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RECENT DEVELOPMENTS IN EXPERIMENTAL ECONOMICS

VOLUME II

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Volume II

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Contents

Part I: Bargaining

The literature reporting bargaining experiments is rich and diverse, and the four papers in this Part are markers on just one of the trails that has been followed.

The paper by Güth, Schmittberger and Schwarze is a good place to start the trail, because they study a very simple form of bargaining game, the ultimatum game, which may be seen as the final stage of a two-person alternating-offer finite-horizon game. The scenario is this. There is some 'cake' (e.g. a certain sum of money) to be divided, and one of the two players has the role of proposing how this cake should be divided between the pair of them. The other player then has two options: either to accept the proposal and take the share offered; or to reject the proposal, in which case both players receive nothing.

The structure of the game could hardly be simpler, and the prediction of standard theory is equally simple. On the assumption that the player receiving the offer prefers something to nothing, he should accept any positive offer. Realizing this, the player making the offer (who is assumed to prefer more money to less) should offer the minimum positive amount the currency allows and expect to keep all the rest of the cake for himself.

Although Güth *et al.* also reported on some other more complicated games, it was the results of these 'easy game' experiments which attracted most attention, because even in such apparently straightforward situations, people's actual behaviour was very different from that which standard theory predicted: a number of positive offers were rejected, and many of the offers were a good deal higher than they 'should' have been. Clearly, this result had uncomfortable implications for a broad class of finite-horizon games where the standard approach is to find the solution for the final (ultimatum) stage of the game, and then work back from there, applying similar reasoning to each preceding stage.

However, in the second paper in this Part, Binmore, Shaked and Sutton questioned the stability of the behaviour observed by Güth *et al.*, and challenged the conclusions suggested by them. The experiments by Binmore *et al.* used a two-stage 'shrinking cake' format, and asked participants to play two games, reversing their roles between the first and the second. They observed a marked change in the patterns of play between the first game and the second, and concluded that experience and hence a better understanding of the structure of the game tended to move behaviour away from 'playing fair' towards 'playing like a game theorist'.

The third paper in this Part, by Ochs and Roth, develops the story with a somewhat more sophisticated experimental design, whereby behaviour in two-stage games could be compared with behaviour in three-stage games, and the role of discount rates (that is, the rates at which the cake shrinks from one round to the next) could be examined. Their design also gave players reasonable opportunities to learn by playing the game ten times in succession, each time with a different partner. Although they interpret their results with caution, there are various regularities in their data – not least, the frequency and persistence of 'disadvantageous counter offers' – which suggest that the absolute magnitudes of monetary payoffs are not the only factors that matter to players, and that distributional considerations also appear to play a significant (if not altogether straightforward) part in the observed behaviour.

The fourth paper, by Prasnikar and Roth, adds a further dimension to this debate. They had noticed that a rather different kind of game – the 'best-shot' public good game – entailed much the same perfect equilibrium solution as the ultimatum game, but produced very different behaviour when studied experimentally: in particular, it seemed that participants in best-shot public good experiments were willing to accept very much more unequal distributions of payoffs than participants in ultimatum games had generally been prepared to tolerate.

Prasnikar and Roth's first set of experiments was designed to control for various disparities between the previous studies which might have contributed to the observed differences in behaviour, e.g. variability in the amount of information players had about each other's payoffs. However, even after controlling for such factors, the distinctive patterns of behaviour persisted.

Following reactions to these results when they were circulated in discussion paper form, Prasnikar and Roth studied a third kind of game where the equilibrium solution also entailed very unequal payoffs, the intention being to investigate some additional hypotheses about the tension between notions of fairness and considerations of strategy. They conclude that the relationship is a subtle and complex one – too subtle and complex to be adequately summarized in a sentence or two in this introduction. Far better to read the paper and let the authors and the results speak for themselves.

