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Risk Aversion in Bargaining: An Experimental Study

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Abstract

This paper reports the results of three experiments designed to test the predictions of the principal game-theoretic models of bargaining concerning the influence of risk aversion on bargaining outcomes. These models predict that risk aversion will be disadvantageous in bargaining except in situations in which potential agreements are lotteries with a positive probability of being worse than disagreement. The experimental results support the models' predictions. However, in the range of payoffs studied here, the effects due to risk aversion may be smaller than some of the focal point effects observed in previous experiments. Implications for further theoretical and experimental work are considered.

This paper reports some experiments designed to investigate how risk aversion influences bargaining success. These experiments are aimed at illuminating how an important individual attribute of the bargainers influences the outcome of a fundamental economic interaction. Some unambiguous predictions that lend themselves to experimental tests arise from game-theoretic models of bargaining.

Game-theoretic models of bargaining can be thought of as falling into two broad classes: *axiomatic* and *strategic*.[1] The preferences of the bargainers are customarily represented by their von Neumann-Morgenstern utility functions.

Roth (1979), Kihlstrom, Roth, and Schmeidler (1981), Roth and Rothblum (1982), and Roth (1985c) systematically studied the models' predictions for the risk posture of bargainers. Surprisingly, a broad class of different models, including all the standard axiomatic models[2] and the strategic model of Rubinstein (1982), yield

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a common prediction: risk aversion is disadvantageous in bargaining, except when the bargaining concerns potential agreements that have a positive probability of yielding an outcome that is worse than disagreement. (This latter situation, which may in many environments be common, will be discussed in more detail later in the context of a specific experimental design.)

This prediction concerning risk aversion is important to test, because it connects the theory of bargaining with one of the most powerful explanatory hypotheses in a number of other areas of economics (e.g., in explanations of investment behavior, futures markets, and insurance).

However, the connection of risk aversion to bargaining is less direct (e.g., plausible theories of bargaining might predict differential success of different bargainers on the basis of personal attributes other than risk aversion). Further, a series of recent experiments has shown that these models lack descriptive power in some important respects. In particular, clear focal point effects have been observed, which will be described in more detail later, that cannot be accounted for within the framework of these classical game-theoretic models. (In view of this, one approach that needs to be pursued is to try to develop models that will directly address the focal point phenomena. A preliminary step in this direction is taken in Roth (1985b).)

The experiments reported here were designed to distinguish between the predictions about risk aversion of the game-theoretic models discussed earlier and three alternate hypothesis: (1) bargaining ability is a personal attribute uncorrelated with risk aversion; (2) bargaining ability is a personal attribute that is correlated with but distinct from risk aversion (e.g., aggressiveness), thus influencing the outcome of bargaining independently of the location of the disagreement point; and (3) the outcome of bargaining is not influenced by the personal attributes of the bargainers, but rather by the structure of the information shared by the bargainers. The last hypothesis is motivated by the focal point effect observed in previous experiments.

1. Binary and ternary lottery games

To test theories experimentally that depend on the von Neumann-Morgenstern utilities of the bargainers, the experiment must permit these utilities to be determined. A class of games that permits this was discussed in Roth (1979) and first used in an experimental setting in Roth and Malouf (1979). In these binary lottery games, each agent i can eventually win only one of two monetary prizes, a_i or b_i (with $a_i > b_i$). The players bargain over the distribution of lottery tickets that determine the probability of receiving the larger prize (e.g., an agent i who receives 40% of the lottery tickets has a 40% chance of receiving the amount a_i and a 60% chance of receiving the amount b_i). Players who do not reach agreement in the allotted time each receive b_i. Since the information about preferences conveyed by an expected utility function is meaningfully represented only up to the arbitrary choice of origin and scale, there is no loss of generality in normalizing each agent's utility so that $u_i(a_i) = 1$ and $u_i(b_i) = 0$. The utility of agent i for any agreement is then precisely equal to his or her probability of receiving the amount a_i (i.e., equal to the percentage of lottery tickets he or she has received).

Note that the set of feasible utility payoffs to the players of a binary lottery game is thus insensitive to the magnitudes of the amounts a_i and b_i for each agent i. One of the effects clearly observed in earlier experiments[3] but not predicted by the classical game-theoretic models is that these magnitudes nevertheless influence the outcome of bargaining. When bargainers knew the amounts of each other's prizes, agreements tended to cluster around two focal points: the equal-probability agreement, which gives each bargainer 50% of the lottery tickets, and the equal expected value agreement, which gives each bargainer the same expected value.[4] When bargainers did not know one another's prizes or when the bargainers had the same prizes (so that the equal probability and equal expected value focal points coincided), agreements were observed to cluster around the equal-probability agreement, often with extremely low variance.[5]

Note also that the reason the set of utility payoffs in a binary lottery game is insensitive to the size of the monetary prizes is that, precisely because each agent faces lotteries between only two final payments, his or her utility is not influenced by his or her risk posture. Risk aversion is a phenomenon that depends on the ability to make tradeoffs between at least three outcomes.

For our present purposes, we will therefore consider bargaining between two players in a *ternary* lottery game, in which each player i has *three* monetary prizes, a_i, b_i, and c_i [$a_i > b_i$ and $a_i > c_i$]. The players bargain over probabilities p_1 and p_2 (with $p_2 = 1 - p_1$), such that player i receives a_i with probability p_i and b_i with probability $1 - p_i$. If the players fail to reach agreement in the allotted time, players 1 and 2 receive c_1 and c_2, respectively. Letting the utility functions of the players be normalized so that $u_i(a_i) = 1$ and $u_i(b_i) = 0$, the utility of agent i for any agreement is once again equal to his or her probability p_i of receiving a_i. However, each player's utility $u_i(c_i)$ for his or her disagreement payoff c_i is determined by his or her risk posture.

It will be convenient in what follows to consider two comparisons of the propensity of bargainers to take risks. The first is the conventional comparison of risk aversion between two individuals. Consider three monetary amounts a, b, and c, with $a > b > c$. Then a measure of an individual's risk aversion on this domain of three possible payoffs is the range of lotteries between a and c that he or she is willing to accept in preference to having the amount b for certain (i.e., the minimum probability of getting a rather than c that makes him or her like the lottery at least as much as the certain amount b. The individual i who is willing to accept the smaller range of lotteries (i.e., who has the higher minimum probability p_i) is said to be the more risk averse of the two individuals on this domain.

