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BARGAINING WITH ASYMMETRIC DISPUTE COSTS*

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Abstract:

We conduct a bargaining experiment where the dispute resolution mechanism can be interpreted as a civil trial or conventional arbitration. The game involves a take-it-or-leave-it bargaining structure, and therefore contains an embedded ultimatum game. The sum of the dispute costs is constant, and in the baseline these costs are symmetric. A within-session treatment introduces an asymmetric distribution of dispute costs. We find that offers are roughly half way between the offer predicted by a model of narrow rationality and an offer which equally splits the surplus resulting from settlement. Based on the empirical rejection behavior, the optimal offer contains approximately 1/6 of the joint surplus from settlement. There is some evidence of higher dispute rates when the cost of a dispute are asymmetrically distributed.

Keywords: experimental bargaining, civil litigation, arbitration, fairness

JEL codes: K41, D82, C91

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1. INTRODUCTION

The large literature on ultimatum game bargaining has demonstrated the potential importance of fairness in determining bargaining outcomes. An important unresolved question concerns the specific real world contexts for which the ultimatum game results have significant predictive power. Outside of the lab, people are likely to encounter ultimatum games which are embedded in some larger bargaining context. Because these embedded ultimatum games may be framed very differently from simple ultimatum games, it is not clear the extent to which the results from the simple games will apply to embedded games. One area where this might be important is in legal bargaining, where disagreement over what constitutes a fair offer may be one cause of bargaining failure. We report on an experiment that provides insight into behavior in an embedded ultimatum game.[1]

Our experimental setting can be interpreted as highly stylized legal bargaining.[2] This bargaining includes an embedded ultimatum game played over the joint savings which are achieved in the event of a settlement. As we describe below, the player in the role of the defendant makes a single take-it-or-leave-it offer to the player in the role of the plaintiff. The offer implicitly proposes a split of the joint savings ‘pie’ giving us an ultimatum game embedded within the larger negotiation. The experimental treatment variable is a systematic variation in the distribution of the dispute costs. The total cost of a dispute is always constant. In our baseline, this cost is divided equally between the two players, while there are two treatments with asymmetric cost structures. The rational risk-neutral theory makes a very sharp prediction

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[1] More generally, it is of interest to understand how fairness manifests itself in a wide range of circumstances. For example, Fehr, Klein and Schmidt (2007) perform an experimental analysis which sheds light on how fairness manifests itself in contract design.

[2] See Sunstein (1999) for a discussion of behavioral law and economics.

on how offers change with the change in the distribution of the costs.[3] The evolution of the fair offer as a function of the distribution of dispute costs is less clear *a priori*. Fairness might be defined over the sum of the dispute costs regardless of how they are distributed, or it may be defined only over the plaintiff's costs. These two possibilities imply differing comparative statics as the distribution of dispute costs is varied.

We find that on average, the defendant offers the plaintiff just over ¼ of the joint surplus from settlement. This is about midway between the rational offer and an equal split of the surplus. The observed comparative statics are consistent with both a model of narrow rationality and a model where fairness is defined over the sum of the dispute costs. Using the observed rejection rates, we can provide a rough estimate of an optimal offer. Based on the empirical rejection behavior, the optimal offer in our experiment contains about 1/6 of the joint surplus from settlement. While the offer from the defendant exceeds the prediction of the rational model, about 63% of this deviation is an optimal response to the demand for fairness on the part of the plaintiff. On the other hand, the plaintiff is willing to accept offers which are much lower than what we have come to expect from simple ultimatum games.

In the rational model, the probability of a dispute is independent of the distribution of dispute costs. We find some evidence that the dispute rate increases when there is an asymmetric distribution of dispute costs. The bargainers appear to have some trouble in agreeing on how a fair offer evolves with the distribution of the dispute costs. Even though our calculation for the optimal offer contains a fairly small portion of the surplus from settlement, the result on dispute rates shows that we cannot overlook the role of fairness in trying to understand pretrial settlement behavior.

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[3] A taste for fairness is compatible with rationality. Here, when we refer to the rational model, we mean a model of narrow rationality in which fairness or other-regarding preferences play~~s~~ no role.

2. BACKGROUND

2.1 Ultimatum Games

In ultimatum bargaining games, two parties are to split a fixed amount of money often referred to as "the pie" (among others, see Güth et al. 1982, Thaler 1988, Slonim and Roth 1998, and Fehr and Schmidt 2000). One party has the power to make a take-it-or-leave-it offer to the other. If the offer is rejected, the entire pie is lost. For example, players *A* and *B* may be asked to split \$10, with *B* given the power to make a single offer to *A*. Player *B* can make any offer between \$0 and \$10, and if *A* rejects it, both receive nothing. A model of narrow rationality predicts that a self-serving *B* will offer *A* \$0.01 (leaving \$9.99 for himself), and that *A* will accept this as \$0.01 is better than nothing. An extensive literature has shown that player *B* offers *A* substantially more than \$0.01, with the modal offer typically containing 50% of the pie and the average offer from 40-45% of the pie. In addition, low offers are frequently rejected in the simple ultimatum game. Thus fairness considerations appears to be vitally important in determining how surplus from settlement is divided between the two parties, and differing perceptions about what is fair can be an independent cause of disputes.

2.2. An embedded ultimatum game

Consider a stylized legal bargaining situation with two players, player *A* (the plaintiff) and player *B* (the defendant).[4] Player *A* is one of two types, either A_H or A_L ("high" or "low"), which she knows but player *B* does not. Player *B* makes offer O_B to player *A*, knowing only the probabilities that *A* is type A_H or A_L. If *A* accepts *B*'s offer, then agreement occurs, and the amount O_B is transferred from *B* to *A*. If *A* rejects O_B, then a predetermined common-knowledge outcome is imposed that is a function of *A*'s type. Disputes are costly: if *A* rejects O_B, both

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[4] In the experiment, we avoided terms such as "plaintiff", "defendant" and the like.

player *A* and player *B* are charged a fixed fee (F_A and F_B, respectively). In the context of stylized legal bargaining, the dispute resolution mechanism can be interpreted as civil litigation or conventional arbitration. The model we have described is a simplified version of Bebchuk (1984).

In our experiment, the sum of *A* and *B*'s dispute costs $F_A + F_B$ is constant. If *A* and *B* can reach a settlement, they have this joint surplus to divide amongst themselves as part of the settlement. But if they disagree (so that the outcome is decided by the costly dispute resolution mechanism) then this joint surplus is a 'pie' that evaporates in the form of dispute costs. The implicit negotiation over this joint surplus from settlement can thus be thought of as an ultimatum game played over the $F_A + F_B$ pie, where the ultimatum game is embedded within a stylized legal bargaining game.[5]

Theoretically, a self-interested player *B* will make an offer that attempts to extract all of the joint surplus from settlement, and a self-interested player *A* should accept any offer that gives her at least as much as her net dispute payoff for her given type.[6] If fairness considerations are present, then *B*'s offer and/or *A*'s minimum acceptable offer would contain some non-zero portion of the joint surplus from settlement, e.g., an equal split of the $F_A + F_B$ surplus. Since our embedded game is framed very differently than the simple ultimatum game, it is unclear *a priori* the extent to which we can expect to observe fairness behaviors in this game.

