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Anomalies
The Ultimatum Game

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Economics can be distinguished from other social sciences by the belief that most (all?) behavior can be explained by assuming that agents have stable, well-defined preferences and make rational choices consistent with those preferences in markets that (eventually) clear. An empirical result qualifies as an anomaly if it is difficult to "rationalize," or if implausible assumptions are necessary to explain it within the paradigm. This column will present a series of such anomalies. Readers are invited to suggest topics for future columns by sending a note with some references to (or better yet copies of) the relevant research. Comments on anomalies printed here are also welcome. The address is: Richard Thaler, c/o *Journal of Economic Perspectives*, Johnson Graduate School of Management, Malott Hall, Cornell University, Ithaca, NY 14853.

Introduction

Imagine yourself in the following situation. Your daughter Eve, off at college, calls you to ask for your sage advice. She has agreed to participate in a laboratory experiment being run in the economics department at her college. The rules were explained in advance so that the subjects could think carefully about their choices. The experiment involves two-player bargaining, with Eve placed in the role of Player 1. She is to be given $10, and will be asked to divide it between herself and another student (Player 2) whose identity is unknown to her. The rules stipulate that she must make Player 2 an offer, and then Player 2 can either accept the offer, in which case he will receive whatever Eve offered him, or he can reject the offer, in which case both

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players will receive nothing. Her question to her wise economist parent: How much should she offer?

Before answering, you decide to check the relevant theory, in this case a paper by Rubinstein (1982) (see also Stahl, 1972). You immedately notice that Rubinstein starts his article with the disclaimer that he is only theorizing about what will happen in a bargaining situation if both parties behave rationally. He explicitly distinguishes this question from two others (p. 97) namely: "(i) the positive question—what is the agreement reached in practice; (ii) the normative question—what is the just agreement."

After reading Rubinstein, including his opening disclaimer, you realize that the theory for the simple game Eve has to play is rather obvious. Player 1 should offer Player 2 a penny. Player 2 will accept this offer, since a penny is better than nothing. However, you now realize why Rubinstein was so careful. Offering only a penny seems to be a risky strategy. If Player 2 views such a small offer as insulting, it would cost him only a penny to reject it. Maybe Eve should offer more than a penny? But how much more? What advice would you give?

While mulling over what to tell your daughter, you get a phone call from a local merchant offering you a consulting job, an event about as frequent as your daughter asking for your advice. The merchant owns a local motel in the college town in which you reside. He is troubled by the fact that a few times a year, such as graduation and homecoming weekends, there is enormous excess demand for rooms. On graduation weekend, for example, some parents stay in hotels as much as 50 miles away. The usual price for a room in his motel is $65 a night. Normal practice in town is to retain the usual rates, but to insist on a three night minimum stay. He estimates that he could easily fill the motel for graduation weekend at a rate of $150 a night, while retaining the three night minimum stay. However, he is a bit uneasy about doing this. He is worried about being labeled a "gouger," and thinks this label might hurt his regular business. "You are an economist," he says. "What should I do?" While thinking over this problem you realize that it has something in common with Eve's dilemma, and that you may need more than economic theory to advise either of your new clients. But what?

Simple Ultimatum Games

The game described by Eve is known as an Ultimatum Game. The first experiments to use this game were conducted by three German economists, Güth, Schmittberger, and Schwarze (1982), or GSS. They divided their sample of 42 economics students in half. One group was designated to take the role of Player 1, the Allocator; the other group took the role of Player 2, the Recipient. Each Allocator was asked to divide c German marks (DM) between himself and the Recipient. If the offer x was accepted then the Allocator received $c - x$ and the Recipient received x. If the offer was rejected, both players received nothing. The size of the stake to be divided, c, was varied between DM4 and DM10. Then, a week later, the same subjects were invited to play the game again.

If the Rubinstein model is a good positive model (in spite of his disclaimer) then two results should be observed.[1] First, allocators should make offers approaching zero. Second, recipients should accept all positive offers. The data are inconsistent with both of these predictions. In the first experiment (with inexperienced subjects) the modal offer was a 50 percent split (7 of 21 cases). The mean offer was $.37c$. Two students did ask for all of c in games where c = DM4, with one of these offers being accepted,[2] the other rejected. All other offers were for at least DM1, and one positive offer of DM1.20 was rejected.