Now consider two bargainers, 1 and 2, involved in a ternary lottery game with prizes a_i, b_i, and c_i, where the prizes available to the two bargainers may be different. Suppose that $a_i > b_i > c_i$ for both bargainers.[6] For each player i, we now consider the minimum probability p_i of getting a_i rather than c_i that makes him or her like the lottery at least as much as getting the amount b_i for certain. The individual i with the higher minimum probability p_i is said to be the more *situationally* risk averse of the two individuals on this domain. Note that when $a_1 = a_2, b_1 = b_2$, and $c_1 = c_2$, one agent is more situationally risk averse than another if and only if he or she is more risk averse in the usual sense. The comparison of situational risk aversion will allow us to look at two bargainers with different prizes and consider the predicted effect on the outcome of bargaining when one of them is willing to accept fewer gambles in terms of potential payoffs than is his or her opponent.[7]

As mentioned earlier, a broad class of axiomatic models[8] make common predictions about bargaining games. To see the specific predictions made for ternary lottery games, we will consider two cases: first, the case in which $a_i > c_i > b_i$ for both bargainers $i = 1,2$, which will be called the case of *high* disagreement payoffs, and second, the case in which $a_i > b_i > c_i$ for $i = 1,2$, which will be called the case of *low* disagreement payoffs.

In the case of high disagreement payoffs, the disagreement utilities are given by $u_i(c_i) = p_i$, where p_i is the probability that makes individual i indifferent between the payoff c_i and the lottery that gives him or her a_i with probability p_i and b_i with probability $1 - p_i$. Since under this normalization the disagreement utilities are the only feature of the model that is not symmetric between the two bargainers (in utility space), it is clear that axiomatic models such as Nash's solution, for example, predict that the resulting agreement will give the higher probability of winning the preferred prize a_i to the player i with the higher disagreement utility $u_i(c_i) = p_i$. That is, these models predict an advantage in bargaining in this situation to the player who is more situationally risk averse.

In the case of low disagreement payoffs, the disagreement utilities $u_i(c_i)$ are given by $u_i(c_i) = p_i/[p_i - 1]$, where p_i is the probability that makes individual i indifferent between the payoff b_i and the lottery that gives him or her a_i with probability p_i and c_i with probability $1 - p_i$. As before, models such as Nash's predict the resulting agreement will give the higher probability of winning the preferred prize a_i to the player i with the higher disagreement utility $u_i(c_i)$, but in this case, the disagreement utility $u_i(c_i)$ is a *decreasing* function of p_i. That is, these models predict a *dis*advantage in bargaining in this situation to the player who is more situationally risk averse.

Note that, in the case of a low disagreement payoff, any agreement assures both bargainers of a higher payoff than they receive in the event of disagreement. In the case of a high disagreement payoff, however, every potential agreement has a positive probability of giving one of the bargainers a lower payoff than if no agreement had been reached, so that in this sense, there is always a risk in coming to an agreement. Models such as Nash's solution thus predict an interaction between the propensity of the bargainers to tolerate risk and whether there is a risk of being worse off after reaching an agreement. Risk aversion is predicted to be disadvantageous in bargaining except when this latter kind of risk exists, when it should be advantageous.[9] (See Roth and Rothblum (1982) for a more general treatment of this risky case; see Roth (1979); Kihlstrom, Roth, and Schmeidler (1981); and Roth (1985c) for treatments of the predictions of different models in the case where no such risk exists.)

2. Study I

Students enrolled in economics classes were provided with the opportunity to volunteer for the experiment. All may have been exposed to some expected utility theory. Some had experience with previous bargaining experiments.

The risk aversion of each participant was assessed by having him or her consider the sequence of choices presented in Table 1. Players were asked to choose between receiving \$5 for certain or participating in a lottery that would give them \$10 with probability p and \$2 with probability $1 - p$, with p decreasing as the sequence of choices progressed. They were instructed that, at the end of the experiment, one element of the sequence (i.e., one line of Table 1) would be chosen at random, and they would receive what they had chosen (i.e., \$5 or the lottery). Participants were then sorted according to their risk aversion (i.e., by how frequently they chose the sure \$5). Individuals in the more risk averse half of each experimental sample bargained with individuals in the less risk averse half of the sample.[10]

After the lottery choices, each pair of bargainers played two ternary lottery

Table 1. Lottery Choices in Study I

\$5 with certainty	versus	70:30 chance of \$10:\$2
\$5 with certainty	versus	65:35 chance of \$10:\$2
\$5 with certainty	versus	60:40 chance of \$10:\$2
\$5 with certainty	versus	55:45 chance of \$10:\$2
\$5 with certainty	versus	52:48 chance of \$10:\$2
\$5 with certainty	versus	50:50 chance of \$10:\$2
\$5 with certainty	versus	48:52 chance of \$10:\$2
\$5 with certainty	versus	46:54 chance of \$10:\$2
\$5 with certainty	versus	44:56 chance of \$10:\$2
\$5 with certainty	versus	42:58 chance of \$10:\$2
\$5 with certainty	versus	40:60 chance of \$10:\$2
\$5 with certainty	versus	38:62 chance of \$10:\$2
\$5 with certainty	versus	36:64 chance of \$10:\$2
\$5 with certainty	versus	34:66 chance of \$10:\$2
\$5 with certainty	versus	32:68 chance of \$10:\$2
\$5 with certainty	versus	30:70 chance of \$10:\$2
\$5 with certainty	versus	28:72 chance of \$10:\$2
\$5 with certainty	versus	26:74 chance of \$10:\$2
\$5 with certainty	versus	24:76 chance of \$10:\$2
\$5 with certainty	versus	22:78 chance of \$10:\$2
\$5 with certainty	versus	20:80 chance of \$10:\$2

games, one game with a_i = \$10, b_i = \$5, and c_i = \$2 for both bargainers i = 1,2 and the other game with a_i = \$10, b_i = \$2, and c_i = \$5 for both bargainers i = 1,2. [Because bargaining was conducted anonymously via computer terminals and this pair of games between the same bargainers was interspersed with games against other opponents, bargainers were unaware that they bargained twice with the same individual (see Methods section).] Since the monetary prizes in these ternary lottery games were the same for both players, the more risk averse of two players is also the more situationally risk averse. The prediction of the classical game-theoretic models is that the more risk averse of the two bargainers will receive less than 50% of the lottery tickets in the low disagreement payoff game and more than 50% in the high disagreement payoff game.

Note that this prediction, which implies that the bargainer who does better in one game should do worse in the other, contradicts the prediction of the other two hypotheses about bargaining ability as a personal attribute. If bargaining ability is related to some personal attribute that influences the outcome of bargaining independently of the position of the disagreement payoff, then the relative outcomes of the two players in the two games should be the same (i.e., the better bargainer should do better in both games). If bargaining ability is related to some personal attribute of the bargainers that is uncorrelated with their risk aversion, then which bargainer does better should be independent of the sorting by risk aversion. If bargaining ability is correlated with risk aversion but unaffected by the position of the disagreement payoff, the more or less risk averse bargainers should obtain consistently better outcomes.

2.1. Methods

Approximately 30 undergraduate volunteers were recruited and were seated at visually isolated computer terminals during each session. They were told that some would stay for the first part of the experiment while others would stay for the whole experiment. They were also told that for those who stayed, the first half of the experiment would be a practice run and their results would not determine their payoffs but would familiarize them with the procedures. The second half of the experiment would determine the payoffs. They were told the payoffs for those who did not stay would be determined in the first stage. Thus, all players were given an incentive to respond seriously in the first stage, even though for some this would be only practice.

