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On the nature of reciprocity: Evidence from the ultimatum reciprocity measure☆

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ABSTRACT

We experimentally show that current models of reciprocity are incomplete in a systematic way using a new variant of the ultimatum game that provides second-movers with a marginal-cost-free punishment option. For a substantial proportion of the population, the degree of first-mover unkindness determines the severity of punishment actions even when marginal costs are absent. The proportion of these participants strongly depends on a treatment variation: higher fixed costs of punishment more frequently lead to extreme responses. The fractions of purely selfish and inequity-averse participants are small and stable. Among the variety of reciprocity models, only one accommodates (rather than predicts) parts of our findings. We discuss ways of incorporating our findings into the existing models.

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1. Introduction

Despite a tradition of research on reciprocal behavior that spans almost three decades, the development of theories of reciprocal behavior still is far from complete. One indication is that there has been a proliferation of reciprocity models (e.g., Rabin, 1993; Dufwenberg and Kirchsteiger, 2004; Sobel, 2005; Falk and Fischbacher, 2006; Cox et al., 2007) that all seem to fit specific situations better than others, and yet there is no clear indication of which model to choose in what situation. In his 2005 review article, Sobel criticizes the existing models of reciprocal behavior for presenting a utility function of others' and own income without providing an explanation for how much weight players are likely to put on others' income relative to their own. More specifically, all of the models posit that the harshness of a reaction to an unkind action is determined by the trade-off between a reduction in the other player's payoff and the costs of punishment. For costs of punishment that are sufficiently low, these models therefore predict the harshest-possible reaction to even the slightest degree of unkindness. We

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argue – and show empirically – that this is wrong. However, as long as the marginal costs of punishment are strictly positive, it is impossible to falsify the above-mentioned models along these lines: it is always possible to adjust the reciprocation parameters such as to accommodate the data, given the reciprocation-parameter distribution is left unspecified in the model expositions. This substantiates a second criticism Sobel (2005, p. 407) expresses, namely that the ability of intention-based models of reciprocity to account for experimental results is "a tribute to their flexibility rather than actual support for the formulation." To corroborate the argument, we introduce the *ultimatum reciprocity measure* which eliminates the marginal costs of punishment altogether. Our experimental data show that a substantial proportion of the population deviates from the models' extreme predition in a systematic way, providing valuable insights into how existing models need to be amended.

In a recent contribution, Cox et al. (2008) abandon the domain of explicit functional forms and make a first step to address Sobel's (2005) first criticism. Our experiment suggests that their model may be an important step forward, being able to accommodate 27–47% of our observations in addition to what can be explained using the more conventional models. Nevertheless, the model still is prone to Sobel's second criticism of a lack of specificity: as we discuss in Section 3, the model accommodates rather than predicts our observations. The ways in which it fails on the specificity domain will provide guidance with respect to the direction in which to refine the model.

Another question that has attracted increased attention in the recent scholarly discussion is that of preference heterogeneity. In the context of our game, this particularly concerns the relative importance of intention-based reciprocal motives and inequity aversion (notably proposed by Bolton and Ockenfels (2000) and Fehr and Schmidt (1999)). Depending on the situation, one or the other seems to dominate. In fact, there is some indication that both play a role: the results of the mini-ultimatum game experiments by Falk et al. (2003) and Cox and Deck (2005) demonstrate the importance of both approaches. When the proposer has the option to offer an equal distribution of earnings and an unequal one favoring herself, the responder rejects the latter significantly more often than when the proposer has to choose between the unequal and an even more unequal distribution of earnings (in Falk et al., 44.4% versus 8.9%). Obviously, this result points to the importance of reciprocity. However, when the proposer has no option but to choose the unequal offer, still a substantial number of responders (18%) reject. As there is no intention to favor herself on the part of the proposer, this observation suggests that inequity aversion is a second empirically relevant trigger for rejections. Other experiments have shown similar patterns (e.g., on the convex ultimatum game, Andreoni et al. (2003), on three-person ultimatum games, Bereby-Meyer and Niederle (2005), and on a three-person gift exchange game, Thöni and Gächter (2007)).

The *ultimatum reciprocity measure* (URM game) has the following structure: a proposer makes a proposal of how to divide an endowment E.[1] The responder can either accept or reject. In the first case, the proposal is implemented, in the second, the responder obtains a fixed fraction κ, $\kappa < 1$, of the offer x and freely chooses the proposer payoff from the interval $[0, E - \kappa x]$. The important feature of the URM game is that (in contrast to most other games with punishment in the literature) punishment is free of marginal costs, only coming at a cost that is fixed once the offer is made.[2] This fixed cost is either equal to half the offer or to three quarters of the offer, depending on the treatment. As we will show below, models of inequity-aversion and reciprocity lead to very different predictions for behavior in the URM game: the first class of models predicts that responders – if they reject an offer – leave the proposers with a payoff which equals their earnings. In contrast, the majority of reciprocity models predicts that responders leave the proposers with zero earnings.

The results we obtain are striking. Less than 10% of the observations can be characterized as stemming from payoff-maximizers, models of inequity aversion account for 16–18%, conventional models of reciprocity for 17–38%.[3] At the same time, we find a substantial fraction of a fourth type that deviates from these predictions in a systematic way, which we call *gradual reciprocators*. These players are characterized by punishment patterns that leave their proposers with payoffs that are increasing in the offer made but generally lead to unequal payoffs. Moreover, the fraction of these players is determined by the treatment parameter. In the treatment with a high fixed cost of punishment, 20% of the population seem to switch from being gradually reciprocal to conforming to conventional reciprocity models. These observations call for an extension of existing models of reciprocity in the spirit of Sobel's first criticism: a characterization of the situation that leads to the prediction of the type distribution induced by the situation.

In Section 5, we discuss a number of approaches of how to modify the existing models in light of our observations. In particular, we characterize the gradual-reciprocator type within the framework of Cox et al. (2008), having dismissed the idea of matching the other's degree of kindness due to a lack of observations of the corresponding response-pattern predictions. With respect to our treatment effect, we note that what appears as an auxiliary assumption that is "sometimes (. . .) useful" (Cox et al., 2008, p. 34) seems to be an *essential* ingredient of a theory of reciprocal behavior. As an alternative, we propose the situation's coerciveness as a promising explanation, defined in terms of the gap between the highest payoff the player can obtain in the given situation and the next-lower obtainable payoff. An evaluation of the idea's predictive power, however, is beyond the scope of this article and is left for future research.

The remainder of the paper is organized as follows: Section 2 introduces the URM game and presents the experimental design and procedure. Section 3 analyzes the game according to the payoff-maximization model, inequity aversion, and

[1] A symbols table can be found in Appendix A.

[2] For games that allow for a change in the other player's payoff free of marginal costs, cf., e.g., Engelmann and Strobel (2004), or Fisman et al. (2007), who examine this question in the dictator game.

[3] Note that we do not consider the proposers in our game; cf. Section 3.

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