In the replication, after a week to think about it, the offers were somewhat less generous, but still considerably greater than epsilon. The mean offer was $.32c$, and only two players offered an even split. However, there was only one offer of less than DM1 and it was rejected. Also, three offers of DM1 were rejected as was an offer of DM3. Thus 5 of the 21 offers were rejected.

Both the Allocators and the Recipients take actions inconsistent with the theory. The Recipients' actions, however, are easier to interpret. When a Recipient declines a positive offer, he signals that his utility function has non-monetary arguments. The decline of an offer of $.1c$ says, "I would rather sacrifice $.1c$ than accept what I consider to be an unfair allocation of the stake." The extent of this willingness to decline positive but unfair offers is explored below. The actions of the Allocators could be explained by either of two motives (or some combination of both). Allocators who make significantly positive offers could either have a taste for fairness, and/or could be worried that unfair offers will be (rationally or mistakenly) rejected. Further experiments reveal that both explanations have some validity.

GSS investigated the behavior of Recipients in a second experiment using 37 new subjects. In this study, subjects were told they would play the game twice, once as Allocator and once as Recipient. In all games, c = DM7. They were asked to make an offer as Allocator, and to indicate the minimum payment they would accept when they played the role of Recipient. (Note that these are real contingent responses, not answers to hypothetical questions.) The Allocators' responses in this experiment were even more generous than those observed in the earlier experiments, the mean offer being $.45c$. Of greater interest are the responses of the subjects as Recipients. All but two of the subjects indicated a reservation demand of at least DM1, and the median reservation demand was DM2.50.

Two related experiments were conducted by Kahneman, Knetsch, and Thaler (1986b), or KKT. In the first, conducted at the University of British Columbia, the GSS study was replicated to determine whether the results might be caused by subjects being confused about the task. A simple ultimatum game was played, with c = \$10 (Canadian). Again subjects were asked to say what they would do in both roles. Two steps were taken to be sure that the subjects understood the task. First, the subjects

[1] Actually, Rubinstein has pointed out to me that these predictions are not derived from game theory per se, but depend also in additional assumptions, such as that the players are expected utility maximizers with path independent utility functions (i.e., they get utility from the outcome of the negotiation, not the process).

[2] We can't be sure whether the Recipient who accepted the zero offer was confused, generous, or simply had a deep understanding of bargaining theory.

were asked two preliminary diagnostic questions. Of the 137 subjects who participated in the study, 22 were dropped because they did not answer both questions correctly. Second, rather than asking subjects to directly state their reservation demand, the subjects were asked a series of yes or no questions of the form: If the other player offers you $.50, will you accept the offer or reject it?[3] These questions were repeated in increments of 50 cents. In three different experiments, the mean minimum acceptable offer varied between $2.00 and $2.59, amounts similar to those obtained by GSS.[4]

The second KKT experiment investigated two questions. First, will Allocators be fair even if their offers cannot be rejected, and second, will subjects sacrifice money to punish an Allocator who behaved unfairly *to someone else*. In the first part students in a psychology class at Cornell University were asked to divide $20 between themselves and another anonymous member of the class. They were given only two choices of allocations: they could keep $18 for themselves and give their partner $2, or they could offer an even split of $10 each. (At these stakes it was not possible to have a large sample size and still pay everyone. Thus, the subjects were told that eight pairs of students would be selected at random and paid.) Unlike the previous experiments, the offers made by the Allocators could not be rejected by the Recipients. Nonetheless, offers were still very generous. Of the 161 subjects, 122 (76 percent) divided the $20 evenly. Therefore, part of the explanation for the generous offers observed in the ultimatum game does appear to be explained by a taste for fairness on the part of the Allocators.