[1]

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AN EXPERIMENTAL ANALYSIS OF ULTIMATUM BARGAINING

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There are many experimental studies of bargaining behavior, but surprisingly enough nearly no attempt has been made to investigate the so-called ultimatum bargaining behavior experimentally. The special property of ultimatum bargaining games is that on every stage of the bargaining process only one player has to decide and that before the last stage the set of outcomes is already restricted to only two results. To make the ultimatum aspect obvious we concentrated on situations with two players and two stages. In the 'easy games' a given amount c has to be distributed among the two players, whereas in the 'complicated games' the players have to allocate a bundle of black and white chips with different values for both players. We performed two main experiments for easy games as well as for complicated games. By a special experiment it was investigated how the demands of subjects as player 1 are related to their acceptance decisions as player 2.

1. Introduction

A game in strategic or extensive form, which is played to solve a distribution problem, is called a bargaining game. Such a game has perfect information if all its information sets are singletons, i.e., there are no simultaneous decisions and every player is always completely informed about all the previous decisions. Consider a bargaining game with perfect information whose plays are all finite. Such a game is called an ultimatum bargaining game if the last decision of every play is to choose between two predetermined results. Often a game itself does not satisfy this definition, but contains subgames for which this is true.

In 2-person bargaining one usually speaks of an ultimatum if one party can restrict the set of possible agreements to one single proposal which the other party can either accept or reject. Since in an ultimatum bargaining game the set of possible outcomes is narrowed down to only two results before the last decision is made, this explains our terminology.

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The speciality of ultimatum bargaining games can be illustrated as follows: Since the length of the play is bounded from above, there is always a player *i* who has to make the final decision. Now for all other players the game is over in the sense that they cannot influence its outcome any longer. So all that player *i* has to do is to make a choice which is good for himself. We can say that player *i* finds himself in a 1-person game. Now consider a player *j* who makes his choice just before player *i* terminates the game. If *j* knows what player *i* considers as good or bad, player *j* can easily predict how player *i* will react. Thus in a certain sense we can say that player *j*, too, is engaged in a 1-person game. In the same way one can see that every player in an ultimatum bargaining game finds himself in a 1-person game. This shows that in ultimatum bargaining games strategic interaction occurs only in the form of anticipating future decisions. There is no mutual interdependence resulting from simultaneous moves or infinite plays.

The obvious solution concept for ultimatum bargaining games is the subgame perfect equilibrium point [Selten (1975)]. The subgame perfect equilibrium behavior can be easily computed by first determining the last decisions, then the second last ones, etc. Most ultimatum bargaining games have only one perfect equilibrium point. The delicate problem to select one of many equilibrium points as the solution of the game is of only minor importance.

In the economic literature bargaining processes are often modelled as ultimatum bargaining games [see, for instance, Ståhl (1972), and Krelle (1976)]. Here we do not discuss whether ultimatum bargaining games can adequately represent real bargaining situations [see Harsanyi (1980), and Güth (1978)]. We are mainly interested in ultimatum bargaining behavior because it allows one to analyse in detail certain aspects of bargaining behavior.

In any multistage bargaining process the parties have to anticipate future decisions. The specialty of ultimatum bargaining games is that these are the only strategic considerations and that especially the last decision is the most simple choice problem. The individually rational decision behavior will therefore be rather obvious even if subjects do not have a strategic training. Our experiments allow us to explore the following questions: Will subjects behave optimally? And if not why and in which direction will they deviate from their optimal decisions? Our approach is to investigate first the most simple bargaining models. Only when knowing what drives the individual decisions in simple games, one can be sure how to interpret the results of more complex situations. Our distinction of 'easy' and 'complicated' games is a small step in this direction. There are so many experimental studies of bargaining behavior that we do not even try to give special references; for instance, many of the 'Contributions to Experimental Economics', edited by H. Sauermann, deal with bargaining problems. But surprisingly enough, as far as we know, nearly no experiments have been performed to analyse ultimatum bargaining behavior. Because of their special structure ultimatum bargaining games are useful to investigate experimentally how bargainers anticipate the decision behavior of their opponents. This is especially true for games with only few players and rather short plays.

