November 2007
Revised August 2008
Revised March 2009

Fairness in an Embedded Ultimatum Game*

Paul Pecorino
Department of Economics,
Finance and Legal Studies
University of Alabama
Box 870224
Tuscaloosa, Alabama 35487
205-348-0379
ppecorin@cba.ua.edu

Mark Van Boening
Department of Economics
University of Mississippi
Holman Hall 373
University, Mississippi 38677
662-915-5841
bmvan@olemiss.edu

Abstract

We embed an ultimatum game in a stylized legal bargaining framework. This changes the framing of the standard ultimatum game in several ways, but also moves the bargaining closer to what is found in some naturally occurring settings. In this context, the ultimatum game is played over the joint surplus which is achieved from settlement as compared to a dispute. In our embedded ultimatum game, the median offer contains only 8% of the joint surplus from settlement. When we replicate the simple ultimatum game, we find that 50% of the joint surplus is contained in the median offer.

*We are grateful to the Office of Naval Research, which provided a grant to fund this research. Our ultimatum game replications were funded out of a minigrant from the Upjohn Institute. We would also like to thank Andrew F. Daughety, participants at the American Law and Economics Association Meeting and an anonymous referee for providing helpful comments on our paper.

1. Introduction

In the simple ultimatum bargaining game, two parties are to split a fixed amount of economic surplus *P*, often referred to as "the pie". One party makes a take-it-or-leave-it offer to the other. If the offer is rejected, the entire pie is lost. Standard "fully rational" economic theory predicts the sender or first-mover will offer the minimum possible $\varepsilon > 0$ to the recipient (leaving $P - \varepsilon$ for himself), and the recipient will accept this offer, as she prefers it to nothing. Despite the obvious appeal of the standard theory, an extensive literature on ultimatum games identifies two stylized facts at odds with the theory: in laboratory games, senders typically offer a one-third to one-half of the pie to the recipient, with an equal-split often a modal outcome, and recipients frequently reject offers that contain one-third or less of the surplus.[1]

Many naturally occurring bargaining situations contain an embedded ultimatum game. An example is civil litigation. Two parties, one with a claim on the other, face a potential judgment to be imposed by a disinterested third party. The involvement of the third party is costly. If the two parties can contract independently and prior to the third-party decision, they can avoid these costs. Thus, a "joint surplus from settlement" accrues to the negotiating parties if they can resolve the claim bilaterally. If one party has the power to make a take-or-leave-it offer to the other prior to the third-party decision, the two are essentially playing an ultimatum game over the joint surplus from settlement – a game that is embedded within the context of the original claim. This type of embedded ultimatum game is present in the canonical models of pretrial settlement, Bebchuk (1984) and Reinganum and Wilde (1986).

[1] See, e.g., Slonim and Roth (1998), Figure 1a. They conduct low, medium and high stakes ultimatum games in the Slovak Republic, with the stakes ranging from 2.5 hours of wages to 62.5 hours of wages. For offers containing 30-35% of the pie, the find dispute rates range from 45.5% in a low stakes ultimatum game to 11.1% in a high stakes game.

An important research question is the extent to which the results of the simple ultimatum games carry over to embedded games. That question is addressed here in a stylized model of pretrial bargaining. We conduct an experimental analysis of this embedded ultimatum game, with a simple ultimatum game run as a control, and find a dramatic difference across the two. In the embedded game, the median sender's offer contains just 8% of the joint surplus from settlement. In contrast, the median offer in the simple game contains 50% of the joint surplus. We also find that the receiver exhibits a willingness to accept the much lower offers she receives in the embedded game. The results are consistent with the idea that the high offers observed in the simple ultimatum game are driven by a fear of rejection, rather than by a desire for fairness on the part of the sender.

In the embedded ultimatum game, the outside option for the player in the role of the plaintiff is randomly determined and corresponds to plaintiffs with large or small claims. The value of the outside option is common information between the parties to the dispute. On *a priori* grounds, one might expect that plaintiffs who receive an unearned windfall of a high outside option might be offered less surplus from settlement than a plaintiff with a low outside option. However, we find there is virtually no difference in how the two plaintiff types are treated with respect to the offer of surplus, and the plaintiff's response to a given offer of surplus is also largely independent of the value of her outside option. Combined with the overall stinginess of the offers, this underscores the relatively small role that fairness pays in the embedded game.