After completing the first part of the study, the same students were given another question. They were told they would be matched with two students who had not been selected to be paid in the first part of the experiment. One of these students had taken the $18 (called U for uneven) while the other had taken $10 (E). A subject was then asked to choose between the following: He could take $6 for himself and give $6 to U, or he could take $5 for himself and give $5 to E. Thus the question came down to whether subjects would be willing to pay a dollar to split money with a stranger who had been generous rather than split with a stranger who had been greedy. A clear majority, 74 percent, elected to take the smaller reward in order to split with E.

Two-stage Bargaining Games

GSS (1982, p. 385) conclude that game theory is "of little help in explaining ultimatum bargaining behaviour." With the honor of game thory at stake (or at least

[3]In other research, Knetsch, Thaler, and Kahneman (1988) have found that this sort of yes or no question is easier for the subject to answer. For example, subjects are more likely to give the correct (demand revealing) answers in a second price auction when the questions are posed in this way.

[4]The three experiments had different groups of students as subjects. In all cases they were told that their partner would be someone in another class. The offers of the Allocators were similar to those obtained by Güth et al., with the mean amount offered ranging from $4.21 to $4.76. Of interest is the fact that the most generous offers were made by students in a psychology class making offers to students in another psychology class. The psychology students were less generous when making offers to students in a commerce class, but the least generous offers were made by commerce students to the psychology students. Similarly, the commerce students indicated the smallest minimum acceptable offer.

its descriptive validity) game theorists Binmore, Shaked, and Sutton (1985), BSS, performed a pair of experiments. They revised the GSS design by adding a second stage to the bargaining game and had the players communicate via linked microcomputers. The two-stage game begins as before with Player 1 in the role of Allocator, Player 2 in the role of Recipient, and with $c = 100$ UK pence. The allocator makes an offer of x (keeping $c - x$ for himself). If this offer is refused, then the game moves to round 2, with the players reversing roles and the stake reduced to δc, where the discount factor δ in this case was set at 0.25. The second round is a simple ultimatum game with $c = 25$p and Player 2 in the role of Allocator. The (subgame perfect) equilibrium for this game is found through a trivial backward induction. If the game reaches round 2, then Player 2 can offer Player 1 just a penny, retaining 24p for himself. Therefore, Player 2 will accept anything more than 24 in round one, so Player 1 should offer 25p on round one.

This game was played twice. In the first game, offers by the Allocators were similar to those observed in earlier experiments. The modal offer was 50 pence, and only 10 percent were in the range 24–26 pence. Also, 15 percent of the first-round offers were rejected (whereas the theory predicts the game will never reach the second round). In the second game, the subjects who had played in the role of Player 2 in the first game were invited to play another game, this time in the role of Player 1. (Responses of their hypothetical partners were not collected.) This time the subjects behaved more in accordance with game theory. The modal offer was just below the equilibrium of 25p. The authors conclude (p. 1180) that considerations of fairness "are easily displaced by calculations of strategic advantage, once players fully appreciate the structure of the game." However, three aspects of the BSS experiments raise questions about how to interpret their results.

First, the subjects were not informed of the existence of a second round until after the first round was played. If subjects thought that the game was now one where they would take turns being Player 1, they may have felt that alternatively taking the equilibrium $.75c$ would average out to a fair distribution.

Second, in conducting their experiments, BSS took the unusual step of telling their subjects how to behave. Specifically, the written instructions included the following passage: "*How do we want you to play*? YOU WILL BE DOING US A FAVOUR IF YOU SIMPLY SET OUT TO MAXIMIZE YOUR WINNINGS." (Emphasis and all caps in the original.) It is difficult to say what effect such instructions might have on the results without a controlled experiment (though it is reassuring that the first round results are similar to those obtained by GSS). However, in another similar context instructions did prove to have a powerful effect. Hoffman and Spitzer (1982) ran an experiment which is very similar to the ultimatum game. The Allocator (who was given that role as a result of a coin flip) could choose between an outcome which gave him \$12 and the recipient nothing, or, if both players agreed, they could divide \$14. Of course, the theory predicts that the players will agree to divide the \$14, with the Allocator getting no less than \$12. Instead, all pairs agreed to split the \$14 evenly, getting \$7 each. In a second paper Hoffman and Spitzer (1985) tried to understand why this happened. Two manipulations were crossed with each other to produce four conditions. In the first, the role of Allocator was determined either by a coin flip, or by playing a simple game with the winner becoming the Allocator. In the second, winners of the coin flip or game were told either that they had "earned" the right to be the Allocator, or that they were "designated" as Allocator. Of the two manipulations, the second was the more powerful. The difference between the game and the coin flip was not significant, but the subjects who had been told that they had "earned" the property right took significantly more of the money. Further research on this type of demand characteristic is clearly needed.

