Monetary and Non-Monetary Punishment in Public Goods Games with Teams.*

Mir Adnan Mahmood[1], Christina Gore[2], and John H. Kagel[1]

[1]Department of Economics, The Ohio State University
[2]Department of Agricultural, Environmental and Development Economics, The Ohio State University

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Abstract

Decisions pertaining to the provision of public goods, as well as imposition of sanctions to curb free riding, are often undertaken by groups rather than individuals. We experimentally investigate the behavior of teams in a public goods game with costly/monetary and verbal/non-monetary punishment. Teams of two take part in a finitely repeated public goods game with and without punishment. Absent of punishment, we find that similar contribution levels across teams and individuals. We find that monetary punishment is effective in significantly raising contribution levels when decision makers are both teams and individuals, with teams nearly reaching the socially optimum level of maximum contributions. Non-monetary punishment is effective in raising contributions when decision makers are individuals. However, in sharp contrast to the above, behavior in teams appears to be unaffected under the threat of non-monetary punishment, with contributions declining sharply in the final periods of the experiment. We find no difference in Punishment behavior between teams and individuals under monetary punishment. However, net benefits are higher under monetary punishment (compared to non-monetary punishment) when DMs are teams.

Keywords: Public goods; Group decision-making; Punishment; Experiment; Communication

JEL Classification: C72; C73; C92; H41

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1 Introduction

The provision of public goods has been a widespread phenomenon. At the micro level, one can think about a household offering up its services for a neighborhood watch. A tier up, one can think about the local government offering to develop the infrastructure of the local county. At the macro level, one can consider national defense to be a prime example. At the global level, the most fundamental examples are policies pertaining to combating climate change. Due to their nature, however, public goods are often subjected to the free-rider problem. As a result, economic theory often predicts under-provision of public goods. To combat this, public goods are often associated with sanctioning mechanisms in place which punish free-riders for their lack of contributions.

A large body of experimental literature has documented behavior in public goods games with and without sanctioning environments. Experimental findings suggest that sanctions are indeed successful in mitigating the free-rider problem and increasing individual contributions to public goods (see Fehr and Gächter, 2000; Masclet et al., 2003; Herrmann et al., 2008, for example) irrespective of whether the sanctions are monetary or verbal in nature. However, this literature assumes that decision makers are individual people. In contrast, most decisions pertaining to public goods are undertaken by teams consisting of multiple people. For example, the decision to contribute to a neighborhood watch is undertaken by the whole household. National defense and climate change policies are set by their respective departments in the nation's government. Similarly, sanctioning environments are also jointly decided upon by teams.

This begs the question: how do teams compare to individuals in public goods games? Recent experimental evidence suggests that teams act more rationally than individuals in a wide variety of settings (Charness and Sutter, 2012; Kugler et al., 2012). However, the literature comparing teams to individuals in public goods games is very scant. Cox and Stoddard (2018) are the first to analyze team behavior in a public goods game. They find similar contribution behavior between teams and individuals, however their experiment does not consider any sanctioning environment. Auerswald et al. (2018) take it a step further and compare teams to individuals in a public goods game with and without costly punishment. They find that costly punishment does increase contribution levels even when decision makers are teams, however they find that teams do punish less than individuals.

This paper seeks to experimentally investigate team behavior in public goods games. In our experiment, a group of decision makers first take part in a finitely repeated public goods game without a sanctioning mechanism and then take part in a finitely repeated public goods game with a sanctioning mechanism. Decision makers are either individuals or a team of two individuals who jointly make a decision. Our experiment allows for intra-team communication to aid coordination over decisions.

We consider two forms of sanctioning mechanisms. The first one is a costly punishment option (henceforth monetary punishment) under which decision makers can assign points to reduce other decision makers payoff at some cost. This is the sanctioning mechanism used in Auerswald et al. and mimics situations in which fines are imposed on free-riders. Our second sanctioning mechanism is a verbal punishment option (henceforth non-monetary punishment) in which decision makers are allowed to express their disapproval of other decision makers' contributions by assigning points. Disapproval is costless to assign and has no impact on earnings. We include non-monetary punishment as a sanctioning mechanism as 1) evidence suggests it has a similar effect in increasing contributions for individuals (Masclet et al., 2003) and 2) many sanctions involve the use of warnings and verbal admonishment.[1]

We find that contribution levels are similar between teams and individuals without punishment. We find that the threat of monetary punishment increases contribution levels when the decision makers are both teams and individuals. We also find that teams contribute more than individuals under monetary punishment. Furthermore, non-monetary punishment also increases contributions for individuals. However, non-monetary punishment appears to have no impact on contributions when decision makers are teams. Teams under non-monetary punishment contribute substantially lower than both individuals under non-monetary punishment *and* teams under monetary punishment.

The remainder of the paper proceeds as follows. Section 2 discusses the related literature in detail. Section 3 presents the experimental design. Section 4 outlines our testable hypotheses. Section 5 documents our results and Section 6 concludes with a discussion and future prospects.

2 Related Literature

Our paper expands on the large experimental literature surrounding public goods game. Ledyard (1995) provides a concise survey of early experimental work. Summarizing those findings, studies show that individuals do not free-ride as game theory predicts. Individuals tend to cooperate more than game theory predicts, which tends to decline as the game progresses so, rates of free-riding increase over time. Fischbacher and Gachter (2010) attributes this effect to the fact that people are "imperfect conditional cooperators" in the sense that people's contribution decisions rely partly on their beliefs about other people's contributions as well as on their "predicted contributions."[2]

Our study investigates the impact that sanctioning institutions, such as monetary and non-monetary punishment, have on sustaining cooperative behavior in a public goods game (for a survey, see Chaud-

[1]A prime example of an agency using both forms of sanctioning mechanisms is the Environmental Protection Agency who undertakes both Civil Administrative Actions (notices of violations – non-monetary) and Civil Judicial Actions (formal lawsuits – monetary) against non-compliant entities. https://www.epa.gov/enforcement/basic-information-enforcement

[2]Predicted contributions here refer to the contribution schedule elicited from each individual conditional on the average contribution of other group members.

huri 2011). Fehr and Gächter (2000) is the first experiment to study the effect of costly monetary punishment on cooperation. In their experimental design, individuals are allowed to assign punishment points to other individuals on the basis of their contribution decisions. Punishment is costly for both the assigner and the assignee. Each point assigned reduces an individuals payoff by 10%. The paper finds that monetary punishment is able to sustain a high degree of cooperation. This finding has been replicated in multiple follow up papers (see for example Masclet et al. 2003; Herrmann et al. 2008; Nikiforakis 2008; Nikiforakis and Normann 2008). Masclet et al. (2003) also documents the effects of non-monetary punishment. In this setting, punishment is costless to assign and does not have any impact on payoffs of individuals who are assigned punishment points. Masclet et al. (2003) finds under Partners matching, non-monetary and monetary punishment result in similar increases in contributions initially, however contributions decline under non-monetary punishment in the latter half. Our experiment expands on this body of literature by examining the effects of non-monetary and monetary punishment when decision makers are teams rather than individuals.

Recently, focus has shifted towards analyzing group decision making in public goods games. Cox and Stoddard (2018) is among the first experiment to analyze a public goods games in which teams of two jointly make contribution decisions. In comparing teams to individuals, they find that teams initially contribute more than individuals, however contribution tends to decline faster for teams. Overall, Cox and Stoddard (2018) documents similar contribution levels for teams and individuals. The experimental design allows for intra-team communication. Analysis of the chat logs indicate support for backwards induction reasoning within teams. Our experiment extends the setting of Cox and Stoddard by incorporating a sanctioning environment in the form of monetary or non-monetary punishment.

Kamei (2018) analyzes a two individual decision maker public goods game with teams and finds that cooperation is easier to sustain under Partners matching than Strangers matching. Christens et al. (2019) documents the effect of identification in public goods games with groups. They find that without identification, groups contribute higher than individuals, however the effect of identification (in increasing contributions) is smaller and temporary for groups.

The most closely related paper to our study is Auerswald et al. (2018) that documents the effect of monetary punishment in a public goods game with teams. The experimental design focuses on 3 person teams in which team members go through a series of rounds of proposals to reach an agreement over contribution and punishment levels. The treatments focus on majority and unanimity rules. The experiment finds that teams under unanimity rules contribute more than individuals, however they also punish significantly less. Furthermore, teams exhibit little to no anti-social punishment compared to individuals. Our paper extends the analysis of Auerswald et al. (2018) by allowing for intra-team communication as well as non-monetary punishment in the spirit of Masclet et al. (2003).

