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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 between 10 and 17 percent 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

An extensive ultimatum game literature 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. This might be important in legal bargaining and labor disputes, 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.

Our experiment consists of highly stylized bargaining, where the dispute resolution mechanism can be interpreted either as a trial or conventional arbitration. 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.[1] 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

[1] For concreteness we will use the terms plaintiff and defendant in our discussion. If the dispute resolution mechanism is interpreted as conventional arbitration in a labor setting, then player *A* would be in the role of the worker and player *B* in the role of the firm. In the actual experiment, we avoided using any of these terms. This contrasts with the approach taken in the literature on self-serving bias, in which players are specifically given a role either as a plaintiff or defendant. For a survey of the self-serving bias literature, see Babcock and Lowenstein (1997).

asymmetric cost structures. The rational risk-neutral theory makes a very sharp prediction on how offers change with the change in the distribution of the costs.[2] 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 20-25% of the joint surplus from settlement. This is about midway between the rational offer and an equal split of the surplus. Eighty-five percent of the 728 offers we observe are consistent with the optimal sorting strategy predicted by the rational model for our asymmetric information bargaining game. 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 estimate that the optimal offer in our experiment contains between 10 and 17 percent of the joint surplus from settlement. While the offer from the defendant exceeds the prediction of the rational model, roughly ½ to ¾ 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. The results on the size of the offers suggest a role for fairness, but one which is considerably smaller than typically found in a simple ultimatum game.

By contrast, however, fairness considerations may play an important role in determining the dispute rate. 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

[2] 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 no role.

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 settlement failure in the face of costly dispute resolution.

Understanding how an asymmetric distribution of dispute costs affects fairness behaviors is important as a practical matter. There is no reason to believe that dispute costs are generally distributed symmetrically among bargaining parties. For example, both Eisenberg and Farber (1997) and Card and McCall (2009) develop empirical models in which the costs of pursuing a dispute varies across injured parties. Moreover, since the injured parties dispute costs vary for reasons unrelated to the dispute costs of their bargaining partner, this implies an asymmetric distribution of costs across bargaining parties in at least some (and perhaps most) cases.

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, Hoffman and Spitzer (1982, 1985), 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.[3] In addition, low offers are frequently rejected in the simple ultimatum game.[4] 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 bargaining model with two players, player A (the plaintiff) and player B (the defendant). 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 player A and player B are charged a fixed fee (F_A and F_B, respectively). 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

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[3] Using an experimental protocol that is virtually identical to the one used in this paper, Pecorino and Van Boening (2010) conduct a simple ultimatum game and are able to replicate standard results on the division of surplus. Also, Hoffman et al. (1994) report a market version of the ultimatum game that is relevant to our bargaining context; see the conclusion for further detail.

[4] See (for example) Table 1 in Slonim and Roth (1998). For offers containing between 30 – 35% of the pie, they find rejection rates of 45.5% in a low stakes ultimatum game, 22.9% in a medium stakes ultimatum game and 11.1% in a high stakes game. These experiments were conducted in the Slovak Republic and the stakes ranged from 2.5 hours to 62.5 hours of the local wage.

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 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.

3. THE EXPERIMENT

3.1. Overview

In this experiment, the distribution of dispute costs is changed once during the course of an experimental session.[7] In each session, dispute costs are symmetric for half the bargaining

[5] While our concern in this paper is fairness, there have been experiments analyzing a variety of other issues in the law and economics literature. A small sampling includes Coursey and Stanley (1988), Main and Park (2002) and Inglis et al. (2005) who study conditional fee shifting, Stanley and Coursey (1990) who study the Priest and Klein (1984) selection hypothesis, Pecorino and Van Boening (2004) who study voluntary disclosure. There is also an extensive literature on arbitration, much of which compares the performance of different arbitration procedures. These include final offer arbitration and conventional arbitration, but others as well. A partial listing of papers in this literature includes Ashenfelter et al. (1992), Pecorino and Van Boening (2001), Dickinson (2004, 2005) and Deck and Farmer (2007, 2009).

[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] All of our experimental materials are available in "Bargaining with Asymmetric Dispute Costs – Appendix", which may be viewed at http://cba.ua.edu/assets/images/ppecorin/Bargaining_with_Asymmetric_Dispute_Costs_-_Appendix.pdf.

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. Treatment 1 favors player A with $F_A = 25$ and $F_B = 125$. Treatment 2 favors player B with $F_A = 125$, $F_B = 25$. 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.[8] 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.[9]

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 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. With regards to the former, consider the case where players define fairness as an equal percentage of

[8] 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.

[9] For example, Inglis et al (2005; Figure 9) show a 10-20% "ex ante inefficiency" for plaintiffs where the last rejected offer is more favorable than the expected court decision; this is comparable our 9-19% A_L rejection rate on positive surplus offers (Figure 3 below). For the ultimatum game, see the discussion of Slonim and Roth in footnote 4. For the literature on civil litigation, see Pecorino and Van Boening (2004).

the joint surplus; this is the equivalent of offering half the pie in the standard ultimatum game. 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 dispute 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 save-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.

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

[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 $\lambda = 1$.

experimental session consisted of a series of rounds, and in every round there was a new random and anonymous pairing of the *A* and *B* players. 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 each 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 for that round.
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.

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

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[11] Under the strictly rational model, player B has three options: make a low offer both A_L and A_H will reject, 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 $O_B < 200 - F_A$ has an expected cost $(2/3)(200 + F_B) + (1/3)(400 + F_B) = 800/3 + F_B$. Any sorting offer in the interval $200 - F_A \leq O_B < 400 - F_A$ has expected cost $(2/3)\ O_B + (1/3)(400 + F_B)$; this cost is minimized at $O_B^R = 200 - F_A$ with expected cost $800/3 + (F_B - 2F_A)/3$. Any pooling offer $O_B \geq 400 - F_A$ will be accepted by both A types, and the cost is $(2/3)\ O_B + (1/3)O_B = O_B$; this cost is minimized at $O_B^P = 400 - F_A$. The sorting offer will be optimal if $F_A + F_B < 400$, as is the case with our parameters.