Third, the two-stage game devised by BSS differs from the simple ultimatum game in one key respect. The equilibrium offer of 25p is distinctly positive. This means that compared to the simple ultimatum game, it is more costly for a Recipient to reject the equilibrium offer, and the equilibrium offer is more fair. To see whether these factors are important, Güth and Tietz (1987) tried a two-stage game with a discount factor of .1 or .9. When $\delta = .1$ the equilibrium offer is a rather unfair $.10c$, while when $\delta = .9$ the equilibrium offer is a full $.90c$ (hardly fair to oneself!). The games were played twice with players switching roles.[5] The stake was either DM5, DM15, or DM35.

The results of these experiments did not support the BSS conclusion that rationality will take over if the players have a chance to think about the game. In the trials where $\delta = .1$, offers increased (moved away from equilibrium) from trial one to trial two (from $.24c$ to $.33c$). For the cases where $\delta = .9$, the mean offers also increased on trial two (from $.37c$ to $.49c$), which is toward the equilibrium value. Averaging across both trials and all levels of c, the mean offers when $\delta = .1$ were $.28c$, while when $\delta = .9$ the mean offers were $.43c$. Neither is close to their respective equilibrium values of $.1c$ and $.9c$. The variation in the level of c also provides some evidence on the robustness of the phenomena under study. If we compare the games played with c = DM5 to those with c = DM35, we find that the offers move part way toward the equilibrium levels (from $.33c$ to $.24c$) when $\delta = .1$, and slightly away from equilibrium (from $.36c$ to $.34c$) to $\delta = .9$. Thus, raising the stakes does little to improve the descriptive value of game theory.[6]

Multi-stage Games

The next contribution to the analysis of ultimatum games is Neelin, Sonnenschein, and Spiegel (1987) (NSS). Subjects in their experiments were Princeton undergraduates enrolled in an intermediate microeconomics class. Subjects played a

[5] One additional rule was put in place. Player 2 could not reject an offer and respond with a counteroffer that gave himself less than he had been offered. Such actions constituted disagreement with both players receiving zero. Thus when $\delta = .1$ if Player 1 offered more than $.1c$ this amounted to an ultimatum since if Player 2 rejected the offer disagreement was declared. The experiments by Ochs and Roth (1988) discussed below show that this rule was probably binding.

[6] What would happen in an ultimatum game with c = \$1000, or \$100,000? None of us have the research funds to run this experiment, so we can only guess. My own guess is that Recipients' minimum acceptable offers would increase with c, but not linearly. When c = \$10, the median minimum acceptable offer is about $.2c$. For c = \$1000 I would guess it would fall in the range $.05c$–$.1c$ (\$50–100). The minimum acceptable offer probably also increases with wealth, implying that resisting unfair offers is a normal good.

series of games with the number of periods (announced in advance) varying between 2 and 5, and $c = \$5$. Player 1 makes an offer in odd-numbered rounds, and Player 2 in even-numbered rounds. If the final round offer is rejected then both players get nothing. The discount rates were varied in such a way that the equilibrium offer in the first period was always $\$1.25 + \varepsilon$ (or \$1.26). In the two-period game the second period c is \$1.25; in the three-period game c falls first to \$2.50 and then to \$1.25; in the five-period game the values for c are \$5.00, \$1.70, \$ .58, \$ .20, and \$ .07.[7] Subjects first played a practice (4-round) game then played the 2, 3, and 5-round games in that order, each with a different anonymous partner. Subjects retained the same role in each game.