Our results are significant, not simply because we show that framing matters; this has been shown elsewhere in the literature. They are important, both because our framing moves the bargaining closer to a naturally occurring setting (though it is still highly stylized) and because the resulting change in behavior is dramatic. We believe our results help identify the types of bargaining interactions in which fairness is plays a significant role. Our results suggest that fairness considerations are considerably less important in stylized legal bargaining than in the simple ultimatum game.

2. Bargaining Mechanism with an Embedded Ultimatum Game

2.1. Previous Literature

The ultimatum game literature begins with Güth et al. (1982), and is surveyed in Thaler (1988), Roth (1995), Camerer and Thaler (1995) and Fehr and Schmidt (2000). (Our discussion of this very large literature is necessarily incomplete.) This literature has shown that fairness considerations are a potentially important determinant of bargaining outcomes. In addition, differing perceptions about what is fair can be an independent cause of disputes. The literature has identified several important treatment variables that (apparently) mitigate the effect of fairness or other-regarding preferences. Having players compete in a contest to determine who makes the first offer, or framing the ultimatum game as a buyer/seller exchange both reduce the offers made by the sender (Hoffman and Spitzer 1985, Hoffman et al. 1994). Low offers randomly generated by a computer, or low offers made due to constraints in the choice set are more likely to be accepted than low offers intentionally made by an unconstrained sender (Blount 1995, Nelson 2002, Falk, et al., 2003). Competitive pressures created by, for example, allowing high earners among the senders to advance and play another game also reduces offers made in the ultimatum game, and competitive pressures can lead to fairly large reductions in the recipient's minimum acceptable offer (Roth et al. 1991, and Schotter et al. 1996).[2] Another strand of the ultimatum game literature has incorporated outside options for one or both players

[2] Andreoni and Blanchard (2007) attempt to remove fairness considerations in the ultimatum game by introducing a tournament structure to the payoffs of both the senders and receivers.

in the bargaining game. A player with an outside option receives some positive payoff in the event of a dispute. The most closely related paper in this literature is Knez and Camerer (1995), and we compare our results to theirs later in this paper.[3]

We analyze an embedded ultimatum game in a setting which can be viewed as stylized pretrial bargaining. In this embedded ultimatum game, the joint surplus from settlement constitutes the pie which is to be split between the two players. This type of embedded game is present in the major theoretical models of pretrial bargaining. For example, in the Reinganum and Wilde (1986) signaling model, the informed plaintiff makes an offer to the uninformed defendant. In equilibrium, this offer is perfectly revealing of the plaintiff's private information and extracts all of the joint surplus of settlement from the defendant. In the Bebchuk (1984) model, the plaintiff knows the distribution of defendant types, but not the exact type of the player she is negotiating with. The defendant knows his type which is the probability p that the plaintiff will prevail at trial. The plaintiff's optimal offer determines a cutoff defendant p^*, where defendants with type $p > p^*$ accept the offer and avoid trial, while defendants with type $p < p^*$ reject the offer and proceed to trial. An absence of fairness in the standard model is reflected in the minimum offer that the cutoff defendant p^* finds acceptable, i.e., the plaintiff's optimal offer extracts all of the joint surplus from settlement from defendant p^*.

Farmer and Pecorino (2004) introduce fairness into both the Reinganum and Wilde (1986) and Bebchuk (1984) models. A taste for fairness is modeled as the percentage of her own court costs that the recipient must retain if she is to settle prior to trial. An increased taste for fairness increases disputes in both models. The extent to which fairness is important in pretrial bargaining is an open question. We address this question in the analysis which follows.

[3] Other papers in this line include Binmore, Shaked and Sutton (1989), Kahn and Murnighan (1993), Croson, Boles and Murnighan (2003) and Schmitt (2004).