This paper also adds to the growing body of literature surrounding group decision making. Experimental evidence suggests that groups act more in accordance to game theoretic predictions than individuals (for a survey of early works in the literature, see Charness and Sutter 2012 and Kugler et al. 2012). For example, group decision making has been studied extensively in a variety of games: Signalling games (Cooper and Kagel, 2005); Centipede games (Bornstein et al., 2004); Beauty contests (Kocher and Sutter, 2005; Sutter, 2005); hidden action trust games (Kugler et al., 2007; Nielsen et al., 2019); and Dictator Games (Doerrenberg and Feldhaus, 2019). However, there is experimental evidence that suggests that groups may not be more rational than individuals. Müller and Tan (2013) experimentally investigates the effect of group decision making in a Stackelberg Duopoly and finds that groups tend to stray further from Subgame Perfect Equilibrium.

More closely related to our setting are the studies documenting the effect of group decision making in repeated Prisoner's Dilemma games. Prisoner's Dilemma games and Public Goods game are very similar in nature in the sense that equilibrium predictions yield a Pareto Dominated outcome. In both cases, equilibrium predictions indicate that all decision makers will choose to defect (in Public Goods Games, defection is equivalent to free-riding) however the Pareto Optimal outcome involves cooperation. Kagel and McGee (2016) look at decision making in teams in a finitely repeated prisoner's dilemma setting. They find that teams exhibit significantly lower levels of cooperation than individuals in early supergames, however cooperation increases in later games to the point where overall teams are more cooperative than individuals. Endgame effects, however are stronger for teams than individuals in that teams are significantly less cooperative in the final stages of the game. Kagel (2018) extends the above to allow for cheap talk between opponents. While cheap talk does increase cooperation in both teams and individual settings, cooperation rates amongst teams are still significantly lower than individuals, especially in later stages of the game.

A point of note is that Public Goods games are inherently more complex than Prisoner Dilemma games. The latter only involves decision makers making a binary decision (Cooperate or Defect) whereas the former involves decision makers choosing over a menu of options in regards to contribution decisions. As pointed out in Cox and Stoddard, this can result in the prevalence of complex social norms in Public Goods games. Furthermore, public goods games allow us to judge the degree of willingness to cooperate by analyzing contribution levels (Auerswald et al.). Lastly, we also focus on how sanctioning institutions (here monetary or non-monetary punishment) can impact cooperation.

3 Experimental Design

We consider a linear public goods game game similar to Masclet et al. (2003) and Auerswald et al. (2018). We follow a 2x2 design in which we vary the treatments across 2 dimensions:

i) Whether the decision maker is an individual, or a team of two individuals who jointly make decisions, and,

ii) Whether the punishment is monetary or non-monetary in nature.

Table 1 summarizes the treatments used for the experiments.

Table 1: Experimental Design

Treatment	Decision Maker	Punishment
1. I-M	Individual	Monetary
2. I-NM	Individual	Non-Monetary
3. T-M	Team	Monetary
4. T-NM	Team	Non-Monetary

For each treatment, a group of 4 decision makers (DMs) take part in a finitely repeated public goods game. DMs are randomly sorted into groups of 4 at the beginning of the session and these groups remain fixed throughout the experiment.[3] Furthermore, in treatments T-M and T-NM, teams are randomly assigned at the beginning of the session and remain fixed throughout the experiment. Each treatment consists of 2 parts.[4]

Part 1 is identical across all treatments. Each DM takes part in 10 periods of a standard Public Goods game. Each DM in a group is endowed with 60 tokens. Every DM i decides to (simultaneously) contribute an amount c_i ($0 \leq c_i \leq 60$) to a "group project". Each token contributed to the group project raises the payoffs of **all** DMs in the group by 0.75 tokens. The payoff for DM i at the end of each period in part 1 is:

$$\pi_i = 60 - c_i + 0.75\left(\sum_{j=1}^{4} c_j\right)$$

In the teams treatment, teams are allowed a total of 2 minutes at the beginning of each period to communicate with each other electronically in order to reach a decision on how much to contribute. In the individuals treatment, decision makers are allowed 1 minute to reach a decision. If they cannot reach

[3]Masclet et al. (2003) show that non-monetary punishment is most effective with individuals under fixed matching. We therefore consider only fixed matching as it allows for a sharper comparison between teams and individual behavior under non-monetary punishment.

[4]Subjects were notified at the beginning that there will be two parts to the experiment and that instructions for part 2 will be given out after the end of part 1. Instructions for the team treatments are given in the appendix.

a decision in this time, the computer selects a random contribution amount on their behalf.[5] At the end of each period, DMs are given feedback about their decision as well as the decisions of all other DMs in their group (including whether or not the decisions were randomly determined) and their payoffs.

Part 2 in each treatment depends on the type of punishment. Part 2 also consists of 10 periods and each period proceeds in 2 stages. The first stage is identical to a period in Part 1; each DM is endowed with 60 tokens and has to decide whether or not to contribute to a "group project," with first stage payoffs $\pi_i^1 = 60 - c_i + 0.75\left(\sum_{j=1}^{4} c_j\right)$.

In the second stage, DMs are notified about the contribution levels of the other DMs in the group and are allowed to (simultaneously) punish them as they see fit.[6] A DM i can punish DM j by assigning them punishment points p_i^j. Each DM can assign a maximum of 15 points to every other DM in their group. For the teams treatments, each DM has 90 seconds to communicate and reach a decision. For individual treatments, each DM has 45 seconds. If a DM fails to reach a decision in time, the computer randomly decides on their behalf.[7] At the end of the period, subjects are provided with feedback on their contribution decisions, their payoffs from stage 1, the number of punishment points they received and assigned, and their final payoffs.

In monetary punishment treatments, each punishment point costs 1 token to assign to another DM and each point assigned to a DM reduces their payoff by 3 tokens, resulting in a reduction to cost ratio of 3:1. This punishment cost setup is identical to the one employed in Auerswald et al. (2018) and Herrmann et al. (2008).[8] Following Auerswald et al., the payoffs for the period are given by:

$$\pi_i^2 = \max\left\{0, \pi_i^1 - 3\sum_{j\neq i} p_j^i\right\} - \sum_{j\neq i} p_i^j$$

Such payoffs ensure that the DMs only bear the cost of assigning punishment points in the case that the reduction from receiving points exceeds the stage 1 payoffs.

In non-monetary punishment treatments, there is no cost to assign punishment and there is no reduction from receiving punishment. The punishment essentially serves as an indicator of a DM's disapproval about another DM's action. This is the setting of the non-monetary punishment setting

[5]Failure to reach a decision in time was very rare for Teams (out of 960 contribution decisions, only 33 decisions were randomly determined, 17 of which occurred in the first period of the entire session).

[6]The identifiers for the other group members are reshuffled randomly every period to prevent reputation building and ensure that DMs don't punish due to past actions. This reshuffling is common knowledge.

[7]Failure to reach a decision in time was observed in 28 out of 480 instances. Further analysis of the data indicates most of these were due to coordination failure and 20 of these instances occurred in the first 2 periods (14 of which happened in the first period).

[8]Nikiforakis and Normann (2008) show that in order for punishment to be effective at increasing the contribution levels, the reduction to cost ratio must be high enough. In particular, they find that a reduction to cost ratio higher than 2 manages to sustain cooperation.

employed by Masclet et al. (2003). As a result, final period payoffs are the same as Stage 1 payoffs:

$$\pi_i^2 = \pi_i^1$$

As a side note, in the Team treatments, both team members get the final payoffs. This is to ensure that the incentives are identical across all treatments.

Sessions were conducted during the months of January and February 2020 at the Ohio State University Experimental Economics Laboratory. Subjects were recruited using the online recruitment system ORSEE (Greiner, 2015). Subjects were seated at computer terminals with privacy dividers in between. Instructions were read out loud at the beginning of the experiment. Subjects were then asked a series of control questions to test their understanding of the experiment and the experiment only proceeded once everyone answered the questions correctly (any mistakes or sources of confusion were clarified personally by the experimenters). Subjects were paid for the total number of tokens accumulated throughout the session at the rate of 100 tokens to \$1. Earnings averaged around \$30 including a \$3 show-up fee. The experiment was programmed in zTree (Fischbacher, 2007).[9] Sessions lasted for 45 minutes for individuals and 75 minutes for teams.

4 Hypotheses

Our hypotheses stem from the fact that teams are expected to act more rationally than individuals. For a given stage game without punishment, there is a unique, dominance solvable Nash Equilibrium in which every decision maker contributes 0 tokens to the project. However, the socially optimum outcome occurs when everyone contributes the maximum possible amount (i.e. their endowment). Given the fact that teams are expected to behave more rationally, we expect lower contributions under team treatments as compared to individuals.