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[5] While our concern in this paper is fairness, there have been a number of experiments analyzing a variety of other issues in the law and economics literature. A small sampling includes Coursey and Stanley (1988) and Main and Park (2002) who study fee shifting, Stanley and Coursey (1990) who study the Priest and Klein (1984) selection hypothesis, Pecorino and Van Boening (2004a) who study voluntary disclosure and Pecorino and Van Boening (2001) and Deck and Farmer (forthcoming) who analyze arbitration procedures.

3. THE EXPERIMENT

3.1. Overview

In this experiment, the distribution of dispute costs is changed once during the course of an experimental session. In each session, dispute costs are symmetric for half the bargaining rounds with $F_A = F_B = 75$ (or \$0.75). For the other bargaining rounds, the dispute costs are changed to one of two asymmetric distributions, one favoring player A ($F_A = 25$, $F_B = 125$) and one favoring player B ($F_A = 125$, $F_B = 25$). Note that the sum of dispute costs is constant under all three distributions at $F_A + F_B = 150$.

The experiment has two main objectives. The first is to determine how the dispute rate is affected by the distribution of dispute costs. Under a model of narrow rationality (e.g., Bebchuk 1984, Reinganum and Wilde 1986), the incidence of disputes is a function of the sum of the court costs, but not of their distribution, so the probability of a dispute is independent of the distribution of court costs.[7] However, if fairness is important in bargaining, deviating from a symmetric distribution of costs may make it more difficult for players to coordinate on a fair offer. This may, in turn, cause the dispute rate to be higher when dispute costs are asymmetrically distributed. We note that empirically, excess disputes are fairly common in an experimental setting such as this. In particular, there tend to be some disputes among A_L players even though this is not predicted in theory (Pecorino and Van Boening, 2004a).

The second objective is to gain insight into if and/or how B's offers and A's accept/reject decisions vary with the distribution of dispute costs (holding the sum of dispute costs constant). It is not immediately obvious if or how a fair offer changes as a function of the distribution of

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[6] For ease of exposition, we will consider the theoretical prediction to fully reflect A's dispute cost and not add in the extra penny we might expect to see to ensure settlement.

[7] Note that the use of conditional cost shifting, e.g., the loser at trial pays the costs of both parties, may affect the probability of a dispute in rational model; Bebchuk (1984) provides an example.

dispute costs. For example, players may define fairness as a percentage of the total joint surplus from settlement, or they may define it as a percentage of the plaintiff's cost of a dispute.[8] With regards to the former, consider the case where players define fairness as an equal percentage of the joint surplus; this is the equivalent of offering half the pie in the standard ultimatum game, which is a result commonly seen in the standard game.[9] In this "equal-split" model, player *B*'s offer always gives each party 75 of the 150 surplus, i.e., the distribution of dispute costs would have no effect on the amount of surplus in a fair offer.

However, if fairness is defined in terms of the plaintiff's costs, changing the distribution of the court costs will affect the amount of surplus contained in a fair offer. In a "save-own-cost" model, players define fairness as allowing the plaintiff (player *A*) to retain her dispute cost as her share of the joint surplus from settlement.[10] With $F_A + F_B$ a constant sum, the defendant's (player *B*'s) share of the surplus also equals his dispute cost F_B. In our baseline ($F_A = F_B = 75$), the save-own-cost offer is the same as the equal-split offer, as F_A costs constitutes half of the surplus. But in our treatment where $F_A = 25$ and $F_B = 125$, a saved-own-cost offer gives 25/150 = 1/6 of the surplus to player *A* and 5/6 to player *B*. In our second treatment ($F_A = 125$, $F_B = 25$), the save-own-cost offer reverses these surplus shares. So if a fair offer equals the amount of *A*'s dispute cost, then a change in the distribution of dispute costs will affect the amount of the total surplus in a fair offer, which is in contrast to the equal-split model. The experiment will help us determine how a fair offer will evolve with the distribution of dispute costs.

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[8] Farmer and Pecorino (2004) model a taste for fairness as a percentage of the plaintiff's court costs.

[9] For example, see Hoffman and Spitzer (1982, 1985).

[10] Consider a model where a fair offer is λ% of the plaintiff's courts costs with $0 < \lambda \leq 1$. Save-own-cost is a special case of this model with $\lambda = 1$.

3.2. Design and parameters

Table 1 summarizes the experimental design. Sessions were held at the University of Mississippi and the University of Alabama. Subjects were recruited from business classes at the respective schools. As they arrived to a session, subjects were randomly assigned to one of two rooms, with subjects in one room being player *A* and subjects in the other room player *B*. Subjects maintained the same role throughout the session, and there was no interaction between the *A* and *B* players; the authors transmitted offers and decisions between the two rooms. Each experimental session consisted of a series of rounds where *A* and *B* players were randomly and anonymously paired. Six of the eight sessions lasted 14 rounds, and two lasted 13 rounds. Player *A*'s payoff from the experiment is the sum of his payoffs from all rounds. Player *B*'s payoff from the experiment is determined by subtracting the sum of the costs from all rounds from a lump sum which is known in advance by player *B*. The amount of the lump sum is never revealed to player *A*. The average earnings per subject were about \$30 with a minimum of \$13.95 and a maximum of \$45.45.

****** Table 1 here ******

In all rounds of all sessions, the probability that player *A* is type A_L is $p(A_L) = 2/3$, and the probability that she is type A_H is $p(A_H) = 1/3$; see step 3 below. The sequence of events in a round is as follows:

1. The fees F_A and F_B that apply for the round are announced to players in both rooms.
2. Player *A* and player *B* are randomly and anonymously paired.
3. A 6-sided die is rolled for each Player *A*. A roll of 1, 2, 3 or 4 is results in outcome L and a roll of 5 or 6 results in outcome H. Thus $p(A_L) = 2/3$ and $p(A_H) = 1/3$. Player *A* observes the outcome of the die roll and player *B* does not.
4. Player *B* decides on an offer to submit to player A. This offer must be between (and including) 0 and 599.

