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Teams in a public goods experiment with punishment☆

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ABSTRACT

Challenges addressed in global politics, such as climate change, maritime piracy and fighting highly contagious diseases, concern global public goods. The related policy decisions are primarily made by teams. In contrast, economic models of global public goods typically assume a single rational decision maker. We use a laboratory experiment to compare team decisions to the decisions of individuals in a finitely repeated public goods game with and without a costly punishment option. Teams of three participants coordinate on decisions either by majority or unanimity rule. We find that, in the absence of a punishment option, teams deciding by the unanimity rule contribute slightly more than individuals. With the punishment option, unanimity teams choose significantly lower levels of punishment and exhibit anti-social punishment less frequently than individuals. A possible explanation is the elimination of extreme preferences for punishment through the coordination process in teams.

1. Introduction

International policy challenges often concern global public goods. Climate change, as one example, is partly attributed to the emission of greenhouse gases. The mitigation of these emissions is a contribution to a global public good. Each country bears the cost of its own mitigation effort, but the benefits accrue to all countries. Another example of an international public good is the fight against maritime piracy. Each country that sends convoying ships to the Horn of Africa makes the passage for all cargo vessels in this area safer. Again, the benefits accrue to traders from all over the world, while the costs are born by the countries providing the convoying ships. For such global public goods, standard economic theory predicts an under-provision due to free-rider behavior in the absence of global regulation. A huge body of experimental literature has shown that private contributions to public goods are indeed below the socially optimal level; however, the contributions are much higher than predicted by orthodox game-theoretic considerations. Explanations for this phenomenon range from confusion (Andreoni, 1995; Houser and Kurzban, 2002) and warm-glow (Palfrey and Prisbrey, 1997) to altruism (Goeree et al., 2002) and conditional cooperation (Fischbacher et al., 2001; Fischbacher and Gächter, 2010).

Public goods experiments usually consider single decision makers, while decisions on global public goods are typically made by teams, as the examples above indicate. The ministry of the environment decides on the national mitigation policy, and the ministry of defense and its experts allocate the resources for fighting maritime piracy. This finding raises the question of whether the results from individual decision-making on public good contributions carry over to team decisions. Do teams show the same behavior regarding the private provision of public goods as individuals do? One may expect that the deliberation in teams fosters strategic considerations and that other-regarding aspects are weakened. With altruism, for instance, individuals may care about other individuals but not about more or less anonymous teams. There is a rapidly growing (experimental) body of literature on team decisions analyzing how teams make decisions and whether their decisions differ from those of individuals (Charness and Sutter, 2012; Kugler et al., 2012). This literature, however, has rarely covered the politically important case of public good provision (Huber et al., 2016), whereas there are several papers on the related prisoner's dilemma (Kagel and McGee, 2016).

Our focus is on teams that jointly provide a single public good. We analyze whether teams contribute significantly more or less than individuals in a standard public goods game with and without a costly punishment option. We extend the standard public goods game with

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four single decision makers to a setting with four teams who jointly provide the public good. Each team consists of three players who have to coordinate on a team decision. We analyze the contributions to the public good, the use of punishment and the final payoff. For the coordination among team members, we use a structured method of team decision-making in the spirit of Gillet et al. (2009). This method allows team members to make proposals, but it does not allow for communication. The proposals are aggregated to a team decision following either a majority rule or a unanimity rule. The lack of direct communication certainly eliminates an important aspect of real-world team decisions. However, this setting allows us to isolate the effects of the decision-making process itself. Therefore, our analysis is one piece of the puzzle. Another piece is the observation of direct communication among team members, which would allow researchers to study the communication effects.

In our experiment, teams deciding by the unanimity rule contribute more to the public good than individuals. Unanimity teams also choose significantly lower levels of punishment and exhibit anti-social punishment less frequently than individuals. In terms of net profits, unanimity teams performed better than individuals.

In Section 2, we develop our working hypotheses. Section 3 describes the experimental setting in detail. Section 4 discusses the treatment effects. In Section 5, we take a closer look at the punishment stage by analyzing disaggregated data on the individual/team level and by distinguishing between social and anti-social punishment. Section 6 concludes.

2. Literature and hypotheses

Charness and Sutter (2012) and Kugler et al. (2012) provide extensive surveys on team decision experiments. According to Charness and Sutter (2012, p. 171), the majority of research concludes that teams tend to behave more in accordance with game-theoretic predictions than individuals. The authors identify three reasons for the difference between decisions made by teams and individuals. First, individual knowledge is aggregated in teams, and thus, teams make qualitatively better decisions (e.g., investment decisions). Second, teams exhibit more detailed reasoning when making strategic decisions (e.g., in the beauty contest game and the trust game). Teams are better able to anticipate the reaction of the other player and his/her best strategy. Third, teams have a stronger focus on payoffs. Fairness and reciprocity appear to play a minor role in team decision-making.

