In each period the participants are divided into groups of four. You will therefore be in a group with 3 other participants.

Detailed instructions for periods 1-10

At the beginning of each period each participant receives 20 ECU. In the following we call this his or her endowment. Your task is to decide how to use your endowment. You have to decide how many of the 20 ECU you want to contribute to a project and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your endowment in each period is 20 ECU. You have to decide how many ECU to contribute to the project by choosing a number between 0 and 20. After choosing your contribution you must press the ok button. Once you have done this, your decision can no longer be revised.

After all members of your group have made their decision then your screen will show you the total amount of ECU contributed to the project by each of the four group members (including your contribution). This screen shows you how many ECU you have earned.

Your income consist of two parts:
1) the ECU, which you have kept for yourself
2) the income from the project = 40 percent of the total contribution of all 4 group members to the project (the total includes your own contribution)

Your income in ECU in each period is therefore: (20-your contribution to the project)+0.4*(total contributions to the project)

The income of each group member from the project is calculated in the same way, this means that each group member receives the same income from the project.

For example, suppose the total of the contributions of all group members is 60 ECU. In this case each member of the group receives an income from the project of 0.4*60=24 ECU. If the total contribution to the project is 9 ECU, then each member of the group receives an income of 0.4*9=3.6 ECU from the project.

For each ECU that you keep for yourself you earn an income of 1 ECU. For every ECU you contribute to the project instead, the total contribution rises by one ECU. Your income from the project would rise by 0.4*1=0.4 ECU. However the income of the other group members would also rise by 0.4 ECU each, so that the total income of the group from the project would rise by 1.6 ECU. Your contribution to the project therefore also raises the income of the other group members. On the other hand you earn an income for each ECU contributed by the other members to the project. For each ECU contributed by any member you earn 0.4*1=0.4 ECU.

To check your understanding of the experiment, please answer the following questions:
1) Suppose each group member has an endowment of 20 ECU. Nobody (including yourself) contributes any ECU to the project. How high is:
   a) Your income for the period? _____
   b) The income of the other group members for the period? _____
2) Suppose each group member has an endowment of 20 ECU. You contribute 20 ECU to the project. All other group members contribute 20 ECU to the project. What is:
   a) Your income for the period? _____
   b) The income of the other group members for the period? _____
3) Suppose each group member has an endowment of 20 ECU. The other three group members contribute a total of 30 ECU to the project.
   a) What is your income if you contribute 0 ECU to the project? _____
   b) What is your income if you contribute 15 ECU to the project? _____
4) Suppose each group member has an endowment of 20 ECU. You contribute 8 ECU to the project.
   a) What is your income if the other group members together contribute a total of 7 ECU to the project? _____
   b) What is your income if the other group members together contribute a total of 22 ECU to the project? _____

Detailed instructions for periods 11-20

Each period consists of two stages. In the first stage you have to decide how many ECU you would like to contribute to a project. In the second stage you are informed on the contributions of the three other group members to the project. You can decide whether or not to register disapproval of each other group member's decision by distributing points to them. The following sections describe the activity in detail.

The first stage

The first stage is identical to the first ten periods. At the beginning of each period each participant receives 20 ECU. In the following we call this his or her endowment. Your task is to decide how to use your endowment. You have to decide how many of the 20 ECU you want to contribute to a project and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your endowment in each period is 20 ECU. You have to decide how many ECU to contribute to the project by choosing a number between 0 and 20. After choosing your contribution you must press the ok button. Once you have done this, your decision can no longer be revised.

After all members of your group have made their decision the your screen will show you the total amount of ECU contributed to the project by each of the four group members (including your contribution). This screen shows you how many ECU you have earned.

Your income consists of two parts:
1) the ECU, which you have kept for yourself
2) the income from the project = 40 percent of the total contribution of all 4 group members to the project (the total includes your own contribution)

Your income in ECU in each period is therefore: (20-your contribution to the project)+0.4*(total contributions to the project)

The income of each group member from the project is calculated in the same way, this means that each group member receives the same income from the project.

For example, suppose the total of the contributions of all group members is 60 ECU. In this case each member of the group receives an income from the project of 0.4*60=24 ECU. If the total contribution to the project is 9 ECU, then each member of the group receives an income of 0.4*9=3.6 ECU from the project.