5. Player B's offer is then communicated to player A, who decides whether or not to accept the offer. Player A's decision is then communicated to player B.
6. If player A accepts player B's offer, then the round is over for that pair.
   Players A's Payoff for the round = Player B's offer
   Player B's Cost for the round = Player B's offer.
7. If player A does not accept B's offer, player A incurs fee F_A and player B incurs fee F_B. A's payoff and B's cost for the round depend on the die roll and the fees.
   Under outcome L: Player A's Payoff for the round = $200 – F_A$
   Player B's Cost for the round = $200 + F_B$.
   Under outcome H: Player A's Payoff for the round = $400 – F_A$
   Player B's Cost for the round = $400 + F_B$.

The information about the contingent payoffs, costs and fees was public. An overhead was displayed in each room that summarized step 1 (fees), and steps 6 and 7 (contingent payoffs and costs). The overhead also included the statement "The same overhead is displayed in both rooms" to emphasize that this was common information. Subjects were not informed how many total rounds there would be or what the dispute costs would be in future rounds. Of the eight sessions, four had symmetric dispute costs in the first half of the session and asymmetric costs in the second half, and four had asymmetric costs in the first half and the symmetric costs in the second half. Thus, dispute costs were changed only once in the session. In all cases, the total cost of a dispute $F_A + F_B = 150$.

The baseline data reported below are divided by the treatment which took place in the session in which the data were generated. In what follows, the data from the Treatment 1 sessions in the top half of Table 1 are denoted B_1 for the baseline and T_1 for the treatment. The data from the Treatment 2 sessions in the bottom half of Table 1 are denoted B_2 and T_2. Under both baselines B_1 and B_2 dispute costs are equal with $F_A = 75$, $F_B = 75$; under treatment T_1, $F_A = 25$, $F_B = 125$; and under treatment T_2, $F_A = 125$, $F_B = 25$.

3.3. Predictions

The parameters of this experiment were chosen so that the strictly rational, risk neutral model predicts a sorting equilibrium for this asymmetric information bargaining game. Under the theory, a rational player *B* will attempt to extract all of the joint surplus from settlement, while a rational player *A* will only accept an offer if it that gives her at least as much as her net dispute payment. Given the game in steps 1–7 above, it is straightforward to show that with our parameter values, *B*'s expected cost is minimized with the sorting offer $O_B^R = 200 - F_A$, which exactly equals A_L's net dispute payment.[11] In this model, *A*'s net dispute payment is the minimum amount she will accept; type A_L requires $O_B^R = 200 - F_A$, to settle, while for type A_H the minimum is $400 - F_A$. Hence *B*'s optimal offer under the rational model is a sorting offer acceptable to A_L but not A_H, and we chose parameters so that the monetary incentives should be sufficient to entice player *B* to identify a sorting strategy over a pooling strategy.[12] In the sorting equilibrium, the dispute rate will be 0% when *A* is type A_L and 100% when she is type A_H. The rational model also makes the comparative static predictions that as F_A changes (a) *B*'s offer to *A* will change by the amount ΔF_A (i.e., $\Delta O_B^R = \Delta F_A$) and (b) both A_L's and A_H's minimum acceptable offer will change by the amount ΔF_A.

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[11] Player *B* has three options: make a low offer neither A_L nor A_H will accept, make a sorting offer A_L will accept but A_H will reject, or make a pooling offer both will accept. Recall that $p(A_L) = 2/3$ and $p(A_H) = 1/3$. The low offer strategy has an expected cost $(2/3)(200 + F_B) + (1/3)(400 + F_B) = 800/3 + F_B$. Any offer in the interval $200 - F_A \leq O_B < 400 - F_A$ will be accepted by A_L and rejected by A_H, so it has expected cost $(2/3)\,O_B + (1/3)(400 + F_B)$; this cost is minimized at $O_B = 200 - F_A$ and the minimum expected cost of the sorting strategy is $800/3 + (F_B - 2F_A)/3$. Any $O_B \geq 400 - F_A$ will be accepted by both A_L and A_H so the pooling strategy has a minimum cost of $400 - F_A$. The sorting offer will be optimal if $F_A + F_B < 400$, as is true with our parameters.

[12] Under the baseline parameters, the minimum expected costs of the three strategies in fn. 11 are \$3.42, \$2.42 and \$3.25, respectively. The sorting strategy dominates a low offer strategy by \$1.00 and the pooling strategy by \$0.83. A sorting strategy remains optimal as the distribution of costs changes, and the differences in expected payoffs remains \$1.00 relative to the low offer and \$0.83 relative to the pooling offer. Over 14 rounds, the optimal sorting offer will earn \$12-\$14 more than either of the other two strategies, which is forty to forty-five percent of our typical subject earnings.

Under the equal-split model of fairness, players view an equal split of the joint surplus as fair, so the offer that minimizes *B*'s expected cost equals A_L's dispute payoff plus one-half of the joint surplus from settlement. In our notation, this is $O_B^E = O_B^R + ½(F_A + F_B) = 200 – ½(F_A – F_B)$, which also equals A_L's minimum acceptable offer under this model of fairness. Analogously, A_H's minimum acceptable offer in this case is her net dispute payment plus one-half of the surplus, or $O_B^R + 200 + ½(F_A + F_B) = 400 – ½(F_A – F_B)$. Thus with our parameters, this model also predicts a sorting equilibrium whereby *B* makes an offer acceptable to A_L but unacceptable to A_H.[13] The equal-split model has the same comparative static predictions as the rational model, i.e., as F_A changes (a) $\Delta O_B^E = \Delta F_A$ and (b) both A_L's and A_H's minimum acceptable offer will change by ΔF_A.

Under the save-own-cost model of fairness, each player views her or his own dispute cost as a fair share of the joint surplus from settlement, so a fair offer contains 100% of player *A*'s dispute cost. The model predicts player *B* offers player *A* $O_B^S = O_B^R + F_A = 200$, which equals A_L's minimum acceptable offer under this model. Type A_H requires $O_B^R + 200 + F_A = 400$ to settle, so as with the previous two models, a sorting offer is again predicted. Note that the save-own-cost point predictions are the same regardless of whether $F_A = 75$, 25 or 125. Thus under this model, the comparative static predictions are that as F_A changes (a) $\Delta O_B^S = 0$ and (b) A_L's and A_H's minimum acceptable offer will not change when F_A changes.[14]

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[13] The derivations are similar to fn. 11, except that a sorting offer is \$2.00 and a pooling offer is \$4.00. The payoffs associated with a low offer, sorting offer and pooling offer under the baseline are \$3.42, \$2.92 and \$4.00, respectively. Again, a sorting strategy is optimal. As with the rational model, the equal split prediction of a sorting offer is not sensitive to the distribution of the dispute costs.

[14] The expected cost calculations under the baseline are the same as in fn. 13.

Table 2 summarizes our predictions for the three alternative models. We are somewhat skeptical that our empirical results will hit any of these point predictions with precision, but the predictions provide benchmarks by which to evaluate behavior. We note that under all three models, a sorting equilibrium is predicted whereby the dispute rate is 0% when A is type A_L and 100% when she is type A_H. In a model with fairness, the prediction of a 0% dispute rate for A_L assumes that B knows what A considers a fair offer. If there is uncertainty over what constitutes a fair offer then we may observe positive dispute rates for A_L players.

