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Rationality and Emotions in Ultimatum Bargaining: Comment

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Introduction

In his paper "Rationality and Emotions in Ultimatum Bargaining", Shmuel ZAMIR presents four different types of variations of repeated ultimatum games (UG) with random matching after each period. The author stresses the close link between game theory and actual behavior. The main argument of the paper is that, despite the seeming discrepancy between actual behavior and theoretical predictions, rationality, in the sense of "*a rational person prefers receiving any positive amount of money to receiving nothing*", is present in the data. However, he does not deny that some part cannot be explained by even short term maximization but rather by other motives. He concludes that we need a model that contains a "*richer interpretation of the notion of rationality*".

In my discussion, I will focus on three issues, some of which are also discussed by ZAMIR, relevant to bridging the gap between the theory and the empirical findings. These issues are choosing the appropriate design, incorporating fairness into a descriptive model, and analyzing the data in terms of learning in order to disentangle strategic or rational features from emotional or other motives.

ZAMIR's paper is an outstanding representation of a variety of experiments within the framework of ultimatum games. These variations exhibit a rich amount of observed and theoretical aspects that is currently discussed in the experimental literature.

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I very much enjoyed the discussions with S. ZAMIR before and after the *Conférence des Annales* about the content of his talk. I also like to thank G. BOLTON for helpful discussions and B. GROSSKOPF for providing the simulation and helpful comments on this paper. Thanks also to S. ZAMIR and E. WINTER for giving their data to me.

The Variations of the Ultimatum Games

The experiments that ZAMIR analyzes are examples of excellent and innovative experimental designs using the ultimatum game. The four types of ultimatum games are the following: 1) the standard UG and the multiple proposer version of it (the market game) run in *various countries*; 2) an UG with real subjects and *virtual players*; 3) a *strategically simplified* UG, *with or without feedback* after each round, and 4) an UG with *sequential proposer competition with or without feedback*.

The central characteristics of these variations consist in making changes of the game without changing the theoretic solutions, simplifying the game and thereby simplifying or narrowing the game theoretic solutions, or extending the game such that additional solution concepts can be applied. By comparing the data of different variations the experimenter intends to disentangle different concepts, such as why people seem to be fair or whether they act rather strategically.

The four-country experiment (ROTH *et al.* [1995]) is the first study of that kind in which cultural differences are being tested in experimental economics. Game theory makes *a priori* no predictions for such differences. The set of solutions does not change. However, as ZAMIR has pointed out, one can show that in each country the proposers give on average best reply to the responders after some time has elapsed. Other researchers followed to analyze data in other games run in different countries or with groups other than the usual student population. For example, COOPER *et al.* [1999] used managers as subjects, or NAGEL *et al.* [1999] used newspaper readers or game theorists. They were also able to show that certain groups conform more to the game theoretic solutions than others, especially more than students. But not in all experiments there will appear such differences as with the market game (9 proposers and one responder, in ROTH *et al.* [1995]). Typically in games with competition between more than two players the data converges after some time to some theoretic solution concept notwithstanding the group composition.

The second study (WINTER and ZAMIR [1999]), the UG with real and virtual players, I find especially intriguing. In a first treatment the real subjects were not informed about the presence of the virtual subjects. They were only debriefed after the experiment of that fact. Therefore the game theoretic prediction is the same as in the original setup without virtual players. Because of the criticism of some experimenters that the subjects were deceived by not being told about the virtual players, in a further study, ZAMIR and WINTER also informed subjects about the existence of the programmed subjects. However, there was no difference between the two studies. The main question is whether proposers become more aggressive (playing closer to the subgame perfect solution) if they realize that offers get more easily accepted. This way one can test whether proposers want to search for best reply (and thus play rational) or whether they stick to fair offers. In fact the mere introduction of some virtual responders, who accept very little amounts, drives the offers close to the game theoretic solution. When the virtual players only accept fair splits, proposers become very generous, offering the 50-50 split. ZAMIR concludes that this indicates that offers are in line with the game theoretic strategy, searching for and finding best reply offers.

Interestingly, real responders hardly react to very greedy proposers in the direction of the game theoretic solution, meaning accepting also gready offers. In the presence of virtual proposers who offer very little (range 13-16) responders reply with a high rejection rate (around 60 % in the last 20 periods). It is clear that they do not learn to accept offers below 20 %. Thus, this part cannot be explained by the game theory but would have to be explained in a grander context as population effects (which may be similar to reputation in super games) or by punishment. This does not help the punisher himself, but the other responders in repeated one-shot games. In any case, I very much agree with the statement by ROTH *et al.* that responders as a group earn more if they appear to be tough and thus do not accept everything, making the game similar to public good experiments. It seems that proposers adjust to responders but not *vice versa*. Below I will also make a link between the actual behavior in this study and a fairness model and two prominent learning models discussed in the experimental literature.