The idea behind the NSS design is that the results of the various length games can be compared to avoid conclusions that are special to a particular game. The value of the design is quickly appreciated when the results are examined. In the two-round games, the game theoretic prediction did pretty well. Of the 50 Allocators (whom NSS call "sellers"), 33 made offers between \$1.25 and \$1.50 (the equilibrium value is \$1.26). These results are similar to those obtained in the second BSS experiment. In the three-round game, however, the results are completely different. Here 28 out of the 50 players offered an even split of \$2.50, with nine others making offers within \$ .50 of this amount. Remember that the equilibrium offer in this game is still \$1.26.

The five-round game yielded yet another pattern of results. The modal (14) first-round offer was \$1.70 and 33 of the 50 offers were in the range \$1.50–2.00. NSS note that the players seem to have adopted the strategy of offering Player 2 the stake to be played for in round 2. This *is* the equilibrium offer in the two-stage game, but not in the longer games. Such a strategy might be adopted if players are myopic, and only think one step ahead, or are just conservative, wishing to minimize the risk that their partner will reject their offer for rational or irrational reasons.

NSS conducted a second experiment in which subjects played the five-round game four times with all the payoffs increased by a factor of 3 ($c = \$15$). The results were essentially unchanged. Seventy percent of the offers were in the range \$5.00–5.10 (the second round stake is \$5.10). No offer close to the equilibrium \$3.76 was observed. There was also no evidence of any learning. That is, there was no apparent trend in the offers over the four trials.

By far the most ambitious set of experiments conducted to date is reported in Ochs and Roth (1988). They introduced the following innovations. First, subjects complete 10 bargains, one after another, with all parameters held constant (but with a different opponent each time).[8] This feature allows for a test of whether subjects learn to be proper economists with practice. Second, discount rates were varied separately for each subject. This was accomplished by having subjects bargain for 100 "chips."

[7] Notice that the backward induction necessary to derive the equilibrium first round offer is a bit more complicated in the three-and five-round games. The analysis for the five-round game is: if the game reaches the fifth round, Player 1 is the Allocator, and he can offer Player 2 a penny (which Player 2 will, by assumption, accept) so Player 1 can get 6 cents at this stage. This implies that at the fourth stage, Player 2 must offer Player 1 at least 6 cents, keeping 14 cents for himself, and so forth.

[8] Subjects were told that at the completion of the experiment that one of the rounds would be selected at random, and they would be paid based on their outcome in that round.

In the first round of any game the chips were worth \$ .30 to each player (so c = \$30). In the second round the chips would be worth δ_1 (\$ .30) to Player 1 and δ_2(\$ .30) to Player 2. In the third round, for three-round games, the discount rates were squared. The two discount rates were common knowledge, but were not necessarily equal. Four combinations for (δ_1, δ_2) were varied experimentally: $(.4, .4), (.6, .4), (.6, .6)$, and $(.4, .6)$. These four conditions were crossed with the number of periods to be played (either 2 or 3) to produce a 4×2 experimental design.

The authors use this complicated experimental design to test two implications of bargaining theory. First, Player 1's discount factor should only matter in games with three periods. (Work through the backward induction to see why.) Second, holding the discount rates constant, Player 2 should receive less in three-period games than in two-period games. (This is true because in three-period games Player 1 gets to make both the first and the last offer.) Also, the theory yields predictions of all the 28 pairwise comparisons between the cells of the experiment.

The results of these experiments provide little support for the descriptive value of game theory, even on the last trials of the experiments. The theory performed well in only one of the eight cells. In the other seven cells, the theoretical mean offer was never within two standard deviations of the actual mean on any trial. Also, both of the additional predictions mentioned in the previous paragraph failed. The Player 1 discount rate mattered in games when it shouldn't, and the length of the game didn't matter when it should. As one simple measure of the ability of the theory to explain the data, Ochs and Roth regressed the observed mean offer on the theoretical offer for the last trials of each cell of the experiment. The R^2 for this equation was .065, and the coefficient on the theoretical offer less than one standard deviation away from zero.