****** Table 2 here ******

4. RESULTS

We first analyze player B's offers, and then analyze player A's accept/reject decisions and the corresponding rejection rates. We then estimate player B's optimal offer conditional on player A's empirical rejection behavior. Recall that in baselines B_1 and B_2, $F_A = 75$, $F_B = 75$, in treatment T_1, $F_A = 25$, $F_B = 125$ and in treatment T_2, $F_A = 125$, $F_B = 25$.

4.1 Player *B* Offers

In Figures 1 and 2, we present information on player B's offers, expressed as a as a deviation from the rational prediction. Thus, in the baseline, an offer of 175 would be expressed as 50, as it exceeds the rational offer $O_B^R = 125$ by 50. This way of expressing the offers eases the comparison between the baseline and the two treatments. Figure 1 shows the offers in B_1 and T_1, and Figure 2 shows the offers in B_2 and T_2. Across all observations, about 85% (616/728) of the offers are in the interval $O_B^R \leq O_B \leq O_B^R + 150$, shown as 0–150 on the figures. These offers are (as predicted by all of our theories) consistent with a sorting strategy which leaves both players a positive surplus from settlement when they are accepted by an A_L player. Most of the sorting offers propose less than 1/3 of the 150 surplus, i.e., they are in the 0–24 and 25–49 intervals.

About 7% (51/728) of all offers are in the range $O_B \geq O_B^R + 200$ ($\geq$ 200 on the figures). These offers are theoretically acceptable to both player *A* types and are therefore consistent with pooling. Under our parameters these offers are not predicted by any of our theories, but it is not surprising that some subjects would make pooling offers. Understanding that a sorting offer is optimal requires a calculation that that some subjects may not have made, or may not have made correctly if they attempted it.

The remaining 8% (61/728) of the offers are more puzzling. About 6% are in the range $O_B < O_B^R$ (< 0 on the figures), where A_L would earn a negative surplus from settlement. There is a sharp increase in these offers in T_1 when compared with B_1 (13% in T_1, 2% in B_1 on Figure 1). Note that in T_1, $F_A = 25$ and $F_B = 125$, which is an unfavorable distribution of costs for player *B*. For some reason, one response to this is an increase in offers containing negative surplus for A_L. The other 2% are in the range $O_B^R + 150 < O_B < O_B^R + 200$ (151–199 on the figures). These "in-between" offers are too low to be accepted by A_H players, but they offer more than 100% of the embedded pie to A_L players. If A_L accepts such an offer, player *B* earns a negative surplus from settlement. Thus, these are very poor offers from player *B*'s perspective.

We focus our regression analysis on the 85% of the offers that are consistent with the sorting strategy, as we wish to gain insight into player *B*'s behavior when he is trying to settle with player A_L. Our current experiment is not designed to provide insight into the relatively infrequent pooling offers (7%) or 'negative surplus' offers (8%). We note that in a simple ultimatum game, it is not possible to propose a division of the pie that leads to negative surplus for either player. As we currently do not have a parsimonious explanation relating the distribution of dispute costs to pooling or negative surplus offers, we leave them for future study.

While the reader should bear in mind the excluded offers in what follows, our results are robust to their inclusion.

Table 3 presents regressions of the player *B* offer for offers within the sorting interval $O_B^R \leq O_B \leq O_B^R + 150$, i.e., offers that contain 0–150 of surplus. The first set of regressions uses all offers in this range, while the second uses the median offer per subject for offers in this range. In the first case, the unit of observation is the individual offer, and in the latter it is the individual subject.[15] With the median calculations, there are two observations per subject in the role of player *B*, one in the baseline and one in the treatment. As can be seen in the table, the results from the two sets of regressions are quite similar. For each treatment, the regressions are of the form

$$\text{Player } B\text{'s Offer} = \beta_0 + \beta_1 TREAT + \varepsilon,$$

where β_0 is the intercept, TREAT is a treatment effect dummy variable that = 0 if $F_A = F_B$, and = 1 if $F_A \neq F_B$ and ε is an error term.

****** Table 3 here ******

The coefficient β_0 provides the estimate of the offer O_B in the baseline, and β_1 provides the estimate of the comparative static ΔO_B due to the treatment. From Table 2 above, our three competing models make the following predictions:

Rational.	$\beta_0 = 125$ in B_1 and B_2, $\beta_1 = 50$ in T_1 and $\beta_1 = -50$ in T_2.
Equal-split.	$\beta_0 = 200$ in B_1 and B_2, $\beta_1 = 50$ in T_1 and $\beta_1 = -50$ in T_2.
Save-own-cost.	$\beta_0 = 200$ in B_1 and B_2, $\beta_1 = 0$ in both T_1 and T_2.

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[15] The median approach is consistent with our player *A* regressions below, where the unit of observation is the individual subject, and it also corrects for the lack of independence among the multiple offers made by the same person. Restricting the offers to the sorting interval causes one observation to be dropped in treatment 1 session S2, as one subject made only pooling offers in the baseline.

The regression results are shown on the left-hand side of Table 3, and statistical tests are shown on the right-hand side.

In Table 3, the four estimates on β_0 range from 163.1 to 166.4. These estimates are roughly halfway between the point estimates of the rational model and the two fairness models, and the null hypotheses $\beta_0 = 125$ and $\beta_0 = 200$ are soundly rejected ($p = .000$ in all eight cases). In contrast, the comparative static estimates for β_1 are quite close to the rational and equal-split predictions. For treatment 1, the point estimates are 49.8 and 47.7 and the null hypothesis H_0: $\beta_1 = 50$ cannot be rejected ($p = .970$ and .825), while for treatment 2, the estimates –46.7 and –47.5 are not statistically different from –50 ($p = .455$ and .799). On the other hand, the save-own-cost prediction H_0: $\beta_1 = 0$ is easily rejected ($p = .000$ in all four cases).

The comparative static results imply that the amount of the joint surplus contained in an offer is approximately equal across treatments. While the players are clearly not splitting the surplus equally, the data are consistent with the idea that fairness requires an offer to contain a constant percentage of the joint surplus, regardless of how the costs of a dispute are allocated. The data are not consistent with an alternative under which fairness is defined as a percentage of the plaintiff's costs of a dispute, rather than a percentage of the total costs of a dispute.[16] Pooling all 616 offers in the sorting range, we find that player *B* offers player *A* about 27% of the joint surplus from settlement.