Hypothesis 1. *Teams contribute less than individuals.*

We also compare how decision makers behave under the threat of monetary and non-monetary punishment. We first consider the effect of monetary punishment on contribution levels. Past experimental evidence suggests that monetary punishment is effective in enhancing cooperation in public goods games (see Fehr and Gächter, 2000; Masclet et al., 2003; Herrmann et al., 2008). Furthermore, Auerswald et al. (2018) show that monetary punishment increases contribution levels even when the

[9]The code used was adapted from the code used by Cox and Stoddard (2018) and Auerswald et al. (2018). The matching protocol and chat construction was adapted from Cox and Stoddard. The construction of the contracts table and the program to check for matching punishment decisions between team members was adapted from Auerswald et al.

Decision Makers are teams, rather than individuals. We expect similar trends as the aforementioned studies in that the threat of monetary punishment increases contribution levels for both teams and individuals.

Hypothesis 2. *The threat of monetary punishment increases contribution levels for both Teams and Individuals.*

In regards to non-monetary punishment, Masclet et al. (2003) document that non-monetary sanctions have a similar effect in raising overall contribution levels when the decision makers are individuals. They argue that informal punishment may yield dis-utility to an individual, prompting them to raise contributions. We expect this result to hold true in our setting as well.

Hypothesis 3. *Individuals increase contribution levels under the threat of non-monetary punishment.*

In regards to team behavior, we expect the coordination process and joint decision making to effectively weed out the aforementioned effect. In particular, if teams are more rational, they should be able to identify that punishment has no effect on their earnings. We therefore expect no change in behavior for teams under the threat of non-monetary punishment.

Hypothesis 4. *Teams are unaffected by the threat of non-monetary punishment.*

We now turn towards punishment behavior. Under monetary punishment, it is costly for a Decision Maker to assign points. Using sub-game perfection, in the second stage it is rational for Decision Makers to assign 0 points. Given this, in the first stage, the equilibrium prediction suggests that no DM will contribute anything. Once again, we expect Teams to follow game theoretic predictions resulting in the following:

Hypothesis 5. *Under monetary punishment, teams punish less than individuals.*

We cannot offer predictions pertaining to punishment behavior under non-monetary punishment. Seeing how punishment has no impact on earnings, in any sub-game perfect equilibrium, each DM will contribute 0 tokens. However, any profile of punishment points is possible in any sub-game perfect equilibrium.

We finally turn towards the effect of received punishment on future contributions. Under monetary punishment, given that teams are expected to be more rational than individuals, we expect contribution decisions under teams to be less effected by received points. We expect similar findings to hold under non-monetary punishment as well. In particular, we expect teams to not react to received punishment under non-monetary punishment.

Hypothesis 6. *Conditional on received points, teams increase their contributions less than individuals.*

5 Results

We present the results from data collected over 10 sessions. We ran 3 sessions each for the T-M and T-NM treatments and two sessions each for the I-M and I-NM treatments. Table 2 below summarizes the number of independent groups, decision makers and subjects per treatment.

Table 2: Summary of Treatments

Treatment	Groups	Decision Makers	Subjects
I-M	6	24	24
I-NM	6	24	24
T-M[a]	6	23	46
T-NM	6	24	48

[a] Due to a low number of show ups in one of the sessions, one of the experimenters had to be randomly matched with a subject to form a team. The experimenter was instructed to simply follow through with what their partner suggested and was not allowed to offer suggestions. We include the data for this team in the analysis.

We first proceed by analysing contribution decisions.

5.1 Contribution Decisions

We analyse treatment differences in contributions across teams and individuals in the baseline (without punishment) and then treatment differences under monetary and non-monetary punishment *relative to the baseline*.

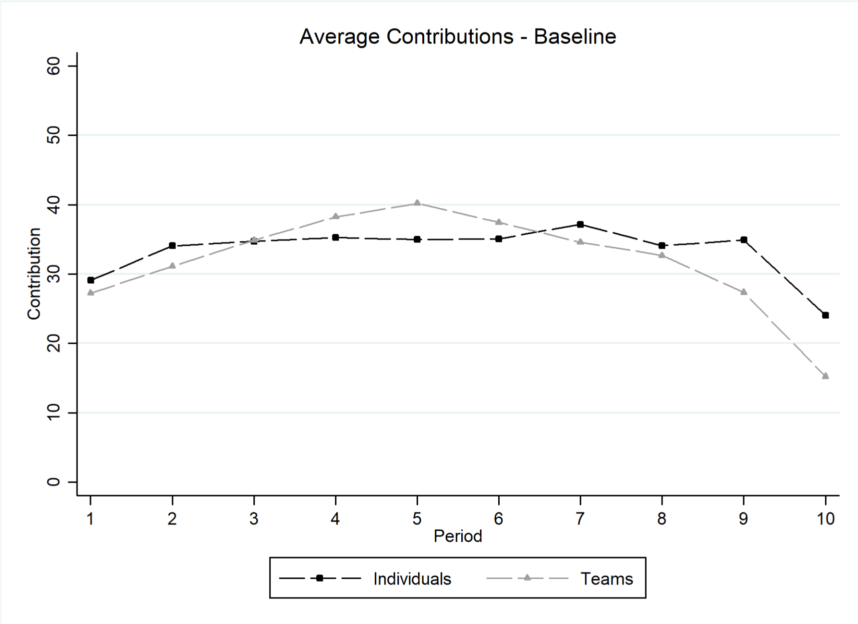
5.1.1 Comparing Teams to Individuals

We first focus on contribution differences between teams and individuals without punishment. Figure 1 shows the trends of contribution levels across time, using pooled data for all treatments in the baseline.[10] Contributions are very similar across teams and individuals. Initially, teams contribute slightly lower than individuals, however contribution levels steadily rise for teams for the first half of the treatment. We then observe a steady decline in contributions for teams. Team contributions drop sharply in the final periods and are on average lower than individuals, indicating stronger endgame effects for teams.

Table 3 reports results from a random effects panel regression using pooled data from all treatments without punishment. Our unit of observation is an independent DM. We cluster standard errors at the group level. Due to a substantial degree of coordination failure at the beginning of the treatment, we control for randomly determined observations by including a dummy variable that captures whether

[10] We pool data since experimental procedures were identical across all treatments for the first part of the experiment.

Figure 1: Contribution Trends without Punishment



or not the DM's contribution was randomly determined. To control for endgame effects, we include a dummy for Periods 9-10.

We find that there is no significant difference in average contribution levels between teams and individuals. On average, without punishment, teams contribute 1.04 tokens more than individuals, however this effect is not statistically significant. We observe significant end-game effects for individuals who reduce their contributions by 4.85 tokens in Periods 9-10. We do observe a significantly sharper endgame effect for teams however - on average teams reduce their contributions by an additional 9.2 tokens in the final 2 periods. The aforementioned are summarized in the following result:

Result 1. *Without punishment, contribution decisions are not significantly different between teams and individuals. However, we observe a sharper endgame effect for teams.*

We now turn to treatment specific effects. In particular, we compare how teams and individuals differ in their contribution decisions under punishment, relative to the baseline.

Figure 2 compares the contribution trends between teams and individuals under both Monetary and Non-Monetary Punishment. The vertical line indicates the restart point at beyond which subjects take part in the with punishment treatment. Trends under monetary punishment are given in Figure 2(a). We can see that without punishment, contributions under teams rise initially, whereas contribution under individuals remain fairly constant. During the middle, teams contribute more than individuals, however contributions drop sharply under teams, signifying a strong endgame effect. In the final periods without punishment, teams contribute substantially less than individuals. From Period 11 onwards (with

Table 3: Contribution levels - Without Punishment

	Baseline
	Contribution
Team	1.038
	(6.420)
EndGame	-4.846*
	(2.713)
TeamXEndGame	-9.215*
	(5.091)
Constant	34.32***
	(5.653)
N	960
Periods	1-10

Notes: Standard Errors clustered at Group level in Parentheses. Results from Random Effects Regression with an independent DM as a unit of observation. Unreported regressors include a dummy for random contribution. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

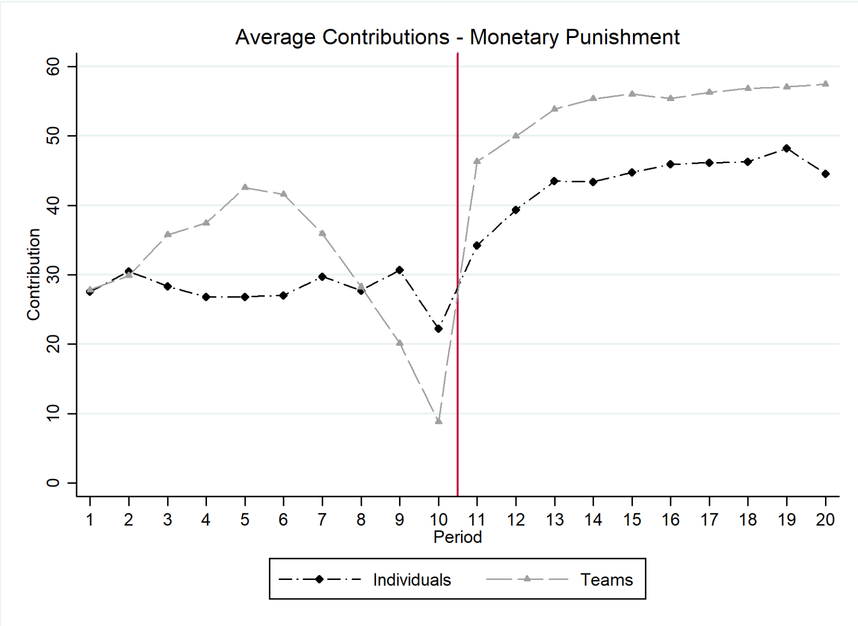
punishment), we observe steadily increasing contributions overtime for both teams and individuals with teams contributing on average more than individuals, almost reaching the socially optimum level of max contributions. Relative to the baseline, contributions are higher under both treatments. In particular, we observe that, for teams, the endgame effect present in the baseline effectively vanishes, resulting in overall higher contributions in the endgame periods relative to the baseline.