The terminals displayed instructions that explained the initial lottery choices. A simulation of the lottery choices was presented to familiarize the participants with the various choices and the mechanics of the terminal. Each player then made the 21 lottery choices in Table 1.

The computer ranked the players according to the number of lotteries they had chosen. The eight least risk averse (i.e., those who had chosen the most lotteries) were ranked 1 to 8, and the eight most risk averse (i.e., those who chose the fewest lotteries) were ranked 9 to 16. Two sets of players completed their participation at this point. Players who chose inconsistently among the lotteries (e.g., a few certain choices, a few lotteries, a few certain choices, etc.) were selected out of the experiment. If a surplus of players (more than 16) remained, all but the eight most risk averse and eight least risk averse players were identified by the computer, and their participation also ended here. Lotteries were conducted for these participants, who were then paid and dismissed.

Those who stayed read instructions on the bargaining games. After a simulated bargaining session, they participated in four practice bargaining sessions, each lasting at most nine minutes. A reversed clock appeared on their screen and counted down the last three minutes of each session. During bargaining, players could send each other any message they wished (excluding identifying themselves) by typing their message, hitting a key to review it, and hitting another key to send it to their opponent. All messages were screened by the experimenter prior to their ultimate delivery; this delayed transmission only briefly.

Proposals could be made at any time. Players simply typed in the number of lottery tickets they demanded and hit keys to review and immediately send their proposal. The review stage provided expected value information about the proposal. All standing proposals were displayed on the screen, with expected values. Typing and sending a proposal that matched your opponent's offer was sufficient to reach an agreement. Proposals and messages could be sent simultaneously by the two bargainers: one player's access to the system did not interfere with that of the other player. The procedures used in the individual bargaining encounters of this experiment are the same as those used in Roth and Murnighan (1982).

Each participant was told that he or she had bargained with a different person in each session. In fact, players ranked first and second bargained twice with players ranked ninth and tenth; those ranked third and fourth with players ranked eleventh and twelfth, etc. The four practice bargaining sessions insured that all bargainers had experience in these games. After a short break, the players repeated the experimental procedures, reading the instructions again, making lottery choices, and bargaining in four games, this time for monetary payoffs. All sixteen players completed the bargaining. The data for players whose second set of lottery choices was inconsistent or changed more than a total of five lottery selections from their first lottery choices were excluded from the analysis. All these players, however, received their payoffs on the basis of their second set of lottery choices and their bargaining choices.

Early in the instructions, the players were told how their payment would be calculated. One of the 21 lottery choices was randomly selected by the computer and the player's decision was implemented (the first payment). If he or she had chosen the certain outcome, he or she received $5, while if he or she had chosen the lottery, it was performed by the computer and the subject was paid according to the outcome. One of the four bargaining postpractice sessions was also chosen randomly by the computer and the outcome was implemented (the second payment). If the player had failed to agree, he or she was paid his or her disagreement prize. If an agreement was reached, the lottery was performed with the agreed upon odds. Those participants who left after the initial lottery choice received only the first payment. Those who stayed received the first and second payments.

2.2. Results

Since the design of the experiment depends on detectable differences in risk aversion between the bargainers, the effectiveness of the separation of the bargainers by risk aversion was first examined. Players identified as less risk averse did choose significantly more lottery choices ($\bar{X} = 11.2$) than players identified as more risk averse ($\bar{X} = 4.2$): $F(1,62) = 112.3, p < .0001$.

Table 2 shows the outcomes from the bargaining pairs in Study I. The large number of disagreements prevents a clear test of the predictions. All of the disagreements occurred in the high disagreement condition, suggesting that the bargainers were reacting strongly to the difference between the low prize ($2) and the disagreement prize ($5) in this condition.

Table 2. Outcomes for Each Bargaining Pair in Study I [Disagreements Are Indicated by the Player's Final Demand (in parentheses)]

Pair Number	Disagreement Prize		Pair Number	Disagreement Prize	
	Low	*High*		*Low*	*High*
1	55–45	50–50 (++)	18	50–50	(61–100)
2	43–57	47–53 (−−)	19	45–55	(100–95)
3	45–55	55–45 (−−)	20	50–50	50–50
4	55–45	(50–60) (+)	21	50–50	(50–70)
5	50–50	(45–75) (+)	22	50–50	(85–95)
6	49–51	(38–66) (+)	23	50–50	50–50
7	55–45	(50–60) (+)	24	50–50	(60–90)
8	60–40	(59–95) (+)	25	55–45	(60–75)
9	50–50	(36–99) (+)	26	50–50	(50–70)
10	50–50	(90–100)	27	38–62	(74–72)
11	50–50	50–50	28	50–50	(50–60)
12	50–50	50–50	29	50–50	(75–90)
13	50–50	(70–80)	30	35–65	(60–70)
14	50–50	(70–80)	31	50–50	(50–80)
15	40–60	(55–70)	32	46–54	(60–80)
16	50–50	(60–70)	33	50–50	(50–65)
17	45–55	(80–80)	34	55–45	(80–70)

Note: The less risk averse player's outcomes are always listed first. (++) and (−−) indicate clear support and clear nonsupport for the risk aversion predictions. (+) and (−) indicate support and nonsupport for the predictions using clear-cut final demands (see discussion of Study II).

3. Study II

As these results accumulated, we decided that changes in the design were necessary. Too many disagreements yielded insufficient data to test the risk aversion prediction meaningfully. Thus, in Study II, the disagreement and low prizes were set closer together, at $4 and $5. The initial set of lottery choices was changed to match these prizes (see Table 3). A new set of volunteers participated; none had participated in the previous experiment. Everything else in the experimental procedures remained the same.

Again, division of the sample into less ($\bar{X}$ = 15.6 lotteries) and more risk averse bargainers ($\bar{X}$ = 6.1) was successful: $F(1,130) = 383.8, p < .0001$. Both groups chose more lotteries than the bargainers in Study I, but the difference between groups remains sizeable.

Table 4 lists the outcomes from Study II. A combination of the results from Study I and Study II can provide the basis for a preliminary rough test of the hypotheses.