4.2 Player *A* Behavior

Figure 3 summarizes player *A*'s accept/reject response to player *B* offers, relative to what the strictly rational, risk neutral model predicts. The first two panels show the percentage of A_L and A_H behavior that is consistent with the predictions of the rational theory, using all 728 offers in the data set. For A_L players, the percentage of decisions consistent with the rational theory ranges from 80% to 91%. For A_H players, the corresponding percentages range from 91% to 98%.[17] Player *A* generally rejects offers when this is the prediction of the rational theory (i.e., when the offer contains negative surplus). Most offers to A_H are sorting offers; these are rejected as predicted and this largely accounts for her near-100% compliance with theory. The vast majority of deviations from the rational theory are on offers which the theory predicts *A* will accept, but which she rejects instead. This is most prevalent when she is type A_L. The third panel of Figure 3 shows A_L rejection rates on the 447 offers with a nonnegative surplus. In the baselines, the rejection rates on these offers are 15% (B_1) and 9% (B_2), and in the treatments they are 19% (T_1) and 21% (T_2). This suggests that players *A* and *B* cannot always agree on what constitutes a fair offer. It also suggests that the players have more difficulty agreeing on a fair offer in the treatments where the dispute costs are distributed asymmetrically.

****** Figure 3 here ******

To further analyze the dispute rates, we present a regression analysis in Table 4. For each treatment, the regression is of the form

$$A_L \text{ Dispute Rate} = \varphi_0 + \varphi_1\text{TREAT} + \varepsilon,$$

where the intercept φ_0 provides the estimate of the dispute rate in the respective baseline, φ_1 provides the comparative static effect of the treatment (*TREAT* is as defined above), and ε is an error term. The unit of observation is the individual. For each player, a two dispute rates are calculated based on their percentage of rejected offers as an A_L player – one dispute rate in the

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[16] In other words, we can reject the model where a fair offer is λ% of the plaintiff's courts costs with $0 < \lambda \leq 1$. Recall that save-own-cost is a special case of this model with $\lambda = 1$.

[17] When we conduct this 'consistency exercise' for the other two models, the A_H percentages are less but still high, in the 90-95% range. However, the A_L percentages drop considerably, to about 50-55% for both models versus the 80-90% for the rational model. Clearly, the rational model does the best of the three in aggregating *A*'s decisions.

baseline, and one in the treatment. For each treatment, Table 4 displays regressions for dispute rates calculated over all offers received by A_L players and for rates calculated over only those offers to A_L that contained between 0–150 of surplus. Again, regression results are shown on the left-hand side of the table, and statistical test are shown on the right.

**** **Table 4 here** ****

The baseline dispute rates range from 8.5% to 16.6%. We reject H_0: $\varphi_0 = 0$ at the 5% level in all cases except for T_2, when only offers containing 0–150 of surplus are considered. In this case, the significance level is slightly above 5% ($p = .052$). These results are consistent with excess disputes reported elsewhere in the experimental bargaining literature.

A more interesting question is whether or not an asymmetric distribution of the dispute costs increases the dispute rate. Our results provide some evidence that this is the case. The point estimates of φ_1 are all positive and economically significant in magnitude, implying an average increase in the dispute rate ranging from 6.4 to 12.8 percentage points.[18] However, the statistical significance of this effect presents a mixed picture. The statistical hypothesis of interest is the null H_0: $\varphi_1 \leq 0$, with the alternative H_1: $\varphi_1 > 0$. In T_1, we reject H_0 when all offers are considered ($p = .038$), but we do not reject when only offers with 0–150 of surplus are considered ($p = .217$). The rejection of H_0 for all offers is driven by the relatively high number of offers containing negative surplus in T_1 versus B_1 (see Figure 1). In T_2, we obtain the opposite result. When all offers are considered, we do not reject H_0 ($p = .152$), but we do reject H_0 when only offers with 0–150 of surplus are considered ($p = .028$).[19] Also note that the increase in the dispute rate, 11.7 percentage points, is quite large in this latter case. We address the origin of this increase below.

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[18] The percentage increase in the dispute rate ranges from 39% to 138%.

[19] Using a 2 × 2 baseline/treatment versus dispute/settlement contingency table with the individual offer as the unit of observation (instead of the individual subject), we obtain virtually identical results: the frequency of disputes is

While the evidence in Table 4 is not conclusive, it suggests that an unequal distribution of dispute costs raises the dispute rate. Treatment 2, in particular, suggests that this increase arises via an inability to coordinate on a fair offer as the distribution of costs changes. There, the distribution of costs goes from $F_A = F_B = 75$ in B_2 to one favoring player *A* in T_2 ($F_A = 25$, $F_B = 125$). In both B_2 and T_2, 87% of player *B*'s offers are in the sorting range, but he responds to the change in cost distribution with a large increase in the frequency of offers in the 0–24 surplus interval and a corresponding decrease in the 25–49 interval (Figure 2). The subsequent increase in disputes is concentrated on offers that contain a 0–150 settlement surplus for player A_L (Table 4), and as shown on Figure 5 below, this is due to a large increase in the rejection rate on offers in the 0–24 interval. An increase in dispute rates arising from an asymmetry of dispute costs is not consistent with the predictions of the rational model where the dispute rate is independent of the distribution of dispute costs. It is also not consistent with a simple model of fairness in which it is common knowledge between the players as to what constitutes a fair offer. However, the nature of a fair offer may not be common knowledge among players. Presumably this is the reason why we observe disputes in simple ultimatum games.[20] When the distribution of dispute costs becomes unequal, the problem of mutually identifying a fair offer becomes more difficult and we observe more disputes.

4.3. Optimal Player *B* Offers

Player *B*'s average offer is roughly midway between the point predictions of the strictly rational and equal-split models, but the comparative statics closely align with the predictions of these two theories. These results are consistent with a modified version of the fairness theory

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higher in the treatment than in the baseline for T_1 all offers ($p = .034$) and T_2 0–150 offers ($p = .022$), and not for T_1 0–150 offers ($p = .245$) and T_2 all offers ($p = .096$).

[20] See the discussion in Bolton (1991: 1112-9).

under which a fair offer contains α times the total surplus, with $\alpha = 0.27$ in our data. However, some of the observed behavior could be due to an inability on the part of player *B* to fully understand what constitutes an optimal sorting offer given player *A*'s behavior. To gain further insight into the role of fairness, we will now take a closer look at offer and rejection behavior.

Figure 4 shows the player *A* rejection rates by interval for B_1 and T_1, and Figure 5 shows the same data for B_2 and T_2. As before, offer intervals are shown as a deviation from the strictly rational prediction. Recall from Figures 1 and 2 that the bulk of the offers are in the 0–24 and 25–49 intervals. With a few exceptions, Figures 4 and 5 illustrate that the dispute rate is decreasing in the amount of surplus offered. Of course, the rational theory predicts that any offer of positive surplus should be accepted. One interpretation of the rejection behavior in Figures 4 and 5 is that player *A* exhibits a taste for fairness, and therefore rejects offers that provide too small a percentage of the joint surplus from settlement.