Figure 2(b) compares the trends under non-monetary punishment. Without punishment, we see similar trends across teams and individuals. Contributions rise initially then drop significantly in the final periods. Furthermore, we see that teams, on average, contribute lower than individuals and this is consistent throughout the treatment. Starting from Period 11 (with punishment), contributions again rise initially in both treatments. However, we see that the levels of contributions start to decline under teams starting from the 14th period. Final contributions in teams are slightly lower than the final contributions in the without punishment part. Furthermore, individuals contribute consistently higher than teams and contributions only decline in the final periods. Relative to the baseline, we see that individuals end up contributing more under punishment.

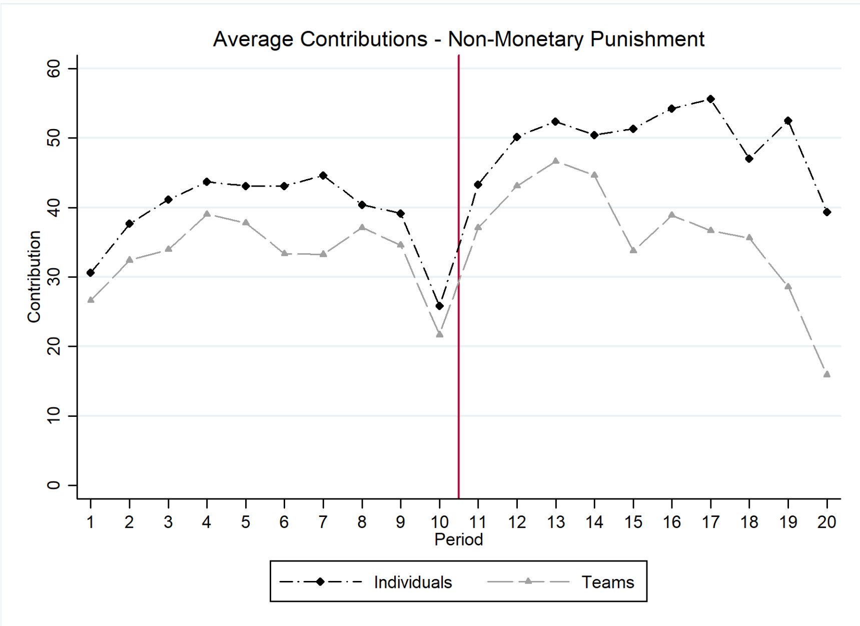
The trends in Figure 2 suggest that there is variation in behavior across treatments, especially in the Baseline. We observe more pronounced end-game effects for teams. To analyse treatment differences, while accounting for end-game effects, we conduct random effects panel regressions to compare behavior between teams and individuals across 4 different regions: i) baseline Periods 1-8; ii) baseline Periods 9-10 (end-game); iii) punishment periods 11-18 and; iv) punishment Periods 19-20 (end-game). We conduct

Figure 2: Comparison of Contributions

(a) Monetary



(b) Non-Monetary



a triple difference analysis by varying 3 factors: 1) the DM unit (team or individual); 2) treatment (baseline or Punishment) and; 3) periods (end-game or early). To account for the random coordination at the beginning of the sessions (due to teams failing to coordinate), we include a dummy variable that captures whether or not the DM a random contribution. The results are shown in Table 4 below. Team is a dummy variable that identifies whether or not DMs were teams or individuals. EndGame is a dummy variable capturing the last 2 periods of each treatment (Periods 9-10 in baseline and 19-10 in Punishment). Punishment is a dummy variable that identifies Punishment periods (11-20).[11]

Table 4: Contribution levels - Teams vs Individuals

	(1) Monetary	(2) Non-Monetary
	Contribution	Contribution
Team	7.583	-5.631
	(9.479)	(8.269)
EndGame	-1.635	-8.057*
	(3.088)	(4.193)
TeamXEndGame	-19.56***	1.256
	(5.354)	(7.510)
Punishment	14.89***	10.04*
	(4.004)	(5.315)
TeamXPunishment	3.283	-5.373
	(4.779)	(6.201)
EndGameXPunishment	5.068	3.396
	(4.251)	(5.416)
TeamXEndGameXPunishment	19.59***	-13.96*
	(5.011)	(8.453)
Constant	28.07***	40.56***
	(8.216)	(7.239)
N	960	960
Periods	1-20	1-20

Notes: Standard Errors clustered at Group level in Parentheses. Results from Random Effects Regression with an independent DM as a unit of observation. Unreported regressor includes a dummy for random contribution. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We first consider contributions under monetary punishment (Panel 1). Relative to the baseline (Periods 1-8), we find that individuals raise contribution levels significantly in Periods 11-18 (Punishment

[11]The Team dummy captures the difference in contribution levels between individuals and teams in Periods 1-8. The sum Team + TeamXEndGame captures the difference between individuals and teams in the endgame periods in baseline (9-10). The sum Team + TeamXPunishment captures the difference between individuals and teams in early punishment periods (11-18). Finally, the sum Team + TeamXEndGame + TeamXPunishment + TeamXEndGameXPunishment captures the difference between individuals and teams in the endgame punishment periods (19-20).

= 14.90, $p < 0.01$) which indicates that monetary punishment is successful in raising contribution levels. We also observe a positive (yet insignificant) marginal effect for teams (TeamXPunishment = 3.28, $p = 0.492$) resulting in a significant and combined effect of Punishment raising contributions by 18.2 tokens (Punishment + TeamXPunishment, $p < 0.01$). What is remarkable is the fact that, while teams exhibit significant endgame effects in the baseline (TeamXEndGame = -19.56, $p < 0.01$), this endgame effect is completely offset in punishment periods (TeamXEndGameXPunishment = 19.59, $p < 0.01$). Comparing contributions in the endgame periods for teams, we find that teams contribute 42.8 more tokens in Periods 19-20 compared to 9-10 ($p < 0.01$).[12] We also find that contributions under teams are higher by 11 tokens on average than individuals in punishment periods, however this effect is only significant in Periods 19-20 ($p = 0.067$).

The results under non-monetary punishment (Panel 2) are quite different. Relative to the baseline (Periods 1-8), we find that individuals raise their contributions by 10 tokens in Periods 11-18 and this effect is significant (Punishment = 10.04, $p = 0.06$). We also observe a modest increase in in end game contributions (EndGamexPunishment = 3.396, $p = 0.531$). We however find a negative marginal effect of punishment for teams (TeamXPunishment = -5.373, $p = 0.386$), resulting in a combined (insiginficant) increase of 4.67 tokens (Punishment + TeamXPunishment, $p = 0.144$). We also observe a sharper endgame effect for teams under non-monetary punishment (TeamXEndGameXPunishment = -13.96, $p = 0.099$). Comparing contributions in endgame periods for teams, we find that teams contribute 5.89 fewer tokens in Periods 19-20 relative to Periods 9-10, however this effect is not significant ($p = 0.296$). We do find, however, teams contributing consistently lower than individuals under non-monetary punishment with the difference being 11 tokens in Periods 11-18 ($p = 0.104$) and increasing to 23.7 tokens in Periods 19-20 ($p < 0.01$).

We summarize these findings below:

Result 2. *Average contributions increase for both teams and individuals under monetary punishment. Average contributions increase for individuals under non-monetary punishment. Teams however don't appear to be affected by non-monetary punishment.*

Result 3. *Teams contribute significantly more than individuals in the endgame under monetary punishment. Teams however contribute significantly less than individuals under non-monetary punishment.*

[12]The difference comes from adding up Punishment, TeamXPunishment, EndGameXPunishment and TeamXEndGameXPunishment.