Consider a game which does not satisfy the definition of an ultimatum bargaining game only because the players can choose between more than just two bargaining results at the last decision stage. Such a game will be called a bargaining game with ultimatum aspect [Güth (1976)]. Fouraker and Siegel (1963) have investigated the bargaining behavior in such games. In their interesting study they confronted their subjects with a bilateral monopoly where first the seller states the price and then the buyer determines his demand at this predetermined price.

Fouraker and Siegel distinguish between complete and incomplete information as well as single and repeated transaction experiments. We restrict our attention to single transaction experiments. It is obvious from the repeated prisoners' dilemma-experiments that a player will not completely exploit the ultimatum aspect if he can be punished later on. Furthermore, we can neglect the incomplete information experiments. Since the players do not know the types of their opponents, games with incomplete information do not satisfy the requirement of perfect information [Harsanyi (1968), and Selten (1982)]. According to their data Fouraker and Siegel consider the subgame perfect equilibrium point to be reasonably consistent with the observed bargaining behavior. In 11 of 20 experiments price and quantity were chosen exactly as predicted by the equilibrium solution. Our data will indicate that this result will change if the payoff distribution according to the equilibrium point is more extreme. Fouraker and Siegel also vary this payoff distribution. Whereas in Experiment 2 the equilibrium payoff of the seller is much higher than the one of the buyer, these payoffs are equal in Experiment 1. For us it is a surprise that nevertheless the number of equilibrium results in Experiment 2 is only slightly smaller than in Experiment 1. According to our data subjects punish an opponent, who exploits the ultimatum aspect, if this is not too costly for them.

It seems that the strategic asymmetry of both players was more acceptable in the experiments of Fouraker and Siegel. This can be due to their special scenario. In highly industrialized countries most consumer markets are considered as seller markets. 'Buyers' therefore might be used to have less strategic power. In an abstract bargaining situation, where the bargaining parties have to divide a given amount of money, an asymmetric power relationship is probably less acceptable.

Another explanation is that subjects in the experiments of Fouraker and Siegel could not see each other. They might not even have been sure whether they actually face an opponent or a preprogrammed strategy. In our experiments all subjects could see each other. But since bargaining pairs were determined stochastically, none of them knew his opponent.

In the following we describe the scenario which was used to observe ultimatum bargaining behavior experimentally. Afterwards the data collected in the experiments will be discussed in detail and compared. In the concluding section we summarize our main results and indicate some perspectives for the future study of ultimatum bargaining behavior.

2. Description of experiments

It is well-known in the economic literature [Selten (1978)] that subjects do not anticipate future decisions in the way which characterizes the individually rational decision behavior in ultimatum bargaining games. Players tend to neglect that there is a last stage which is so important for the normative solution. Thus it is more than doubtful whether the special structure of ultimatum bargaining games will be fully recognized if the bargaining process is more complicated in the sense that the number of stages is very large.

Now we are interested in ultimatum bargaining behavior since in these games strategic interaction occurs only in the form of anticipation. To make sure that all subjects are aware of the special game situation, the easiest non-trivial ultimatum bargaining games with only two players and two decision stages have been used to test ultimatum bargaining behavior.

The experiments can be partitioned into two subgroups: In one group the two subjects have to determine only how to distribute a given amount of money. These experiments will be called 'easy games'. In the experiments of the second group they have to distribute certain amounts of black and white chips which do not have the same value for both of them. These experiments will be called 'complicated games'. Whereas the optimal decision behavior in easy games is obvious, complicated games require a slightly more thorough analysis of the game situation. Comparing the results for easy and complicated games will show how the complexity of the game model influences bargaining results.

Before every experiment subjects were introduced to the bargaining situation in an informal way. The oral instructions were given according to the rules listed in the appendix. Each experiment consisted of several games which were played simultaneously. The group of $2k$ subjects was first subdivided by chance into two subgroups of equal size k. All subjects in one of the two subgroups were determined to be player 1 in the corresponding ultimatum game. They were informed in advance that their opponent will be chosen by chance out of the other subgroup. So no player 1 knew his opponent for sure. The k easy games differed only with respect to the amount c which was to be distributed among the two subjects. All experiments were games with complete information.