[12] Under the baseline parameters, the minimum expected cost of the sorting strategy is \$2.42; the low-offer strategy expected cost is \$3.42, and the sorting strategy cost is \$3.25 (see fn. 11). Thus the expected cost of the sorting strategy is \$1.00 less than a low-offer strategy and \$0.83 less than the pooling strategy. A sorting strategy remains optimal as the distribution of costs changes, and the amount of the differences remains the same (\$1.00 and \$0.83, respectively). Over 14 rounds, the optimal sorting offer will earn \$12-\$14 more than either of the other two strategies, which is 40-45% of our typical subject earnings.

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]

Table 2 summarizes our predictions for the three alternative models. [15] 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

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[13] Using O_B^E in place of O_B^R in the fn. 11 calculations, this model's sorting strategy also has the lowest expected cost compared to the corresponding low-offer and pooling strategies (e.g., in the baseline it is \$2.91 versus \$3.42 and \$3.75, respectively). As with the rational model, the equal split prediction of a sorting offer is not sensitive to the distribution of the dispute costs.

[14] Using O_B^S instead of O_B^R in fn. 11, this model's sorting strategy again leads to a lower expected cost than the corresponding low-offer and pooling strategies.

[15] Conditional on there being a sorting offer, our theoretical predictions are robust to the introduction of risk aversion on the part of either player. At the time player A makes her accept/reject decision, she faces no risk: she knows her exact payoff if she accepts the offer and her exact payoff if she rejects it. Thus, the predictions on A's behavior will not change if A is risk averse. Conditional on player B making a sorting offer (an offer only A_L will accept), the theory's prediction as to the amount of this offer is not a function of whether or not B is risk averse: the optimal sorting offer is simply the lowest offer that A_L will accept. If B is sufficiently risk averse, then he will engage in a pooling strategy and hedge against the 1/3 chance of encountering a player A_H. (Relative to the sorting strategy, B's loss in expected value from pooling is \$0.83 per round or about \$11 over the course of the experiment.)

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.[16]

****** 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 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 $O_B^R \le O_B \le O_B^R + 150$, 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. Across the baselines and both treatments 49% (354/728) of the offers contain less than 1/5 of the 150 surplus, i.e.,

We find that only 7% of offers fall in the pooling range, which suggests a limited amount of risk aversion on the part of player B.

they are in the 0-29 interval. These offers are quite stingy compared to what is normally observed in a simple ultimatum game. The 60–89 interval is 30-cent interval centered on the equal-split value of 75. To the extent that these offers are consistent with an equal-split of the embedded surplus, only 11% (82/728) propose such a division (6% or 42/728 propose exactly 75).

About 7% (51/728) of all offers are in the range $O_B \geq O_B^R + 200$ (≥ 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. Alternatively, these offers could result from extreme risk aversion (see fn. 15).

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 notable increase in these offers in T_1 when compared with B_1 (13% in T_1, 2% in B_1 on Figure 1), but the increase is concentrated in the two sessions with sequence (T_1, B_1).[17] Figure 2 shows the frequency of 'negative surplus' offers as 7% B_2 and 4% in T_2, and we observed no discernable patterns across sessions, sequence, subjects or rounds. The final 2% of player *B*'s offers are in

[16] As discussed in footnote 15, conditional on there being a sorting offer, risk aversion plays no role in our theoretical model. However, if the demand for fairness is unobservable, then risk aversion may play a role in our empirical results. See the discussion in Section 4.3.

[17] Twenty-three of the twenty-four of the T_1 'negative-surplus offers' occur in sessions S2 and S6. Eighteen occur in S2: subject 13 submitted one such offer, subjects 11 and 12 submitted two each, subjects 16 and 17 submitted four each, and subject 14 submitted six; nine occur in rounds 1-3, and nine occur in rounds 4-7. Notably, these same *B* players collectively submit only one negative-surplus offer in B_1 of S2 (submitted by subject 14 in round 8). In session S6, five negative-surplus offers occur in T_1 (albeit all in rounds 1-3) and zero occur in B_1. In the two (B_1, T_1) sessions S1 and S5 there are only a total of three negative-surplus offers, with all three occurring in B_1 of S1.

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, but they are also quite rare.

Below we provide separate results for regressions on all offers and regressions on the 85% of the offers that are consistent with the sorting strategy. We focus on the latter, because we wish to gain insight into player *B*'s behavior when he is trying to settle with player A_L, but our results are largely robust to the inclusion or exclusion of offers outside the sorting range. 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. We currently do not have parsimonious explanations relating the distribution of dispute costs to pooling or negative surplus offers.

Table 3 presents feasible generalized least squares regression results for player *B* offers. The technique estimates a covariance parameter for each of the twenty-seven *B* players, which yields standard errors robust to subject-specific heteroscedasticity.[18] The upper portion of the table shows results for Treatment 1 and Treatment 2 using offers within the sorting interval $O_B^R \le O_B \le O_B^R + 150$, i.e., offers that contain 0–150 of surplus, and the lower portion shows results using all offers. In each case, the left-hand side variable is the offer made in round *i* of session *j* by *B* player *k*. The right-hand side variables are dummy variables for the experimental

[18] Specifically, we use the Stata 11 xtgls, panel(hetero) command (StataCorp, 2009). This effectively reduces the independence assumption from one of independence between observations to the weaker one of independence between *B* players. *B* players do not interact with one another, and they are randomly and anonymously re-paired each round with *A* players.

treatment of asymmetric costs and the within-session ordering of the baseline and the treatment. Specifically, the regressions are of the form

$$Player\ B's\ Offer_{ijk} = \beta_0 + \beta_T Treatment_{ij} + \beta_{BF} BaseFirst_{ij} + \varepsilon_{ijk}$$

where β_0 is the intercept, Treatment is a dummy variable that equals 1 if the given round has asymmetric dispute costs in effect and equals 0 if dispute costs are symmetric, and BaseFirst is a dummy variable which equals 1 if the round is from a session where the baseline occurs first, i.e., with sequence (B, T), and equals 0 if the treatment occurs first.

