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# Sequential decision and strategy vector methods in ultimatum bargaining: evidence on the strength of other-regarding behavior

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## Abstract

Comparisons of ultimatum game results elicited using the strategy vector method against results from sequential decision protocol and recommended play treatments show little difference between methods. This result has implications for the innateness of “other-regarding behavior” and experimental methods.

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Ultimatum experiments yield results deviating significantly and consistently from standard game theoretic predictions. Typically, proposers offer in excess of 30% of their endowments and responders reject small, but strictly positive, offers.<sup>1</sup> One conclusion from these results has been that individuals’ decision-making is influenced by “other-regarding behavior”.<sup>2</sup> Here, we focus on the possibility that individuals do not significantly reflect on the nature of their decisions and the strategic environment in which they find themselves. To this end, we test the sensitivity of behavior in an ultimatum game to (i) the protocols for eliciting decisions and (ii) the information directing participants towards optimal decision-making.

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<sup>1</sup> See Camerer (2003) for a review. These results are robust across information conditions, degrees of anonymity and property rights. See Güth et al. (1982), Hoffman et al. (1994, 1996) and Ruffle (1998).

<sup>2</sup> In using the term “other-regarding behavior,” we capture concerns for fairness (as in Rabin, 1993), the distribution of resources (as in Fehr and Schmidt, 1999) or the intentions of others (as in Dufwenberg and Kirchsteiger, 2004).

As a baseline, we use the strategy vector method (Selten, 1967) to elicit participants' decisions. Under the strategy vector method, individuals must provide a complete strategy profile for the game. That is, prior to knowing their role, participants must indicate the offer they would extend in the role of proposer and their contingent decisions (i.e. "accept" or "decline" decisions for each possible offer) in the role of responder. We compare results from this treatment with results utilizing a sequential decision protocol in which individuals make decisions as they encounter them in a game. Thus, proposers make decisions knowing their role and responders accept or reject knowing the offer. Finally, we compare results from the strategy vector method with results from a "recommended play" treatment in which participants were explained how to behave in the game under the standard assumption of self-interested preferences over wealth. After receiving this information, in which participants were directed towards the subgame perfect Nash equilibrium, participants' behavior was elicited using the strategy vector method.

Strikingly, we find few differences in behavior across treatments. In terms of mean offers and acceptance rates, we find no difference across treatments. In terms of distributions, only in the recommended play treatment (where participants were explicitly told the Nash prediction) do we observe a treatment effect in the distribution of offers. We infer two lessons from these results. First, the behaviors elicited from participants using the strategy vector method may not be significantly different from those obtained using the sequential decision protocol. This implies that use of the strategy vector method (which yields more information about individuals' behavior off the path of actual play) may not alter the manner in which individuals play sequential bargaining games. Secondly, the fact that proposers continued to extend offers of 30–40% and responders continued to reject strictly positive offers, despite changes in the method of eliciting behavior (the sequential decision protocol) and information on wealth maximizing behavior (the recommended play treatment), implies that individuals' concerns for others (either through preferences over the distribution of wealth or concerns over positive and negative reciprocity) are robust.

If one conjectures that the deviations observed from the subgame perfect Nash equilibrium in the ultimatum game are due to participants mis-understanding the structure of the game or inadequately reflecting on behavior, employing the strategy vector method should encourage more reflection and consideration of others' optimal strategies. This arises from participants having to consider their behavior in both roles (proposer and responder), thereby focusing attention on the strategic behavior of their potential partner. The strategy vector method also provides more information about players' behavior than the sequential decision protocol. However, the strategy vector method may suffer from several shortcomings. For example, since participants must respond for all possible outcomes, incentives may be diluted and participants (particularly responders) may be less influenced by emotions (particularly the negative emotions motivating negative reciprocity).<sup>3</sup> Further, the need for psychological consistency may generate behaviors under the strategy vector method that would not arise under the sequential decision protocol.

Previous research has explored the differences in behavior engendered by the use of the sequential decision protocol ("hot") and the strategy vector method ("cold"). For example, Brandts and Charness

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<sup>3</sup> As discussed by Loewenstein and Schkade (1999), there may exist a "hot/cold empathy gap" yielding differences in behavior under each method. See Roth (1995) for discussion of the advantages and disadvantages of the strategy method. The strategy method has been used in a variety of experiments. See Charness and Rabin (2002), Fischbacher et al. (2001), Güth et al. (1998), Keser and Gardner (1999) and Mitzkewitz and Nagel (1993).

