The Effects of Beliefs versus Risk Preferences on Bargaining Outcomes*

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Abstract

In bargaining environments with uncertain impasse outcomes (e.g., litigation or labor strike outcomes), there is an identification problem that confounds data interpretation. In such environments, the minimally acceptable settlement value from a risk-averse (risk-loving) but unbiased bargainer is empirically indistinguishable from what one could get with risk-neutrality and pessimism (optimism). This paper reports data from a controlled bargaining experiment where risk preferences and beliefs are both measured in order to assess their relative importance in bargaining outcomes. The average lab subject is risk-averse, yet optimistic, which is consistent with existing studies that examine each in isolation. I also find that the effects of optimism dominate those of risk-aversion. Optimistic bargainers are significantly more likely to dispute and have aggressive final bargaining positions. Dispute rates are not statistically affected by risk preferences, but there is some evidence that risk aversion leads to less aggressive bargaining positions and lower payoff outcomes. A key implication is that increased settlement rates are more likely achieved by *minimizing* impasse uncertainty (to limit the potential for optimism) rather than maximizing uncertainty (to weaken the reservation point of risk-averse bargainers), as has been argued in the dispute resolution literature.

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1. Introduction

Theoretical research on bargaining has produced a well-known result that risk aversion will harm an individual's bargaining position, ceteris paribus. This result has been shown in a variety of game-theoretic models, including the highly influential models in Nash (1950) and Rubinstein (1982).[1] Analysis of bargainer decision-making under uncertainty, such as in Farber and Katz (1979), produces a similar result in the sense that risk aversion lowers a bargainer's threat point (or certainty equivalent for the lottery). Laboratory data generally confirms the theoretical prediction that risk aversion harms bargaining outcomes, although estimated risk aversion effects are sometimes weak or dominated by other features of the bargaining situation, such as focal points or explicit disagreement costs (see Murnighan et al., 1988, Farber et al., 1990).

A separate strand of literature examines the effects of biased beliefs on bargaining outcomes. Though there exists evidence of pessimism in some environments (e.g., Clark and Friesen, 2005), the weight of the research in psychology and economics has documented decision-maker overconfidence or optimism in a variety of settings.[2] Babcock and Loewenstein (1997) argue that a many results from laboratory and field evidence on bargaining impasse are consistent with the notion that bargainers are over-confident (i.e., optimistic) or possess a self-serving bias in negotiations. Though bargainer optimism may manifest itself in multiple ways, this paper is specifically concerned with the optimism that bargainers have over the likely outcome from impasse,

[1] This result does not hold only in the event that agreement outcomes are lotteries, as shown in Roth and Rothblum (1982).

[2] Abdellauoi (2000) estimate probability weighting functions from laboratory subjects and confirm an overweighting of low-probability events and an underweighting of high-probability events—consistent with Tversky and Kahneman (1992). This more general tendency for subject beliefs indicates that, *a priori*, both optimism and pessimism should be a concern. Context is likely a determining factor—overweighting a low probability event, for example, may be considered pessimistic (acquiring food-borne illness) or optimistic (winning the lottery).

when such outcomes are uncertain. Theoretically, the bargainers' *contract zone*—the region of outcomes mutually preferred to dispute—may disappear if bargainers are optimistic about the likely outcome from the impasse lottery (see framework in Farber and Katz, 1979). Both field and laboratory evidence show evidence of higher dispute rates when optimism is present (e.g., Neale and Bazerman, 1985; Farber et al., 1990; Babcock et al., 1995; Babcock and Loewenstein, 1997; Farmer et al, 2004; Dickinson, forthcoming). However, risk preferences are not measured in these studies, and therefore represent a confound in the data interpretation.[3]

The theoretical effects of optimism work opposite the effects of risk aversion in terms of a bargainer's threat point or reservation value—the negotiated outcome that provides the same utility as playing the impasse lottery (i.e., the certainty equivalent). This has important implications because the behavioral outcomes from a risk-averse individual who is optimistic can be observationally equivalent to those from a risk-neutral yet unbiased bargainer. In other words, the effects of risk preferences in the data cannot be identified unless one measures beliefs as well. An example of this identification problem is found in the well-cited research of Ashenfelter et al. (1992), among others, in which lab results are said to be consistent with risk aversion. Observationally equivalent data could be generated by risk-neutral but pessimistic subjects in their experiments.[4]

This paper examines the relative effects of risk preferences and beliefs in a bargaining context. Existing bargaining research has examined each in isolation, but to this author's knowledge there is no previous study eliciting subjects' home-grown

[3] Neale and Bazerman (1985) use a framing manipulation (gains v. losses) and *assume* risk attitude based on the frame of the negotiations.

[4] Alternatively, if the Ashenfelter et al. (1992) subjects are, on average, risk-averse and optimistic, then results consistent with risk aversion may indicate that subject risk aversion *dominates* the subjects' optimism. The precise contribution of each factor is nonetheless unidentified.

preferences for risk *and* subject beliefs over uncertain impasse outcomes. Neale and Bazerman (1985) address both optimism and risk preferences in a mock negotiations experiment. However, they do not directly measuring risk attitudes. Farber et al. (1990) examines the effects of risk aversion in a mock negotiations exercise in which bargainers are optimistic, but both risk aversion and optimism are *induced* in their research. The contribution of the present research is that I elicit subjects' naturally occurring beliefs and risk preferences in a zero-sum bargaining experiment with uncertain disagreement (i.e., impasse) outcomes in two of three treatments. Further, it important to use a more abstract bargaining experiment in the present context, due to the prime objective of identifying risk attitude and belief effects on bargaining outcomes.[5]

The present data show that the average subject is risk-averse yet optimistic, consistent with previous research that has examined each separately.[6] Optimism has a strong effect on increasing the likelihood of dispute, though it may improve one's outcome in a voluntarily negotiated settlement by making final bargaining positions more aggressive. Risk aversion does not have a statistically significant effect on dispute rates, but there is some evidence that it harms one's outcome in a negotiated settlement, as predicted by theory. Overall, the lab evidence indicates that the effects of optimism behaviorally dominate the effects of risk aversion. If these results can be extended to

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[5] Roth (1995) describes our concern with face-to-face context-laden experiments. While they have obvious value in bargaining research, we believe that they should logically follow more abstract context-free experimental research. The issue is that these less-controlled face-to-face bargaining experiments introduce confounds into the data that are not easily quantifiable. In the end, this makes it more difficult to properly identify the desired treatment effects of an experiment. Of course, the trade-off is that more abstract experiments are less externally valid (i.e., less realistic). This explains why experiments in less controlled, but more realistic, environments are necessary to test the bounds of any theory.

[6] As noted in Section 2 of the paper, this evidence lends empirical support to a model like rank-dependent utility (RDU), as an alternative to expected utility analysis. This is because a model like RDU allows a risk-seeker to be someone who either has a concave utility function *or* has an optimistic distortion of the probability weights on the lottery—expected utility considers that risk attitude is wholly determined by marginal utility considerations.

naturally occurring bargaining situations where there is uncertainty surrounding the impasse outcome, these results have important implications on institutional design of dispute resolution procedures. A key implication is that a reduction in dispute rates—a commonly used measure of bargaining or settlement procedure success—is more likely achieved by *minimizing* impasse uncertainty (to limit the potential for optimism) rather than maximizing uncertainty (to weaken the reservation point of risk-averse bargainers), as has been argued in the existing literature (see Stevens, 1966).

2. Hypotheses

A central motivation for this research comes from the identification problem noted in the introduction, whereby the individual effect of risk preferences or expectations may not be identified. Rank-dependent utility (RDU) models separate risk-seeking behavior into that which comes from curvature of the utility function (i.e., increasing marginal utility) and that which comes from probabilistic risk-seeking (i.e., optimism in regards to probability weights of the lottery). In Yaari's (1987) "dual theory" when utility u(x)=x, then distortions in the probability distribution function over outcomes, f(.), produce results similar to distortions in the shape of u(.) without the distortions in f(.). Chateauneuf and Cohen (1994) and Wakker (1994) both consider this problem in a rank-dependent utility (RDU) framework, and extend the results of Yaari (1987). In essence, their extensions theoretically establish that an individual can still be a risk-seeker without a convex utility function, u(x), as long as the distribution function over x, f(x), is sufficiently optimistic.