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

The coefficient β_0 provides an estimate of the offer O_B in the baseline. The parameter β_T 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, $\beta_T = 50$ in T_1 and $\beta_T = -50$ in T_2.
Equal-split.	$\beta_0 = 200$ in B_1 and B_2, $\beta_T = 50$ in T_1 and $\beta_T = -50$ in T_2.
Save-own-cost.	$\beta_0 = 200$ in B_1 and B_2, $\beta_T = 0$ in both T_1 and T_2.

Note that none of our theories predict an order effect, and the hypotheses above assume $\beta_{BF} = 0$. The statistical tests related to our hypotheses are presented on the right-hand side of Table 3.

The results in Table 3 are essentially the same for sorting-range offers (top panel) and all offers (lower panel).[19] In the interest of brevity, we focus our analysis on offers in the sorting range. The estimates on β_0 are 147.37 in Treatment 1 and 152.93 in Treatment 2. These estimates are somewhat below the halfway point (162.5) between the prediction of the rational model and the two fairness models. The null hypotheses H_0: $\beta_0 = 125$ and H_0: $\beta_0 = 200$ are soundly rejected ($p < .000$) in both treatments. These β_0 estimates suggest that after controlling for treatment and order effects, the average offer contains about 15-18% of the joint surplus from settlement (e.g., (147.37 – 125) / 150 = 0.15); the midway point of 162.5 equates to 25% of the surplus. We conclude that none of the three competing models accurately predict the average offer, with our estimate a little less than midway between the strictly rational theory and the two models of fairness.

In contrast, the comparative static estimates for β_T are quite close to the rational and equal-split predictions. For Treatment 1, the β_T estimate is 49.35 and it does not reject the null hypothesis H_0: $\beta_T = 50$ ($p = .844$; the All Offers β_T estimate has $p = .191$). For Treatment 2 the corresponding β_T estimates is –49.62, and it fails to reject H_0: $\beta_T = -50$ ($p = .903$; the All Offers estimate has $p = .841$). We note that the save-own-cost prediction $\beta_T = 0$ is always rejected. These comparative static results imply that the adjustment of the joint surplus contained in an offer is, on average, quite consistent with treatment effect expected under the rational and equal split models. There is no evidence supporting the save-own-cost prediction.

In both treatments the shift to asymmetric costs has a statistically significant (average) adjustment as predicted by the rational and the equal split hypotheses. While the players are clearly not splitting the surplus equally (see the β_0 estimates), the data are consistent with the idea that fairness requires an offer to contain about 15-20% of the joint surplus, regardless of how the costs of a dispute are allocated. The data are not consistent with an alternative model 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.[20]

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[19] The results are also robust to the omission of the eighteen offers containing exactly zero surplus; see Table 3 fn. *b*.

[20] 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 $\lambda = 1$.

There is evidence of an order effect that we did not anticipate with our design. In both Treatment 1 and Treatment 2, the β_{BF} estimates are positive and statistically significant, suggesting more generous offers when the baseline game is played first.[21] These estimates are economically significant as well. The Treatment 1 β_{BF} estimate implies that after controlling for the treatment effect, when the baseline occurs first the average offer contains about 13% more surplus (19.05 / 150 = 0.13) or about 28% in total ((147.37 + 19.05 – 125) / 150 = 0.28). In Treatment 2, the β_{BF} estimate implies that the corresponding effect is about 9% more surplus or about 27% total. These are both slightly above the 25% implied by the 162.5 midway point between the predictions of the rational model and the two fairness models. A possible ex post explanation is that the baseline may condition players towards fair behavior, because the equal distribution of the costs makes it easier for them to identify a fair offer. Regardless, we are left with the interpretation that after controlling for the treatment effect, the average offer contains about 15-20% of the surplus when asymmetric dispute costs occur first, and about 27-28% when symmetric dispute costs occur first. Averaging across both orderings of the experiment, we conclude that a typical offer contains about 20-25% of the total 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. Panels 1 and 2 (left and middle) show the respective percentages of A_L and A_H behavior that are consistent with the predictions of the

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[21] The Treatment 1 β_{BF} estimate of 39.63 under All Offers is particularly large. This is due in large part to the 'negative-surplus' offers that are much more prevalent and larger in magnitude in sequence (T_1, B_1) vs. sequence (B_1, T_1); see the discussion of Figure 1 above. Thus the average offer is much lower under sequence (T_1, B_1), and β_{BF} estimates large and positive, but the effect drops almost in half (to 19.05) when offers outside the sorting range are omitted. The two (T_1, B_1) sessions S2 and S6 have twenty-four negative-surplus offers averaging –108.9 (median of –132.5), while the two (B_1, T_1) sessions S1 and S5 have only three such offers averaging –75.3 (median of –76).

rational theory. Across all 728 offers in the dataset, player A decisions are largely consistent with the rational theory. The consistency rates for A_L are 88% in the baselines (weighted average of 86% in B_1 and 91% in B_2), and 81% in the treatments. The corresponding rates for A_H are 97% and 94%.[22] When we conduct this 'decisions-consistent-with-theory' exercise for each of the two fairness models, the A_H percentages are less but still high (90-95%). However, the A_L percentages drop considerably, to about 50-55% for both models. Clearly, the rational model does the best of the three in aggregating A's decisions. When we do observe deviations from the rational theory, the vast majority occurs when player A rejects an offer which the theory predicts she will accept. This is most prevalent when she is type A_L. Player A_L received 438 offers with positive surplus, i.e., offers $O_B > 200 - F_A$.[23] Panel 3 on the right of Figure 3 shows the rejection rates on those offers: 15% (B_1) and 9% (B_2) in the baselines, and 19% (both T_1 and T_2) in the treatments. 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.[24]

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

To better understand if and how our experimental treatments of asymmetric costs affect the probability of a dispute for A_L players, we estimate probit regressions that control for the

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[22] The high consistency rates for A_H are not surprising, as nearly all the offers she sees are less than her dispute payoff (93% of all the offers are less than $400 - F_A$; see the discussion of Figures 1 and 2 above). She rejects nearly all of these, and this largely accounts for her near-100% compliance with the rational theory.