2.2. An Embedded Game

Consider two-party civil litigation where the plaintiff has either a weak or a strong case against the defendant. Litigation proceeds in three stages: mandatory costless discovery, pre-trial negotiation, and trial. In the costless discovery stage, the defendant is informed as to whether the plaintiff has a strong or weak case.[4] In the negotiation stage, the two parties attempt to resolve the plaintiff's claim through a take-it-or-leave-it offer from the defendant to the plaintiff. If the offer is accepted, trial is avoided and the plaintiff receives a transfer from the defendant equal to the amount of the offer. If the plaintiff rejects the offer, the case proceeds to trial, where the plaintiff is awarded a common-information "dispute payoff " from the defendant. The dispute payoff is contingent on the quality of the plaintiff's case. In addition, both parties incur a positive common-information trial cost independent of the plaintiff's case. Thus, the plaintiff's net payoff at trial equals her type-contingent dispute payoff minus her trial cost. Similarly, defendant's net cost equals his trial cost plus the dispute payoff to the plaintiff.

The economic incentives in this scenario can be captured with a simple two-player bilateral bargaining model. Player B is endowed with a sum over which player A has a (partial) claim. Player A is randomly one of two types, either type A_L who receives a low payoff or type A_H who receives a high payoff in the event of a dispute. Player B is costlessly informed of A's type and then makes a single offer to player A.[5] If A accepts B's offer, the amount of the offer is transferred from B to A, and the matter is resolved. If A rejects B's offer, then a dispute occurs, and A receives a common-knowledge type-dependent dispute payoff from B. In addition, both

[4] Eliminating asymmetric information from the experiment greatly simplifies the bargaining problem for the defendant. This removes a possible confounding factor from the analysis.

[5] We refer to player A with female pronouns, and player B with male pronouns for convenience. In the actual experiments, subjects are assigned roles without regard to gender.

players incur a common-knowledge dispute cost that reduces their respective earnings. We denote these costs as fees F_A and F_B, respectively; these fees are constant across player A types.[6]

In contrast to the simple ultimatum game, the entire bargained over amount does not disappear when there is a dispute. Instead, the total cost of dispute $F_A + F_B$ is the surplus that evaporates when A rejects B's offer – this is the joint surplus from settlement. Thus this bargaining situation is an embedded ultimatum game defined by the dispute costs F_A and F_B. To the extent that B's offer and A's accept/reject decision incorporate both A's type-dependent dispute payoff and a proposed division of the joint surplus from settlement, A and B negotiate implicitly rather than explicitly over the potentially foregone surplus. The joint surplus $F_A + F_B$ can be thought of as an "embedded pie" analogous to the "pie" in the simple ultimatum game. In both the embedded game and the simple game, a self-interested player B will try to extract the entire joint surplus from settlement less some arbitrarily small amount $\varepsilon > 0$. In the simple ultimatum game, this player B offers ε to player A, and in the embedded game he offers player A her type-dependent dispute payoff $- F_A + \varepsilon$. In both cases, a self-interested player A will accept such an offer, as it makes her marginally better off than if she rejects the offer.

As an example, in our experiment, A_L's dispute payoff is \$2.00, while $F_A = F_B =$ \$0.75. Thus, the embedded ultimatum game is played over the sum of the dispute costs $F_A + F_B =$ \$1.50, and the fully rational offer to A_L is \$2.00 – \$0.75 + \$0.01 = \$1.26.

Our experiment is designed to answer two questions. First, does behavior in the embedded game differ by the recipient's (player A's) type? Because the dispute costs F_A and F_B are constant, the total surplus from settlement $F_A + F_B$ is the same regardless of whether player A is type A_L or type A_H. Thus the problem of splitting the surplus would seem to be independent of

---

[6] In the actual experiment, our instructions referred to them simply as "fees that are incurred when A does not accept B's offer" and subjects' Record Sheets had lines for recording "Fees" absent of any F_A or F_B notation.

A's type. However, if other-regarding preferences like fairness are an issue, then behavior may depend upon player *A*'s luck in drawing either the high or low type. For example, player *B* might be more generous in the division of surplus when player *A* is type A_L and entitled to the low dispute payoff than when she is type A_H and is entitled to the high dispute payoff, e.g., *B* might view A_H's dispute payoff as an unearned windfall relative to A_L. Similarly, player *A* may be less willing to accept a given split of the surplus when she is type A_L than when she is type A_H. If the players cannot agree on how a "fair" offer changes with the high or low outcome, then an increase in dispute rates may result. In our empirical analysis, we compare player *B*'s offers to A_L with his offers to A_H, to see if the amount of surplus offered is a function of player *A*'s type. We then compare the rejection behaviors of A_L and A_H, to see if they vary with player type, when controlling for the amount of surplus offered.