It follows from the current work on RDU that identifying the contribution of *u*(.) and *f*(.) for a given utility certainty equivalent is confounded. For exposition purposes, the basic result can be proved from the following simplified framework: Assume a well-behaved utility function, *u*(x,*r*), continuous in both x$\in [\underline{x}, \bar{x}]$ and $r \in [\underline{r}, \bar{r}]$, with u_x>0. Risk preferences—that is, curvature of the utility function—are defined solely by *r,* with $\underline{r} < r < \hat{r}$ defining risk-averse preferences, $r = \hat{r}$ defines risk-neutrality, and $\hat{r} < r < \bar{r}$ defines risk-loving preferences. Define beliefs with *f*(x) that satisfies that properties of a density function, and let $\hat{f}(x)$ define an unbiased belief over *f*(x), which is defined as a belief that accurately reflects the expected (i.e., average) outcome that would result from the (impasse) lottery.[7] Optimism is defined as f_{opt}(x) such that $F_{\text{opt}}(x_\mu) < \hat{F}(x_\mu)$, where *F*(x) is the cumulative distribution function for *f*(x), and x_μ is the mean level of *x* that will result from impasse. In other words, optimistic beliefs imply a bargainer expected payoff outcome from dispute that is higher than will actually occur on average, which implies that *less* of the density function's area is below x_μ. Pessimism implies $F_{\text{pess}}(x_\mu) > \hat{F}(x_\mu)$.

The utility of dispute for the risk-neutral and unbiased bargainer is given by

(1) $$\int_{\underline{x}}^{\bar{x}} \hat{u}(x) \cdot \hat{f}(x)\, dx = \hat{U}_x$$

<u>Proof</u>:

Define $g(r, belief) = \int_{\underline{x}}^{\bar{x}} u(x,r) \cdot f(x)\, dx - \hat{U}_x$, which is the difference between utility of the lottery and utility of the lottery if the individual were risk-neutral and unbiased. Note *g*(.) will be continuous in $r \in [\underline{r}, \bar{r}]$. Consider first optimistic beliefs, *f*(x)=f_{opt}(x) (defined above). Assume $\exists$ $r_1 < \hat{r}$ such that $g(r_1$, opt) =

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[7] This assumption is less restrictive than requiring the belief density function to exactly match the true outcome lottery (i.e., $\hat{f}(x)$ =*f*(x) for each x in $[\underline{x}, \bar{x}]$).

$\int_{\underline{x}}^{\bar{x}} u(x,r_1)\cdot f_{opt}(x)\,dx - \hat{U}_x < 0$.[8] Given the definition of $f_{opt}(x)$, for any $r_2 \geq \hat{r}$ we have $g(r_2, \text{opt}) = \int_{\underline{x}}^{\bar{x}} u(x,r_2)\cdot f_{opt}(x)\,dx - \hat{U}_x > 0$. Continuity guarantees that $\exists\ r^*$ ($< \hat{r}$) such that $g(r^*, \text{opt})=0$.[9] Similarly, if the individual is pessimistic and $\exists$ $r_3 > \hat{r}$ such that $g(r_3, \text{pess})>0$, then for any $r_4 \leq \hat{r}$ we have $g(r_4,\text{pess})<0$, which implies that $\exists\, r'$ ($>\hat{r}$) such that $g(r', \text{pess})=0$. Together this guarantees the existence a $g(r^*, \text{opt}) = g(r', \text{pess})$. ■

So, given the uniqueness of U_x (i.e., the integral) at each x, for a given risk-averse or risk-loving utility function, there will exist some $f_{opt}(x)$ and $f_{pess}(x)$ such that

(2) $$\int_{\underline{x}}^{\bar{x}} u_{ra}(x)\cdot f_{opt}(x)\,dx = \hat{U}_x = \int_{\underline{x}}^{\bar{x}} u_{rl}(x)\cdot f_{pess}(x)\,dx$$

A simple example will help illustrate this point. Assume f(x) is a binary lottery, (p_L,p_H), describing the probabilities of the low and high x outcomes x_L=100 and x_H=200, respectively, at impasse (see Chateauneuf and Cohen (1994) for examples of specific utility functions that highlight their results). Let (p_L,p_H)=(.5,.5) so, on average, x_μ=150. If utility is defined simply as $U=x^r$, then $0<r<1$ defines a risk-averse, and $r>1$ a risk-loving individual. An unbiased and risk-neutral individual (r=1) would therefore be willing to accept any x≥150 in a negotiated settlement to avoid the uncertain lottery. If the individual were risk-averse, say $r=1/2$, but unbiased, then the individual's "threat" point is lowered to about x=146 (i.e., he would accept any x≥146 in a negotiated settlement). However, if the risk-averse individual is also slightly optimistic with f_{opt}(x)=(.46,.54), then the threat point is again 150. Bargaining behavior from the risk-

[8] That is, assume there is some level of risk aversion that dominates the effect of optimism. The alternative implies that the individual is so extremely optimistic that the optimism cannot be dominated by any level of risk-aversion. This case still implies that risk-aversion makes the true effect of the optimism unidentifiable.
[9] More specifically, this is an application of the Zero theorem.

averse and optimistic individual will be empirically indistinguishable from that of a risk-neutral and unbiased bargainer.[10]

While some researchers have devised clever experiments to separately identify utility effects without knowledge of beliefs (Wakker and Deneffe, 1996; Fennema, H., and M. van Assen, 1998; Abdellaoui, 2000), their research cannot confirm whether biased beliefs in their settings transfer to bargaining settings. Furthermore, their results (i.e., biased beliefs and utility functions consistent with the prospect theory of Kahneman and Tversky, 1979) do not speak to whether risk attitudes or beliefs are the more significant determinant of bargaining outcomes.

A Specific Framework

More specific hypotheses about the effects of risk preferences and expectations can be derived from the utility specification used in Farber and Katz (1979). Specifically, consider a *B* (buyer) and *S* (seller) engaged in zero-sum bargaining over one dollar (or any fixed amount of money). Bargainer utility is defined as:

$$U_S = \frac{1 - e^{xc_s}}{1 - e^{c_s}} \quad \text{and} \quad U_B = \frac{1 - e^{zc_b}}{1 - e^{c_b}}$$

where x is the fraction of the pie player *S* receives, and $z=1-x$ is the amount that player *B* receives. With these parameterizations utility increases in the fraction of the pie received, with $U(0)=0$ and $U(1)=1$. Risk preferences are defined solely by $-c_i$ for $i=b,s$, the Arrow-Pratt measure of absolute risk aversion. As such, player i is risk-averse (loving) when $c_i <$ (>) 0. The buyer and seller have beliefs, $y_b \sim N(z_{bF}, \sigma_b^2)$ and $y_s \sim N(y_{sF}, \sigma_s^2)$, respectively, of what the impasse outcome would be for themselves. Farber and

[10] Of course, we are referring to bargaining behavior that is based on utility values. Such would likely be the case for bargaining threat points, which are assumed to affect final bargaining positions and dispute rates.

Katz (1979) derive the bargainers' certainty equivalents or reservation values, $X_{i,R}$ for i=b,s: the lowest (highest) amount the seller (buyer) would be willing to accept (give) in a negotiated settlement. For the seller they show this to be $X_{s,R}=y_{sF}+(1/2)\sigma_s^2 c_s$. Assuming that a bargainer is willing to accept any negotiated settlement providing a greater share of the pie then his reservation value, the seller is therefore willing to discount his lowest acceptable negotiated settlement if risk-averse, $c_s<0$, and/or pessimistic, $y_s^{pess} < y_{sF}$. The opposite is true if the seller is risk-loving and/or optimistic. The buyer's reservation value is given by $Z_{b,R}=z_{bF} + (1/2)\sigma_b^2 c_b$. The buyer similarly discounts his reservation value if risk-averse and/or pessimistic.[11] They show that the contract zone, Δ, of mutually beneficial bargaining outcomes is given by

$$(5) \qquad \Delta = (X_{bR} - X_{sR}) = (y_{bF} - y_{sF}) - \left[\frac{c_b\sigma_b^2 + c_s\sigma_s^2}{2} \right]$$

Equation (5) highlights the predicted effects of optimism and risk preferences on bargaining outcomes. A necessary condition for a positive contract zone, which I assume to be a measure of the likelihood of a settlement, is to either have average bargainer pessimism (y_{bF}-y_{sF}>0) or average bargainer risk aversion ($c_b+c_s<0$). Sufficient conditions also include the cases where risk-aversion dominates any optimism, or pessimism dominates any risk-loving preferences. Similarly, necessary conditions for no contract zone are optimism and/or risk-loving behavior. A more complicated noncooperative bargaining framework could be utilized, but it was noted in the introduction that these stylized results are common across numerous frameworks in the literature.