[23] Under the rational theory, the recipient of an offer with 0 surplus is indifferent between acceptance and rejection. As a result, our calculation includes only offers with a positive surplus. A_L players received a total of eight offers with exactly zero surplus; five were rejected (one in T_1 of S2, one in T_2 of S4, one in B_2 of S8, and two in T_2 of S8) and three were accepted (one in B_2 of S4, one in T_2 of S4, and one in B_2 of S8). Including these eight offers has a minimal effect on our analysis.

[24] These statements are generally true at the session level. In all eight sessions, A_L rejects offers that have positive surplus in both the baseline and the treatment. Six of the eight sessions had higher A_L dispute rates on those offers in the treatment than in the baseline, one had equal dispute rates, and one had a lower dispute rate in the treatment.

amount of surplus contained in each offer. Table 4 reports the results in a manner analogous to the player *B* regressions in Table 3. The upper portion shows the results for Treatment 1 and Treatment 2 using A_L decisions on offers that occur in the sorting interval (i.e., offers containing 0–150 of surplus), while the lower portion shows results from A_L decisions on all offers. We note that 86% (412 / 477) of the offers received by A_L lie in the sorting interval. Our estimation method again allows us to compute robust standard errors by estimating a covariance parameter for each of the twenty-seven A_L players.[25] The left-hand side variable is (0,1) depending on whether or not A_L player *m* accepts or rejects, respectively, the offer she sees in round *i* of session *j*. The right-hand variables include the amount of surplus in each offer O_B relative to the prediction of the rational model, and two dummy variables that are identical to those in the player *B* regressions above: one for the experimental treatments of asymmetric dispute costs, and one for the within-session ordering of the baseline and the treatment. Specifically, Table 4 reports the estimation of

$$A_L\text{'s Decision (reject = 1)}_{ijm} = \Phi(\gamma_0 + \gamma_S Surplus_{ijm} + \gamma_T Treatment_{ij} + \gamma_{BF} BaseFirst_{ij})$$

where Φ is the standard normal cumulative density function, γ_0 is the intercept, Surplus is $O_B - O_B^R = O_B - (200 - F_A)$, Treatment is a dummy variable that equals 1 if the given round has asymmetric dispute costs in effect and equals 0 if dispute costs are symmetric, and BaseFirst is a dummy variable which equals 1 if the round is from a session where the baseline occurs first, and equals 0 if the treatment occurs first.

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

[25] Specifically, we use the Stata 11 probit, vce(cluster) command (StataCorp, 2009). As discussed in fn. 18, this reduces the assumption of independence between observations to the weaker one of independence between A_L players. *A* players do not interact with one another, and they are randomly and anonymously re-paired each round with *B* players.

In addition to the regression estimates shown on the left-hand side of Table 4, the marginal effects and their statistics are shown on the right-hand side.[26] Our results are again very robust to the inclusion or exclusion of offers outside the sorting range, so we concentrate our analysis on A_L decisions on offers in the sorting range.[27] As expected, the amount of surplus in an offer lowers the probability of a dispute, as the γ_S estimates are negative and statistically significant: –0.015 (p = .019) in Treatment 1 and –0.025 (p = .005) in Treatment 2. The corresponding marginal effects are also negative and statistically significant. The two estimates of –0.006 (p = .000) and –0.005 (p = .002) imply that on average, each additional unit of surplus reduces the probability of a dispute by roughly 0.5 percentage points.

A more interesting question is whether or not an asymmetric distribution of the dispute costs increases the likelihood of a dispute. Our results provide some evidence that this is the case, but they present a mixed picture. The main and marginal effects for γ_T all estimate positive, suggesting that after controlling for the surplus in an offer, asymmetric dispute costs increase the likelihood of a dispute. But in Treatment 1 neither the main nor the marginal effects are statistically significant (p = .507 and .509, respectively) and in Treatment 2 they are only significant at the 10% level (main p = .081, marginal p = .067). We note that the estimates of the marginal effects imply differences similar to those observed on panel 3 of Figure 3. Under Treatment 1, the Sorting Offers and All Offers γ_T marginal effects suggest that the likelihood of a dispute is about 3-4 percentage points higher when the dispute cost asymmetry favors player A

[26] The dummy variable marginal effects are the differences between the average estimated probabilities over each of the (0,1) values. For example, in the Treatment 1 Sorting Offer regression, the average estimated probability of rejection is .170 when each of the 214 observations has Treat = 0 and Surplus and BaseFirst take on their observed values, and it is .202 when Treat = 1. This yields the difference .032 reported in Table 4. The Surplus marginal effect is the derivative of the standard cumulative normal for the estimated equation. Standard errors are calculated via the delta method.

[27] The results are also robust to the exclusion of the eight offers to A_L with exactly zero surplus (see Table 4 fn. *c*), and to the exclusion of only those offers with negative surplus.

($F_A = 25$, $F_B = 125$) versus the baseline ($F_A = F_B = 75$); on Figure 3 the difference is 4 percentage points, with a 15% dispute rate in B_1 versus 19% in T_1. Similarly, the Treatment 2 marginal effects suggest that a dispute is 8-10 percentage points more likely when asymmetric dispute costs favor player *B* ($F_A = 125$, $F_B = 25$) versus the baseline; on Figure 3 the difference is 10 percentage points with a 9% dispute rate in B_2 versus 19% in T_2. However, the difference is not statistically significant in Treatment 1, and only marginally so in Treatment 2.

There is again evidence of an order effect, but it is not uniform across treatments. In both Treatment 1 and Treatment 2, the main and marginal effects of γ_{BF} are positive, but in Treatment 1 they are relatively large and statistically significant (main = 0.814, $p = .048$; marginal = 0.190, $p = .049$) and in Treatment 2 they are small and statistically insignificant (main = 0.096, $p = .728$; marginal = 0.019, $p = .728$).