3.1. *Bargaining ability and risk aversion effects*

If bargaining ability is a personal attribute unrelated to risk aversion or to the disagreement payoffs, a bargainer should do well consistently, especially when

Table 3. Lottery Choices in Study II

$5 with certainty	versus	60:40 chance of $10:$4
$5 with certainty	versus	55:45 chance of $10:$4
$5 with certainty	versus	50:50 chance of $10:$4
$5 with certainty	versus	45:55 chance of $10:$4
$5 with certainty	versus	40:60 chance of $10:$4
$5 with certainty	versus	38:62 chance of $10:$4
$5 with certainty	versus	36:64 chance of $10:$4
$5 with certainty	versus	34:66 chance of $10:$4
$5 with certainty	versus	32:68 chance of $10:$4
$5 with certainty	versus	30:70 chance of $10:$4
$5 with certainty	versus	28:72 chance of $10:$4
$5 with certainty	versus	26:74 chance of $10:$4
$5 with certainty	versus	24:76 chance of $10:$4
$5 with certainty	versus	22:78 chance of $10:$4
$5 with certainty	versus	20:80 chance of $10:$4
$5 with certainty	versus	18:82 chance of $10:$4
$5 with certainty	versus	16:84 chance of $10:$4
$5 with certainty	versus	14:86 chance of $10:$4
$5 with certainty	versus	12:88 chance of $10:$4
$5 with certainty	versus	10:90 chance of $10:$4
$5 with certainty	versus	08:92 chance of $10:$4

Table 4. Outcomes for Each Bargaining Pair in Study II [Disagreements Are Indicated by the Player's Final Demands (in parentheses)]

Pair Number	Disagreement Prize		Pair Number	Disagreement Prize	
	Low	*High*		*Low*	*High*
1	50–50	47–53 (++)	35	52–48	(55–50)
2	50–50	47–53 (++)	36	50–50	50–50
3	53–47	49–51 (++)	37	45–55	(70–67)
4	50–50	45–55 (++)	38	52–48	(53–70)
5	60–40	50–50 (++)	39	50–50	50–50
6	53–47	40–60 (++)	40	50–50	50–50
7	47–53	40–60 (++)	41	50–50	(85–90)
8	55–45	40–60 (++)	42	50–50	(54–52)
9	48–52	52–48 (−−)	43	50–50	(50–60)
10	38–62	46–54 (−−)	44	50–50	(50–55)
11	49–51	50–50 (−−)	45	50–50	(60–50)
12	49–51	50–50 (−−)	46	45–55	(49–65)
13	55–45	(50–80) (+)	47	50–50	(50–55)
14	50–50	(45–84) (+)	48	(53–51)	(60–54)
15	(63–52)	47–53 (+)	49	50–50	50–50
16	51–49	(60–45) (−)	50	(50–59)	50–50
17	45–55	(50–54) (−)	51	(50–55)	50–50
18	48–52	(50–51) (−)	52	50–50	(50–53)
19	50–50	(55–89)	53	50–50	(61–80)
20	50–50	50–50	54	50–50	50–50
21	50–50	50–50	55	50–50	50–50
22	50–50	(55–51)	56	50–50	50–50
23	50–50	(65–62)	57	50–50	50–50
24	49–51	49–51	58	(54–49)	(50–56)
25	51–49	51–49	59	55–45	(100–50)
26	50–50	50–50	60	50–50	(55–50)
27	50–50	(51–80)	61	50–50	50–50
28	50–50	(52–52)	62	49–51	(52–53)
29	50–50	(55–50)	63	50–50	(52–60)
30	50–50	(62–50)	64	46–54	(55–89)
31	50–50	(53–51)	65	50–50	50–50
32	(50–55)	(50–54)	66	50–50	(55–75)
33	(50–53)	50–50			
34	50–50	50–50			

Note: The less risk averse player's outcomes are always listed first. (++) and (−−) indicate clear support and clear nonsupport for the risk aversion predictions. (+) and (−) indicate support and nonsupport for the predictions using clear-cut final demands.

paired with the same opponent. Fourteen bargaining pairs reached two 50–50 agreements; six reached two agreements with one 50–50; and six reached two non 50–50 agreements. Only the last six pairs address this question. Of these, one of the bargainers did better in both games only twice. Clearly, there is not enough data to say that bargaining ability explains the results.

The second hypothesis suggests that either the more or less risk averse bargainer consistently should do better. For each of the possible agreements (even if one of the bargaining pair's interactions was a disagreement), the more risk averse bargainer did better 27 times, compared to 14 for the less risk averse bargainer. Using the binomial test, two-tailed, this difference is marginally significant ($p = .061$). Thus, the more risk averse bargainer often received the better outcome. Breaking down this advantage on the basis of the value of the disagreement prize, the more risk averse bargainers do significantly better when the disagreement prize is high ($p = .035$, binomial test, one-tailed, see Table 5). When the disagreement prize is low, the more risk averse bargainers also do well, but not significantly better than the less risk averse bargainers.

The predicted effects of risk aversion will be fully supported when a pair of bargainers reach different agreements in their two bargaining sessions and the less risk averse bargainer does better when the disagreement prize is low. In Study I, pairs of bargainers reached two agreements only three times; Study II produced 12 additional diagnostic outcomes. Nine cases support the prediction; six do not.

An additional subset of these data also provides some information to test the prediction. In situations where a disagreement occurred, say in the high disagreement game (the most frequent case), support for the predictions could also be counted if the less risk averse player's final demand when they disagreed was *less* than his or her agreed upon outcome in the low disagreement game. In such situations, if bargaining had continued until an agreement was reached, the less risk averse player would necessarily have obtained a lower outcome than he or she received in the low disagreement game unless bad faith bargaining (increasing your demands rather than making concessions) occurred.[11] Tables 2 and 4 display the results when this data is considered: it is called clear-cut final demand data and labeled (+) or (−). The clear-cut final demand data provides additional

Table 5. The Frequency of Advantageous Outcomes Obtained by the More or Less Risk Averse Bargainers in Studies I and II

	Disagreement Prize	
	Low	High
More risk averse bargainer does better	20	7
Less risk averse bargainer does better	13	1

$\chi^2(1) = 3.81, p < .06$

evidence for the evaluation of the risk aversion prediction: 18 cases support, 9 do not. A binomial test indicates that these data approach standard significance levels: $p = .062$, two-tailed.

The data from Studies I and II are insufficient to support any firm conclusions, although they are in the predicted direction. One reason is the low variance of the data: Study I suffered from frequent disagreements; Study II from frequent 50–50 (nondiagnostic) agreements. Study III was designed to provide a greater opportunity for the effects of risk aversion to be observed.

4. Study III

Previous studies (e.g., Roth and Malouf, 1979; Roth and Murnighan, 1982) indicated that, although 50–50 agreements remain frequent, common knowledge of different high prizes leads to agreements between 50–50 and a second focal point, the equal expected value outcome. To move the agreement away from the 50–50 focal point and thus give differences in risk aversion more scope to affect the outcome, the large prizes the two bargainers stood to win in Study III were made unequal: $a_1 = \$8$ and $a_2 = \$16$. The other prizes were $b_i = \$4$ and $c_i = \$3$ for both bargainers $i = 1,2$ in the low disagreement game and $b_i = \$4$ and $c_i = \$5$ for $i = 1,2$ in the high disagreement game. In half of the bargaining pairs, the more risk averse bargainers were assigned the \$8 high prize; in the other half, the more risk averse bargainers were assigned the \$16 high prize.