[11] The buyer's reservation value can alternatively be defined in terms of the maximum amount the buyer would be willing to give to the seller in a negotiated settlement, $X_{b,R}=y_{bF} - (1/2)\sigma^2 c_b$, where $y_{bF}=1-z_{bF}$ is the buyer's expectation of what the impasse outcome would provide to the seller.

It should also be noted that this framework generates comparative static predictions on dispute rates *and* bargainer reservation values. Specifically, optimism increases reservation values, which I assume will lead to more aggressive final bargaining positions. Risk aversion not only moderates reservation values, but the extent to which it does is an increasing function of the impasse uncertainty: $\frac{\partial X_{sR}}{\partial c_s} = \left(\frac{1}{2}\right)\sigma_s^2 > 0$, and similarly for the buyer. It is this result that leads to the familiar prediction that risk aversion harms one's bargaining position, ceteris paribus. Assuming that the contract zone is a predictor of dispute rates, optimism is predicted to increase dispute rates, but an increase in a bargainer's level of risk aversion is predicted to decrease dispute rates to an extent that depends on the perceived risk of impasse, σ^2.[12]

3. The Experiment

Subjects participate in a two-stage experiment. In the first stage, subjects complete the lottery-choice experiment described in Holt and Laury (2002). Subjects face ten pairs of lotteries, and for each pair must state a preference for the safe or the risky lottery option. The total number of safe versus risky options a subject chooses is used to generate a measure of risk preference. Specifically, decisions are used to determine a subject's range of relative risk aversion for the utility function $U(x)=x^{1-r}/(1-r)$. Though I use the midpoint of the range as a control variable in the econometric

[12] There is some debate in the literature over the link between dispute rates and the size of the contract zone. Some argue that larger contract zones imply lower dispute rates (e.g., Crawford, 1982; Farber and Bazerman, 1987), but an alternative view is that larger contract zones imply more over which to dispute, thereby increasing dispute rates (e.g., Tracy, 1986, 1987; Crampton, 1992). The weight of the laboratory evidence is that optimism or decreased outcome uncertainty leads to higher dispute rates (e.g., Ashenfelter et al, 1992; Dickinson, forthcoming), and so we assume that smaller contract zones imply more likely dispute in the present paper.

analysis, one could also just use the total number of safe choices as a proxy for risk preferences. What is most useful for the present purposes is to have an ordinal ranking of risk preferences, and the same ordinal ranking would apply to risk preferences in the Farber and Katz (1979) framework shown in the previous section.

Payoff amounts in the Holt and Laury low-payoff experiment are multiplied by two, which meant that the "safe" options had high/low payoffs of $4.00/$3.20, while the "risky" options all had high/low payoffs of $7.70/$.20. Each of the ten pairs of lottery choices asks for the subject's preference of playing the Option A lottery (the safe gamble) or the Option B lottery (the risky gamble). The ten paired Option A/Option B choices differ by systematically varying the odds of winning the high (low) payoff amount from odds of 1/10 (9/10) to 10/10 (0/10). Subjects must state an option preference (or indifference) for each of the ten paired options, but only one will be randomly selected for payoff at the end of the experiment. At the end of the experiment, a paired option is randomly selected for each subject individually, and the subject's preferred option choice is played out using a 10-sided die. Finalization of the first-stage lottery-choice experiment is deferred to the end of the experiment to limit wealth effects across experiment stages. Subjects are also made aware that there decisions from stage one do not affect earnings in stage two of the experiment, and vice-versa.

The second-stage experiment is the main bargaining experiment. The experimental environment was designed to test a zero-sum bargaining framework similar to that of Farber and Katz (1979). Subjects were randomly assigned as Player A or Player B in a zero-sum bargaining experiment. It is common knowledge that subjects bargain with the same anonymous counterpart for the entire 15-round experiment. The players bargain over the variable X, and Player A (B) has a payoff table that shows cash payoffs per round are decreasing (increasing) in the level of X. Players are only aware of their own payoff Table, which showed payoffs ranging from $0 to $2.50, depending on the level of X. In order to limit the possibility of a focal point at half the pie, Player A was given a suggested bargaining range for X of [200,700] and a payoff tables based on the payoff function $P_A(\$)=1.00+(500-x)(.005)$. Similarly, Player B was suggested a range of [300,800], and a payoff based on the function $P_B(\$)=1.00+(x-500)(.005)$. So, the "pie" is actually $2.00 per round and would be split at X=500, though this was not the center of either Player's suggested bargaining range.[13]

This use of asymmetric bargaining ranges is meant to simulate incomplete information concerning your counterpart's bargaining range. Though there may be a concern that this experimental design feature creates asymmetric information that may be confused with the effects of asymmetric beliefs, it should be noted that this detail remains constant across all rounds and all treatments. Therefore, while it may contribute to higher overall dispute rates, which are accounted for in the data estimation procedure as a pair-specific effects, it should not be a cause of differences across experimental treatments.

Players participated in three distinct experimental treatments of 5 rounds each, which was unknown to the subjects, a priori. Each bargaining round is two minutes in length. If subjects reach the end of the round without having mutually agreed on a value of X, they are prompted to submit their "final offers", x_A and x_B, for X. If final offers converge or criss-cross (i.e., $x_A \geq x_B$) then the value of X for the round is the average of the final offers—a last-minute settlement. If final offers fail to converge—what I will

[13] Player payoffs were not truncated at zero in the experimental application either. For example, if Player A agreed to a Player B proposal of X=800, then Player A's earnings for the round would be negative, though negative earnings occur in less than 2% of the data.

refer to as disagreement or dispute—then the dispute settlement process differs by treatment. In the no arbitration (NA) treatment, subjects both earn a zero payoff in the event of dispute. In the other two treatments, a computerized random number generator determines the value of X for the round. The random X selection process is used to simulate the uncertainty surrounding the payoff outcome is dispute occurs, which may simulate the uncertainty of arbitration, litigation, continued dispute, termination of the bargaining relationship, etc. I refer to these two treatments as CA treatments (CA for Conventional Arbitration), and it is clear that the "cost" of these dispute settlement procedures is an uncertainty cost as opposed to the certain monetary cost of the NA treatment (see Stevens, 1966, for a useful discussion of this important distinction).

The two CA treatments differ with respect to the variance of the underlying normal distribution used to generate the settlement X-values in the event of disagreement. In CA(30), the impasse outcome distribution has mean of x=500 and standard deviation equal to 30. The other treatment, CA(120) has the same mean but standard deviation of 120. So, the settlement outcome is much more uncertain in CA(120) than in CA(30), but in NA there is certainty that the entire pie is destroyed at impasse. In both CA treatments, the instructions include a table showing 100 draws from the exact CA distribution that would be used in the event of impasse to determine payoffs. This approach is used in Ashenfelter et al, (1992) as an information provision procedure that most likely mirrors the way in which bargainers gather information in the field (e.g., from seeing a history of previous arbitration decisions or court rulings). Importantly, this procedure also leaves ample room for subjects to form divergent beliefs about the likely outcomes from impasse (as noted in Dickinson, 2004). Subject always participate in the

NA treatment from rounds 6-10, but whether CA(30) or CA(120) occur in the initial rounds 1-5 varies across subject groups. All subject pairs play all five rounds of each treatment consecutively prior to new instructions appearing on the screen to inform them of the treatment changes.