While the evidence in Table 4 is not conclusive, it suggests that an unequal distribution of dispute costs raises the dispute rate. Of particular interest is Treatment 2 where the distribution of costs goes from $F_A = F_B = 75$ in B_2 to one favoring player *B* in T_2 ($F_A = 125$, $F_B = 25$). Further analysis of the data reveals that in T_2, there is a sharp increase in the A_L dispute rate for offers containing less than 10% of the surplus: the rejection rate for offers containing zero to fourteen cents of surplus is 24% in B_2 versus 61% in T_2 (see Figure 5 below). Neither the rational nor the fairness models we consider here predict an increase in dispute rates arising from an asymmetry of dispute costs. One explanation as to why disputes are observed in simple ultimatum games is that the nature of a fair offer may not be common knowledge among players.[28] When the distribution of dispute costs becomes unequal, the problem of mutually identifying a fair offer may become more difficult and consequently yield more disputes. Our

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

results suggest that this may be more prevalent when the distribution of costs is unfavorable to the player making the accept/reject decision.

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, and the comparative statics closely align with the predictions of these two theories. These results are consistent with a modified version of the fairness theory under which a fair offer contains α times the total surplus, with α ranging from about .20 to .25 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. Alternatively, as we discuss below, it could reflect risk aversion on the part of player *B*. 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_L rejection rates by interval for B_1 and T_1, and Figure 5 shows the same data for B_2 and T_2. As on Figures 1 and 2, offer intervals are shown as a deviation from the strictly rational prediction. Recall that those figures show player *B*'s offers as heavily concentrated in the 0-29 interval. To obtain better insight on rejection behavior within this portion of the distribution, on Figures 4 and 5 the 0–29 interval is split into the two new intervals 0–14 and 15–29. (Accordingly, the 90–129 and 130–150 intervals on Figures 1 and 2 are collapsed in a 90–150 interval on Figures 4 and 5.) On Figure 4, both the B_1 and T_1 the dispute rates are fairly flat at about 25-30% across the 0–14, 15–29 and 30–59 intervals (separate calculations find the dispute rates for the 0–59 interval are 23% in B_1 and 28% in T_1), and the respective dispute rates are essentially zero for offers of 60 or above. Figure 5 shows a somewhat different picture. First, over the 0–14 interval there is a substantial difference between the B_2 and T2 dispute rates: 24% and 61%, respectively. Second, in both the baseline and treatment, there appears to be a decay in dispute rate moving from the 0–14 to the 15–29 interval, with disputes being quite rare for offers of 30 or above. We note that in both Treatment 1 and Treatment 2, the 0–14 baseline dispute rates are similar: 27% in B_1 and 24% in B_2. 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.[29] 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*.[30] For each baseline and treatment, we calculate this expected surplus ex post, using the median offer within each interval and the observed A_L rejection rate for each interval.[31] The resulting expected value functions are overlaid on the Figures 4 and 5 offer intervals. In Figure 4, the maximum expected value in B_1 is EV = 105, which occurs at both the offer of $O_B - F_A = 5$ for the 0–14 interval and the offer of 25 for the 15–29 interval. In T_1, the ex post expected value is maximized at EV = 110 by an offer of 5. In Figure 5, the B_2 expected payoff is relatively flat over the 5-25 range, as an offer of 5 yields EV

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

[30] 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. If we include all offers in the computation of the rejection rate, the optimal offer is always 25.

[31] Our results are largely robust to alternative 'representative' offers such as the interval mean or mode. We do not use individual offers, as some have very few or no occurrences, e.g., across all eight sessions there is only one offer containing a surplus of 13 and none containing 14.

= 111 and an offer of 25 has EV = 113. So in both baselines B_1 and B_2, there is little difference in player *B*'s expected value from an offer of 5 or 25. In T_2, the optimal offer is 25, and there is a sharp increase in the expected value as the offer increases from 5 to 25.

Similar analysis using uniform 5-cent and 10-cent offer intervals implies that in B_1 the optimal offer range is 10-25, in T_1 5-15, in B_2 10-15, and in T_2 25-30. Our collective interpretation of these various expected-value calculations is that the ex post optimal offer is in the 15-20 range, with the exception of T_2 where there was a change in the rejection behavior of A_L. This translates into about 10-13% of the embedded pie. Since player *B* offers 20-25% of the surplus to player *A* on average (see section 4.1 above), we can conclude that roughly ½ of the deviation from the prediction of the rational model is an optimal response to demands for fairness on the part of player *A*. In treatment T_2, the optimal offer is about 25, or about 17% of the embedded pie. In this case, roughly ¾ of the deviation from the rational prediction is an optimal response to *A*'s fairness demand. Recall that in T_2 there is a sharp increase in *A*'s rejection rate on offers containing less than 10% of the surplus (potentially in response to an unfavorable dispute cost distribution). Taken together, the data suggest that the typical offer by player *B* is a fairly accurate gauge of what *A* considers a fair offer, and that *B* adjusts accordingly when *A* increases her demand.

About ¼ to ½ of the deviation in the player *B*'s offer from the rational prediction cannot be explained by player *A*'s demand for fairness. This corresponds to about $.10 to $.20 per round. This 'excess generosity' offered by *B* to *A* may reflect systematic errors on *B*'s part; player *A*'s demand for fairness is not directly observable, and player *B* may simply overestimate this demand. In addition, the excess surplus in the offer may reflect risk aversion on the part of player *B*. Since the demand for fairness is unknown, player *B* faces a rejection risk from A_L

players which is not present in the theory we presented in Section 3. Raising the amount of the surplus in the offer reduces *B*'s surplus if the offer is accepted, but also lowers the probability of rejection. If *B* is risk averse, he would make an offer which exceeds the expected value maximizing offer.

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. 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, (b) payments by Player *B* are framed as a cost to Player *B* and (c), player *A* receives a nonzero payoff in the event of a dispute.[32] Finally, providing Player *B* with a lump sum at the beginning of the experiment may create something of a property right in his mind.[33] We believe these differences in framing are an accurate reflection of the ways in which legal bargaining differs from a simple ultimatum game.