(2000) compare behavior across hot and cold treatments of the prisoners' dilemma game and the chicken game. In these experiments behavior was stable across both treatments, even though the cold treatment provided more opportunities for participants to reflect on the behavior of themselves and others. From this, they conclude that the method of eliciting behavior does not matter for simple sequential games.<sup>4</sup> However, using binary-offer ultimatum games, Güth et al. (2001) found strong differences between hot and cold treatments: replacing "exactly equal splits" with "nearly equal splits" in the proposer's strategy space led to fewer rejections under the hot treatment but no change under the cold treatment.<sup>5</sup> In ultimatum games, Blount and Bazerman (1996) found that the minimum acceptable offer elicited by the strategy method differed significantly from those expressed directly by responders. Similarly, Brosig et al. (2003) find that second movers punish more in sequential bargaining games under the hot treatment than the cold treatment.

Our experiments differ from these in that we consider a complete specification of the ultimatum game, including nature as a first mover assigning participants' roles. Thus, our experiments provide an alternate test of the strategy vector method against the sequential decision protocol in that individuals must consider their behavior and provide complete strategies in both roles. This forces individuals to think about others' behavior in an explicit way, putting them directly "in the shoes" of a decision maker in each role. The fact that we observe little difference in behavior across our treatments implies that the other-regarding behavior inferred from our results is robust and an innate aspect of individuals' preferences.

## 1. Experimental design and procedures

We conducted three treatments of a one-shot, \$10 ultimatum game with 482 undergraduate students. Under our protocol, proposers' offers were restricted to integer values over the interval \$0–10. Instructions regarding the basic format of the game were provided at the outset of each treatment.<sup>6</sup> In each treatment, roles were randomly assigned and bargaining dyads were randomly matched.

In the baseline treatment (the pure strategy vector method treatment SM), participants had to provide a complete strategy profile for their actions in each role. One can think of the ultimatum game as an extensive form game in which (i) nature chooses each player's role, (ii) the proposer chooses her offer and (iii) the responder accepts or rejects. Thus, in this treatment, participants had to provide how much they would offer in the role of proposer and, in the role of responder, indicate their conditional acceptance or rejection for each potential offer. After strategy profiles were completed, participants' roles and bargaining pairs were randomly assigned and matched.

We explore the robustness of results derived utilizing the strategy vector method in two ways. First, we alter the decision protocol. The sequential decision treatment (SD) followed the standard protocol in which participants were randomly assigned the role of proposer or responder. The proposer then chose how much of the \$10 endowment to offer the responder. After being informed of the offer, the responder could accept the offer (in which case she received the offer and the proposer received the remainder of the endowment) or reject the offer (in which case both participants received zero).

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<sup>4</sup> Cason and Mui (1998) find similar results in sequential dictator games.

<sup>5</sup> Hoffman et al. (1998) find similar differences across hot and cold treatments.

<sup>6</sup> Instructions are available from the authors.

Table 1  
Mean offers and acceptance rates

Treatment	SM, $n = 162$	SD, $n = 129$	RP, $n = 190$
Mean offer	3.84	3.74	3.48
Mean accept. rate	81.54%	76.74%	79.84%

Secondly, we provided participants with information on optimal behavior assuming preferences over wealth. Thus, the recommended play treatment (RP) was identical to the SM treatment except that participants received information about optimal behavior prior to giving their complete strategies. That is, participants were explained the subgame perfect Nash prediction given self-interested preferences over wealth: given that a self-interested, wealth maximizing responder should accept any (non-negative) offer, a proposer with self-interested preferences over wealth should offer the smallest possible amount. Following these instructions, participants gave their complete strategy profile (following the pure strategy vector method) and were randomly assigned roles and bargaining pairs. The idea here was to see if a better understanding of rational choice theory in the context of the ultimatum game would influence participants' behavior.

## 2. Results

Mean offers and mean acceptance rates are presented in Table 1. Strikingly, there is very little difference across treatments in our experiments (cf. Camerer, 2003).

Figs. 1 and 2 illustrate the distribution of offers and acceptance rates across the three treatments. Wilcoxon ( $W$ ) tests find no difference in the distribution of offers between the SM and SD treatments ( $W = 0.719$ ,  $p = 0.47$ ), but identify a difference between the SM and RP treatments ( $W = 2.908$ ,  $p < 0.05$ ).