In the previous study it is not adequate to expect only strategic or rational aspects on the side of the responders because of these other motives mentioned above. The question is how to avoid direct punishment or population effects while at the same time allowing for a repetition of the same game. The third experiment (ABBINK *et al.* [1999]), ZAMIR discusses, suggests one possibility. The main question is whether responders act differently over time if they know that proposers are not informed immediately about responders reaction after a given period (covered treatment) as compared to the situation when they know it immediately (open treatment). Thus, in the covered treatment population effects or immediate punishment are excluded. I want to make an additional comment about the design. This study is a good representation of how much one can simplify an already simple game in order to show certain effects. The ultimatum game depicts the last period of a bargaining situation. Since the authors want to study responders when offered low cake size, they restrict the offers to two options: fifty–fifty or an 80-20 split. This way they can hope to see reactions to low offers more likely as if they had allowed a larger strategy set.[1] The game theoretic solution set decreases to two elements, the subgame perfect solution and the solution with fair offer.

The lower (but still positive) rejection rate in the covered treatment indicates that many subjects understand that group reputation has no bite. However, as ZAMIR points out, rationality cannot explain these rejections but resistance to unfairness can. He also states that fairness models cannot explain the difference between the two treatments. In the next section we will discuss a fairness model and some inference for some of the discussed experiments. ZAMIR and his co-authors show that proposers react strongly to rejections of the previous period (see figure *Proposers' Switches to the Equal Offer*). This kind of sequential dependency has been called directional learning (first introduced by SELTEN and STOECKER [1987] in the experimental literature) which I will present below.

The fourth and last study, which ZAMIR discusses, analyzes an UG with three proposers who move sequentially, if the single responder rejects. For

1. Another alternative would have been the usage of the so-called strategy method (see, for example, SELTEN [1967], or MITZKEWITZ and NAGEL [1993] who study an UG, in which a responder has to respond to each possible offer a proposer could make).

this game cooperative and non-cooperative solutions can be applied: The subgame perfect solution concept (with backward induction and giving virtually nothing for the responder); the Core (with only competitive aspects and giving all to the responder); and the Shapley Value (giving 3/4 of the pie to the responder and the same amount to all proposers). Interestingly, the three solution concepts have different outcomes unlike in UG with simultaneous moves of multiple proposers or responders. The result of this study is that some qualitative aspects of backward induction can be observed since offers decrease from the first to the third proposer. However, offers are higher than 50 % and therefore competitive aspects are also important. ZAMIR notes that the actual share to the responders is closest to the one predicted by the Shapley value. Experimental economics has become especially important when discussing multiplicity of theoretical solutions or concepts. Which concept is selected cannot be decided without studying how people act (*e.g.* SCHELLING [1960], LUCAS [1986], OCHS [1995], BORNSTEIN *et al.* [1999]).

Fairness Models

I will briefly mention some *fairness models* that have been applied in the context of the class of games considered here and discuss it in connection with study 2 and 3. It is common to distinguish two types of models, (1) Relative Payoff models and (2) Intentionality models. Relative payoff models (*e.g.* FEHR and SCHMIDT [1999] and BOLTON and OCKENFELS [2000]) assume that people care about how their payoff compares to that of others while intentionality models (*e.g.* RABIN [1993], DUFWENBERG and KIRCHSTEIGER [1998] and CHARNESS and RABIN [2000] presume that people react to the (expected) intentions of others.

The fairness model (ERC) *à la* BOLTON and OCKENFELS [2000] can explain low offers if some responders are replaced by computers and accept everything (compare figure 2.1 and 2.5 of study 2 in ZAMIR's paper). In equilibrium, proposers are familiar with, and respond to, the distribution of actual acceptance thresholds. The threshold level is the parameter of the fairness model. As this level drop, proposals move closer to dictator game offers which are, on average, lower than (standard) ultimatum game offers. This of course means that proposers have to become familiar with the game and responders' reaction. Therefore, BOLTON and OCKENFELS and also FEHR and SCHMIDT typically analyze the last period, after learning has occurred.

For this reason the difference of offers in the early rounds in the covered and open treatment of study 3 (page 24, observation 4) cannot be explained by the fairness model. Only if proposers in the covered treatment *believe* that rejection rates are higher than in the open, then the difference in proposals is as ERC would predict. Of course, we don't know what actual beliefs were. ERC cannot explain observation 3 (also p. 24), that early rejection rates are higher in the open than in covered treatment. One could argue that rejection rates for the two treatments converge by the final rounds, and so the model is, in equilibrium, correct. BOLTON himself (private communication) doesn't think that this is wholly convincing. He rather agrees with ZAMIR's argument that the data requires both a reputational as well as fairness feature. *(Comment: please check, whether observation 3 and 4 of* ZAMIR*'s paper are on page 24 in the printed pages!)*

Learning Models

In this last point, I will discuss two *learning models*, the reinforcement model (introduced into experimental literature by ROTH and EREV [1995] and the directional learning model (introduced by SELTEN and STOECKER [1987]) in connection with the second study with the virtual players. Learning has probably received the highest attention in the last decade when talking about discrepancy of behavior and theory or convergence to theoretical solutions.