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

[32] This aspect of the experiment is related to the literature on ultimatum games with outside options. The paper in this literature most closely related to ours is Knez and Camerer (1995). Pecorino and Van Boening (2010) discuss the ways in which the framing in the Knez and Camerer experiments differs from the framing in stylized legal bargaining. In addition, there is no asymmetric information in Knez and Camerer.

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

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 bargaining game, offers by the defendant contain 20-25% of the surplus from settlement, and given the plaintiff's rejection behavior, the optimal offer contains about 10 to 17 percent 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 when contextual changes are implemented, for example in Hoffman et al.'s (1994) market exchange.[34] We extend the game to an embedded context, but one where the players are still explicitly engaged in a bargaining activity.

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. In particular, we find evidence of an increased dispute rate when the distribution of dispute costs favors the party which makes the offer (or alternatively, when the distribution is unfavorable to the party making the accept/reject decision). While this effect is found to be statistically significant at only the 10% level, the point estimates are quite large, suggesting an 8-10 percentage point increase in the dispute rate under this treatment. The increase in the dispute rate appears to result from an

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[34] Hoffman et al. (1994) report a posted-offer exchange version of a $10 ultimatum game (*B* is a seller and *A* is a buyer) that shifts *B*'s offers towards the rational prediction of $0. The Contest Exchange treatment, where subjects earn the right to be the seller, has the biggest effect: the mean and median offers (n = 24) are $3, and there are no offers above $5. Based on the data in their Figure 3(d), we compute that their average offer contains 30% of the surplus, which is similar to the 20-25% we find here, and that their ex post optimal offer contains 10% of the surplus v. our finding of 10 to 17 percent. We note that their offers are restricted to 10% increments of the pie ($1/$10)

inability of some players to agree on how a fair offer evolves with the distribution of dispute costs. This suggests that the role of fairness cannot be overlooked in trying to explain 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 as a contribution to that process.

while our increments are less than 1% ($0.01/$1.50), their *n* is smaller than ours, and their subjects played a single round while ours play multiple rounds.

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Table 1. Experimental Design

Session	Sequence [a]	Rounds 1 – 7 F_A	Rounds 1 – 7 F_B	Rounds 8 – 14[b] F_A	Rounds 8 – 14[b] F_B	Pairs	Location [c]
Treatment 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							
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] B_1 and B_2 denote $F_A = F_B$ baselines, T_1 and T_2 denote $F_A \neq F_B$ treatments.

[b] In sessions S2 and S4 this denotes rounds 8 - 13.