Beliefs are elicited prior to each round of bargaining in both CA treatments. Subjects are prompted on-screen to input their belief or expectation about the average outcome they feel they would get if the dispute settlement procedure were used. It is made clear that their response does not imply that they will have to use the dispute settlement procedure; voluntary settlement is always allowed at any point during the bargaining round or at the final offer stage if $x_B \geq x_A$. Subjects are given a small financial incentive to provide unbiased responses. One round is randomly selected at the end of the experiment, and a subject belief response in the selected round is rewarded with a $2 payoff if it is accurate—within 10 units of x above or below the true average of the dispute settlement distribution (i.e., a belief response in the interval [490,510]). The use of a randomly selected belief at the *end* of the experiment is also meant to minimize any potential wealth effect of the belief elicitation procedure on bargaining outcomes.

4. Results

Sixty-three pairs of bargainers who engaged in the 15-round experiment described above. The experiment was finished within an hour, and the average subject payoff was $13.50. Figures 1-3 plot out the cumulative distribution functions (CDFs) of subject risk preferences and beliefs. In Figure 1, the CDFs of risky choices, which proxy for subject risk preferences, are plotted against the CDF that would result from risk neutral subject choice (i.e., the risk-neutral subject would choose exactly six risky choices in the Holt and Laury (2002) lottery choice experiment). One can test for differences in the buyer versus seller CDF using the Smirnov test for two-sample differences, which assumes that the distributions are independent. One fails to reject the null hypothesis of no difference in the buyer and seller CDFs ($p>.10$ for the two-sided test), but one rejects the null hypothesis that each of these CDFs is equal to the risk-neutral benchmark CDF ($p=.10$ in each case for the one-sided test against the alternative hypothesis that the risk neutral CDF lies below the buyer or seller CDF). However, the *median* buyer and seller are both risk-neutral. Though we do find evidence of risk aversion, on average, the sample subjects are not highly risk-averse.[14] Also, there is no statistically significant difference in the risk preferences of buyers and sellers.

Figures 2 and 3 show the belief-CDFs for buyers and sellers in the low-variance treatment, CA(30), (Figure 2) versus the high variance treatment (Figure 3). The unit of observation in these figures is a subject's average belief over the five treatment rounds. Similar figures result from utilizing each individual belief as the unit of observation, but averaging over the five treatment rounds creates sixty-three independent blocks of observations for each subject. This allows appropriate use of the Smirnov full-sample test to examine subject's beliefs. In the low-variance treatment one fails to reject the hypothesis that buyers have unbiased beliefs ($p>.10$)—this is tested against the unbiased benchmark that a subject would expect $x=500$ in each case). However, using a binomial test for the number of instances where beliefs are optimistic versus unbiased or pessimistic, one rejects the null hypothesis in favor of the alternative hypothesis that

[14] The average subject risk aversion parameter, r, in Holt and Laury (2002) is in the $r=.3$ to $r=.5$ range. Average risk aversion parameters in this experiment are buyer $r=.23$ and seller $r=.12$. Our subjects are still estimated to be risk-averse, although somewhat less so than the subjects in Holt and Laury.

buyers are optimistic (p=.05). For sellers, the Smirnov test rejects the null hypothesis of unbiased beliefs in the low-variance treatment in favor of the alternative hypothesis of seller optimism (p=.01), as does the binomial test (p=.10). One fails to reject the null hypothesis that buyer and seller beliefs are different using the Smirnov test in the CA(30) treatment (P>.30), thus indicating that pairwise optimism is not statistically significant in the low variance treatment.

In the high-variance treatment, CA(120), one rejects the null hypothesis of unbiased beliefs against the alternative of optimism for sellers but not for buyers using the Smirnov test (p>.10 for buyers, p=.01 for sellers). However, with the binomial test one finds support favoring the alternative hypothesis of optimism for both buyers and sellers (p=.01 in both cases). Using the Smirnov test, sellers and buyer beliefs are significantly divergent (p=.01) in the CA(120) treatment—this indicates significant pairwise optimism in the high variance treatment.

In short, optimism is present in the data, and the nonparametric tests (as well as the pattern of the CDSs in Figures 2 and 3) indicate that subjects are more optimistic in the CA(120) treatment than in the CA(30). The summary data show that the average buyer belief of the likely impasse outcome in CA(30) is x=483, but in CA(120) it is x=467. For the sellers, the average belief is an impasse outcome of x=518 in CA(30) and x=537 in CA(120). As a whole, the data are supportive of the hypothesis that bargainers are not only optimistic, but that their optimism is greater when the decision environment is more uncertain.

4.1 Dispute Rates

Average dispute rates across all bargaining pairs for each treatment are NA (18%), CA(30) (57.7%), and CA(120) (61%). If one calculates average dispute rates for a bargaining pair in each five-round treatment, then one can examine treatment effects as a matched pairs sample with N=63 independent observations. The matched pairs (signed rank) test rejects the null hypothesis of equal average dispute rates in comparing the NA treatment to the CA(30) ($p<.01$) and CA(120) ($p<.01$) treatments in favor of the alternative hypothesis that disputes are significantly higher in the arbitration treatments. Though average dispute rates are higher in CA(120) than CA(30), one fails to reject to null hypothesis of equal average dispute rates when comparing CA(120) to CA(30) ($p=.21$). A more thorough econometric analysis is needed in order to disentangle the effects of treatment, beliefs, and risk preferences from the data.

The data set includes a total of 945 observations when considering each round of bargaining by each subject-pair. Of course, since these bargaining pairs are fixed for the entire 15-round experiment, the data across rounds are likely to not be independent of one another. In order to take this into account, all of the estimated models use a random effects specification to deal with pair-specific heterogeneity and correlation of error terms across rounds by a given bargaining pair. In addition, history variables that describe the experience and dispute history of the pair in the experiment are included.[15]

Table 1 shows estimates of a random-effects probit model. Dispute is coded as equal to one if the bargaining pair utilizes the dispute settlement procedure at the end of

[15] In addition, each model was estimated using a cluster-correction for the covariance matrix (clustered around each bargaining pair), without random effects. Of course, the cluster correction assumes a consistent estimate of the coefficient vector, $\hat{\beta}$, and so it was considered most important to gather consistent estimates of $\hat{\beta}$. In any event, *none* of the main results shown in this paper are sensitive to the alternative estimation procedure. These results are available from the author on request.

the round (NA or CA). Recall that if the round ends with no agreement but the subjects' final offers criss-cross (i.e., $x_A \geq x_B$), then this is coded as Dispute equal to zero—a last-chance settlement is achieved. Model #1 is a simple treatment effects model—NA is the omitted reference treatment—with additional experience variables *Round*=1-15 and *Dispute History*=1-14. *Round* captures the potential effect of general experiment bargaining experience or learning, while *Dispute History* measure the distinct effect of bad history as proxied by the number of previous rounds of dispute in which the bargaining pair has engaged.

The estimated marginal effects in Model #1 indicate that bargaining history, *Round* and *Dispute History*, does not significantly affect dispute rates—this result is robust across all models in Table 1. In Model #1 disputes are significantly more likely in either of the CA treatments compared to NA, which replicates results from previous experimental research (e.g., Ashenfelter et al., 1992; Bolton and Katok, 1998; Dickinson, 2004) and from field data results comparing dispute rates when arbitration is used to those when labor strikes are used—strikes are comparable to the high cost of dispute in the NA treatment (see Currie and McConnell, 1991). The marginal increase in dispute rates over the NA treatment is significantly higher in CA(120) than in CA(30) (p=.05 for the Wald test of the linear coefficient restriction on the two treatment variables). Unlike the results in Ashenfelter et al., (1992), I find evidence that disputes are *more* likely when outcome uncertainty is higher. Significantly, this is *opposite* the conventional wisdom articulated in Stevens (1966) and modeled in Farber and Katz (1979), where arguments are made in favor of higher outcome uncertainty in order to promote more voluntary settlements due to risk aversion.

