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# Who cooperates in repeated games: The role of altruism, inequity aversion, and demographics

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ABSTRACT

We explore the extent to which altruism, as measured by giving in a dictator game (DG), accounts for play in a noisy version of the repeated prisoner's dilemma. We find that DG giving is correlated with cooperation in the repeated game when no cooperative equilibria exist, but not when cooperation is an equilibrium. Furthermore, none of the commonly observed strategies are better explained by inequity aversion or efficiency concerns than money maximization. Various survey questions provide additional evidence for the relative unimportance of social preferences. We conclude that cooperation in repeated games is primarily motivated by long-term payoff maximization and that even though some subjects may have other goals, this does not seem to be the key determinant of how play varies with the parameters of the repeated game. In particular, altruism does not seem to be a major source of the observed diversity of play.



## 1. Introduction

Understanding when and why people cooperate in social dilemmas is a key issue not just for economics but for all of the social sciences (as noted by e.g., Ahn et al., 2003; Gächter and Herrmann, 2009). Here we focus on the infinitely (i.e., indefinitely) repeated prisoner's dilemma, where cooperation can be an equilibrium if future payoffs loom sufficiently large compared to the present. Laboratory experiments have shown that the overall fraction of subjects who cooperate once they have some experience with the game depends on the payoff parameters, with cooperation being much more prevalent when the returns to cooperation are higher and the future looms larger (e.g., Dal Bó and Frechette, 2013; Rand and Nowak, 2013). Nonetheless, there is typically some cooperation even when cooperation is not an equilibrium, and some defection when cooperative equilibria exist. Moreover, there is substantial heterogeneity across subjects in a given treatment: Some may cooperate in most periods while others cooperate hardly at all. This raises the question of who these cooperators are, if they

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differ in other measurable characteristics from the subjects who do not cooperate, and how such differences vary depending on the gains from cooperation.

Understanding the heterogeneity of play seems useful for understanding when cooperation will arise, and also for the debate about the role of other-regarding or "social" preferences in supporting cooperation. In particular, the data raise the question of whether the cooperators are motivated by more than just maximizing their own monetary payoff. Although other-regarding motivations clearly play an important role in generating cooperative behavior in some interactions, the extent to which they affect play in infinitely repeated games remains largely unknown.

As a first step toward understanding the sources of heterogeneous play and the way subjects respond to changes in game parameters, we combine data on play in an infinitely repeated noisy prisoner's dilemma or "RPD" that was previously analyzed in Fudenberg et al. (2012) with data from an additional dictator game played by the same subjects, and also with survey responses and demographic data.[1] First, we relate each subject's play in the RPD to their generosity in a dictator game (DG). Next, we investigate whether accounting for inequity aversion (Fehr and Schmidt, 1999) or pure altruism does a better job of explaining the observed distribution of strategies than money maximization. In addition, we use responses to survey questions to explore the motivations underlying cooperative play in the RPD, as well as to explore whether self-reported prosocial behavior outside the laboratory is a good indicator of experimental behavior in the RPD and DG. We also examine whether individual characteristics such as age, major, gender and risk attitudes are useful in explaining heterogeneity.

In the RPD, subjects could either cooperate or defect in each round, with a constant probability of continuing to another round, and a constant probability that each player's decision will be changed to the opposite. At the end of the last repeated game, subjects played a DG. To reduce the influence of RPD play on the DG, we specified that the recipient would be a subject in a later experiment; this was easy to do with the DG but would have been more difficult to implement with a sequential-move game such as the ultimatum or trust games. Behavior in the DG is known to be affected by factors such as double blindness, adding third players, random moves, or expanded choice sets (e.g., Hoffman et al., 1994; List, 2007; Bardsley, 2008; Cooper and Kagel, forthcoming). Nonetheless, DG giving has been shown to correlate with charitable giving (e.g., Benz and Meier, 2008) and returning money mailed to subjects in misaddressed envelopes months or years after the DG (Franzen and Pointner, 2013), suggesting that the DG does provide relevant information about altruistic preferences. Moreover, the DG is not the only game where behavior is sensitive to strategically incidental factors: behavior in other games commonly used to measure social preferences, such as the ultimatum game, the one-shot prisoner's dilemma and related public goods games, can react to both priming and framing (e.g., Liberman et al., 2004; Lelived et al., 2008; Benjamin et al., 2012; Ellingsen et al., 2012; Rand et al., 2013; Rand and Engel, forthcoming); and, at least in Dreber et al. (2013), DG giving is less influenced by framing effects than the Prisoner's Dilemma.

The returns to cooperation in the RPD varied, with four different payoff specifications. While the frequency of cooperation varied also with the payoff specification, giving in the DG did not, which suggests that spillovers from the RPD to the DG were minimal. When we predict RPD cooperation with DG play, we find that an individual's giving in the DG is not correlated with either playing C in the first period of the repeated game or the overall frequency of cooperation in the repeated game, except in the one "non-cooperative" treatment where cooperation is not an equilibrium. In addition, we find no correlation between DG giving and leniency (waiting for multiple defections before punishing) which is substantially more frequent when the returns to cooperation are high, and earns high payoff in these treatments; and we find no correlation between forgiveness (returning to cooperation after punishing) and DG giving, except in the non-cooperative treatment. We also relate DG giving to the distribution of strategies played, and find that players who are selfish in the DG are more likely to play "Always Defect" in the non-cooperative treatment, while selfish players are marginally significantly *less* likely to play always defect in the "cooperative" treatments where cooperation is an equilibrium. Thus altruism as measured by DG giving seems to play a role in promoting cooperation only when cooperation is not supported by self-interest. When the monetary payoffs strongly support cooperation, DG giving has little explanatory power, and what power it may have suggests that in these cases selfishness promotes rather than inhibits cooperation.

We also explore the implications of one sort of social preferences for play in our RPD game through the use of the Fehr and Schmidt inequity aversion model (1999). While the FS model does not capture many important aspects of social preferences such as reciprocity, spite and efficiency concerns (e.g., Rabin, 1993; Levine, 1998; Brandts and Solà, 2001; Charness and Rabin, 2002; Cox et al., 2008), and does not allow for a preference for ex-ante equality (e.g., Bolton et al., 2005; Krawczyk and Le Lec, 2010; Fudenberg and Levine, 2012), it is a parsimonious and widely used specification that is easy to implement, readily yields concrete predictions, and provides a straightforward basis of comparison to monetary payoff maximization.[2]

To apply the FS model, we investigate the expected utility of the various strategies used in the experiment if subjects had utility as described by the inequity aversion model with parameters $\alpha = 2$, $\beta = 0.6$, where $\alpha$ measures the loss from disadvantageous inequity and $\beta$ measures the loss from advantageous inequity. We chose these parameters because Fehr and Schmidt (2010) argue that many experiments are well summarized by supposing that some fraction of the population has these payoffs and the rest has "standard" payoffs $\alpha = \beta = 0$. With these parameters, the highest utility goes to subjects

[1] Outside of the laboratory, actions are often observed with noise: someone who claims they worked hard, or that they were too busy or sick to help, may or may not be telling the truth, so incorporating noisy observations of intended actions brings the lab situation closer to the field. The presence of this noise also facilitates the identification of the subjects' strategies as e.g. even an agent who intends to always cooperate will sometimes defect "by mistake".

[2] There is some debate about just how widely and accurately the FS model applies; see Binmore and Shaked (2010) and Fehr and Schmidt (2010).