[c] 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

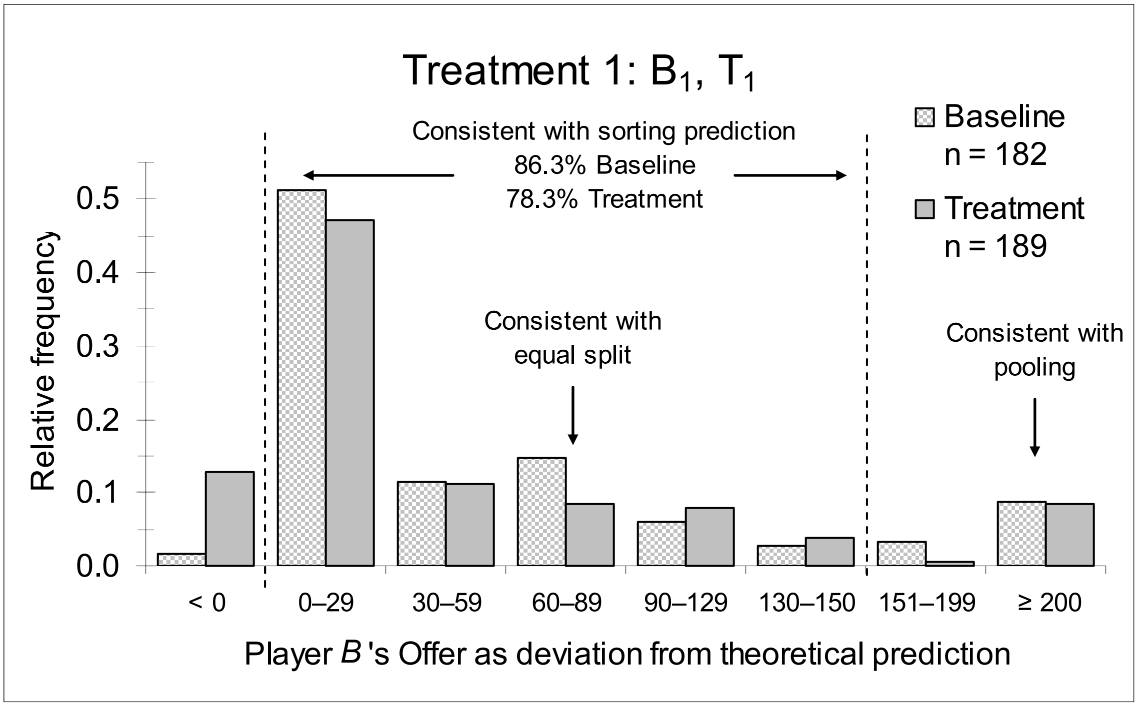

FIGURE 2. Player *B* Offers in Treatment 2

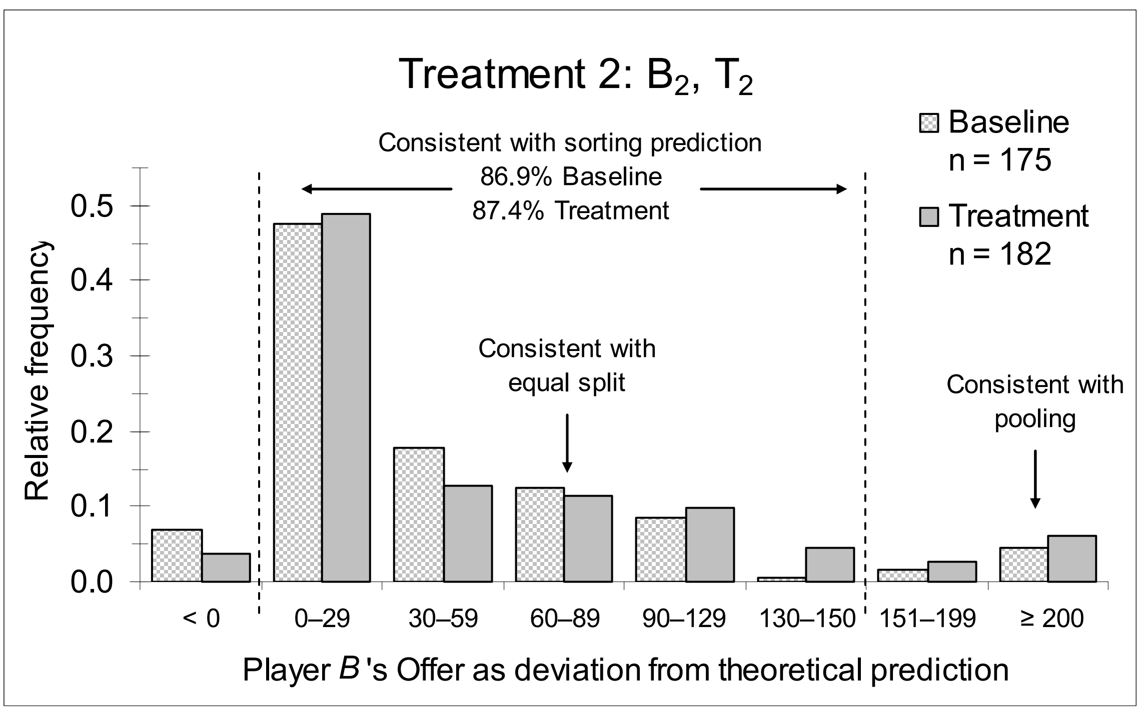

TABLE 3. Player *B* Generalized Least Squares Regressions

Player *B*'s $Offer_{ijk} = \beta_0 + \beta_T Treatment_{ij} + \beta_{BF} BaseFirst_{ij} + \varepsilon_{ijk}$

	Estimated Model and Statistics [a]				Statistical Tests: H_0, χ^2 statistic and *p*-value				
	$\hat{\beta}_0$ (s.e.)	$\hat{\beta}_T$ (s.e.)	$\hat{\beta}_{BF}$ (s.e.)	Wald χ^2 *p*-value	β_0 = 125	β_0 = 200	β_T = 0	$\lvert\beta_T\rvert$ = 50 [c]	β_{BF} = 0
Sorting Offers [b]									
Treatment 1 *n* = 305	147.37 (2.69)	49.35 (3.29)	19.05 (3.30)	268.9 *p*=.000	69.13 *p*=.000	382.72 *p*=.000	225.21 *p*=.007	0.04 *p*=.844	33.29 *p*=.000
Treatment 2 *n* = 311	152.93 (2.62)	–49.62 (3.13)	12.05 (3.13)	264.5 *p*=.000	113.54 *p*=.000	322.56 *p*=.000	252.17 *p*=.000	0.01 *p*=.903	14.74 *p*=.000
All Offers									
Treatment 1 *n* = 371	149.13 (4.46)	43.04 (5.32)	39.63 (5.36)	119.4 *p*=.000	29.21 *p*=.000	129.86 *p*=.000	65.40 *p*=.000	1.71 *p*=.191	54.76 *p*=.000
Treatment 2 *n* = 357	158.23 (3.79)	–49.13 (4.35)	13.46 (4.37)	138.0 *p*=.000	77.00 *p*=.000	121.72 *p*=.000	127.69 *p*=.000	0.04 *p*=.841	9.61 *p*=.000

[a] s.e. = standard error; Wald χ^2 and *p*-value test for overall significance of the model.

[b] Sorting offers are those offers containing 0–150 of surplus. Four offers in Treatment 1 and fourteen offers in Treatment 2 contain exactly zero surplus; omitting those observations has a minimal effect on the results.

[c] Null hypothesis H_0: $\lvert\beta_T\rvert = 50$ is tested as H_0: $\beta_T = 50$ under Treatment 1 and as H_0: $\beta_T = -50$ under Treatment 2.

