Testing Noncooperative Bargaining Theory: A Preliminary Study

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Bargaining theory has received much attention of late. There has also been a growing interest in experimental work on bargaining, notably by Reinhard Selten (1978), and by Alvin Roth, M. Malouf, and J. Murnighan (1981). This work confirms a view that is common among social psychologists: namely, that subjects tend to seek a "fair" outcome to bargaining problems. The thrust of the inquiry is then to determine what the subjects will regard as fair in a given situation.

A tension exists between this work and the theoretical approach revitalized by Ariel Rubinstein (1982). (See also Binmore, 1982, 1983; Shaked and Sutton, 1984.) This new approach involves modeling the process of offer and counteroffer by means of which agreement can be reached, as a formal noncooperative game; and studying agreements that can be sustained as equilibria of this game.

The tension is sharply illustrated by a recent experimental study of W. Güth, R. Schmittberger, and B. Schwarze (1982). (See also Güth, 1983.) Two subjects have to divide a sum of money (the "cake"), using the following primitive procedure: Player 1 makes a demand, which Player 2 can then accept or refuse. This concludes the game. If the demand is refused, both players receive nothing. A strategic analysis assigns all (or nearly all) of the cake to Player 1, but experiments show that a much "fairer" division is usual.

*London School of Economics, Houghton St., London WC2A 2AE, UK. We gratefully acknowledge the financial support of the International Centre for Economics and Related Disciplines (Suntory-Toyota Foundation), and the hospitality of the Psychology Department at LSE, where our experimental work was conducted, under the immediate supervision of Yasmin Batliwala, Mimi Bell, and Maria Herrero. We also thank Werner Güth, Alvin Roth, and particularly Reinhard Selten for comments on an early draft.

The work of Güth et al. seems to preclude a predictive role for game theory insofar as bargaining behavior is concerned. Our purpose in this note is to report briefly on an experiment that shows that this conclusion is unwarranted. (Only the briefest account of the experiment is offered here; for a full account, see our 1984 paper.)

This does not mean that our results are inconsistent with those of Güth et al. Under similar conditions, we obtain similar results.[1] Moreover, our full results would seem to refute the more obvious rationalizations of the behavior observed by Güth et al. as "optimising with complex motivations." Instead, our results indicate that this behavior is not stable in the sense that it can be easily displaced by simple optimizing behavior, once small changes are made in the playing conditions.

I. The Experiment

In the present work, we went beyond the one-stage "ultimatum" game of Güth et al. and examined a two-stage game, as follows:

Stage I: The cake is of size 100 pence. Player 1 makes a proposal (X); Player 2 accepts (1 receives X, 2 receives $100-X$) or rejects (game continues).

Stage II: The cake is of size 25 pence. Player 2 makes a proposal (X'); Player 1 accepts (1 receives X', 2 receives $25-X'$) or rejects (1 receives 0, 2 receives 0).

A game-theoretic analysis requires that Player 1 makes an opening demand in the range 74–76 pence, and Player 2 accepts any opening demand of 74 pence or less (for he cannot do better by refusing, even if he obtains the entire cake in the second stage).

[1] See fn. 2 below.

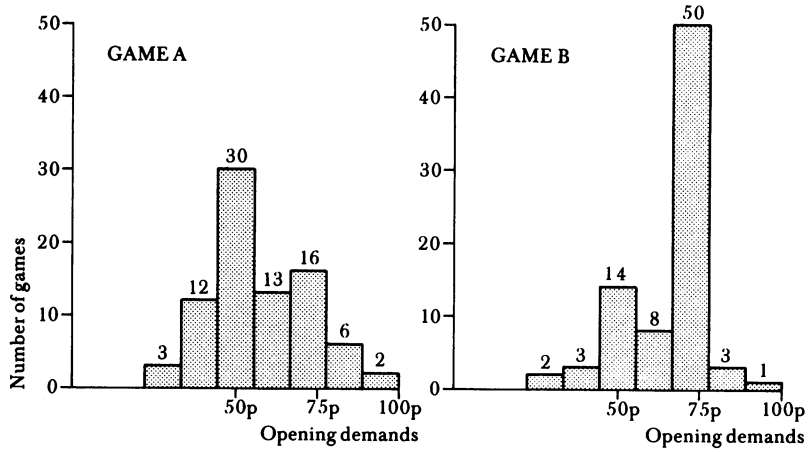

FIGURE 1. OPENING DEMANDS FOR MAIN RESULTS

We studied the game, using subjects who were isolated from each other, and who communicated their decisions via linked microcomputers. Following lengthy pilot studies, in which we solicited players' comments after they had played the game, we decided to extend the design, as follows. We invited the subject who had filled the role of Player 2 to play the game again, but this time he would fill the role of Player 1. We recorded only his opening demand in this second game (Game B).