For each ECU that you keep for yourself you earn an income of 1 ECU. For every ECU you contribute to the project instead, the total contribution rises by one ECU. Your income from the project would rise by 0.4*1=0.4 ECU. However the income of the other group members would also rise by 0.4 ECU each, so that the total income of the group from the project would rise by 1.6 ECU. Your contribution to the project therefore also raises the income of the other group members. On the other hand you earn an income for

each ECU contributed by the other members to the project. For each ECU contributed by any member you earn 0.4*1=0.4 ECU.

The second stage

At the beginning of the second stage, your screen shows you how much each of your group members contributed to the project. In this stage you have the opportunity to register **your approval or disapproval o**f **each** other group member's decision by **distributing points**. **You can award a large number of points to any member of your group if you disapprove of his or her decision (10 points for the most disapproval. 0 points for the least disapproval.)**

The other group members can also assign points to you if they wish to. This is apparent from the input screen at the second stage. On the screen, you can see how much each group member contributed to the project at the first stage. Please recall that the same three people will be in your group for the entire experiment.

You must decide how many points to give to each of the other three group members. If you do not wish to register a disapproval of the decision of a specific group member then you must enter 0.

After all participants have made their decisions, your income from the period will be displayed on your computer screen.

Detailed Instructions for periods 21-30
In the next ten periods, each period will follow the same rules as periods 1-10.

General instructions (Non-monetary Punishment Stranger)

You are now taking part in an economic experiment. If you read the following instructions carefully, you can, depending on your decisions and the decisions of others, earn a considerable amount of money. It is therefore very important that you read these instructions with care.

The instructions we have distributed to you are solely for your private information**. It is prohibited to communicate with the other participants during the experiment.** Should you have any questions please ask us. If you violate this rule, we shall have to exclude you from the experiment and from all payments

During the experiment your entire earnings will be calculated in ECU (Experimental Currency Units). At the end of the experiment the total amount of ECU you have earned will be converted to ECU at the following rate:

30 ECU=$1

Each participant receives a lump sum payment of ___ ECU at the beginning of the experiment. At the end of the experiment your entire earnings from the experiment will be immediately paid to you in cash.

The experiment is divided into periods. In each period the participants are divided into groups of four. You will therefore be in a group with 3 other participants.

Detailed instructions for periods 1-10

At the beginning of each period each participant receives 20 ECU. In the following we call this his or her endowment. Your task is to decide how to use your endowment. You have to decide how many of the 20 ECU you want to contribute to a project and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your endowment in each period is 20 ECU. You have to decide how many ECU to contribute to the project by choosing a number between 0 and 20. After choosing your contribution you must press the ok button. Once you have done this, your decision can no longer be revised.

After all members of your group have made their decision then your screen will show you the total amount of ECU contributed to the project by each of the four group members (including your contribution). This screen shows you how many ECU you have earned.

Your income consist of two parts:
1) the ECU, which you have kept for yourself
2) the income from the project = 40 percent of the total contribution of all 4 group members to the project (the total includes your own contribution)

Your income in ECU in each period is therefore: (20-your contribution to the project)+0.4*(total contributions to the project)

The income of each group member from the project is calculated in the same way, this means that each group member receives the same income from the project.

For example, suppose the total of the contributions of all group members is 60 ECU. In this case each member of the group receives an income from the project of 0.4*60=24 ECU. If the total contribution to the project is 9 ECU, then each member of the group receives an income of 0.4*9=3.6 ECU from the project.

For each ECU that you keep for yourself you earn an income of 1 ECU. For every ECU you contribute to the project instead, the total contribution rises by one ECU. Your income from the project would rise by 0.4*1=0.4 ECU. However the income of the other group members would also rise by 0.4 ECU each, so that the total income of the group from the project would rise by 1.6 ECU. Your contribution to the project therefore also raises the income of the other group members. On the other hand you earn an income for each ECU contributed by the other members to the project. For each ECU contributed by any member you earn 0.4*1=0.4 ECU.