****** Figures 4 and 5 here ******

The empirical rejection behavior in the figures allows us to estimate the optimal offer, conditional on this behavior.[21] An offer O_B earns, in expected value terms, $(150 - O_B)\times(1 - A_L$ rejection rate on $O_B)$ of surplus for player *B*.[22] For each baseline and treatment, we calculate this expected surplus *ex post*, using the median offer within each 25 cent interval and the corresponding A_L rejection rate for the given interval. The resulting six-interval expected value functions are graphed on both figures, and we use the median offers which maximize these functions to be our estimates of the optimal offers. The optimal offer is 25 in B_1 and T_2 and 5 in

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[21] A similar type of analysis is performed by (among others) Bolton (1991: 1112-1119).

[22] The rejection rate is for A_L players only. Keep in mind that we have a robust prediction of a sorting offer, even in the presence of fairness behavior. The question here is how much surplus should be offered to A_L players in this offer, given her taste for fairness. The rejection rate by A_H is 100% in the region of the *ex post* optimal offer.

T_1 and B_2, but except for T_2, the difference in expected value between an offer of 5 and an offer of 25 is small. In T_2, the optimal offer is 25 and there is a sharp increase in the expected value of an offer as it increases from 5 to 25. While our estimates are fairly crude, taken as a whole they seem to suggest that 25 is the optimal offer for player *B*, which translates to 1/6 (17%) of the embedded pie.[23] Since player *B* offers 27% ($0.40/$1.50) of the surplus to player *A* on average, we can conclude that roughly 63% ($0.25/$0.40) of the deviation from the prediction of the rational model is an optimal response to demands for fairness on the part of player *A*. Thirty-seven percent ($0.15/$0.40) of the deviation from the rational model reflects an excess generosity on the part of player *B*. A possible explanation for this excess generosity is that some of the *B* players lack a complete understanding of the sorting strategy.

One interpretation of our results is that fairness plays a much smaller role in our embedded game than it does in a simple ultimatum game. Differences in framing between a simple ultimatum game and our embedded game appear to be responsible for reducing, but not eliminating the role of fairness in our experiment. In a simple ultimatum game, it is clear to the players that they are dividing a sum of money which is common knowledge. In our game, it may not appear to the players that they are engaged in the task of dividing $1.50 as (a) the task is embedded in the larger bargaining context, and (b) payments by Player *B* are framed as a cost to Player *B*. Finally, providing Player *B* with a lump sum at the beginning of the experiment may create something of a property right in his mind.[24] We believe these differences in framing are an

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[23] If all the offers are pooled across the baseline and two treatments and we use $.10 intervals, we find that 25 is the optimal offer. In this division of the data, 25 is the median of the 21–30 interval.

[24] Recall that the amount of the lump sum is not revealed to player *A*.

accurate reflection of the ways in which pretrial bargaining differs from a simple ultimatum game.[25]

5. CONCLUSION

What do our results tell us about bargaining behavior? First, about 85% of the offers are consistent with sorting offers as predicted by the rational model and the two models of fairness. About 15% of the offers are inconsistent with all three of these models. These inconsistencies aside, we find that these basic models aggregate the data fairly well, with the rational model doing the best. Second, the fairness expressed in the sorting offers does, as in a simple ultimatum game, appear to be defined over the size of the entire pie, which here is the joint surplus from settlement. An alternative possibility, that fairness is defined over the plaintiff's dispute costs, is soundly rejected by the data. Third, in this stylized legal bargaining game, offers by the defendant contain about 27% of the surplus from settlement, and given the plaintiff's rejection behavior, the optimal offer contains about 1/6 (17%) of the joint surplus from settlement. This indicates that player *B* makes and player *A* is willing to accept offers far lower than what is typically the case in a simple ultimatum game. Similar results have been reported elsewhere in the literature, but only under extreme procedures such as maximal social distance or a reframing of the game to an exchange context.[26] Here, we maintain some, but minimal social distance, and we maintain the explicit nature of the take-or-leave-it bargaining.[27]

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[25] For a fuller discussion of framing issues in a related set of experiments, see Pecorino and Van Boening (2004b).

[26] There are a large number of variations on the ultimatum game which have produced many interesting results, including presenting the game as a buyer/seller exchange (Hoffman et al., 1994).

[27] Using an experimental protocol that is virtually identical to the one used in this paper, Pecorino and Van Boening (2004b) conduct a simple ultimatum game and are able to replicate standard results on the division of surplus.

The results above suggest that the model of narrow rationality does a fairly good job of explaining the data. However, another aspect of the data is not as supportive of this model. There is some evidence that dispute rates increase when dispute costs are asymmetric**,** at least when the cost distribution is unfavorable to the player making the offer, i.e., our defendant player *B*. This appears to result from an inability of some players to agree on how a fair offer evolves with the distribution of dispute costs. Moreover, the point estimates of this effect are large. This suggests that the role of fairness cannot be overlooked in trying to explain pretrial settlement behavior.

Fairness behaviors can affect the distribution of the surplus from settlement and may also affect the probability a settlement is reached. While research on simple ultimatum games has led to very important behavioral insights, we believe it is important for future research to study how fairness behaviors are manifested when the ultimatum game is embedded in a larger bargaining context. This bargaining context should reflect, at least in a stylized manner, some of the important ways in which naturally occurring or ‘real-world’ bargaining is framed differently than bargaining in a simple ultimatum game. We view this analysis of stylized legal bargaining as a start on that process.

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Table 1. Experimental Design

		Rounds 1 – 7		Rounds 8 – 14[a]			
Session	Sequence	F_A	F_B	F_A	F_B	Pairs	Location[b]
Treatment 1: Baseline B_1, Treatment T_1							
S1	B_1, T_1	75	75	25	125	6	Mississippi
S5	B_1, T_1	75	75	25	125	7	Alabama
S2	T_1, B_1	25	125	75	75	7	Mississippi
S6	T_1, B_1	25	125	75	75	7	Alabama
Treatment 2: Baseline B_2, Treatment T_2							
S3	B_2, T_2	75	75	125	25	5	Alabama
S7	B_2, T_2	75	75	125	25	7	Mississippi
S4	T_2, B_2	125	25	75	75	7	Alabama
S8	T_2, B_2	125	25	75	75	7	Mississippi

[a] Sessions S2 and S4 lasted 13 rounds.