5.1.2 Comparing Monetary and Non-Monetary Punishment

We now analyze the contribution differences under monetary and non-monetary punishment. Figure 3 compares contribution trends between Monetary and Non-monetary punishment for both teams and individuals. Comparing individuals in Figure 3(a), we find that without punishment (Period 1-10), contributions are consistently higher under I-NM. Contributions increase initially under I-NM and decline in the latter half. In contrast, under I-M, contributions remain fairly stable overtime. With punishment (Periods 11-20), contributions on average are higher under both treatments. We see contributions steadily rise under both treatments. However, contributions do decline in the final periods under non-monetary punishment. On average, contribution levels are higher under non-monetary punishment as compared to monetary punishment.

Comparing teams in Figure 3(b), we find similar trends without punishment. Initially, contributions increase under both treatments, and start to decline in later periods. The decline happens faster under T-M. Starting from Period 11 (with Punishment), we again observe an initial rise in contribution levels under both treatments. However, contributions show a steadily increasing trend under monetary punishment under which teams converge to nearly full cooperation. In contrast, under non-monetary punishment, teams show a significant decline after Period 13, to the point where, in the end, contributions are even lower than without punishment.

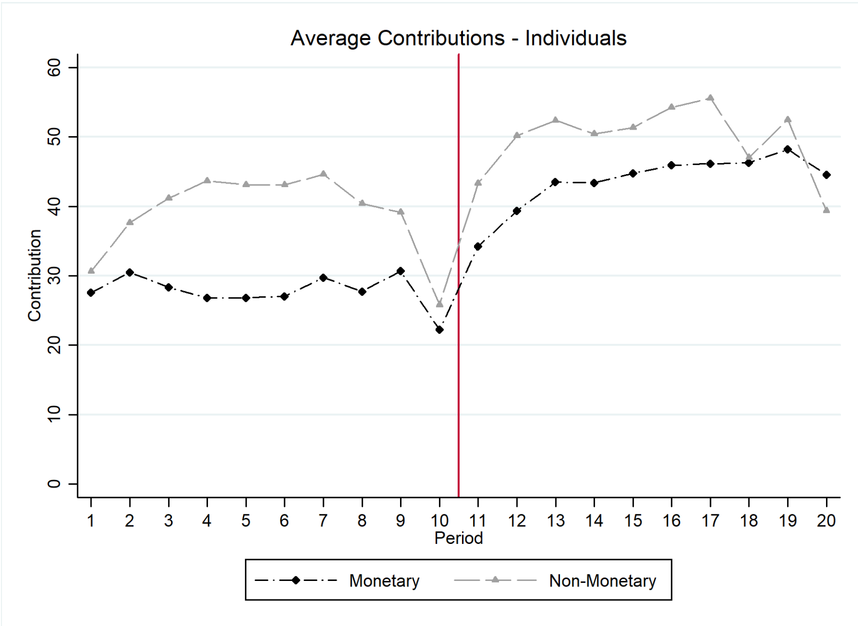
Table 5 presents random effects regression results documenting the effect of monetary and non-monetary punishment on contributions in both teams and individual treatments. We conduct a triple difference analysis by varying 3 factors: 1) the sanctioning mechanism (monetary or non-monetary); 2) treatment (baseline or Punishment) and; 3) periods (end-game or early). To account for the random coordination at the beginning of the sessions (due to teams failing to coordinate), we include a dummy variable that captures whether or not the DM made a random contribution. MP is a dummy variable that identifies whether or not the observations are from monetary or non-monetary punishment treatments. EndGame is a dummy variable capturing the last 2 periods of each treatment (Periods 9-10 in baseline and 19-10 in Punishment). Punishment is a dummy variable that identifies Punishment periods (11-20).[13]

Considering individuals (Panel 1), we observe that, relative to the baseline, there is a positive marginal effect of monetary punishment in raising contributions, however this effect is insignificant (MPXPunishment = 4.85, $p = 0.466$). Comparing contribution decisions in the punishment periods, we find that contributions are higher by 7.6 tokens in Periods 11-18 under non-monetary punishment, but

[13]The MP dummy captures the difference in contribution levels between monetary and non-monetary punishment treatments in Periods 1-8. The sum MP + MPXEndGame captures the difference between monetary and non-monetary punishment in the endgame periods in baseline (8-10). The sum MP + MPXPunishment captures the difference between monetary and non-monetary punishment in early punishment periods (11-18). Finally, the sum MP + MPXEndGame + MPXPunishment + MPXEndGameX-Punishment captures the difference between monetary and non-monetary punishment in the endgame punishment periods (19-20).

Figure 3: Comparison of Contributions

(a) Individuals



(b) Teams

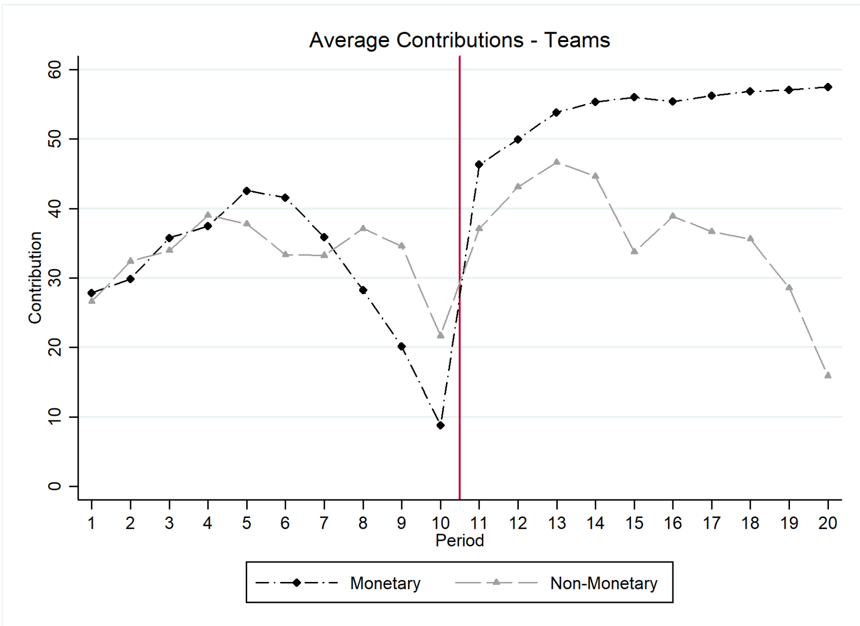


Table 5: Contribution levels - Monetary vs Non-Monetary Punishment

	(1) Individuals	(2) Teams
	Contribution	Contribution
MP	-12.48	0.577
	(10.94)	(5.539)
EndGame	-8.057*	-6.873
	(4.191)	(6.107)
MPXEndGame	6.422	-14.24**
	(5.205)	(7.236)
Punishment	10.04*	4.601
	(5.312)	(3.262)
MPXPunishment	4.849	13.65***
	(6.650)	(4.022)
EndGameXPunishment	3.396	-10.50
	(5.413)	(6.569)
MPXEndGameXPunishment	1.672	35.08***
	(6.881)	(7.092)
Constant	40.56***	35.00***
	(7.235)	(3.752)
N	960	960
Periods	1-20	1-20

Notes: Standard Errors clustered at Group level in Parentheses. Results from Random Effects Regression with an independent DM as a unit of observation. Unreported regressor include a dummy for random contribution. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

lower by 0.5 tokens in Periods 19-20. However, neither of these differences is significant ($p = 0.29$ and 0.95 respectively).

Turning towards teams (Panel 2), we find a stark difference in contribution levels across monetary and non-monetary punishment. The marginal effect of Monetary punishment is highly significant (MPXPunishment = 13.65, $p = 0.001$) and the difference becomes more pronounced in the endgame (MPXEndGameXPunishment = 35.08, $p < 0.01$). It is very evident that teams contribute significantly lower under non-monetary punishment. In Periods 11-18, the difference is around 14.22 tokens ($p = 0.04$) and it becomes even larger in the endgame periods 19-20 (35.1 tokens, $p < 0.01$).

Our results are summarized as follows:

Result 4. *There is no significant difference in contribution levels across monetary and non-monetary punishment when decision makers are individuals. However, contributions are significantly higher under monetary punishment, compared to non-monetary punishment, when decision makers are teams.*

5.2 Punishment Decisions

We focus on Hypothesis 5 by analyzing Punishment Decisions across different treatments. Figure 4 plots out the average number of punishment points assigned by a DM as a function of the receiver's deviation from own contribution. That is, we plot the average number of punishment points assigned by DM i to DM j as a function of the deviation of DM j's contribution from DM i's contribution ($c_j - c_i$). We partition the deviation into intervals with equal ranges of 6 tokens. For instance, the interval [-60, -54) includes all observations in which $c_j - c_i$ is between -60 tokens and -53 tokens (inclusive).[14] In plotting these figures, we discard all data pertaining to random punishment as a result of DM's failing to assign points in the given time limit. The numbers on the bars represent the number of observations in each interval.