Kugler et al. (2012) refer also to results from social psychology addressing team decision-making. Most of this literature analyses behavior in a prisoner's dilemma situation and stresses that individuals behave differently as sole decision makers compared to deciding as members of a team. In social psychology, this difference in behavior is usually referred to as the *discontinuity effect*. Two main motives for the discontinuity effect are `greed' and `fear' (Wildschut et al., 2003). 'Greed' refers to a player's stronger focus on payoffs in team decisions. Greed is explained by either the higher anonymity within a team that provides shelter from social punishment or the social support within a team for self-interest behavior (social support of shared self-interest hypothesis; see also Kugler et al. 2007). The second motive, `fear', refers to the expectation of decision makers that teams act more competitively and less cooperatively (schema-based distrust hypothesis). In a prisoner's dilemma situation, decision makers tend to expect teams to act more selfishly and thus to defect more often; they fear being exploited and protect themselves by choosing defection as well. In the public goods game, which is a variant of the prisoner's dilemma problem, the discontinuity effect would suggest that teams contribute less.

Economic research has also investigated team decisions and generally finds that teams behave more in accordance with game-theoretic predictions than individuals. The interactive tasks for which this effect was found include the ultimatum game (Robert and Carnevale, 1997; Bornstein and Yaniv, 1998), the dictator game (Luhan et al., 2009), the beauty contest game[1] (Kocher and Sutter, 2005), the centipede game (Bornstein et al., 2004), the gift-exchange game (Kocher and Sutter, 2007), the trust game (Kugler et al., 2007), the finitely repeated prisoner's dilemma game (Kagel and McGee, 2016), the sequential market game (Stackelberg duopoly, Cardella and Chiu, 2012) and the signaling game with limit pricing and market entrance (Cooper and Kagel, 2005). There are also at least four studies in which teams behave less in accordance with game theory or are less able to process information efficiently. Cason and Mui (1997) were among the first to study experimentally the decisions of teams in an economic framework. In a dictator game, they found: ``*[…] that when a team consists of members who have made different individual offers* [in a previous individual stage of the game, authors' note]*, the team offer tends to be dominated by the more other-regarding member*' (Cason and Mui, 1997, p. 1477). They used an experimental setting with 2-person teams and face-to-face communication. Luhan et al. (2009) repeated the game in a different environment (communication via electronic chat, 3-person teams). They found that teams act more selfishly and that the most selfish player in a team has the strongest influence. The second study that deviates from the main stream of literature is that by Cox and Hayne (2006), who studied a common value auction with risky outcomes. The authors identified a *curse of information*. If additional information is provided on the value of the auctioned item, individuals and teams bid less rationally. In addition, this curse of information effect is stronger for teams. Third, Sutter et al. (2009) show that teams suffer more often from the winner's curse, as teams remain longer in auctions and pay higher prices than individuals. The fourth and most recent study is by Müller and Tan (2013). The researchers established a sequential 2-player market game (Stackelberg duopoly) and found no significant difference between individuals and teams in a 1-shot game. In the repeated game, team decisions were less in accordance with game-theoretic predictions than were individual decisions.

Among the interaction tasks that have been implemented with teams, the finitely repeated prisoner's dilemma game by Kagel and McGee (2016) and the public goods game with an option for ostracism by Huber et al. (2016) are closest to our setting. Kagel and McGee (2016) compared the decisions of 2-person teams playing against each other. Members of a team were allowed to communicate via chat for a certain time span before making a decision. They found that teams cooperated significantly less than individuals in the first super-game, whereas, in the subsequent super-games, the level of cooperation among teams achieved or exceeded the level of individuals. However, as the decision on cooperation in the prisoner's dilemma is binary, there is no information on how strong the willingness to cooperate is. Huber et al. (2016) compare the decisions of 2-person teams who can communicate face-to-face with those of individuals in a standard public goods game. They extend the standard setting by allowing players to vote for the exclusion of other players subsequent to the contribution stage, a specific form of binary punishment option. They find no significant difference in contributions between teams and individuals in the absence of the punishment option and lower average contributions by teams when voting for exclusion was allowed.

We implement a standard public goods game that

(i) extends the binary perspective of a prisoner's dilemma (cooperation or no cooperation) to a scale of cooperation levels (contributions to the public good),
(ii) provides a perfectly controlled decision-making process (coordination via proposals instead of face-to-face communication), allowing us to compare different decision-making rules and
(iii) allows for costly punishment.

[1] Groups tend to perform better during the game due to improved reasoning abilities but not in the first period.