The reinforcement model has its origin in the psychological literature. The main feature is that strategies or choices that have performed well in the past will be chosen more often in the future. Using this kind of model the important ingredient is the knowledge about the payoff of each *chosen* strategy. Strategic elements or cognitive understanding of the game are outside the scope of this model.

The model works as follows. In the first period each strategy is given an initial propensity which is related to the payoffs within the game. A uniform propensity distribution means that all strategies are chosen with the same probability. If a strategy is chosen, its (discounted) propensity is updated by the additional payoff the player received. Propensities of unchosen strategies remain unchanged. Thus, this model does not consider any rational reasoning, but consists of a rather mechanistic updating process. A subject does not even need to know the game he is playing.

The simulation of this model (adapted from GROSSKOPF [2000]) is done such that each proposer has 9 strategies (offer levels 1-9) with uniform initial propensities for each offer. Responders are modeled as fully rational, accepting all offers, which is the most extreme behavior. Mean simulated offers do not change over time, but stay close to initial offers. This is contrary to the finding in the treatment when virtual responders accept between 13-16 and thus are less extremely rational. Proposers in that treatment converge to about 30 % offer rates.

So far the reinforcement model has been very successful to explain qualitative features of actual data in most experiments (exception are presented, for example, in GROSSKOPT [2000] who studies UG with responder competition). The virtual player treatments present another examples where this model seems to fail. Here the rationality of the real proposers, that is to actively search for best replies, is very important. Sticking to the fair offers as is typically observed in the first periods is not the optimal and does not correspond to actual offers over time.

Part of what is actually going on in terms of learning, search for better action or even maximization can be explained by the so called directional learning theory. This learning model requires some cognitive understanding about the causal relationships of actions and payoffs of the game. Given this theory a player asks himself after each period whether he could improve his payoffs by playing a different strategy (*ex post* reasoning). If he finds such a better strategy he will move into the direction of this better strategy. Therefore he needs some causal understanding between his behavior and the resulting payoffs.

In study three of ZAMIR and his co-authors apply the directional learning model. We will apply it to study two, the virtual player study.[2] The theory

2. I only used the data with 12 players of each treatment. The results also hold for the 20-player treatments. Within the study of ultimatum games this theory has been applied first by MITZLEWITZ and NAGEL [1993].

predicts in a qualitative way that after a rejection of an offer the proposer realizes that a higher offer might have given a positive payoff. Therefore, if he considers a change in the next period, he should increase his offer. On the contrary, if his offer is accepted he might conjecture that a lower offer might have produced a higher payoff and thus decrease the next periods offer. Stated in a weaker manner, it is conjectured that (1) increases of offers should be more likely after rejections than after acceptance and (2) decreases should be more likely after acceptance than after rejection (3) increases should be more likely than decreases after rejection and finally (4) decreases should be more likely than increases in case of acceptance of an offer.

I calculated the relative frequencies of increases, decreases and unchanged behavior after acceptance and rejection, respectively. I also checked the relative frequencies of acceptance in each treatment. All 4 hypothesis are fulfilled in all treatments. Now I want to explain, why there is such a clear decrease of offers in the treatment where virtual players accept until range 23-26 or range 13-16 and not in the other two treatments. In all treatments offers are decreased by about 20 to 30 % after acceptance. However, in the treatment with no virtual players or with range 46-49 these decreases are offset by increases of offers (81 % and 54 %, respectively) after rejection, which occur in 19 % and 31 % respectively. In treatment with range 23-26 and range 13-16 increases after rejections are also high (55 % and 95 %), however rejections occur only in 10 % or 7 % of the cases. Thus in all treatments, change of behavior is very similar. However, since rejections occur much less in the treatments with virtual players, who accept very unfair offers, offers converge in the direction of the subgame perfect equilibrium.

Conclusion

ZAMIR presented a variety of excellent experiments in the area of ultimatum games. His main argument was that rationality is present in these kind of games which is disputed by many researchers. In the studies he presented, he and his co-authors carefully varied the environment in order to separate strategic features from other motivations.

Offers are easily rationalizable in terms of search for best reply. Models that incorporate fairness into the equilibrium concept can explain such behavior. Most important there is the knowledge of the threshold of the responders. A model as the reinforcement model that does not account for search of better actions (also called virtual reinforcement) cannot mimic such behavior. Building in the cognitive elements of learning direction theory describes the actual data better (see STAHL [1996], CAMERER and HO [1998] or GROSSKOPF [2000]).

However, responders' reaction is not (completely) driven in the direction of accepting everything in the variety of studies mentioned. Even the very clean study of the covered ultimatum game in study three of ZAMIR's paper does eliminate rejection rates completely. Here also a fairness model cannot explain the data. Also learning studies are mute about this issue. ■

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