Figure 4(a) compares punishment decisions across teams and individuals under monetary punishment. We observe similar patterns across both teams and individuals in the sense that larger negative deviations from own contribution are often associated with a higher amount of punishment given. When deviations are closer to 0 (i.e., contributions are similar), we observe very little punishment.[15] However, we do observe a minor amount of anti-social punishment (see Auerswald et al., 2018, for a definition) when decision makers are individuals as there is a positive amount of punishment given even when the deviation from own contribution is positive. When discarding random punishment, we observe little to no anti-social punishment when decision makers are teams.

[14] Negative values indicate that DM j contributed less than DM i. The parentheses indicate that the end points are not included in the intervals, whereas the square brackets indicate inclusion.

[15] A substantial number of observations lie in the [0, 6) interval (430 for individuals, 485 for teams). We find that the average punishment assigned in this interval is less than 0.5 points.

Figure 4(b) compares punishment decisions across teams and individuals under non-monetary punishment. We again observe very similar trends. The amount of punishment increases with larger negative deviations. Unlike monetary punishment however, we observe a substantial degree of anti-social punishment even when the decision makers are teams instead of individuals. Furthermore, the degree of anti-social punishment appears to be higher for teams than individuals.

To investigate how different punishment decisions are across teams and individuals, we conduct a regression analysis to compare punishment decisions while controlling for i) positive deviation from own contribution and ii) the absolute value of the negative deviation from own contribution. We control for random punishment by discarding all data with random punishment.[16]

Table 6: Comparing Punishment Decisions

	Monetary[a]	Non-Monetary[b]
	Punishment Given	Punishment Given
Absolute Negative Deviation	0.348***	0.261***
	(0.0531)	(0.0137)
Positive Deviation	0.135**	0.0527
	(0.0595)	(0.0498)
Team	-3.860	3.876***
	(2.530)	(1.209)
Team X Negative Deviation	0.162	-0.0584
	(0.103)	(0.0379)
Team X Positive Deviation	-0.0236	-0.0690
	(0.0877)	(0.0658)
Constant	-5.786**	0.877*
	(2.420)	(0.418)
N	1386	1407

Notes: (a) Results from Tobit Regression with an independent DM as a unit of observation. (b) Results from pooled OLS with an independent DM as a unit of observation. Standard Errors clustered at Group level in Parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data discards random punishment observations.

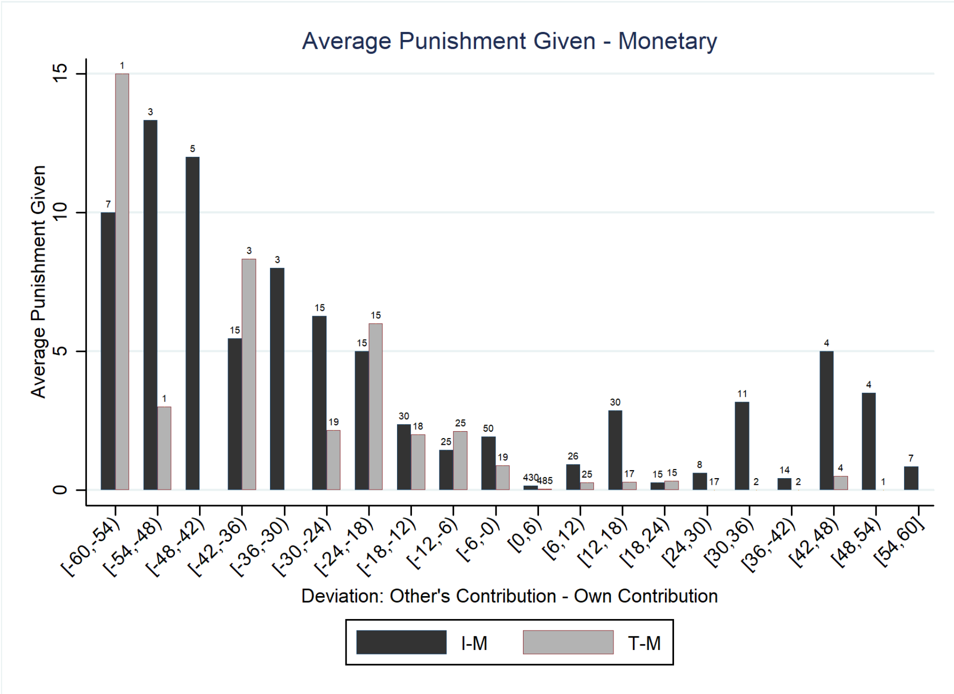
We find that higher amounts of negative deviation always result in a greater number of punishment points assigned to other DMs. We, however, observe no significant difference in punishment behavior between teams and individuals under monetary punishment. However, teams on average assign more punishment points than individuals under non-monetary punishment.

Result 5. *Controlling for contribution deviations, teams on average assign the same number of points as individuals under monetary punishment. However, teams punish more than individuals under non-monetary*

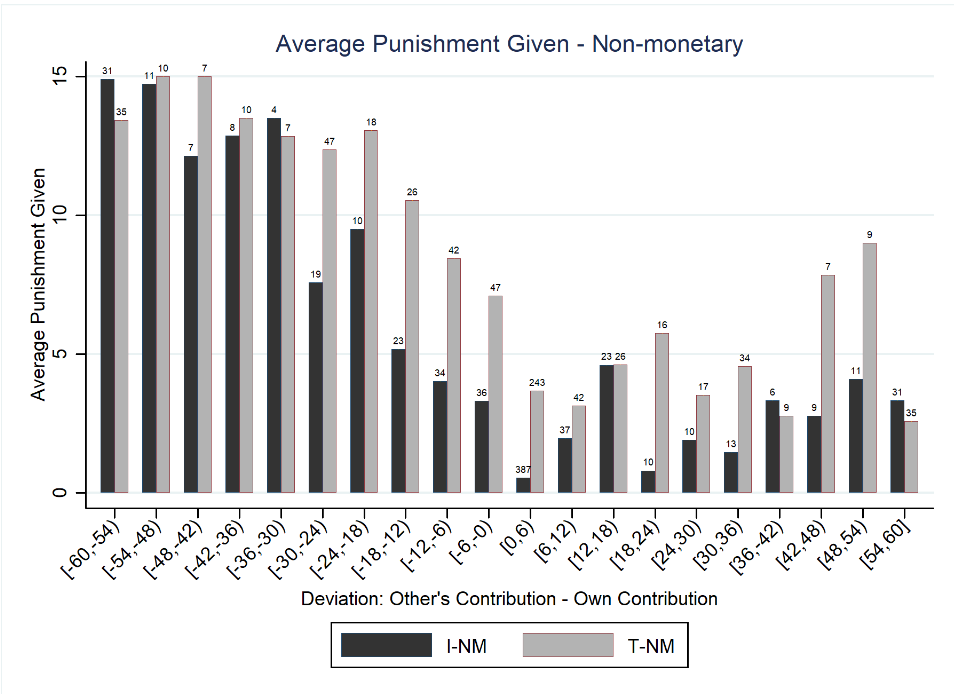
[16]Since we conduct this analysis at the individual DM level, we feel it is more appropriate for us to discard such data. For Monetary punishment, we discard 54 observations out of 1440. For Non-monetary, we discard 33 out of 1440 observations.

Figure 4: Average Punishment Points Assigned

(a) Monetary



(b) Non-monetary



punishment.

5.3 The Effect of Punishment on Contribution

We now turn towards analyzing Hypothesis 6. Table 7 documents the effects of lagged punishment received on changes in contribution under both Monetary and Non-Monetary punishment. We control for lagged contributions and the lagged average of other group member's contributions.

Table 7: Effect of Lagged Punishment - Teams vs Individuals

	Monetary	Non-Monetary
	$c_{t+1} - c_t$	$c_{t+1} - c_t$
Lagged Contribution	-0.315***	-0.600***
	(0.0725)	(0.0622)
Lagged Other's Contribution	0.264***	0.358***
	(0.0577)	(0.0930)
Lagged Punishment (Team)	0.131	-0.215*
	(0.0992)	(0.112)
Lagged Punishment (Individuals)	0.360**	-0.0642
	(0.143)	(0.122)
Constant	2.800	11.65*
	(2.483)	(6.047)
N	432	432
Periods	12-20	12-20

Notes: Standard Errors clustered at Group level in Parentheses. Results from Random Effects Regression with an independent DM as a unit of observation. Unreported regressor include a dummy for random contribution. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We find that under monetary punishment, individuals raise their current contribution by around 0.4 tokens for each punishment point received. Teams on the other hand exhibit virtually no change in their contribution levels. The difference in responses is statistically significant ($p < 0.01$). Under non-monetary punishment, we find that teams *reduce* contributions conditional on receiving points. Individuals, on the other hand do not react to lagged punishment.