[b] Sessions conducted at the University of Mississippi, Oxford, MS and the University of Alabama, Tuscaloosa, AL

Table 2. Theoretical Predictions

Model	Prediction	Point Predictions		
		B_1, B_2	T_1	T_2
		$F_A = 75$ $F_B = 75$	$F_A = 25$ $F_B = 125$	$F_A = 125$ $F_B = 25$
Rational				
B's Offer	$O_B^R = 200 - F_A$	125	175	75
A_L accepts	$O_B \geq O_B^R$	125	175	75
A_H accepts	$O_B \geq O_B^R + 200$	325	375	275
Equal-split				
B's Offer	$O_B^E = O_B^R + ½(F_A + F_B)$	200	250	150
A_L accepts	$O_B \geq O_B^E$	200	250	150
A_H accepts	$O_B \geq O_B^E + 200$	400	450	350
Save-own-cost				
B's Offer	$O_B^S = O_B^R + F_A$	200	200	200
A_L accepts	$O_B \geq O_B^S$	200	200	200
A_H accepts	$O_B \geq O_B^S + 200$	400	400	400

FIGURE 1. Player *B* Offers in Treatment 1

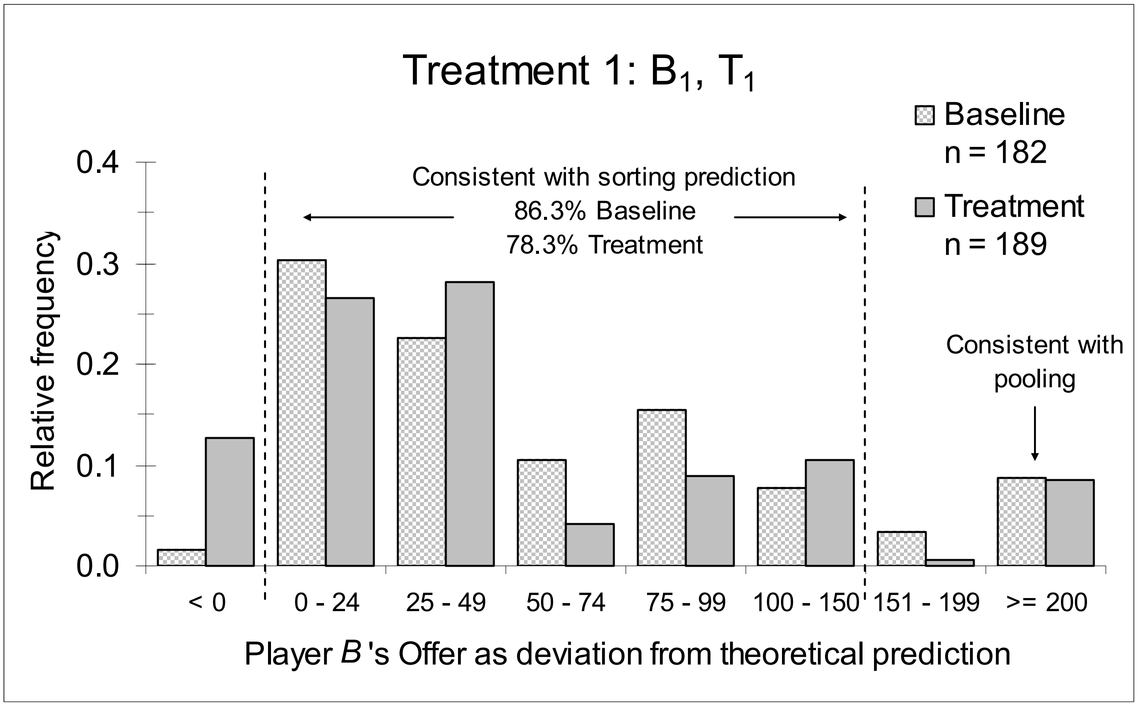

FIGURE 2. Player *B* Offers in Treatment 2

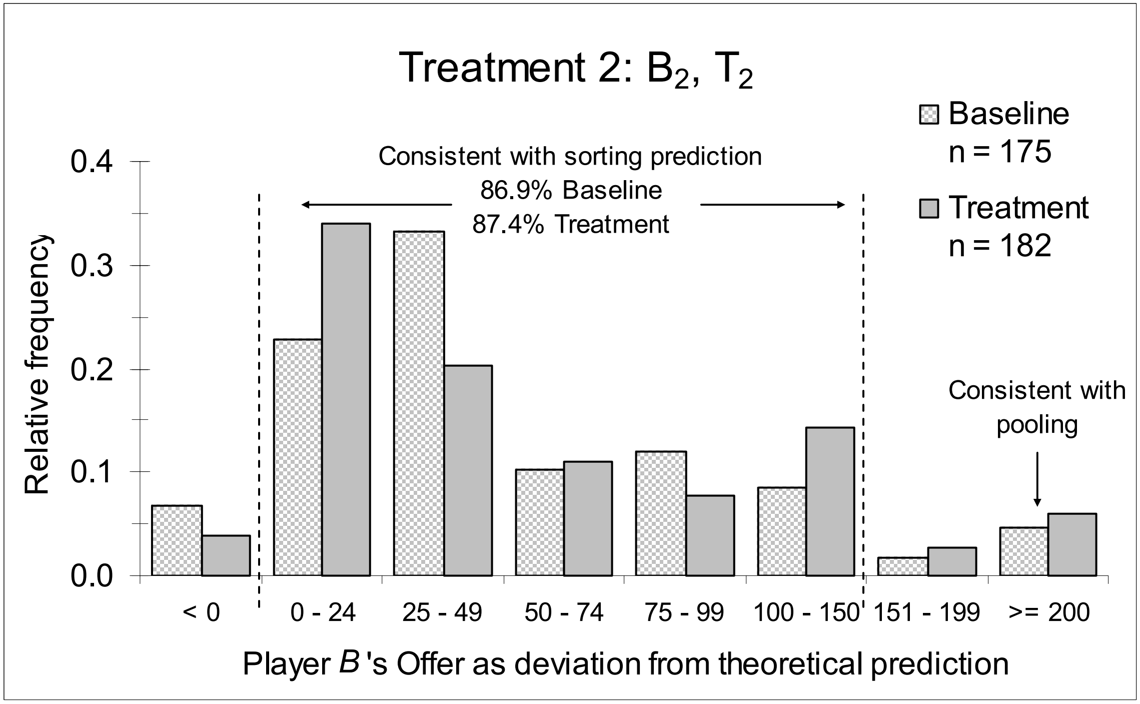

TABLE 3. Player *B* Regressions for Offers with 0 – 150 of Surplus

Model: Player *B*'s Offer = $\beta_0 + \beta_1\text{TREAT} + \varepsilon$

	Regression Results					H_0 and *p*-values			
Treatment 1 B_1, T_1	β_0	β_1	R^2	F	n	$\beta_0 = 125$	$\beta_0 = 200$	$\beta_1 = 50$	$\beta_1 = 0$
All offers	165.1	49.8	0.29	124.1	305	.000	.000	.970	.000
Median offer per subject	166.4	47.7	0.29	20.7	53	.000	.000	.825	.000
Treatment 2 B_2, T_2	β_0	β_1	R^2	F	n	$\beta_0 = 125$	$\beta_0 = 200$	$\beta_1 = -50$	$\beta_1 = 0$
All offers	165.2	–46.7	0.27	115.1	311	.000	.000	.455	.000
Median offer per subject	163.1	–47.5	0.32	23.3	52	.000	.000	.799	.000