The procedure was the same as the procedure for Studies I and II. Prior to being paired for bargaining, players completed the list of lotteries in Table 3. Their responses determined their categorization as more or less risk averse. However, since the prizes faced in the bargaining now differ from the prizes in the Table 3 lotteries, we need to consider how the relative situational risk aversion of the bargainers is related to their relative risk aversion as assessed through their choices from Table 3. Before describing the experimental assessment of this relationship in this subject population, let us consider what we might expect to find. Let i and j be two individuals such that i was more risk averse than j (i.e., for whom there was a probability p such that j was willing to accept a lottery with probability p of receiving \$10 and probability $1 - p$ of receiving \$4 instead of taking \$5 for certain, while individual i was unwilling to accept the lottery).

Consider first the cell in which the more risk averse of the two bargainers, individual i, has the high prize of \$8 and the less risk averse of the two, individual j, has the high prize of \$16. Since j was willing to accept a lottery that gave him \$10 with probability p, he also should be willing to accept the (otherwise identical) lottery that gives him \$16 with probability p, rather than settle for the certain \$5.[12] Similarly, since i preferred the certain \$5 to the lottery that gave him \$10 with probability p, he should also prefer it to the otherwise identical lottery that gives him \$8 with probability p. Thus, there should be a probability p defining a lottery between each bargainer's highest and lowest payoff such that i prefers his middle payoff for certain and j prefers the lottery. Thus, when j is assigned the \$16 high prize, i should be more situationally risk averse than j, as well as more risk averse.

When i has the high prize of \$16, nothing can be said about the relative situational risk aversion of the two bargainers, since, at the probability p discussed earlier, individual i might now be willing to accept the (more attractive) lottery with a potential payoff of \$16, while individual j might no longer be willing to accept a lottery whose maximum payoff was only \$8. Thus, no prediction about their outcomes can be made on the basis of the prediction of the classical game-theoretic models. However, since the risk aversion of the two bargainers can still be compared, the hypothesis that bargaining ability is related to a personal attribute correlated with risk aversion predicts that the relative shares agreed by this particular pair of bargainers in this cell will be correlated with the relative outcomes of more and less risk averse bargainers in the other cell of the experiment.[13]

4.1. *Assessment of relative situational risk aversion*

Nineteen undergraduates enrolled in economics classes, sampled from the same population as subjects for Studies I, II, and III, made six sets of lottery choices, one of which was the same set of 21 choices given to all of the bargainers in Studies II and III (Table 3). The others included high, certain, and low payoffs of: (1) \$16, \$5, and \$4; (2) \$16, \$4, and \$3; (3) \$10, \$5, and \$2; (4) \$8, \$5, and \$4; and (5) \$8, \$4, and \$3.

In general, all of the subjects' choices were highly correlated. As in each study, subjects' responses to the Table 3 choices were used to identify a group of eight subjects with relatively high risk aversion and another group of eight with relatively low risk aversion. The mean number of lottery choices was 8.1 for the more risk averse subjects and 19.1 for the less risk averse (fairly comparable to the sample of bargainers across the experiments and clearly different from each other). Their choices in the other lotteries were then investigated. When the less risk averse respondents' choices were compared to their choices in the lottery where the high, certain, and low payoffs were \$16, \$5, and \$4 and, at the same time, the more risk averse respondents' choices were compared to their choices in the \$8, \$5, and \$4 lottery, there were almost no changes in the ordering of the players (from more to less risk averse): Spearman's $\rho = .93$. More importantly, there were no changes within the groupings based on the original lottery choices. Subjects who would have been classified as more risk averse on the basis of the \$10, \$5, and \$4 lottery would have also been classified as more risk averse had they responded to the \$8, \$5, and \$4 lottery. Those who would have been classified as less risk averse on the basis of their original lottery choices would also have been classified less risk averse on the \$16, \$5, and \$4 lottery. Thus, their relative situational risk aversion was consistent across the two lotteries, as posited.

Similar comparisons for the complementary condition, where the less risk averse players were given the \$8 high prize and the more risk averse players the \$16 high prize, were, as expected, considerably different. Compared to the original lottery choices, this sample's choices in the respective lotteries were less consistent: Spearman's $\rho = .63$. In addition, among the eight individuals who would have been classified as more risk averse on the original \$10, \$5, and \$4 lottery, three would have been classified as less risk averse on the \$16, \$5, and \$4 lottery. The individuals who would have been classified as less risk averse on the original lottery were, in three cases out of eight, more risk on the \$8, \$5, and \$4 lottery. Thus, again as hypothesized, the situational risk aversion of the less and more risk averse players is less clear in this condition.

4.2. *Results of Study III*

As in the previous two studies, the more risk averse bargainers chose significantly fewer lotteries ($\bar{X} = 7.0$) than the less risk averse bargainers ($\bar{X} = 17.0$): $F(1,146) = 414.8, p < .0001$. The number of lottery choices again rose for both groups; the differences between them remain very strong. Table 6 shows the data from each of the bargaining encounters.

Evaluating the differential ability of the bargainers in Study III is not as simple as it was in Studies I and II. Instead of a single focal point of 50–50, each bargaining encounter now has two focal points, 50–50 and 33–67 (33 for the \$16 high prize player; 67 for the \$8 high prize player). Because of the new focal point, the \$8 high prize player could be expected to obtain no less than 50% of the lottery tickets, which turned out to be the case. Thus, the alternate hypotheses tested in Studies I and II cannot be tested here. However, the qualitative risk aversion predictions (i.e., the less risk averse bargainers will do better when the disagreement prize is low than they will when it is high) can be evaluated in the condition where the less risk averse player has the \$16 high prize. In this condition, the results indicate that the prediction was supported 18 times and not supported 12 times. Although these findings are in the right direction, they are not significant ($p < .20$, binomial test, one-tailed). When clear-cut final demand data are added, four additional supporting cases and no nonsupporting cases are included. These combined results (22 to 12) approach significance: $p < .06$. Thus, as with Studies I and II, the risk aversion prediction is moderately supported.

The analysis of variance findings provide an additional test. In a 2 (less risk averse versus more risk averse bargainer) × 2 (disagreement prize: \$3 or \$5) ANOVA on each bargainer's outcomes in the conditions where the less risk averse player had the \$16 high prize, the main effect for bargainers was significant: $F(1,220) = 112.0, p < .001$, indicating that the player with the \$8 high prize (the more risk averse player in these condition) received larger mean payoffs (55.4) than the player with the \$16 high prize (44.6). The bargainer by disagreement prize interaction approached standard significance levels: $F(1,220) = 2.89, p < .10$, indicating that the less risk averse bargainer did better (45.4) when the disagreement prize was low rather than when it was high (43.7), as predicted by the risk aversion hypothesis.