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

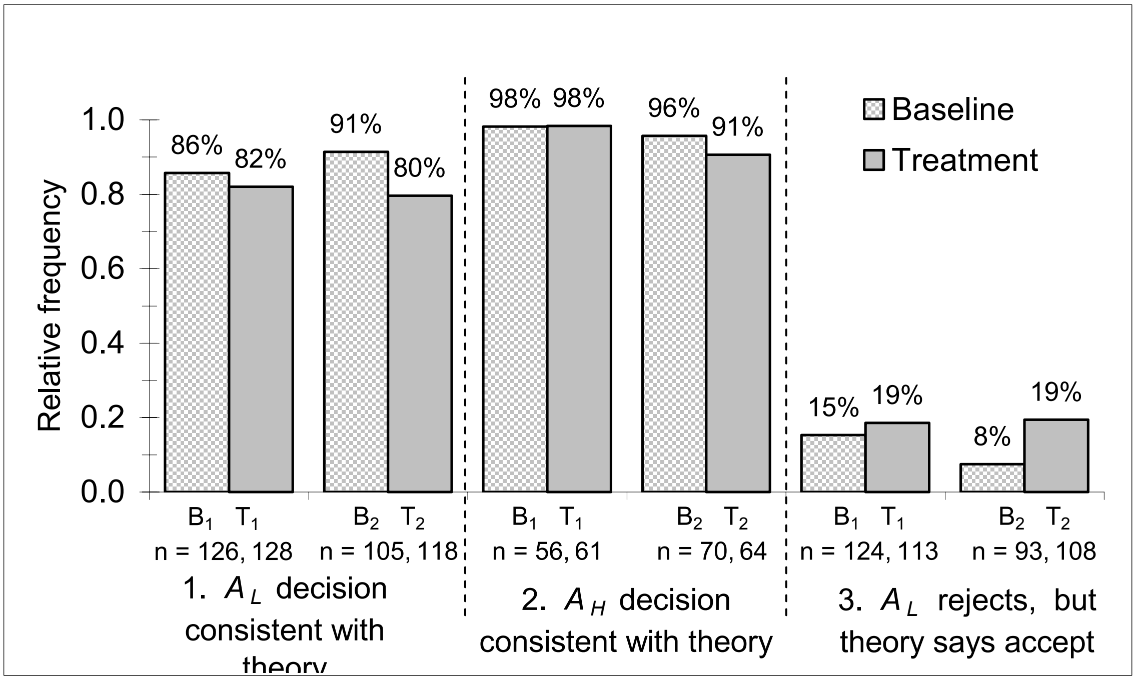

TABLE 4. Player A_L Probit Regressions

A_L*'s* Decision (reject = 1) $_{ijm} = \Phi(\gamma_0 + \gamma_S Surplus_{ijm} + \gamma_T Treatment_{ij} + \gamma_{BF} BaseFirst_{ij})$								
	Estimated Model and Statistics [a]					Estimated Marginal Effects [b]		
	$\hat{\gamma}_0$ (s.e.) *p*-value	$\hat{\gamma}_S$ (s.e.) *p*-value	$\hat{\gamma}_T$ (s.e.) *p*-value	$\hat{\gamma}_{BF}$ (s.e.) *p*-value	Wald χ^2 *p*-value psuedo-R^2	$\hat{\gamma}_S$ (s.e.) *p*-value	$\hat{\gamma}_T$ (s.e.) *p*-value	$\hat{\gamma}_{BF}$ (s.e.) *p*-value
Sorting Offers [c]								
Treatment 1 $n = 214$	–0.902 (.333) p=.007	–0.015 (.006) p=.019	0.138 (.207) p=.507	0.814 (.411) p=.048	9.36 p=.025 R^2 = .14	–0.004 (.002) p=.018	0.032 (.049) p=.509	0.190 (.097) p=.049
Treatment 2 $n = 198$	–0.585 (.332) p=.078	–0.025 (.009) p=.005	0.519 (.298) p=.081	0.096 (.277) p=.729	10.03 p=.018 R^2 = .22	–0.005 (.002) p=.002	0.105 (.057) p=.067	0.019 (.056) p=.728
All Offers								
Treatment 1 $n = 254$	–0.854 (.289) p=.003	–0.016 (.003) p=.000	0.172 (.222) p=.438	0.782 (.378) p=.038	21.50 p=.000 R^2 = .28	–0.003 (.001) p=.000	0.037 (.048) p=.441	0.166 (.080) p=.039
Treatment 2 $n = 223$	–0.289 (.264) p=.272	–0.032 (.009) p=.000	0.399 (.274) p=.146	0.080 (.258) p=.755	13.39 p=.004 R^2 = .36	–0.006 (.001) p=.000	0.079 (.053) p=.134	0.016 (.050) p=.754

[a] s.e. = standard error; *p*-values for the estimated coefficients test the null hypothesis H_0: $\gamma_i = 0$, and the Wald χ^2 *p*-value tests for goodness of fit; R^2 is McFadden's pseudo- R^2.

[b] s.e. = standard error; *p*-values test the null hypothesis H_0: Marginal Effect $\gamma_i = 0$.

[c] Sorting offers are those offers containing 0–150 of surplus. One offer received by A_L in Treatment 1 and seven offers in Treatment 2 contain exactly zero surplus; omitting those observations has a minimal effect on the results.

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

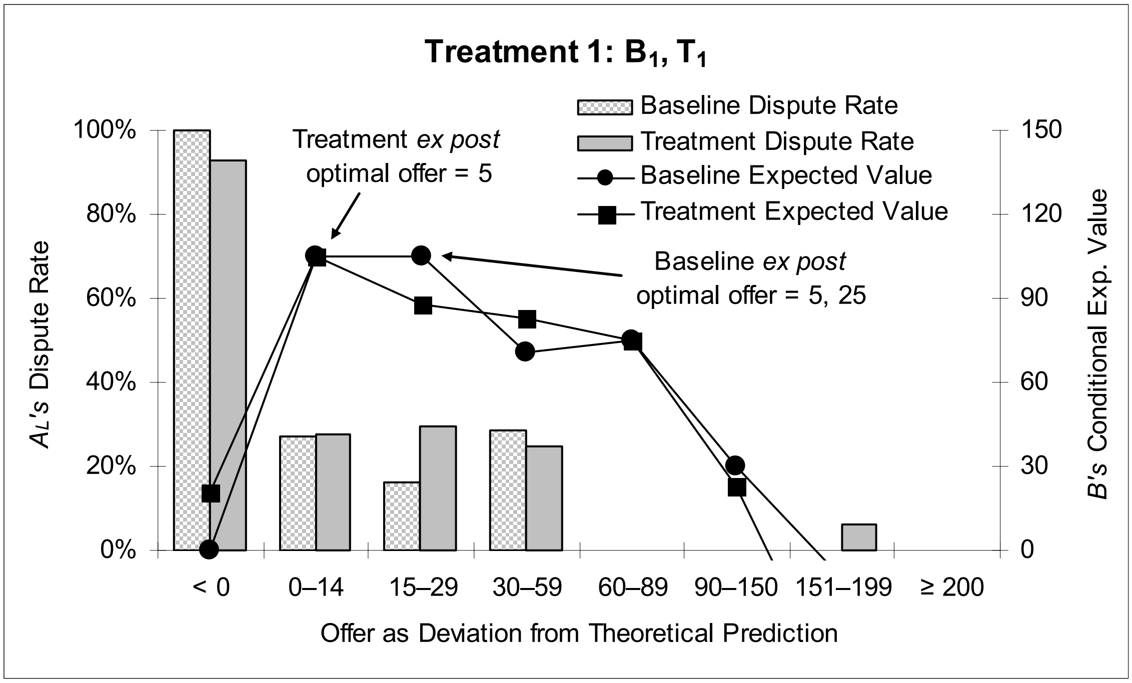

FIGURE 5. Player A_L Rejection Rates and Player *B* Conditional Expected Value in Treatment 2