Model #2 and #3 results in Table 2 attempt to shed more light on the potentially counterintuitive result in Model #1. Specifically, Model #2 adds a control for pairwise beliefs (seller minus buyer expectation of likely x-outcome at impasse)[16], and Model #3 then adds additional controls for bargainer risk preference by utilizing the subject's risk aversion parameter and risk aversion parameter interacted with the high variance CA(120) treatment based on the comparative static predictions from the Farber and Katz (1979) framework. The results from Models #2 and #3 indicate that beliefs (i.e., *Expectations Difference*) significantly alter the likelihood of dispute, but risk preferences do not. A bargaining pair that is optimistic (*Expectations Difference*>0) significantly increases the likelihood of dispute, and this effect is robust to the addition of risk preference controls in Model #3.

Though the magnitude of the marginal effects on CA(30) and CA(120) do not differ much across Models 1-3, the slight improvement in the fit of the model is enough to eliminate the significance in the estimated differences of the two CA treatments, ceteris paribus. In other words, once controls are added for beliefs and risk preferences, there is no statistically significant difference in the likelihood of dispute in CA(30) versus CA(120). This is precisely what one would predict given that the two CA treatments present the bargainers with a mean preserving spread for the uncertain impasse outcome distributions. The risk preference and belief variables in Model #3 imply that the pure treatment effects are those for a risk-neutral and unbiased bargaining pair, which theoretically should not differ in dispute likelihood across *any* two CA treatments with identical average settlement outcomes.

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[16] This particular coding of beliefs implies that beliefs are identical in the NA treatment, where beliefs were not elicited. *Expectations Difference* is coded as equal to zero for all rounds of the NA treatment where the impasse outcome is known with certainty to be zero payoffs.

4.2 Final Bargaining Positions and Settlement Outcomes

Though dispute rates are the most commonly used measure of a dispute settlement procedure's success, final bargaining positions are of significance as well. I do not formally incorporate final offer effects into the theoretical framework or experimental design, but final bargaining positions at impasse—perhaps a measure of the aggressiveness of the bargainer—are still useful in examining how close the pair was to agreement.

The results in Table 2 show random effects GLS estimates of a buyer and seller final bargaining position model. The dependent variable in this case, *Final Bargaining Position*, is coded as follows: when the round ends in dispute, *Final Bargaining Position* is equal to the subject's submitted final offer. When the round ends in voluntary settlement, *Final Bargaining Position* is equal to the settlement x-value. I therefore utilize the entire sample of treatment rounds (63 pairs times 15 rounds—N=945) in estimating the separate models for buyers and sellers. All independent variables are as described before with the exception of *Expectations* in the NA treatment. The dispute rate probit model codes the pair's expectation *difference* as zero in NA, it is not appropriate to code individual expectations as zero in NA. While the pair has identical expectations that payoffs at impasse in NA are zero for both, a zero payoff maps to a different x-outcome for buyers and sellers. Expectations are meant to elicit what x-value (*not* what payoff level) the bargainer feels she is likely to get from the dispute resolution mechanism). So, because buyer payoffs are zero at x=700, then buyer expectations are coded as equal to 700 in the NA treatment. Similarly, seller expectations are coded as equal to 300 in NA.

The results from Table 2 indicate that the main hypothesis are (weakly) confirmed. The *Expectations* variables indicate that final offers are significantly positively related to beliefs of the likely impasse outcome in the CA treatments. That is, optimism, which implies a higher (lower) belief for the seller (buyer) causes final bargaining positions to diverge. Risk preference has a statistically significant effect only in the seller equation, though in the direction predicted by theory. A more risk-averse seller lowers his final bargaining position by about 20 x-units, which is in the direction that harms the seller's monetary payoff. Only in the buyer equation is *Dispute History* significant, indicating the buyers moderate their final offers the more they are previously disputed.

Because the results in Table 2 include both voluntary settlement as well as disputed bargaining rounds, some of the Table 1 results are responsible for a portion of the Table 2 results. For example, if optimism significantly reduces the likelihood of voluntary settlement (Table 1), then it reduces the number of cases where *Final Bargaining Position* will be coded as the voluntary settlement x-value versus being coded as the impasse final offer (Table 2).[17] An alternative examination is therefore included in Table 3, which shows estimates of a model of voluntarily-negotiated settlements in the sub-sample of rounds ending in agreement (N=515). Due to the possibility of sample selection bias, I report both results from a sample-selection corrected procedure as well as from a random effects model on the subsample of data.

[17] Utilizing only the selected sample of dispute=1 outcomes does not alter the result that optimism causes final bargaining position divergence (whether or not we correct for sample selection. The two-stage sample-selection term is statistically insignificant). Depending on whether we correct for sample-selection or not, the risk aversion results do change. They disappear in the case where we correct for sample selection (although the sample selection lambda term is insignificant in the second-stage regression) and, when we do not correct for sample selection, the results estimate that risk-averse *buyers* (not sellers) moderate their final offers. These results are available on request.

As predicted by theory, settlements outcomes are positively related to the bargaining pair's average beliefs, though not significantly so in the random effects (non-sample-selection corrected) model. Also, risk aversion significantly worsens the settlement outcome for the seller. There is no significant difference in estimated settlement values in the distinct CA treatments, which is what one would predict once having controlled for beliefs and risk preferences. Though there is some significance of statistical and economic importance in the Table 2 and 3 results, it is also clear that the models do not explain much of the data variation overall.

In sum, the analysis indicates that optimism significantly increases the likelihood of dispute, it causes final bargaining positions to diverge, and it seems to influence settlement outcomes. The effects of risk preferences are not as conclusive or as strong as the estimated belief-effects. However, when the risk-preference effects are significant, they are in the direction predicted by theory. Risk aversion does not significantly influence dispute rates, but there is some evidence that it weakens one's final bargaining position and harms one's settlement outcome.

5. Structure versus unstructured bargaining

Much of the experimental bargaining literature has focused on more structure games than considered above. For example, the much-analyzed ultimatum game (Guth et al, 1982) is highly structured. In this game, one subject makes an offer, and this offer is either accepted or rejected—end of game. Rejection yields a zero payoff for both parties, while acceptance implies the pie is divided as proposed. The NA treatment of the bargaining experiment of the present paper can be considered a somewhat unstructured version of the ultimatum game. Both sides can make multiple proposals (or none), and payoffs are zero if neither bargainer accepts a proposal from the counterpart (i.e., assuming the final offers are counted among them). Because so much of the literature has focused highly structured bargaining games relative to the present experiments, I next discuss some additional experiments that were run using an ultimatum game structure.

Fifty-two bargain pairs participated in a structured experiment that consisted of the stage-one lottery choice experiment, and a stage two ultimatum game experiment. In the stage-two experiment, subjects were randomly assigned as Player A or Player B and anonymously matched with another subject playing the other role. Player A (the proposer) had to make a proposal to divide a \$20 pie with Player B under two different scenarios, and under those same two scenarios Player B must make an ex ante accept/reject decision on all possible divisions of the \$20 pie (in increments of \$.50). In scenario #1, if player B rejects Player A's offer, then both players receive a zero payoff. However, in scenario #2, if the offer is rejected, then the division of the \$20 is determined by a "random selection device". This device, unbeknownst to the subjects, was the role of a 20-sided die (i.e., a uniform distribution). Subjects were given information on the likely divisions of the pie by being shown a table of 100 previous draws from the same random selection device.

Subject beliefs are elicited as in the unstructured bargaining experiment, and subjects are informed that once decisions are made, one of the scenarios will be randomly chosen for binding payment. In the event that scenario #2 was chosen as the binding scenario, then the Player A offer is compared with the Player B response and, if the Player B choice was to reject such an offer made by the Player A with whom she was matched, then the random selection device was used. The lottery choice experiment was consummated and subjects were compensated for accuracy of belief at the end of the one-round experiment, as in the unstructured experiment.

Curiously the results of the structured ultimatum experiment are quite different from those in the unstructured bargaining experiment. The summary results are shown in Figures 4 and 5, which show the results for the Players A (proposer) and Players B (responders) in the standard ultimatum game and the one including a random decision process (RDP) in the event of impasse.[18] The average proposal is \$7.91 (40%) of the pie in the standard ultimatum game with zero payoffs at impasse, and \$7.81 (39%) of the pie in the ultimatum with RDP treatment. There is no statistically significant difference in mean proposals (paired two-sample t-test, p=.80). Players B indicated that, on average, offers at or below \$6.09 (30%) of the pie would be rejected, but this average rejection point significantly rises to \$7.43 (37%) with the RDP (p=.01). The standard ultimatum results are comparable to those in the extant literature. Players A and B are both risk-averse on average with risk-aversion parameter of .28 and .41, respectively, using the Holt and Laury (2002) lottery choice method.