Table 6. Outcomes for Each Bargainer Pair in Study III [Disagreements Are Indicated by the Player's Final Demands (in parentheses)]

Less Risk Averse Player—$8 High Prize More Risk Averse Player—$16 High Prize			Less Risk Averse Player—$16 High Prize More Risk Averse Player—$8 High Prize		
Pair Number	Disagreement Payoff $3	$5	Pair Number	Disagreement Payoff $3	$5
1	60–40	59–41	1	47–52	45–55 (++)
2	65–35	60–40	2	40–60	33–67 (++)
3	55–45	49–51	3	48–52	47–53 (++)
4	35–65	(30–82)	4	60–40	40–60 (++)
5	70–30	(68–35)	5	45–55	40–60 (++)
6	65–35	(65–78)	6	50–50	35–65 (++)
7	48–52	50–50	7	49–51	35–65 (++)
8	59–41	63–37	8	50–50	35–65 (++)
9	60–40	58–42	9	30–70	16–84 (++)
10	70–30	67–33	10	60–40	52–48 (++)
11	60–40	(60–55)	11	51–49	48–52 (++)
12	(75–60)	50–50	12	50–50	47–53 (++)
13	(58–52)	52–48	13	43–57	40–60 (++)
14	65–35	67–33	14	48–52	40–60 (++)
15	50–50	(75–50)	15	30–70	27–73 (++)
16	(80–33)	80–20	16	54–46	48–52 (++)
17	(60–45)	(70–50)	17	55–45	51–49 (++)
18	57–43	55–45	18	50–50	47–53 (++)
19	60–40	56–44	19	40–60	45–55 (−−)
20	57–43	(57–44)	20	45–55	50–50 (−−)
21	60–40	(80–85)	21	35–65	45–55 (−−)
22	45–55	47–53	22	46–54	49–51 (−−)
23	50–50	65–35	23	50–50	55–45 (−−)
24	55–45	58–42	24	40–60	42–58 (−−)
25	59–41	(66–35)	25	31–69	35–65 (−−)
26	(50–99)	(60–99)	26	50–50	53–47 (−−)
27	(75–99)	(80–99)	27	58–42	61–38 (−−)
28	50–50	50–50	28	39–61	50–50 (−−)
29	58–42	58–42	29	40–60	50–50 (−−)
30	50–50	50–50	30	48–52	49–51 (−−)
31	55–45	55–45	31	(50–60)	30–70 (+)
32	70–30	70–30	32	49–51	(47–55) (+)
33	50–50	50–50	33	(36–65)	34–62 (+)
34	50–50	50–50	34	49–51	(45–62) (+)
35	66–34	66–34	35	(48–60)	40–60
36	(60–50)	(60–50)	36	(48–60)	(43–60)
37	50–50	50–50	37	(40–65)	37–63
			38	50–50	(50–70)
			39	(50–60)	50–50
			40	45–55	(50–60)
			41	45–55	(45–60)
			42	50–50	(50–65)
			43	(50–70)	33–67

(continued)

Table 6. (*Continued*)

Less Risk Averse Player—$8 High Prize More Risk Averse Player—$16 High Prize			Less Risk Averse Player—$16 High Prize More Risk Averse Player—$8 High Prize		
Pair Number	Disagreement Payoff $3	$5	Pair Number	Disagreement Payoff $3	$5
			44	35–65	(40–80)
			45	32–68	(50–68)
			46	(47–58)	43–57
			47	(52–51)	(50–58)
			48	(37–67)	(38–70)
			49	(47–55)	47–53
			50	39–61	(40–69)
			51	45–55	45–55
			52	50–50	50–50
			53	50–50	50–50
			54	46–54	46–54
			55	30–70	30–70
			56	45–55	45–55
			57	35–65	35–65
			58	45–55	45–55
			59	50–50	50–50
			60	50–50	50–50
			61	45–55	45–55
			62	50–50	50–50
			63	50–50	50–50
			64	50–50	50–50
			65	50–50	50–50
			66	40–60	(45–64)
			67	36–64	36–64
			68	(50–55)	50–50
			69	(45–65)	40–60

Note: The less risk averse players' outcomes always listed first. No risk aversion prediction is made when the less risk averse player has the $8 high prize. Results clearly supporting the prediction are followed by (++), by (−−) if they show clear nonsupport, and (+) or (−) if the support results from clear-cut final demands.

5. Overall results

The risk aversion prediction was addressed by the results from all three studies. From Studies I and II, marginal support for the prediction was obtained by frequencies of 9 to 6 and 18 to 9 (when the clear-cut final demand data are included). In Study III, the frequencies were 18 to 12 and 22 to 12. When the data from all three studies are considered together (in the sense of a small meta-analysis; Hunter, Schmidt, and Jackson, 1982), 27 cases supported the prediction and 18 did not ($p < .12$, binomial test, one-tailed), indicating marginal support for the prediction. When clear-cut final demands are included, the frequencies over all these studies are 40 and 21 ($p = .001$, binomial test, one-tailed), indicating strong support for the prediction.

5.1. *Evidence for focal point effects*

A focal point in all three studies, and the only natural focal point in Studies I and II, is the 50–50 agreement. In addition, a nonprominent (cf, Schelling, 1960) focal point, 33–67, would equalize expected values in Study III. Focal point effects are evident in the predominantly 50–50 agreements in Studies I and II, with little dispersion from that point, and in Study III when agreements fall between the two focal points. Tables 7 and 8 document the frequency of 50–50 outcomes and the mean outcomes, variances, and some information about final demands when agreements were not reached.

Table 7. The Frequency of 50–50, Non-50–50, and Disagreement Outcomes

			OUTCOMES					
		Low and Disagreement Prizes	50–50 Frequency	%	Non-50–50 Frequency	%	Disagreement Frequency	%
Study 1		Dis $2 Lo $5	19	56%	15	44%	0	21%
		Dis $5 Lo $2	5	15%	2	6%	27	79%
		Overall	24	35%	17	25%	27	40%
Study 2		Dis $4 Lo $5	37	56%	22	33%	7	11%
		Dis $5 Lo $4	20	30%	12	18%	34	52%
		Overall	57	43%	34	26%	41	31%
Study 3	Hi $8 for Less Risk Averse Player	Dis $3	7	19%	23	62%	7	19%
		Dis $5	7	19%	18	49%	12	32%
		Combined	14	19%	41	55%	19	26%
	Hi $16 for Less Risk Averse Player	Dis $3	16	23%	40	58%	13	19%
		Dis $5	13	19%	43	62%	13	19%
		Combined	29	21%	83	60%	26	19%
		Overall	43	20%	124	58%	45	21%