A point of note is that under monetary punishment, teams are already contributing near the maximum value of 60 tokens. Furthermore, we have a significantly large proportion of DMs assigning punishment of 0 points. We are not surprised to see the lack of significance in the regression results.

5.4 Analysis of Net Benefits

In comparing monetary and non-monetary punishment for individuals, Masclet et al. (2003) showed that after subtracting out the costs of punishment, net benefits from public good contributions were higher under non-momentary compared to monetary punishment in the first 5 periods, with no significant differences in the last 5 periods. We conduct a similar analysis below at the group level.

We define net benefit to be the benefit accrued to all DMs in a group from contributing, net of any punishment costs (either from assigning or receiving punishment). More specifically,for non-monetary punishment, since punishment is costless, we have

$$\begin{aligned}\text{Net Benefit (NM)} &= \sum_{i=1}^{4}\left(60 - c_i + 0.75\sum_{j=1}^{4} c_j\right) \\ &= 240 + 2\sum_{i=1}^{4} c_i\end{aligned}$$

For Monetary punishment, each point costs 1 token to assign and reduces payoffs to the receiver by 3 tokens. Essentially, each point assigned by any one DM reduces overall benefit (across all DMs) by 4 tokens. So net benefit is

$$\text{Net Benefit (M)} = 240 + 2\sum_{i=1}^{4} c_i - 4\sum_{i=1}^{4}\sum_{j\neq i} p_i^j$$

The random punishment in the early periods from teams failing to coordinate on time adds a great deal of noise when analysing net benefits under monetary punishment. To account for this, we re-scale total punishment in a given group as follows. First, we compute the average of punishment points across all DMs whose punishment was not random. we then re-scale this average by multiplying it by 4.[17]

We break down the Punishment Periods into two halves (Periods 11-15 and Periods 16-20) and take the average of net benefits over all group-period combinations. The tables below summarize the average values. Reported p-values are from a Mann-Whitney U test with group-period combinations as a unit of observation.

Comparing individuals, we more or less replicate the result in Masclet et al. (2003). Comparing individuals under MP and NMP, we find that net benefits are consistently higher under non-monetary punishment. For the first half, net benefits are 636.5 tokens under non-monetary and 504.6 tokens under monetary and this difference is significant (p = 0.027). We see this difference decline in the second half

[17]Without controlling for this, we would end up in a situation in which, due to random punishment, on average net benefits would be lower under monetary punishment, biasing our results downwards. Given that in teams and MP, contributions are often clustered close together, we feel that taking the average of punishment points over all non-random observations gives a better indication of how subjects would behave.

Table 8: Net Benefits

		Monetary	Non-Monetary	p-value
Individuals	Periods 11-15	504.6	636.5	0.027
	Periods 16-20	550	638.2	0.097
Teams	Periods 11-15	624.3	568.4	0.022
	Periods 16-20	674.4	489	< 0.001

(638.2 under non-monetary and 550 under monetary) and this difference is statistically significant (p = 0.097).

Contrasting this with teams, we find the opposite. Teams yield a higher net benefit under monetary punishment compared to non-monetary punishment. Comparing the averages in Periods 11-15, we see teams earning on average 60 more tokens under monetary punishment (p = 0.022). This difference increases substantially in the last 5 periods of the game and is highly statistically significant (p < 0.0001).[18]

Our results are summarized as follows:

Result 6. *Net benefits are higher under monetary punishment (compared to non-monetary) when DMs are teams. The reverse is true for when DMs are individuals.*

6 Discussion

We experimentally investigate the behavior of teams in a public goods game with and without a sanctioning environment. We consider sanctions of two kinds: 1) monetary punishment in which decision makers can assign points to reduce others' payoffs at some cost and 2) non-monetary punishment in which decision makers can assign points to indicate their measure of disapproval of others' decisions, which has no impact on earnings. We find that without punishment, contribution behavior is similar across both teams and individuals. We find that monetary punishment increases contributions for both teams and individuals and that non-monetary punishment increases contributions for individuals. In contrast, teams appear to be unaffected by non-monetary punishment. We find that teams contribute significantly lower under non-monetary punishment compared to teams under monetary punishment and individuals under non-monetary punishment.

These findings have some interesting implications. Many real life sanctioning mechanisms make use of both monetary and non-monetary punishment to effectively combat the prevalence of free-riding. For example, the EPA uses both measures against violators of pollution abatement policies. Furthermore, many of these decisions pertaining to public goods provisions and sanctions are undertaken jointly by

[18]Without accounting for random punishment, net benefits averaged 588 tokens under monetary punishment in Periods 15-16. As a consequence, the difference was insignificant. In periods 16-20, net benefits were 666 tokens under monetary punishment, with no change in significance.

teams comprising of more than one individual. Given that teams are unresponsive to non-monetary punishment, this does provide an indication for the appeal of using monetary punishment to effectively enhance cooperation.

Furthermore, analyzing team behavior can also give us some insight as to how joint decision making can effectively rule out or overcome certain innate desires that individuals have and take into account when making their decisions. For example, our experiment suggests that individuals do react to non-monetary punishment and increase cooperation. Masclet et al. (2003) observe the same behavior and argue that this effect may stem from the fact that individuals may feel dis-utility from receiving any form of disapproval in a group setting. In contrast, teams don't appear to be effected in the same way. It is highly possible that joint decision making can effectively introduce an "us versus you" dynamic in social dilemma settings which might make teams less sensitive to disapproval from other members, especially if disapproval has no effect whatsoever on their payoffs.

To further investigate the joint decision making process we intend on exploring communication logs between team members. Recall that in our experiment, team members are allowed to communicate freely with each other in order to coordinate their decisions. These communication logs can reveal valuable information as to the rationale behind joint decision making. We wish to focus on motives pertaining to contribution decisions under the threat of punishment as well as motives for punishing others. We conjecture that punishment decisions are associated with pro-social beliefs i.e. teams punish others more following discussions about putting pressure on others to enhance cooperation (curb free-riding). We also expect to see, under monetary punishment, contribution decisions being motivated by the threat of punishment in the sense that teams contribute higher following discussions that exhibit fear of receiving punishment *or* discussions that exhibit negative emotions pertaining to past punishment. Lastly, we expect teams to disregard non-monetary punishment when coordinating on contributions, however we still expect to see a positive correlation between pro-social beliefs and punishment decisions.

One final point to note is that, contrary to past experiments on public goods games, we observe a substantially high degree of cooperation without sanctions. In contrast, past experimental evidence suggests a rapid decline in cooperation over time, both in teams and individual treatments. We attribute this to the fact that our experimental design utilizes a rather high MPCR of 0.75 whereas past experimental studies use an MPCR of 0.4. An MPCR of 0.75 makes cooperation more likely as it only requires 2 out of 4 decision makers to contribute in order to profit. In contrast, an MPCR of 0.4 requires 3 decision makers to contribute in order to profit, making cooperation all the more difficult. We conjecture that contribution levels will decline significantly over time in all treatments without punishment. We expect similar results to the above under monetary punishment, however we expect sharper differences between teams under non-monetary and monetary punishment. We leave the investigation of behavior with a lower MPCR to future research.

Appendix A Instructions for Team Treatments

These instructions are adapted and modified from the instructions used in Masclet et al. (2003), Cox and Stoddard (2018) and Auerswald et al. (2018). Instructions for individual treatments are available on request.

Instructions

Welcome and thank you for participating in this economic experiment. This experiment will take approximately 60-75 minutes. If you read the instructions carefully, you can earn a considerable amount of money depending on your decisions and the decisions of others which will be paid to you in cash at the end of the experiment.

Before we begin, we ask that you turn off your cell phones for the duration of the experiment. We also ask that you do not communicate with anyone and only use the experimental software provided to you. Failure to comply with these rules will result in dismissal from the experiment and forfeiture of any earnings you may have otherwise received.

Overview of The Experiment

This experiment consists of **two** parts as well as a small questionnaire in the end. Instructions for Part 1 will be provided below and instructions for Part 2 will be given out after the end of part 1. During the experiment you will earn **'Tokens'**. You will be paid based on the total number of tokens you accumulate during both Part 1 and 2 of the experiment. At the end of the experiment the total number of tokens you earned will be converted to dollars at the following rate:

100 tokens = $1

You will also receive a show up fee of $3. Your payment will be paid to you in cash at the end of the experiment.

Team Formation

For the duration of this experiment, you will be making decisions in **teams of two**. At the beginning of the experiment, you will be randomly matched with someone else in the room. You and your partner must decide things together. **You will have the same partner for the whole experiment**. You and your partner will receive the same earnings for the experiment, depending on your teams' decisions and the decisions of other teams.