Beliefs, however, are unbiased for both Players A and Players B, with average belief of a RDP payout of \$10 and \$10.32, respectively (P>.10). Though there was variation in beliefs across the subjects, beliefs were not a significant predictor of proposals or rejection points. Only for Players B was risk aversion determined to significantly lower the subjects rejection point, consistent with theory. These results are from OLS regressions (available on request), but they do not explain much of the data variation. Perhaps most interestingly, while these structured experiments still some

[18] One Player A and two Players B were removed from the data for analysis due to subject confusion over the experimental procedures (e.g., one subject wrote "confused" on the decision sheet).

evidence that risk aversion harms one's bargaining position when impasse outcomes are uncertain, optimism about the likely impasse outcome is not present in the structured ultimatum experiment.[19]

It is possible that the lack of optimism in the ultimatum-RDP experiment is due to the use of a uniform, rather than normal, settlement distribution. Another possibility is that these results indicate that the optimism present in the unstructured bargaining experiment may, in part, be due to the asymmetric in the subjects' suggested bargaining ranges—this asymmetry is not present in the structured ultimatum games. Recall that the midpoint of the suggested bargaining range for the Buyers (Sellers) is x=450 (x=550). If subject beliefs are anchored to their bargaining range, then this apparently affects the subject's reference point for bargaining in an important way. Specifically, it may be generating some of the optimism in the data. The experiment was not designed with this in mind, but the author finds nothing to indicate that symmetric bargaining ranges are the norm in naturally occurring negotiations. However, optimism is more serious in CA(120) than CA(30), even though suggested bargaining ranges remain unchanged. At most, anchoring to bargaining ranges is only a partial explanation for the optimism in the unstructured experiment, but it does highlight a potentially significant limitation in applying results from many structured bargaining experiments to naturally occurring bargain environments.

6. Conclusion

Risk preferences and bargainer beliefs are two of the most commonly considered factors affecting bargainer behavior. Empirical studies have typically examined one or

[19] It is still possible that Players A are optimistic as to the minimal offer that would be accepted. I do not explore this type of optimism in the data.

the other in evaluating bargaining outcomes. This is significant given that there is an identification problem inherent in evaluating outcomes from many bargaining environments with uncertain impasse outcomes. For example, given that the effects of optimism are shown to counteract some of the predicted effects of risk aversion, the outcomes from risk-averse yet optimistic bargainers may be empirically indistinguishable from outcomes generated by risk-neutral and unbiased bargainers (or risk-loving yet pessimistic bargainers). This problem has been recognized in the dual-theory literature (Yaari, 1987) and the literature on rank-dependent utility models (Chateauneuf and Cohen,; 1994; Wakker, 1994).

This paper presents results from an experiment designed to examine the relative contribution of beliefs and risk preferences in bargaining outcomes. Subjects participate in a two-stage experiment. Stage one is the lottery choice experiment of Holt and Laury (2002), utilized to generate a relatively rich measure of risk preferences for each subject. The second-stage experiment is the bargaining experiment that matched subjects in a zero-sum bargaining game for a series of rounds with different degrees of uncertainty surrounding the impasse or disagreement outcome. In the CA treatments, a random number generation process determines the outcome at impasse, and subject beliefs are elicited at the beginning of each CA round. Thus, data on naturally occurring subject beliefs and risk preferences are generated in order to properly identify their individual contributions to bargaining outcomes.

The results are consistent with the prevailing wisdom that the average subject is risk-averse, yet optimistic about the likely outcome from bargaining impasse. This, in and of itself, implies that an unbiased estimate of the effect of risk aversion or optimism on bargaining outcomes may be difficult to acquire without controlling for both in the data analysis. The resultant analysis shows that optimism significantly increases the likelihood of dispute, significantly increases the divergence of final bargaining positions, and significantly alters voluntary settlements (in the direction favoring the more optimistic bargainer). The effects of risk aversion are not as ubiquitous, though when present they are in the direction predicted by theory. Risk aversion does not significantly affect dispute rates, though it does significantly moderate the final bargaining position of the sellers. As a result, the voluntary settlement outcomes are biased in favor of the less risk-averse bargainer (i.e., the buyers). Results from a second experiment using the structure ultimatum game show that some portion of the optimism in the unstructured bargaining experiment may be due to asymmetric bargaining ranges for the subjects—a problem that is likely present in naturally occurring negotiations.

The importance of these results is highlighted by the potential for drawing false inference from the data. Had these (unstructured) bargaining experiments not measured risk preferences or beliefs, the results would appear consistent with the hypothesis that subjects are risk-loving. However, the experimental design allows us to identify that subjects are risk-averse yet optimistic. The result that the effects of optimism are estimated to dominate those of risk aversion has significant implications in terms of optimal dispute settlement design. While outcome uncertainty has been considered a useful way to promote voluntary settlement (Stevens, 1966), outcome uncertainty is shown to foster the growth of optimism—optimism is worse in CA(30) than CA(120). The design of dispute settlement institutions aimed at promoting voluntary settlement might be improved by limiting outcome uncertainty in order to limit the potential for optimism to influence bargaining outcomes. This is contrary to what has previously been argued in the literature, but it results from the fact that optimism may harm the likelihood of voluntary settlement more than the typical level of risk aversion helps. A reduction in optimism would also increase convergence of final bargaining positions, which may help increase the quality of bargaining relationships even when agreement is not yet reached.

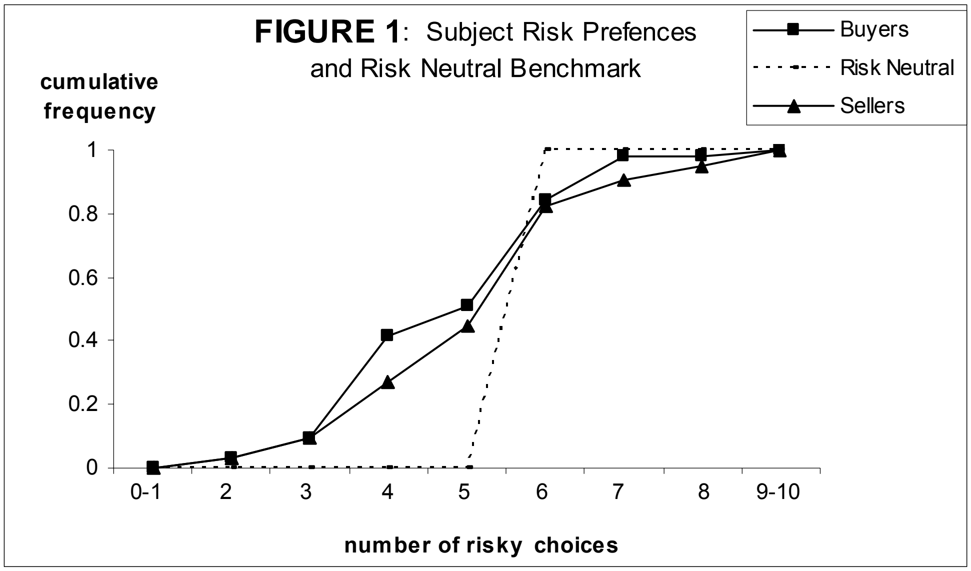

FIGURE 1: Subject Risk Prefences and Risk Neutral Benchmark
Buyers
Risk Neutral
Sellers
cumulative frequency
1
0.8
0.6
0.4
0.2
0
0-1
2
3
4
5
6
7
8
9-10
number of risky choices