The number k of games ranged from 9 to 12. So the chances to meet a specific subject as player 2 were rather low for all players 1. All subjects were seated in the same room at desks which were far enough from each other to exclude verbal communication. Furthermore, players 1 and players 2 were at opposite sides of the room. Each participant could see all the others and had a complete control that the experiment was performed according to the instruction rules in the appendix. We did not observe attempts to exchange messages during the experiments. Between experiments communication was not restricted.

2.1. Easy games

In an easy game the two subjects were first determined to be player 1 and player 2. The subject chosen to be player 1 then declares which amount a_1 he claims for himself. The difference between the amount c (>0), which can be distributed, and a_1 is what player 1 wants to leave for player 2. Given the decision of player 1 player 2 has to decide whether he accepts player 1's proposal or not. If 2 accepts, player 1 gets a_1 and player 2 gets $c-a_1$. Otherwise both players get zero.

Every subject in the subgroup of players 1 got a form (table 1) which informed him about the total amount c to be distributed. Player 1 had to write down the amount of money a_1 which he demands for himself. Then the forms were collected and distributed by chance to the subjects in the other subgroup. Player 2 had to indicate whether he accepts the proposal of player 1 or not. Two tickets were attached to each form, one for player 1 and one for player 2. On each ticket there was a capital letter, indicating the game, and the player number. So, for instance, *X1* is on the ticket of the subject who is player 1 in game *X*. We called *X1* the sign of this subject. The subjects had to show their tickets to get their payoffs.

Table 1

The form given to subjects engaged in easy games.

The amount c to be distributed is $c=$ DM ... Player 1 can demand every amount up to $c=$ DM ...
Sign of player 1:... 1
Decision of player 1: I demand DM ...
Sign of player 2:... 2
I accept player 1's demand:... I refuse player 1's demand: ... (indicate the decision you prefer by an '*X*'!)

Let us shortly discuss the rational decision behavior in easy games. Indivisibility of money implies that there is a minimal positive amount ε of money. Consider now an easy game: A rational player 2 will always prefer the alternative which yields more for him and will choose conflict only if this does not cost him anything. Thus the optimal decision for player 1 is to demand $c-\varepsilon$ for himself and to leave the minimal positive amount ε to player 2. This clearly illustrates the ultimatum aspect of easy games: The decision of player 1 implies that player 2 can only accept his minimum or choose conflict.

2.2. Complicated games

The experiments of complicated games were performed in a similar way. In a complicated game player 1 first has to divide a bundle of 5 black and 9 white chips. In order to do this player 1 determines a vector (m_1, m_2) indicating the decision for one bundle (I) with m_1 ($\leqq 5$) black and m_2 ($\leqq 9$) white chips and the complementary bundle (II) with $(5-m_1)$ black and $(9-m_2)$ white chips. After the decision of player 1 player 2 has to decide whether he wants to have bundle (I) or bundle (II). The other bundle is given to player 1. Player 1 got DM 2 for each chip. Player 2 was paid DM 2 for a black chip and DM 1 for a white chip. Both players were informed about these values.

The form given to the subjects engaged in a complicated game is shown in table 2. Again several examples were calculated to make sure that every subject completely understood the rules of the game. Some subjects had difficulties to learn how the distribution of chips determines the money payoffs.

In the complicated game the rational decision behavior is not so obvious. A rational player 2 will always choose the bundle which yields a higher payoff for him. For player 1 it is evident that he has to design bundles I and II such that the bundle, which player 2 will prefer, contains as few white

Table 2

The form given to subjects engaged in complicated games.

Sign of player 1:... 1	
Decision of player 1: Player 2 has to choose between	
(I)	...black chips and ... white chips (not more than 5 black and 9 white chips), or
(II)	the remaining chips.
Sign of player 2:... 2	
Decision of player 2:	
I choose vector (I) of black and white chips ...	
I choose the remaining vector of chips (II)...	
(indicate the decision you prefer by an '*X*'!)	