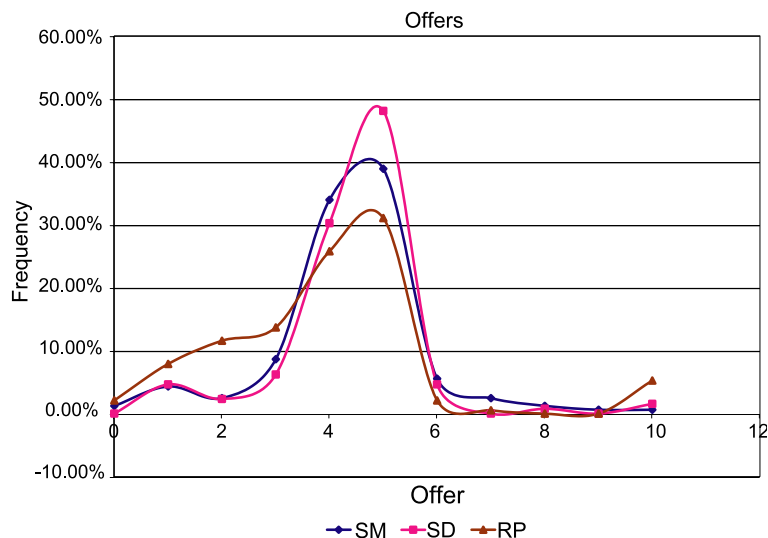


Fig. 1. Frequency of offers under each treatment.

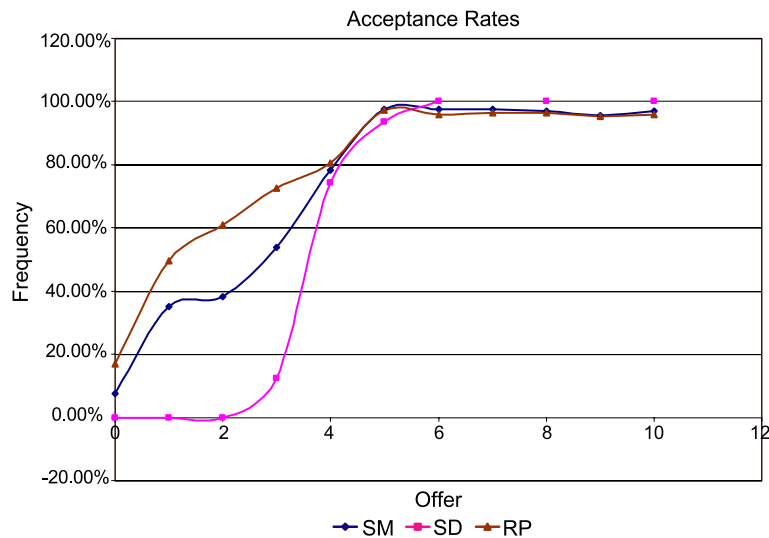


Fig. 2. Frequency of acceptance (given offer) under each treatment.

That is, the distribution of proposers' offers did not differ with a change in the elicitation method (SM vs. SD) but did differ when participants were explicitly directed towards the Nash prediction (SM vs. RP).

With respect to the distribution of acceptance rates, we find no difference between the treatments when looking at the entire distributions.<sup>7</sup> Since acceptance rates are identical for offers in excess of \$5, we explored differences in the truncated distribution of acceptances, looking only at the distribution of acceptances for offers less than or equal to \$5. Comparing treatments in this way, we are unable to reject the null hypothesis between the SM and SD treatments ( $W = -1.152$ ,  $p = 0.25$ ) or between the SM and RP treatments ( $W = -0.731$ ,  $p = 0.46$ ). Thus, neither the method of eliciting responders' accept/decline decisions (SM vs. SD) nor information on optimal behavior (SM vs. RP) affected the distribution of acceptance rates.<sup>8</sup>

Although the SD and RP treatments differ in more than one respect (i.e. decision protocol and directing participants towards the game theoretic prediction), it is interesting to note that Wilcoxon tests identify differences in both the distribution of offers ( $W = 3.432$ ,  $p < 0.05$ , SD vs. RP) and the distribution of acceptances ( $W = 4.128$ ,  $p < 0.05$ , SD vs. RP).

### 3. Discussion

Our results indicate that the use of the strategy vector method for eliciting participants' behavior in sequential bargaining experiments may not significantly bias individuals' behavior. In our ultimatum game experiments, there was no difference in results derived from the strategy vector method and the

<sup>7</sup> Pairwise comparisons of the treatments yield  $|W| < 1.0$  and  $p \geq 0.60$  for all comparisons.