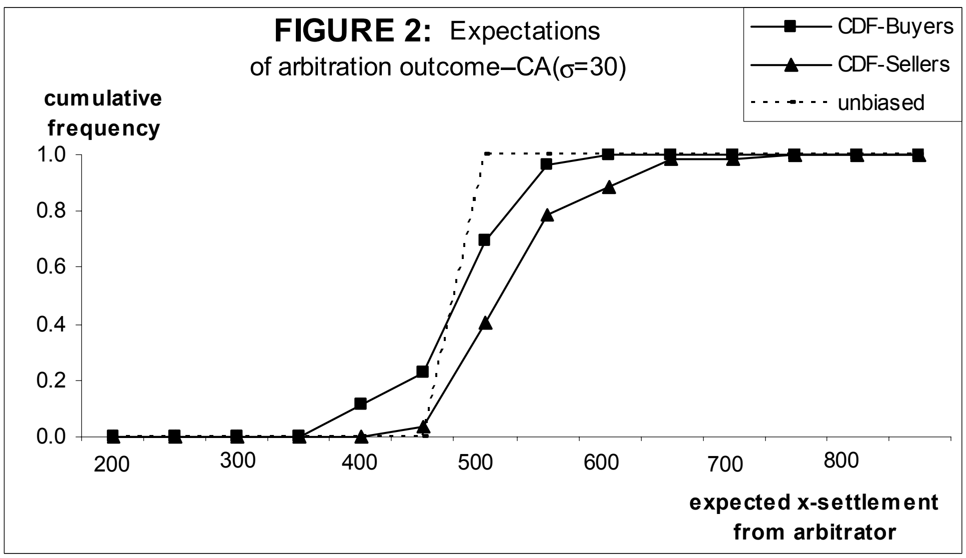

FIGURE 2: Expectations of arbitration outcome–CA(σ=30)
CDF-Buyers
CDF-Sellers
unbiased
cumulative frequency
1.0
0.8
0.6
0.4
0.2
0.0
200
300
400
500
600
700
800
expected x-settlement from arbitrator

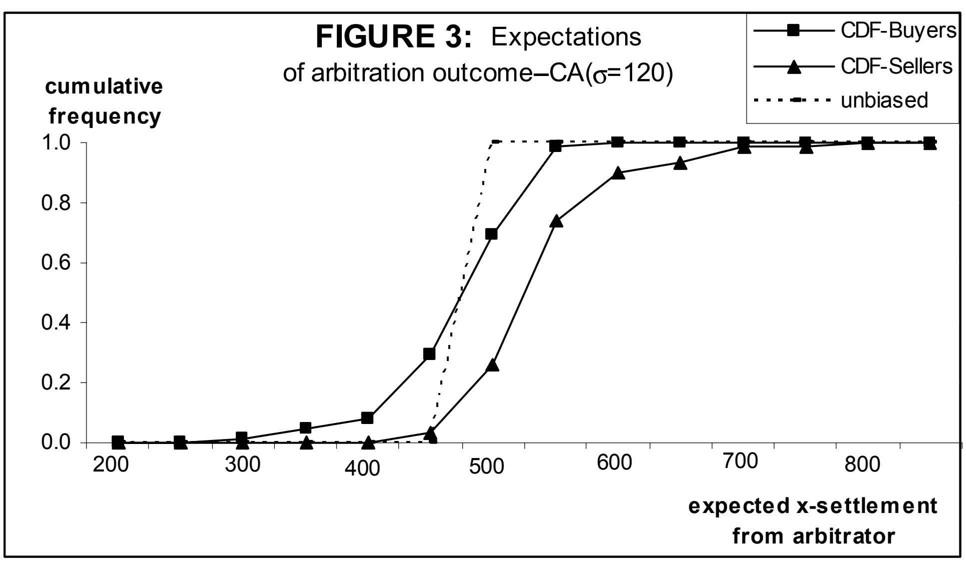

FIGURE 3: Expectations of arbitration outcome–CA(σ=120)
CDF-Buyers
CDF-Sellers
unbiased
cumulative frequency
1.0
0.8
0.6
0.4
0.2
0.0
200
300
400
500
600
700
800
expected x-settlement from arbitrator

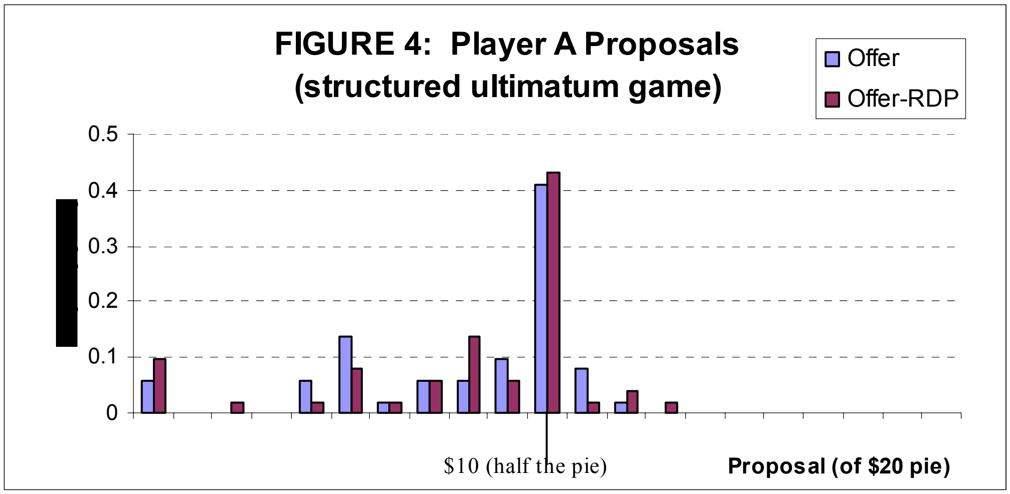

FIGURE 4: Player A Proposals (structured ultimatum game)

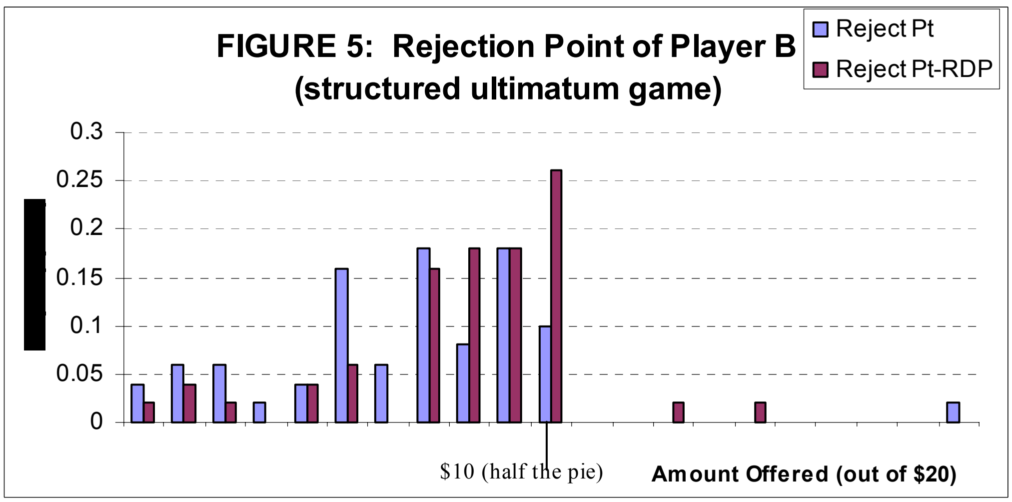

FIGURE 5: Rejection Point of Player B (structured ultimatum game)

Table 1 DISPUTE RATE MODELS Dependent variable=Dispute (random-effects probit estimates) *N=945*			
	MODEL #1	**MODEL #2**	**MODEL #3**
Independent Variable	**Marginal effect (st. error)**	**Marginal effect (st. error)**	**Marginal effect (st. error)**
Constant	-.30 (.04)***	-.30 (.04***	-.28 (.05)***
CA(30)	.41 (.04)***	.39 (.04)***	.39 (.05)***
CA(120)	.47 (.04)***	.45 (.04)***	.44 (.05)***
Expectations Difference	---	.0005 (.00)**	.0005 (.00)*
Buyer Risk Avers. parameter	---	---	-.10 (.09)
Seller Risk Avers. parameter	---	---	.02 (.08)
Buyer Risk par.*Arb(σ=120)	---	---	.07 (.08)
Seller Risk par.*Arb(σ=120)	---	---	-.04 (.07)
Round	-.003 (.01)	-.004 (.01)	-.004 (.01)
Dispute History	-.01 (.02)	-.008 (.03)	-.009 (.03)
χ^2(model)	14.63***	13.31***	12.90***
Wald test($\beta_{(\sigma=30)}=\beta_{(\sigma=120)}$)--$\chi^2$	5.26**	3.82**	1.97
% correctly predicted	66%	65%	66%
Likelihood ration index (McFadden, 1974)	.099	.111	.112