Ochs and Roth also replicate the earlier findings by GSS and KKT regarding Recipients' willingness to decline positive but unfair offers. In these games, if players cared only about monetary payoffs, then Player 2 would never reject Player 1's initial offer and subsequently demand less for himself in his counter offer. Yet Ochs and Roth find that for 81 per cent of the counterproposals, Player 2 demands less cash than he was originally offered by Player 1. The conclusion that subjects' utility functions have arguments other than money is reconfirmed.

We have seen that game theory is unsatisfactory as a positive model of behavior. It is also lacking as a prescriptive tool. While none of the subjects in Ochs and Roth's experiments came very close to using the game-theoretic strategies, those who most closely approximated this strategy did not make the most money. In fact, in 4 of the 8 cells, the player with the highest average demand (over the ten trials) had the *lowest* average earnings.

Ultimatums in the Market

The willingness of people to resist what they consider to be unfair allocations has implications for economics that go well beyond bargaining theory. Any time a monopolist (or monopsonist) sets a price (or wage), it has the quality of an ultimatum. Just as the Recipient in an ultimatum game may reject a small but positive offer, a buyer may refrain from purchasing at a price that leaves a small bit of consumer surplus but is viewed as dividing the surplus in an unfair manner. Consider the following problem posed to two groups of participants in an executive education program (Thaler, 1985). One group received a version with the passages in brackets, the other the passages in parentheses.

> You are lying on the beach on a hot day. All you have to drink is ice water. For the last hour you have been thinking about how much you would enjoy a nice cold bottle of your favorite brand of beer. A companion gets up to go make a phone call and offers to bring back a beer from the only nearby place where beer is sold (a fancy resort hotel) [a small run-down grocery store]. He says that the beer might be expensive and so asks how much you are willing to pay for the beer. He says that he will buy the beer if it costs as much or less than the price you state. But if it costs more than the price you state he will not buy it. You trust your friend, and there is no possibility of bargaining with the (bartender) [store owner]. What price do you tell him?

Notice that the scenario here is a simple ultimatum game with the respondent in the role of the Recipient. The median response for the fancy hotel version was \$2.65, while the median for the grocery store version was \$1.50. Because of a difference in perceived costs, the price of \$2.65 seems fair for a resort hotel, but a "rip-off" in a run-down grocery store.

In general, consumers may be unwilling to participate in an exchange in which the other party gets too large a share of the surplus. This may explain why some markets (Super Bowl tickets, reservations at the most popular restaurant in town on Saturday night, Bruce Springsteen concert tickets) fail to clear at the official price set by the seller. Whenever the seller has an ongoing relationship with the buyer and the market clearing price would be considered unfairly high, the seller has an incentive to keep prices below the equilibrium in order to retain future business. (These issues are discussed in more detail in Thaler, 1985, and Kahneman, Knetsch and Thaler, 1986a.)

Commentary

Bell, Raiffa, and Tversky (1988) have suggested that it is useful to distinguish three kinds of theories of decision making under uncertainty. *Normative* theories tell us how a rational agent should behave. *Descriptive* theories tell us how agents do behave. *Prescriptive* theories offer advice as to how to behave when faced with one's own cognitive or other limitations. The research on the bargaining games indicates that we need a similar triple of game theories. Game theory as it currently exists is a normative theory. It characterizes optimal behavior when selfishness and rationality are common knowledge. Experimental research is starting to provide the evidence necessary to formulate a good description of how people actually behave. However, as yet we have little research that would help develop prescriptive game theory. The analysis of Eve's problem illustrates this gap in our repertoire. To solve for the income maximizing offer, one would have to be able to characterize the acceptance function for the recipient. For any given offer, what is the probability it will be rejected by the recipient?

In multi-stage games, the optimal strategy is even less clear. Consider the five-stage game in NSS where $c = \$15$. The values for c in the second through fifth stages of the game are: \$5.10, 1.74, .60, and .21. What is an optimal offer at stage 1? There are two important prescriptive game theoretic considerations. What offer will Player 2 consider fair? Does Player 2 understand the game? Both factors may be important. To get a sense of the possible role of the second factor, I arranged to have a question posed on the final exam for an MBA level course on "Pricing and Strategy" at Cornell. The course has intermediate microeconomics as a prerequisite, and the students had discussed game theory, backward induction, and simple ultimatum games in class. The exam consisted of eight questions from which the students had to answer five. The question of interest began with a description of the five-round game played in NSS. The students were told to assume that both players are rational, and both wish to maximize the money they earn in this game. They were then asked: What is the smallest offer Player 1 can make in round 1 which be accepted by Player 2?