II. The Results

We focus here on the main features of interest. The opening demands made in Game A and Game B, respectively, are shown in the histograms in Figure 1. They exhibit a marked change of behavior between Game A and Game B. A tendency to "play fair" in Game A becomes a strong tendency to play "like a game theorist" in Game B.

This marked change in behavior constitutes the first of the two main findings of the present study. The null hypothesis is that the opening demands in each game are drawn from the same population and is rejected at the 0.1 percent level (Kolmogoroff-Smirnoff two-tailed test).

Focusing on those subjects who filled the role of Player 2 in Game A, we looked at the subsample who faced a "high" demand in that game. A fair player would reject a high demand, and would not himself make a high demand (when offered the chance to act as Player 1, in Game B). *The results* (shown in Table 1) *indicate little support for the view that a substantial proportion of the population are "fairmen" as opposed to "gamesmen."* The table shows the relationship between a subject's response to the opening demand made of him in Game A, and the opening demand which he later makes when acting as Player 1 in Game B. Cell G denotes Gamesmen, cell F denotes Fairmen. We chose the midpoint between 50 and 75 as our dividing line between low and high demands. The table refers only to the subsample of our population who faced high demands in Game A.

TABLE 1

Opening Demand in Game B	Response to High Opening Demands ($63 \le a \le 77$) in Game A	
	No	Yes
$b \le 62$	1(F)	2
$b \ge 63$	2	17(G)

What, then, of the players who filled the role of Player 1 in Game A, and who exhibited a marked tendency to make fair de-

mands? While we have considered various possible explanations, the interpretation that we favor is this: subjects, faced with a new problem, simply choose "equal division" as an "obvious" and "acceptable" compromise —an idea familiar from the seminal work of Thomas Schelling (1960). We suspect, on the basis of the present experiments, that such considerations are easily displaced by calculations of strategic advantage, once players fully appreciate the structure of the game.

Finally, it is important to note that Güth et al. did in fact study subjects playing the one-stage ultimatum game for a second time, without observing any marked change in behavior.[2] Thus, it is not *only* this feature which distinguishes our results from theirs.

The key feature to note, in this respect, is that *responses to opening demands in Game A* were strongly biased in favor of "rationality." (Of 22 opening demands in the range $63 \leq a < 77$, only 3 were rejected.) On the other hand, at the second stage of Game A —following a refusal at the first stage—subjects showed a strong tendency to reject high demands (as in the study of Güth et al).

Our suspicion is that the one-stage ultimatum game is a rather special case, from which it is dangerous to draw general conclusions. In the ultimatum game, the first player might be dissuaded from making an opening demand at, or close to, the "optimum" level, because his opponent would then incur a negligible cost in making an "irrational" rejection. In the two-stage game, these considerations are postponed to the second stage, and so their impact is attenuated.[3]

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[2] Opening demands were slightly higher, and refusals of these demands *more frequent.*

[3] There remains the possibility that the difference between our results and those of Güth et al. might be traced to differences in the experimental environment rather than to differences in the game played. Güth et al. operated in an open environment within which subjects could see each other (although the identity of their current opponent was, of course, a secret). Our assistant, Yasmin Batliwala, has run a controlled experiment to check for this possibility (which will be reported separately). Replicating our experimental conditions, she compared the behavior of subjects playing our two-stage game with that of a control group playing the one-stage ultimatum game. Broadly, the results confirmed our present interpretation. Behavior in the two-stage game was similar to that reported in this paper. Behavior in the one-stage ultimatum game was consistent with the observations of Güth et al. in that game theory was a poor predictor of outcomes.