<sup>8</sup> It is interesting to note that, in the SM and RP treatments, only 92.8% and 91.1% of participants would have accepted their own offer.

sequential decision protocol. Only when participants were directed towards the subgame perfect Nash prediction did we observe differences in the distribution of offers, although these differences were not detectable when looking at mean behavior. That we observe no differences between the distribution of acceptances obtained from the strategy vector method and the other treatments provides strong evidence on the robustness and innateness of reciprocity in individual decision-making.

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## References

- Blount, S., Bazerman, M., 1996. The inconsistent evaluation of absolute versus comparative payoffs in labor supply and bargaining. *Journal of Economic Behavior and Organization* 30, 227–240.
- Brandts, J., Charness, G., 2000. Hot vs. cold: sequential responses and preference stability in experimental games. *Experimental Economics* 2, 227–238.
- Brosig, J., Weimann, J., Yang, C.-L., 2003. The hot versus cold effect in a simple bargaining experiment. *Experimental Economics* 6 (1), 75–90.
- Camerer, C.F., 2003. *Behavioral Game Theory*. Princeton Univ. Press, Princeton, NJ.
- Cason, T.N., Mui, V.L., 1998. Social influence on the sequential dictator game. *Journal of Mathematical Psychology* 42, 248–265.
- Charness, G., Rabin, M., 2002 (August). Understanding social preferences with simple tests. *Quarterly Journal of Economics* 117 (3), 817–869.
- Dufwenberg, M., Kirchsteiger, G., 2004 (May). A theory of sequential reciprocity. *Games and Economic Behavior* 47 (2), 268–298.
- Fehr, E., Schmidt, K., 1999 (August). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics* 114 (3), 817–868.
- Fischbacher, U., Gächter, S., Fehr, E., 2001. Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters* 71, 397–404.
- Güth, W., Schmittberger, R., Schwarze, B., 1982. An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior and Organization* 3, 367–388.
- Güth, W., Huck, S., Rapoport, A., 1998. The limitations of the positional order effect: can it support silent threats and non-equilibrium behavior. *Journal of Economic Behavior and Organization* 34, 313–325.
- Güth, W., Huck, S., Mueller, W., 2001. The relevance of equal splits in ultimatum games. *Games and Economic Behavior* 37, 161–169.
- Hoffman, E., McCabe, K., Smith, V.L., 1994. Preferences, property rights, and anonymity in bargaining games. *Games and Economic Behavior* 7, 346–380.
- Hoffman, E., McCabe, K., Smith, V., 1996. Social distance and other-regarding behavior in dictator games. *American Economic Review* 86 (3), 653–660.
- Hoffman, E., McCabe, K.A., Smith, V.L., 1998. Behavioral foundations of reciprocity: experimental economics and evolutionary psychology. *Economic Inquiry* 36, 335–352.
- Keser, C., Gardner, R., 1999. Strategic behavior of experienced subjects in a common pool resource game. *International Journal of Game Theory* 28, 242–251.
- Loewenstein, G., Schkade, D., 1999. Wouldn't it be nice? Predicting future feelings. In: Kahneman, D., Diener, E., Schwartz, N. (Eds.), *Well-Being: The Foundations of Hedonic Psychology*. Russell Sage, New York.
- Mitzkewitz, M., Nagel, R., 1993. Experimental results on ultimatum games with incomplete information. *International Journal of Game Theory* 22, 171–198.

- Rabin, M., 1993. Incorporating fairness into game theory and economics. *American Economic Review* 83, 1281–1302.
- Roth, A.E., 1995. Bargaining experiments. In: Kagel, J.H., Roth, A.E. (Eds.), *Handbook of Experimental Economics*. Princeton Univ. Press, New Jersey, pp. 253–348.
- Ruffle, B.J., 1998. More is better, but fair is fair. Tipping in dictator and ultimatum games. *Games and Economic Behavior* 22, 247–265.
- Selten, R., 1967. Die strategiemethode zur erforschung des eingeschränkt rationalen verhaltens im rahmen eines oligopol-experiments. In: Sauerman, H. (Ed.), *Beiträge zur experimentellen Wirtschaftsforschung*. J.C.B. Mohr (Paul Siebeck), Tübingen, pp. 136–168.