FIGURE 3. Player *A* Decisions Relative to the Rational Theory

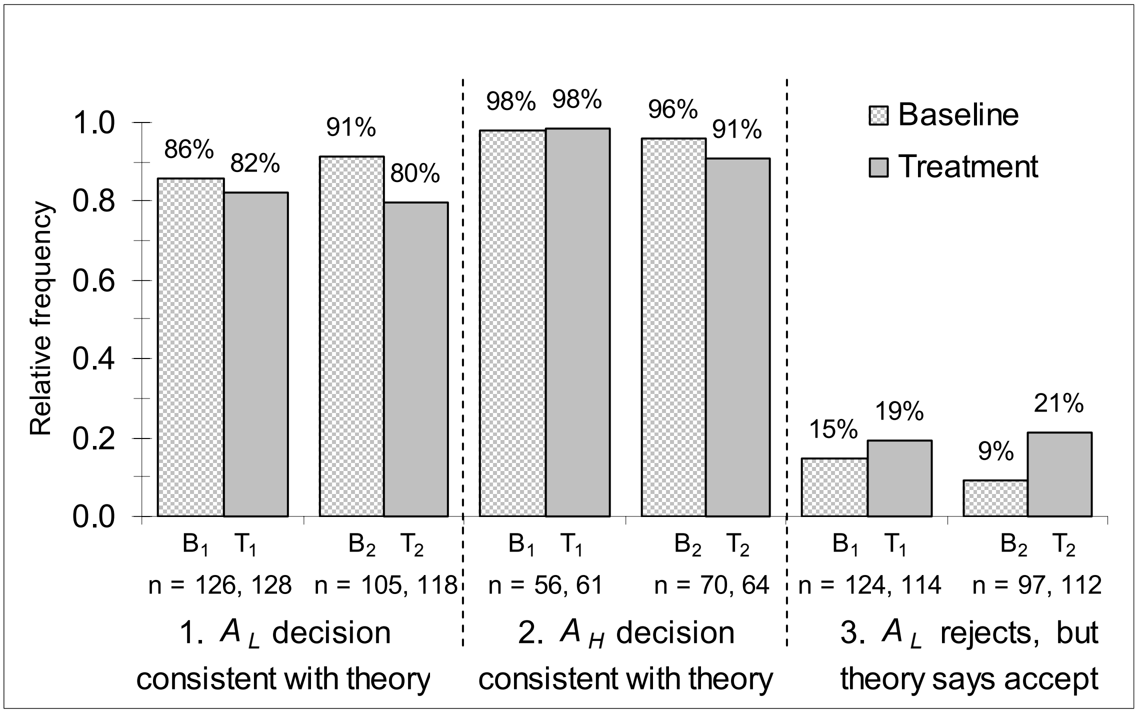

TABLE 4. Player A_L Dispute Rate Regressions

Model: Player A_L Dispute Rate = $\varphi_0 + \varphi_1$TREAT + ε

	Regression Results					H_0 and *p*-value	
Treatment 1 B_1, T_1	φ_0	φ_1	R^2	F	n	$\varphi_0 = 0$	$\varphi_1 \leq 0$
All offers	0.148	0.128	0.06	3.53	54	.003	.016
Offers with 0 – 150 of Surplus	0.153	0.064	0.01	0.62	54	.011	.217
Treatment 2 B_2, T_2	φ_0	φ_1	R^2	F	n	$\varphi_0 = 0$	$\varphi_1 \leq 0$
All offers	0.166	0.065	0.02	1.08	52	.001	.152
Offers with 0 – 150 of Surplus	0.085	0.117	0.07	3.84	52	.052	.028

FIGURE 4. Player A_L Rejection Rates and Player *B* Conditional Expected Value in Treatment 1

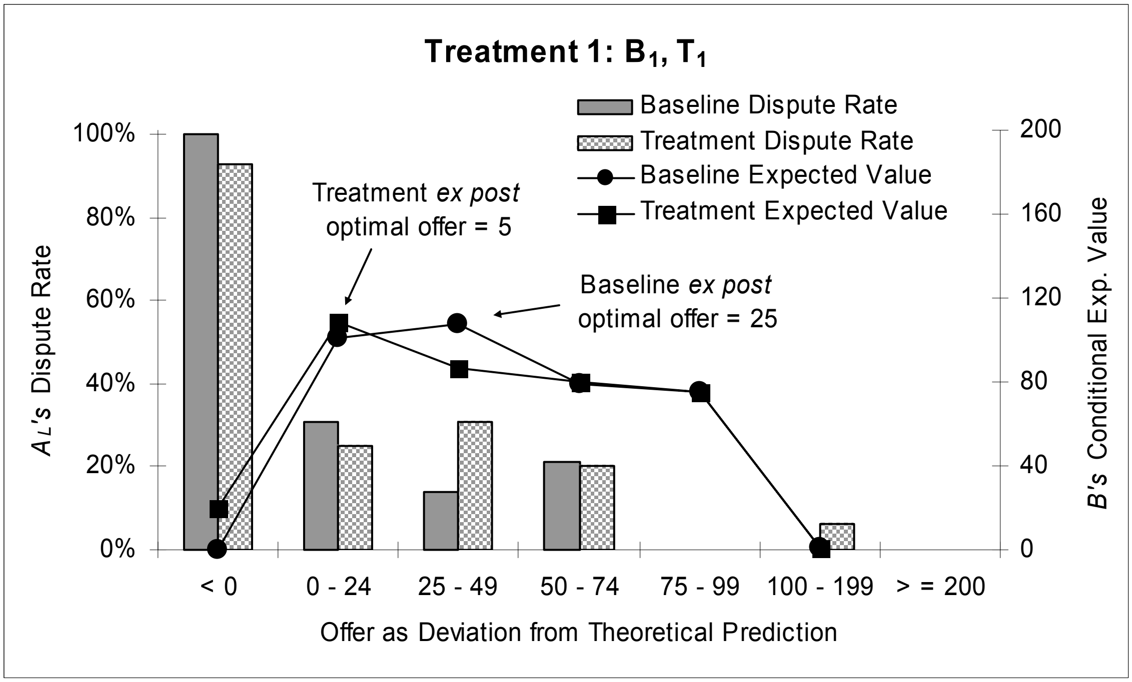

FIGURE 5. Player A_L Rejection Rates and Player B Conditional Expected Value in Treatment 2