*,**,*** represent significance at the .10, .05, or .01 level, respectively, for the two-tailed test

Table 2 FINAL BARGAINING POSITION EQUATIONS Dependent variable=Final Bargaining Position (Random effects specification) *N=945*		
	Buyer Equation	**Seller Equation**
Independent Variable	**Coeff. (st. error)**	**Coef. (st. error)**
Constant	327.64 (35.40)***	456.77 (16.90)***
CA(30)	28.30 (12.63)**	-17.30 (12.63)
CA(120)	25.49 (13.10)**	.71 (13.06)
Expectations (beliefs)	.22 (.05)***	.15 (.05)***
Risk Aversion parameter	5.24 (13.06)	-20.10 (11.60)*
Risk parameter*Arb(σ=120)	-12.97 (12.45)	11.99 (10.71)
Round	-1.23 (.96)	-.34 (.97)
Dispute History	6.18 (1.91)***	1.43 (1.95)*
Model test $F[7, 937]$	8.19***	9.68***
Adjusted R^2	.05	.06

*,**,*** represent significance at the .10, .05, or .01 level, respectively, for the two-tailed test

Table 3 **X-VALUE MODELS** **Dependent variable=Agreement X-Value** ***Subsample of voluntary agreements (N=515)***		
Independent Variable	**Two-Stage Heckit** **Coefficient (st. error)**	**Random effects model** **Coefficient (st. error)**
Constant	383.59 (58.31)***	409.46 (58.29)***
CA(30)	10.15 (36.66)	2.34 (8.65)
CA(120)	12.66 (43.46)	6.70 (11.01)
Average Belief (of bargaining pair)	.22 (.11)**	.16 (.11)
Buyer Risk Aversion parameter	-14.66 (13.14)	-8.53 (14.02)
Seller Risk Aversion parameter	-25.69 (9.07)***	-25.21 (12.07)**
Buyer Risk parameter*Arb(σ=120)	-17.92 (22.85)	-19.41 (21.24)
Seller Risk parameter*Arb(σ=120)	-14.68 (21.10)	-7.86 (19.53)
Round	.50 (1.28)	.39 (1.20)
Dispute History	2.19 (2.10)	2.22 (2.54)
Lamba (sample selection term)	-7.07 (53.85)	---
Model test (F-stat)	2.53***	2.79***
Adjusted R^2	.03	.03

*,**,*** represent significance at the .10, .05, or .01 level, respectively, for the two-tailed test

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TEXT OF EXPERIMENTAL INSTRUCTIONS (SHOWN ON SCREEN IN LAB).
Samples of screen-shots included in instructions can be viewed at
http://www.appstate.edu/~dickinsondl/instructions.html

General Instructions: Player A (Player B)

This is an experiment in decision-making. Please read the following instructions carefully. The amount of money that you earn in this experiment will depend, in part, on your decisions as well as the decisions of the person with whom you will be randomly matched.

You have been randomly assigned as a Player A (Player B) in this experiment. You and a randomly chosen counterpart will be given a fixed amount of time in a decision-making round to mutually agree upon the size of a variable, X.

[two-minute time limit announced by experimenter]

Your range of possible X values lies from 200 to 700 (300 to 800) in increments of one (this may not be the same range as that for your counterpart). The value of X at the end of the round will determine your cash earnings for that round. As a Player A (Player B), your cash earnings for any given round are largest (smallest) for smaller values of X. Similarly, your cash earnings for any given round are smallest (largest) for larger values of X. You will be given a payoff sheet that translates the different values of X into earnings in cents. (Player B earns more for larger values of X). Please study this payoff sheet carefully so that you fully understand how your earnings will vary given the different possible values of X.

[payoff sheets handed out by experimenter]

If you and your counterpart can mutually agree upon the size of X for that round, then you can look to your payoff sheet to determine how much you will receive for that round. In a few moments we will discuss what will happen should you and your counterpart not be able to come to an agreement by the end of the allotted time.

Your interaction with your counterpart will only be through the computer terminal. You will never know the identity of your counterpart and your counterpart will never know your identity. You are matched with the same counterpart for the entire experiment.

The next screen will show you the environment in which you will interact with your counterpart. If at any point during the instructions you have a question, please raise your hand so the experimenter can help you.

In your interactions with your counterpart, you will submit your proposal for the size of X on this screen

[sample screen picture]

To enter a proposal for X, click on the "New Offer" box, enter a proposal for X and then hit "Offer". Note: The sample screens are based on player A's point of view.

At this point, Player B will see Player A's current proposal and may or may not accept it. Player B can similarly make proposals that Player A sees in the counterpart's box at the right of the screen. Suppose that Player B wishes to propose X=600 rather than accept Player A's current offer.

[sample screen of offer]

In this example, Player B's proposal is seen to be X=600. This is listed as his/her current offer. Player A may accept the current offer at any time by clicking the "Agree" button.

If you accept the current offer of your counterpart, the round would be over. You may, however, choose to not accept the current offer. You can update your current offer by increasing or decreasing it, and your counterpart can also update his/her offer. After updating an offer, it will be reflected in your offer box. Only current offers (offers at the top of the list) can be accepted. Even though offers can be updated at any time, it may be wise to give the other Player a few moments to either accept your offer or update his/her offer.

Suppose that you did not accept the proposed offer and you enter another offer.

[sample screen of a new offer]

At this point, your counterpart will see your current proposal for 349 [in this example] as well as all previous proposals for this round. However, only X=349 will be listed as the current offer. As such, your counterpart may now choose to either accept your proposal or update his/her proposal. Let's suppose that your counterpart choose to accept your proposal at this point.

[sample screen of offer acceptance]

Your counterpart has accepted your offer, and so X=349 for that round. Once the round is over, either another round of similar interactions will occur, or instructions will follow to indicate the differences in the subsequent round(s). You will be asked to indicate when you are ready to continue with the experiment.

The computer will keep track of your cumulative experimental earnings and post them on your main computer screen. You will also have a timer on the screen to let you know how much time is left in a particular round. Please take a moment to locate these information items on your screen once bargaining begins.

The next several screens will inform you as to what will happen should you not come to an agreement within the time limit.

<u>Treatment Instructions: NA</u>

For the next several rounds, there will be a particular procedure used to deal with the possibility that you and your counterpart may not reach an agreement by the end of the round. Should you reach the end of the round without having mutually agreed upon a value of X, you will both receive $0 for that round. This does not affect any of your previous earnings, nor does it apply to future earnings (future rounds of the experiment).

It is important for you to understand this rule. The screen below shows you what you would see if the round were to end in this scenario.

[sample screen of round ending without agreement]

This procedure of dealing with no agreement at the end of the round will continue until you are otherwise notified. When you have finished the last round of this procedure, you will be notified through the instruction boxes on your computer screen. If you have any questions before starting this set of rounds, please raise your hand now. Otherwise, click below to start.

Treatment Instructions: CA

For the next several rounds, there will be a particular procedure used to deal with the possibility that you and your counterpart may not reach an agreement by the end of the round. Should you reach the end of the round without having mutually agreed upon a value of X, the computer will generate a value of X for you. Some values of X are more likely to be chosen than others, but there is a random element to the computer's choice. Whatever value of X the computer randomly generates, that will be the value of X used to determine both your and your counterpart's payoffs for that round. To give you some information about this random number generation procedure, the next screen will show you the last 100 values of X generated by the exact same method that will be used in your case (should you not reach an agreement prior to the end of the round).

These are the last 100 values of X randomly generate by the computer (The order in which they are shown is irrelevant). This should be used to give you an idea of more likely and less likely values of X.

[sample 10x10 table of 100 X-values drawn from appropriate distribution (no decimals)]

If you have not reached an agreement by the end of the round, the same random number generation procedure that generated these 100 values of X will be used to determine your value of X for that round. If you have any questions before starting this set of rounds, please raise your hand. Otherwise, click below to start.