Of the 30 students in the class, only 13 chose to answer this question, and only 9 answered it correctly. This implies that more than half the class was not sure they knew the answer to the question, and of those who did think they knew the answer, 30 percent got it wrong. Clearly, this is not a trivial question, and backward induction is not an intuitively obvious concept. To see the importance of this issue, consider a Player 1 who is thinking about making an offer of \$4.00 to Player 2. While Player 1 may know that this is more than Player 2 can hope to get if he rejects the offer, if Player 2 thinks he can get \$5.09, he may mistakenly turn the offer down.

So, if Eve were playing this five-round game, before giving her any advice we would want to know how smart her opponent is. Has he studied game theory? Does it look as if he can subtract, much less perform a backward induction? More generally, in order to develop prescriptive game theory, the assumption that rationality and wealth maximization are common knowledge will have to be modified. A rational wealth maximizing player must realize that his opponent may be neither, and make appropriate changes to his policies.[9] Notice that in developing prescriptive game theory, it is necessary to do both theory and empirical work. Theory alone cannot tell us what factors enter our opponent's utility function, nor what bounds must be placed on his rationality.

[9]This sort of analysis is common in expert bridge. In tournament bridge, experts often play against non-experts, unlike many other competitive events. Optimal strategy in a weak field depends in part on giving one's opponents numerous opportunities to make mistakes.

One conclusion which emerges clearly from this research is that notions of fairness can play a significant role in determining the outcomes of negotiations. However, a concern for fairness[10] does not preclude other factors, even greed, from affecting behavior. In their article, BSS pose the problem starkly as a contest between two extreme positions. People are thought either to be "fairmen" who divide everything equally, or "gamesmen" who behave selfishly and rationally like proper economic agents. I think it is safe to say that most people are not well described by either extreme view. Rather, most people prefer more money to less, like to be treated fairly, and like to treat others fairly. To the extent that these objectives are contradictory, subjects make trade-offs.[11] Behavior also appears to depend greatly on context and other subtle features of the environment. In some experiments most Allocators choose even splits, in others most choose the game-theoretic allocation. Future research should investigate the factors that produce each kind of behavior, rather than attempt to demonstrate that one type of behavior or the other predominates.

Just as the characterization of the behavior of subjects as either fairmen or gamesmen is too simplistic, so is any distinction on a "hard" vs. "soft" dimension. There is a tendency among economists to think of themselves, and the agents in their models, as having hard hearts (as well as heads, noses, and other extremities). *Homo economicus* is usually assumed to care about wealth more than such issues as fairness and justice. In contrast, many economists think of other social scientists (and the agents in *their* models) as "softies." The research on ultimatum games belies such easy characterizations. There is a "soft" tendency among the allocators to choose 50–50 allocations, even when the risk of rejection is eliminated. Yet the behavior of the recipients, while inconsistent with economic models, is remarkably hard-nosed. They say, in effect, "Take your offer of epsilon and shove it!"

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[10]It must be emphasized that issues of fairness are complicated. Perceptions of fairness often diverge fror those which seem natural to economists. For example Kahneman, Knetsch, and Thaler (1986a) found tha most people believe a queue is more fair than a market, and Yaari and Bar-Hillel (1984) found that whe making judgments of justice, people distinguish between "needs" and "wants." Fairness *arguments* are als quite common in negotiations. While bargainers use fairness arguments for self-serving reasons ("I think should get more because that would be fair . . .") such arguments can nonetheless be effective (Roth, 1987

[11]To illustrate, in the experiment conducted by Kahneman et al. (1986b) Allocators were permitted t choose between just two divisions of $20, either $18–2 or $10–10. Most chose the even allocation. Howeve had they been allowed to choose an intermediate allocation, such as $12–8, many might have selected tha

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