Second, does behavior in the embedded game differ substantially from behavior in the simple ultimatum game? Theoretically, player *B* should attempt to extract all of the available surplus (less $\varepsilon > 0$), regardless of whether the game is a simple one or an embedded one. But the ultimatum game literature reports that the sender (our player *B*) frequently offers one-third to one-half of the "pie" to the recipient (our player *A*). It is an open question whether fairness concerns will be more or less prevalent in our embedded game, independent of relative effects across types A_L and A_H. To compare behavior across the two games, we run a simple ultimatum game as a control. The procedure in our simple game is virtually identical to that in our embedded game, but there are some important differences in framing which we discuss in Section 3.2. We believe that these differences in framing are a valid reflection of differences between legal bargaining and a simple ultimatum game. Importantly, we hold social distance constant across the two games. In our empirical analysis of the two games, we compare the surplus contained in the player *B* offers, and we compare the player *A* rejection behavior, when controlling for the amount of surplus offered.

3. The Experiment

3.1 Design

Table 1 summarizes the six sessions in our experimental design.[7] In sessions S1 through S4 subjects played the embedded ultimatum game, and in sessions S5 and S6 they played a simple ultimatum game. Subjects were recruited from business classes at the Oxford campus of the University of Mississippi and the Tuscaloosa campus of the University of Alabama. Each experimental session consisted of a series of rounds and at the start of every round, new random and anonymous pairings of *A* and *B* players were implemented.[8] Subjects were not informed ahead of time how many rounds there would be. A typical session, inclusive of an instructional period at the beginning and private payment at the end, lasted between one-and-a-half and two hours. The instructional period provided a clear demonstration of the mechanics of the experiment and the incentives from the perspectives of players A_L, A_H, and *B*. Most subjects earned around \$15-\$35 US, with a minimum of \$8 and a maximum of \$42.[9]

Our experimental design included some social distance between subjects. 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*. An experimenter (one of the authors) was assigned to each room. Subjects were not informed of their role until the end of the experimental instructions; all subjects received common instructions that explained how both

---

[7] All of our experimental materials are available at http://www.cba.ua.edu/~ppecorin/App.pdf.

[8] If a session had seven pairs of subjects, then a player had a 1/7 chance of being randomly repaired with their current bargaining partner in the next round. However, players had no way of knowing that such a random repairing had occurred.

player *A* and player *B* made decisions and earned money. Subjects maintained the same role throughout the session, and other than the written messages transmitted by experimenters between the two rooms, there was no interaction between the *A* and *B* players.[10] Each subject had a private Record Sheet, and each experimenter had forms on which to record information. Players wrote their decisions on their respective Record Sheet, and an experimenter recorded this information on his form. After all subjects in a room had made their decisions, the experimenters met in the hallway between the two rooms, silently copied information from one another's forms, and then returned to the rooms and wrote the results on the respective subject's Record Sheet. In both the instructions and in the experiment itself, we avoided contextual language such as the terms, plaintiff, defendant, and trial.

3.1.1 The Embedded Ultimatum Game

Subjects played an embedded ultimatum game in each round of sessions S1 through S4, and all four sessions lasted 13 rounds. In the event of a dispute, each party incurs a dispute cost of $F_A = F_B =$ \$0.75, so the embedded game is played over the joint surplus from settlement $F_A + F_B =$ \$1.50 each bargaining round. The sequence of events in each round is as follows:[11]

1. Player *A* and player *B* are randomly and anonymously paired.
2. A 6-sided die is rolled in front of each Player *A*. A roll of 1, 2, or 3 results in outcome L and a roll of 4, 5 or 6 results in outcome H. Thus each outcome applies with probability 1/2.
3. Player *B* is then informed as to the outcome of the die roll (H or L).
4. Player *B* decides on an offer to submit to player A. This offer must be between (and including) \$0.00 and \$5.99.