To facilitate your decision making, you and your partner will be allowed to communicate with each other using a chat box, like instant messaging. These messages will be recorded, however only you and your partner will be able to see them. **When communicating with your partner, we ask that you; 1) Be civil and not use any profanity; 2) do not reveal any personal identifying information.**

Instructions for Part 1

Part 1 of this experiment consists of 10 rounds. At the beginning of Round 1, your team will be **randomly and anonymously** assigned to a group with 3 other teams. Therefore, each group will have 4 teams. This group will remain fixed for all of Part 1.

At the beginning of each round your team will receive 60 tokens. These 60 tokens are referred to as your team's endowment. Your team's decision in each round is to choose how many tokens from your team account to contribute to a group project and how many to keep for your team. Your team must make this decision without knowing the decisions of the other teams in your group.

Each Token that your team keeps earns your team 1 Token. For every Token your team contributes to the group project, the group project increases by one Token. Your team's earnings from the group project are equal to 0.75*the total number of tokens contributed to your group's project. All other teams in your group will also earn 0.75*the total number of tokens contributed to the group project.

You will have **2 minutes** (120 seconds) to decide how much of your endowment to keep for your team and how much to contribute to the group project. You should use the chat box to communicate with your partner before deciding.

Once you decide on a contribution, press the **"Send Choice"** button. You will then see your and your partner's contribution suggestions. If your suggestions don't match, you will be asked to revise your decision. If your decisions match, you will be allowed to continue. At this point, **both of you must click the Continue button to finalize your decision**. If you fail to reach a decision, the computer will choose a random contribution for your team. This is just to ensure that the experiment continues as scheduled and should not be used as an option.

After all teams in your group have made their decision your screen will show you the total number of Tokens contributed to the group project, the breakdown for what each team contributed, whether the team's decision was joint or random and your earnings for this round. Note that the IDs of other teams in your group are randomly shuffled every round. You will not know which ID corresponds to which team.

Your teams' earnings consist of two parts:

1. The Tokens your team decided to keep

2. The total contribution of all 4 teams to the group project * 0.75.

That is your team's earning for each round will be equal to:

(60 – your team's contribution) + 0.75*(total number of tokens contributed to the Group project)

Earnings of each team from the project are calculated the same way. Note, that each of you will earn whatever your team earns (i.e. you and your partner will both get your teams' earnings).

To test your understanding of the experiment, we would like you to answer the following questions. We will go over the answers. If you have any questions, raise your hand and an experimenter will come to answer them.

Questions for Part 1

1. Your partner will remain the same for the whole experiment (True/False) _________
2. The teams in your group will change every round (True/False) ________
3. You and your partner will both be paid your team's earnings (True/False) ________
4. How many tokens are in your team account at the start? ______
5. Each token your team contributes to the group project raises the earnings of _______ teams in your group by _______ tokens.
6. Each token contributed to the group project by other teams raises your teams' earnings by _________ tokens
7. Suppose your team contributes X tokens to the project and the other teams contribute 0. Each team gets _______ tokens from the project.
8. Suppose your team and all the other teams in your group contribute a total of Y tokens. Each team gets ________ tokens from the project.

Instructions for Part 2 - Monetary Punishment

Part 2 of the experiment also has 10 rounds. At the beginning of Round 1, your team will be assigned to the **same group as in Part 1**. Therefore, each group will have 4 teams. This group will remain fixed for all of Part 2. Each round consists of 2 stages. Your earnings for each round depend on the decisions in both stages.

Stage 1

Stage 1 is identical to what you have done in Part 1: Your team will receive 60 tokens and must decide how much to keep or contribute to the group project. Your potential earnings from stage 1 will be the same as in part 1.

(60 – your team's contribution) + 0.75*(total number of tokens contributed to the Group project)

Stage 2

At the beginning of Stage 2, your screen will show you the total number of Tokens contributed to the group project, the breakdown for what each team contributed, whether the team's decision was joint or random and your earnings for the first stage. Note that the IDs of other teams in your group are randomly shuffled every round. You will not know which ID corresponds to which team.

At this point your team can assign between 0 and 15 points to what each of the other teams contributed to the group project as a measure of your disapproval of what each team did. Each point your team assigns to a team **costs your team** 1 token and **costs the other team** 3 tokens. Each other team has the same opportunity to assign points as well. Your team must make this decision without knowing the decision of the other teams in your group.

Each team will have **90 seconds** to decide on whether to issue disapproval points and, if so, how many to each other team. Once again you should plan on doing this in consultation with your partner via the chat box. Once you reach a decision, click the **"Send Choice"** button. The screen will display whether you and your partner have made the same decision as well as the total cost of your assigned points. If you and your partner have not made the same decision, you will be asked to revise your decision. If you and your partner have made the same decision, you will be allowed to continue. **Both you and your partner must click "continue" to finalize your decision**. If either you or your partner fail to reach a decision in time, the computer will randomly decide for your team. This is just to ensure that the experiment continues as scheduled and should not be used as an option.

How much a team's earnings from the first stage are reduced depends on the total number of points received from all other teams. The reduction from receiving points **cannot exceed** your stage 1 earnings, however, your team must still bear the cost of assigning disapproval points.

After every team has made their decision in stage 2, you will be provided information on your teams' earnings in stage 1, the total points your team assigned, the total number of points received by your team and your teams' final earnings for the round. Your teams' final earnings are calculated as:

1) If your earnings from stage 1 are higher than the reduction by receiving points:

Your team's earnings = (Your team's earnings from stage 1) – [3 x (total received points)] - total assigned points

2) If your earnings from stage 1 are less than (or equal to) the reduction by receiving points:

Your team's earnings= 0 – total assigned points

As in part 1, each of you will earn whatever your team earns (i.e. you and your partner will both get your teams' earnings).

To test your understanding of the experiment, we would like you to answer the following questions. We will go over the answers. If you have any questions, raise your hand and an experimenter will come to answer them.

Questions for Part 2

1. Stage 1 is identical to Part 1 in the experiment (True/False) ________
2. Each point your team assigns to another team in your group costs your team _______ tokens.
3. Each point your team is assigned costs your team ______ tokens.
4. Suppose your team assigns X points to team A, Y to team B and Z to team C. The total cost of your assigned points is _______ tokens.
5. Suppose your team is assigned X points from the other teams in your group. This reduces your team's earnings by ______ tokens.

Instructions for Part 2 - Non-Monetary Punishment

Part 2 of the experiment also has 10 rounds. At the beginning of Round 1, your team will be assigned to the **same group as in Part 1**. Therefore, each group will have 4 teams. This group will remain fixed for all of Part 2. Each round consists of 2 stages.

Stage 1

Stage 1 is identical to what you have done in Part 1: Your team will receive 60 tokens and must decide how much to keep or contribute to the group project. Your potential earnings from stage 1 will be the same as in part 1.

(60 – your team's contribution) + 0.75*(total number of tokens contributed to the Group project)

Stage 2

At the beginning of Stage 2, your screen will show you the total number of Tokens contributed to the group project, the breakdown for what each team contributed, whether the team's decision was joint or random and your earnings for the first stage. Note that the IDs of other teams in your group are randomly shuffled every round. You will not know which ID corresponds to which team.

At this point your team can assign between 0 and 15 points to what each of the other teams contributed to the group project as a measure of your disapproval of what each team did. **The points your team assigns to other teams cost your team nothing. Similarly, the points received by your team has no impact on your team's earnings.** They just represent your disapproval of other teams' choices in stage 1.

Each team will have **90 seconds** to decide whether or not to assign disapproval points and if so, the number of points to assign to each other team. Once again you should plan on doing this in consultation with your partner via the chat box. Once you reach a decision, click the **"Send Choice"** button. If you and your partner have not made the same decision you will be asked to revise your decision. If you and your partner make the same decision, you will be allowed to continue. **Both you and your partner must click "Continue" to finalize your decision**. If either you or your partner fail to reach a decision in time, the computer will randomly decide for your team. This is just to ensure that the experiment continues as scheduled and should not be used as an option.

After every team has made their decision in stage 2, your screen will show your team's earnings in stage 1, the total number of points your team assigned, and the total number of points your team received and your team's final earnings for the round.

Your team's earnings = Your team's earnings from stage 1.

As in part 1 each of you will earn whatever your team earns (i.e. you and your partner will both get your teams' earnings).

To test your understanding of the experiment, we would like you to answer the following questions. We will go over the answers. If you have any questions, raise your hand and an experimenter will come to answer them.

Questions for Part 2

1. Stage 1 is identical to Part 1 in the experiment (True/False) ________
2. You will have between _____ and ______ disapproval points to send to other teams in stage 2.
3. Each point you assign to another team results in _______ disapproval points for that team.
4. The points you assign cost your team nothing (True/False) _______
5. The points other teams assign your teams cost your team nothing (True/False) _______

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