Table 8. Mean Outcomes, Final Demands, and Variances

		Outcomes			*Final Demands* (includes outcomes)				
			Less Risk Averse Player $\bar{X}$ – More Risk Averse Player $\bar{X}$			Less Risk Averse Player		More Risk Averse Player	
		Freq.	$\bar{X}$ $\bar{X}$	Variance	Freq.	$\bar{X}$	Variance	$\bar{X}$	Variance
Study 1	Dis \$2 Lo \$5	34	49.2–50.8	(24.6)	34	49.2	(24.6)	50.8	(24.6)
	Dis \$5 Lo \$2	7	50.3–49.7	(5.57)	34	59.4	(217.0)	72.4	(266.8)
Study 2	Dis \$4 Lo \$5	59	49.9–50.1	(7.91)	66	50.2	(9.99)	50.4	(9.11)
	Dis \$5 Lo \$4	32	48.5–51.5	(9.87)	66	52.6	(76.9)	56.6	(124.5)
Hi \$8 for Less Risk Averse Player	Dis \$3	30	56.8–44.2	(65.4)	37	58.4	(85.2)	46.9	(226.1)
	Dis \$5	25	57.4–42.6	(68.0)	37	59.6	(109.9)	49.4	(314.8)
Hi \$16 for Less Risk Averse Player	Dis \$3	56	45.4–54.6	(53.3)	69	45.6	(48.0)	55.8	(54.4)
	Dis \$5	56	43.6–56.3	(65.8)	69	44.0	(57.2)	57.9	(71.5)

Note: Disagreement outcomes of zero for both players have been excluded from the outcome analyses.

The results are clear: In Studies I and II, 50–50 agreements considerably outnumbered non-50–50 agreements, and the variances of the outcomes are relatively small. The mean outcome of 49.4–50.6 is very close to 50–50. In Study III, far fewer agreements were 50–50, the non-50–50 agreements outnumbered them by a considerable margin, and the variances of the outcomes increased dramatically. The mean outcome (to the \$8 high prize player) rises to 56.3. The obvious clustering of agreements around 50–50 (see Tables 2, 4, and 6) in Studies I and II dissipates in Study III, where the outcomes primarily range between the two focal points, 50–50 and 33–67 (67–33 in Table 6, when the less risk averse player had the \$8 rather than the \$16 high prize). The 50–50 outcome occurs more often than any other (it is a focal point), but does not predominate as in Studies I and II, when it was the only focal point. Thus, the data replicate the focal point effects observed in earlier experiments.

5.2. Other considerations

Most of the agreements (152 out of 299; see Table 9 and Figure 1) were made in the last 30 seconds of the 9-minute bargaining time. If this last half minute is divided into five-second intervals, most of these agreements were made within the last five seconds. As the time progresses from 510 to 540 seconds, the frequencies of agreements in each five-second interval are 12, 9, 9, 15, 23, and 84 (see Figure 2). Clearly, there is an overwhelming concentration of agreements in the last seconds. Informal analysis of previous experiments appears to indicate that this *deadline effect* is independent of the time allowed to reach agreement (e.g., when the bargaining lasts for 12 minutes instead of 9, agreements are still concentrated at the end). However, this phenomena requires further analysis before we can do more than speculate about it. (See Roth, Murnighan, and Schoumaker, 1987, for a fuller discussion.)

Many negotiations, however, ended in disagreement; analysis of the players' final demands provides additional information concerning the nature of the bargaining process for disagreements. Table 8 documents both agreement outcomes and final demands. Clearly, final demands tend to be greater than agreement outcomes, but for Studies I and II, they increased considerably more for the more risk averse player than for the less risk averse player when the disagreement prize was high (when disagreements were most frequent). This is particularly true

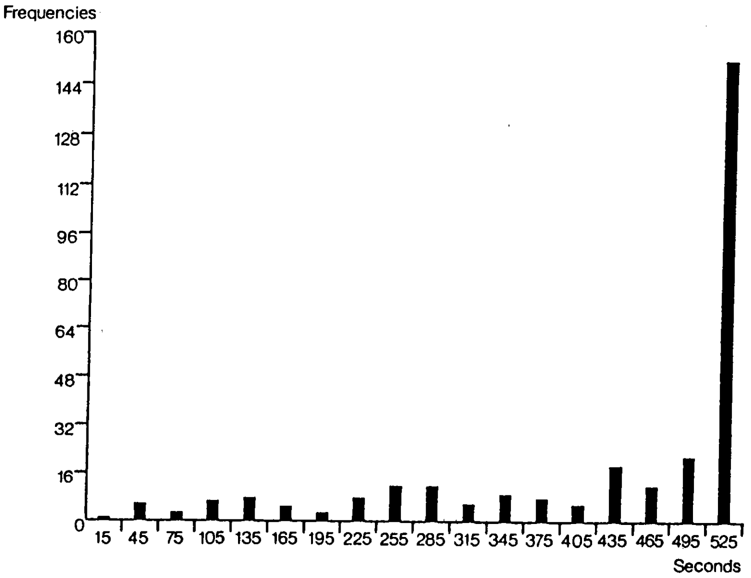

Fig. 1. The distribution of agreement times (in seconds) in all three studies. Numbers on the horizontal axis indicate the midpoint of 30 second intervals. Thus, 525 indicates agreements in the last 30 seconds of bargaining (i.e., 511–540).

Table 9. The Distribution of Agreement Times in All Three Studies

		Agreement Times (in seconds)																	
	Disagreement Prize	0–30	31–60	61–90	91–120	121–150	151–180	181–210	211–240	241–270	271–300	301–330	331–360	361–390	391–420	421–450	451–480	481–510	511–540
Study I	High	0	0	0	0	0	0	0	1	1	0	0	2	0	0	2	1	0	0
	Low	0	0	1	2	2	0	1	1	2	4	2	0	1	1	3	4	1	6
Study II	High	0	1	0	1	0	1	0	1	0	1	0	2	0	0	1	1	5	18
	Low	0	0	0	1	0	0	1	1	2	3	1	0	1	2	4	2	6	38
Study III[a]	High	1	0	0	1	1	0	1	1	2	1	0	1	0	1	2	0	0	13
	Low	0	1	1	0	2	0	0	2	1	0	0	2	0	0	3	1	1	16
Study III[b]	High	0	2	0	2	1	0	0	0	4	2	0	2	2	1	3	2	4	31
	Low	0	2	1	0	2	4	0	1	0	1	3	0	4	1	1	1	5	30
	TOTALS	1	6	3	7	8	5	3	8	12	12	6	9	8	6	19	12	22	152

a. The less risk averse player had the \$8 high prize; the more risk averse the \$16 high prize.
b. The less risk averse player had the \$16 high prize; the more risk averse the \$8 high prize.