[9] All earnings were from decisions, i.e., we did not pay a "show-up fee" for prompt arrival.
[10] Nor was there interaction amongst players within a room during a session. Also, at the conclusion of a session, doors on each room were closed, the *A* players were paid and excused, and after all had exited, the *B* players were then paid and excused.
[11] This presentation and the one below for the simple ultimatum game are similar to the presentation included in the subjects' instructions.

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 = \$0.75 and player *B* incurs fee F_B = \$0.75. *A*'s payoff and *B*'s cost for the round depend on the die roll and these \$0.75 fees.

   Under outcome L: Player *A*'s Payoff for the round = \$2.00 – \$0.75 = \$1.25

   Player *B*'s Cost for the round = \$2.00 + \$0.75 = \$2.75.

   Under outcome H: Player *A*'s Payoff for the round = \$4.00 – \$0.75 = \$3.25

   Player *B*'s Cost for the round = \$4.00 + \$0.75 = \$4.75.

Steps 2 and 3 ensure that the outcome which applies in the event of a dispute is common information prior to the time when Player *B* makes his offer.[12] The dispute costs are also common information. In each session, an overhead was displayed in both the player *A* room and the player *B* room that summarized steps 6 and 7 above (except that dollar amounts were shown simply as 200, 400, and 75). The overhead included the information that a roll of a 1, 2, or 3 resulted in outcome L, and a roll of 4, 5 or 6 resulted in outcome H. The overhead also included the statement "The same overhead is displayed in both rooms" to emphasize that this was common information. Player *A*'s payoff from the experiment is the sum of her payoffs from all rounds. Player *B*'s payoff is determined by subtracting the sum of the costs from all rounds from a lump sum which is known in advance by player *B* and which is never revealed to player *A*.[13]

[12] Strictly speaking, we cannot induce common knowledge, as the subjects' cognitive activities are outside of our experimental control. We can, however, induce common information.

[13] There is a literature in which the size of the pie is not known, and this is found to reduce the size of the offer in the ultimatum game. See, for example, Güth et al. (1996) and Güth and Huck (1997). In our game the pie is $F_A + F_B$, and this is common information. If player *A* knew the lump sum, this would represent a confounding factor in analyzing fairness behavior. In particular, some players might focus on the lump sum rather than $F_A + F_B$ in their

3.1.2 The Simple Ultimatum Game

With the exceptions discussed below, the experimental protocol, procedure, instructions, etc., in our simple game are identical (or as close as we could make them) to our embedded game. The two control sessions S5 and S6 were both conducted at the University of Alabama, and each lasted ten rounds.

The simple ultimatum game is played over $1.50, which equals the cost of a dispute in the embedded game. The sequence of events in a round is as follows:

1. Player *A* and player *B* are randomly and anonymously paired.
2. Player *B* decides on an offer to submit to player A. This offer must be between (and including) $0.00 and $1.50.
3. 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*.
4. 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 Payoff for the round = $1.50 – Player *B*'s offer.
5. If player *A* does not accept *B*'s offer, then

   Players *A*'s Payoff for the round = 0

   Player *B*'s Payoff for the round = 0.

We ran the simple ultimatum game for ten rounds at $1.50 per round. We then ran four additional rounds in S5 and five additional rounds in S6 at $15 per round. The purpose of these "high stakes" rounds was two-fold. First, when we recruited subjects, we gave the same recruitment speech for all six sessions, as part of our control. In order to bring the *ex ante* average hourly earnings of the baseline sessions in line with those of the treatment, we added the high stakes rounds in sessions S5 and S6. Second, this served as an additional check that our

---

determination of a fair offer. Our decision to make *B*'s lump sum private information is based on pilot experiments from a previous set of experiments.

protocol yielded results similar to those reported in the literature. We only report the results of the $1.50 ultimatum games, but behavior (as measured by percentage of the surplus offered) changed very little when the stakes were increased. The subjects were not told in advance that the late rounds would include a larger pie.