To check your understanding of the experiment, please answer the following questions:

1) Suppose each group member has an endowment of 20 ECU. Nobody (including yourself) contributes any ECU to the project. How high is:
   a) Your income for the period? _____
   b) The income of the other group members for the period? _____
2) Suppose each group member has an endowment of 20 ECU. You contribute 20 ECU to the project. All other group members contribute 20 ECU to the project. What is:
   a) Your income for the period? _____
   b) The income of the other group members for the period? _____
3) Suppose each group member has an endowment of 20 ECU. The other three group members contribute a total of 30 ECU to the project.
   a) What is your income if you contribute 0 ECU to the project? _____
   b) What is your income if you contribute 15 ECU to the project? _____
4) Suppose each group member has an endowment of 20 ECU. You contribute 8 ECU to the project.
   a) What is your income if the other group members together contribute a total of 7 ECU to the project? _____
   b) What is your income if the other group members together contribute a total of 22 ECU to the project? _____

Detailed instructions for periods 11-20

In each period, the participants are divided into groups of four. You will therefore be in a group with 3 other participants. However, you will never be matched with the same 3 participants in any 2 consecutive periods. The computer terminals throughout the room are numbered 1-16. Each period, you will have a different computer assignment. Your computer assignments are provided to you on the **Computer Assignment Sheet** within

your instruction packet**.** At the end of each period, the experimenter will make an announcement to signal when to move to the computer assignment for the following period.

Each period consists of two stages. In the first stage you have to decide how many ECU you would like to contribute to a project. In the second stage you are informed on the contributions of the three other group members to the project. You can decide whether or not to register disapproval of each other group member's decision by distributing points to them. The following sections describe the activity in detail.

The first stage

The first stage is identical to the first ten periods. At the beginning of each period each participant receives 20 ECU. In the following we call this his or her endowment. Your task is to decide how to use your endowment. You have to decide how many of the 20 ECU you want to contribute to a project and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your endowment in each period is 20 ECU. You have to decide how many ECU to contribute to the project by choosing a number between 0 and 20. After choosing your contribution you must press the ok button. Once you have done this, your decision can no longer be revised.

After all members of your group have made their decision the your screen will show you the total amount of ECU contributed to the project by each of the four group members (including your contribution). This screen shows you how many ECU you have earned.

Your income consists of two parts:
1) the ECU which you have kept for yourself
2) the income from the project = 40 percent of the total contribution of all 4 group members to the project (the total includes your own contribution)

Your income in ECU in each period is therefore: (20-your contribution to the project)+0.4*(total contributions to the project)

The income of each group member from the project is calculated in the same way, this means that each group member receives the same income from the project.

For example, suppose the total of the contributions of all group members is 60 ECU. In this case each member of the group receives an income from the project of 0.4*60=24 ECU. If the total contribution to the project is 9 ECU, then each member of the group receives an income of 0.4*9=3.6 ECU from the project.

For each ECU that you keep for yourself you earn an income of 1 ECU. For every ECU you contribute to the project instead, the total contribution rises by one ECU. Your income from the project would rise by 0.4*1=0.4 ECU. However the income of the other group members would also rise by 0.4 ECU each, so that the total income of the group

from the project would rise by 1.6 ECU. Your contribution to the project therefore also raises the income of the other group members. On the other hand you earn an income for each ECU contributed by the other members to the project. For each ECU contributed by any member you earn 0.4*1=0.4 ECU.

The second stage

At the beginning of the second stage, your screen shows you how much each of your group members contributed to the project. In this stage you have the opportunity to register **your approval or disapproval o**f **each** other group member's decision by **distributing points**. **You can award a large number of points to any member of your group if you disapprove of his or her decision (10 points for the most disapproval. 0 points for the least disapproval.)**

The other group members can also assign points to you if they wish to. This is apparent from the input screen at the second stage. On the screen, you can see how much each group member contributed to the project at the first stage.

You must decide how many points to give to each of the other three group members. If you do not wish to register a disapproval of the decision of a specific group member then you must enter 0.

After all participants have made their decisions, your income from the period will be displayed on your computer screen. Record your period earnings on your record sheet.

Detailed Instructions for periods 21-30

In the next ten periods, each period will follow the same rules as periods 1-10.