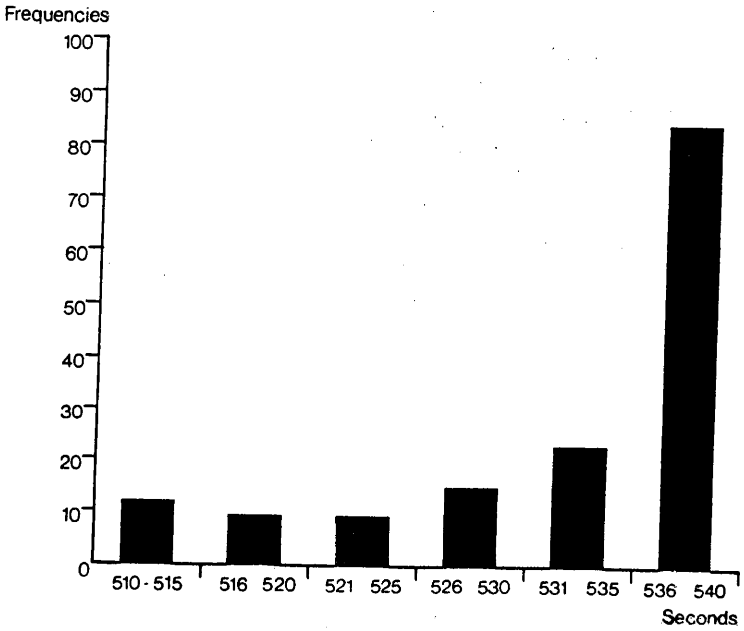

Fig. 2. The distribution of agreement times in the last 30 seconds of negotiation, again for all three studies.

for Study I. As expected, the more risk averse players appear much less interested in reaching an agreement when a payoff lower than the disagreement prize was possible.[14] This may explain their better performance. In addition, the increase in variances in their final demands suggests that idiosyncratic behavior is more prevalent in these conditions.

6. Discussion

These results provide some accumulated support for the prediction made by a wide variety of game-theoretic models about the effect of risk aversion on the outcome of bargaining. At the same time, the preponderance of 50–50 agreements in the first two studies and the move away from 50–50 agreements toward the other focal point in Study III attest to the (unpredicted) power of focal points in driving the outcomes, in the range of payoffs studied here. The frequency data support the notion that risk aversion affects the outcomes of bargaining, but the quantitative analysis of Study III suggests that these effects are smaller (i.e., shifts in the less risk averse $16 high prize players' outcomes from 43.7 to 45.4) than the focal point effects (shifts in agreements from 49.4–50.6 to 44.4–55.6). However it is difficult to make such a comparison precise in a meaningful way, for two reasons.

First, the relatively small effect attributable to differences in risk aversion may be due to the relatively small prizes used in these studies.[15] Whether the effects of risk aversion will be larger when the stakes are larger is an empirical question. When the stakes are sufficiently large, risk aversion might conceivably become the primary influence on the outcome of bargaining, as predicted by the game-theoretic models.[16,17]

Second, the extent of the focal point effects might be attributed to the distance between focal points. Setting the high prizes at less distant values would lead to less movement away from 50–50 outcomes and smaller focal point effects, while setting the prizes at more distant values (e.g., $5 and $20), as we have done in previous research (Roth and Murnighan, 1982), appears to accentuate the focal point effects even further. The results of Studies I and II suggest that both focal point and risk aversion effects may be stronger than those driven by personal attributes other than risk aversion (at least in this bargaining environment).

This strengthens the argument that classical game-theoretic models of bargaining are not informationally rich enough to be good descriptive models. If the relative magnitudes of the two effects does not reverse when stakes are increased, then a good model of bargaining will have to describe how the bargainers' information about the magnitudes of the prizes influences the outcome of bargaining.

In conclusion, these experimental results present some evidence in support of the qualitative predictions of the game-theoretic models, while at the same time replicating some results of earlier experiments that are at variance with the predictions of these models. Regarding the predicted effects of risk aversion, the results showed that the more risk averse bargainers did better when the disagreement prize was high than they did when it was low, as predicted. However, the unpredicted effects were larger than the predicted effects: focal points seemed to drive the outcomes more than risk aversion. Further empirical work is needed to determine if the relative magnitude of these effects persists as the stakes become higher. If so, a new theoretical framework for studying bargaining that incorporates both the predicted effects of risk aversion of existing models and the unpredicted information effects that have been consistently observed in these experimental studies may be required.

Notes

1. The most influential single model has undoubtedly been the axiomatic model of Nash (1950). For a survey of the literature on axiomatic models, see Roth (1979). A particularly interesting strategic model has recently been proposed by Rubinstein (1982). An overview of a variety of strategic models can be found in Roth (1985a).

2. Including those of Nash (1950), Kalai and Smorodinsky (1975), and Perles and Maschler (1981).

3. Perhaps most clearly in Roth and Murnighan (1982).

4. It is this latter agreement, of course, that is sensitive to the magnitudes of each player's monetary prizes. The distribution of agreements in Roth and Murnighan (1982) was observed to be bimodal, with

modes at each of these focal points, while the distribution of *outcomes* was trimodal, with the third mode being bargaining sessions that ended in disagreement.

5. For example, see Roth and Malouf (1979).

6. The case of other orderings (e.g., $a_i > c_i > b_i$) will be handled similarly.

7. Note that to say that one individual is more risk averse than another is to compare personal attributes of the two individuals, but to say that one individual is more *situationally* risk averse than another is not a comparison of personal attributes, since it might be reversed in another situation in which the individuals were faced with different prizes.

8. Including all those that are symmetric in the space of individually rational utility payoffs and monotone in a bargainer's disagreement utility.

9. The intuition here is that a more risk averse bargainer needs to be offered better terms to enter into this kind of risky agreement, so that, conditional on an agreement being reached, we should expect to observe more risk averse bargainers obtain better terms than less risk averse bargainers in this case.

10. The details of this matching, as well as the details of how individuals who made inconsistent choices were pruned from the experimental population, are described in the Methods section.

11. We never observed any agreements where bargaining in bad faith increased a player's potential outcomes. Instead, this was not frequent, and was usually a cue for disagreements.

12. We assume here only that, in otherwise identical choice situations, individuals prefer larger payoffs to smaller ones.

13. Note that this hypothesis yields no clear prediction that can be tested by a single cell of this experiment, since the previous experimental results concerning the focal point effect make it very likely that the player with the $8 high prize will get a larger share of the lottery tickets than the player with the $16 prize. However if risk aversion and bargaining ability are correlated, there will be an interaction between which player has the larger prize and which is more risk averse.

14. Paradoxically, over all three studies, as the number of lottery choices increased (i.e., as risk aversion decreased), the time needed for subsequent negotiations increased. For the less risk averse players, the corelation between agreement time and lottery choices was .13; for the more risk averse players, $r =$ .16 ($n = 202, p < .05$ in both cases).

15. In some moods, it strikes us as rather remarkable that *any* indirect effect attributable to differences in risk aversion can be detected on a domain whose highest payoff is $16. In this regard, note that an experimental study by Harrison (1985) using even smaller payoffs than those used here (and employing a different experimental design) reports roughly comparable results.

16. In just such a way, gravity is an insignificant force on the scale of molecules, but the primary force determining the shape of galaxies.

17. However, in a study of out of court settlements of product liability suits, Viscusi (1988) concludes that risk aversion plays a "reasonably substantial" role that is, however, "by no means the major force driving behavior. . . ."

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