3.2. Differences in Framing

There are several ways in which the framing of the simple ultimatum game differs from the embedded game. In the embedded game, it is clear that player *B* is making a payment to player *A,* while in the simple ultimatum game it appears the players are splitting $1.50. (Note that we never use the word "split" in describing this game to the subjects.) Player *B* incurs a cost each round in the embedded game, but receives a payoff each round in the simple ultimatum game. At the end of an embedded game session, Player *B*'s costs over all rounds are subtracted from a lump sum known to him but not known by player *A*, and this difference is his net earnings. Player *A* receives the sum of her payoffs across rounds as her earnings. In the simple game, both *A* and *B* receive the sum of their respective per-round payoffs as earnings. In both games, players bargain over the $1.50 joint surplus from settlement, albeit explicitly in the simple game and implicitly in the embedded game. In addition, there is no extraneous "judgment at trial" in the simple ultimatum game, but in the embedded game this "judgment" is $2.00 for A_L players and $4.00 for A_H players. While the differences in framing are important, we believe they are valid reflections of the ways in which legal bargaining would differ from bargaining in a simple ultimatum game.

While our embedded ultimatum game captures some important aspects of the way legal bargaining is framed, there are of course other aspects of legal bargaining which we do not capture. For example, animosity may develop between the plaintiff and defendant, and this might reduce fairness concerns on the part of the party making the offer. Also, in our experiment, plaintiffs with valuable claims receive them randomly, whereas plaintiffs in the naturally occurring world may have a valuable claim because of sustaining a serious injury. This might affect the defendant's perceptions of what constitutes a fair offer. Finally, the presence of insurance on the part of the either the plaintiff or defendant might influence what is perceived as a fair offer.[14] In our design, neither *A* nor *B* can insure against contingent outcomes (i.e., the die roll). Thus, the reader should bear in mind that our experiment captures some, but not all, of the framing which relevant for pretrial bargaining.

3.3 Predictions

We focus on two possible outcomes: the theoretical predictions of the strictly rational model and the equal split of the surplus outcome. For simplicity, we refer to this latter prediction as the "fair" outcome. While there are other possible outcomes, our emphasis on these two is based on a simple, parsimonious model of self-interest in the one case and on an empirical regularity reported in the literature in the second.

As described above, the strictly rational theory predicts that in both the embedded and simple games, a self-interested player *B* will offer player *A* the minimum amount necessary to avoid a dispute. Theory also predicts that a self-interested player *A* will never accept an offer which is less than her net dispute payoff, i.e., her dispute payoff less her dispute cost F_A. In the embedded game, player *B* knows *A*'s type when he makes his offer, so he makes an offer conditional on *A*'s type. Ignoring the ε = \$0.01 necessary to ensure settlement, under our parameterization the strictly rational risk-neutral model makes the following predictions for the embedded game:

[14] Zeiler et al. (2007) show that in Texas malpractice cases, policy limits play a large role in determining payment amounts. In particular, they find that policy limits act as a *de facto* cap on payments to the plaintiff.

(i) Player B's offer to type A_L is \$2.00 – \$0.75 = \$1.25. Type A_L rejects any offer less than \$1.25, and accepts any offer that equals or exceeds \$1.25. The predicted dispute rate is 0%.

(ii) Player B's offer to type A_H is \$4.00 – \$0.75 = \$3.25. Type A_H rejects any offer less than \$3.25, and accepts any offer that equals or exceeds \$3.25. The predicted dispute rate is 0%.

In the simple game, the corresponding predictions are:

(iii) Player B's offer to A is \$0.00. Player A accepts any offer that equals or exceeds \$0.00. The predicted dispute rate is 0%.

Empirically, excess disputes are fairly common in an experimental setting for both the embedded game and the simple game.[15] These excess disputes may occur because players cannot agree on what constitutes a fair offer. In the simple ultimatum game literature, an equal split of the surplus is a frequent outcome. In our embedded game, if player B conforms to the equal-split prediction, his offer will equal player A's net dispute payoff plus half of the joint surplus from settlement or, more formally, (A's dispute payoff – F_A) + ½($F_A + F_B$). Similarly, if player A conforms to this equal-split view, she will accept nothing less than this amount. The equal-split predictions for our embedded game are

(i) Player B's "fair" offer to type A_L is (\$2.00 – \$0.75) + ½(\$0.75 + \$0.75) = \$2.00. A "fair" type A_L rejects any offer less than, and accepts any offer that equals or exceeds \$2.00. If both A_L and B consider \$2.00 a "fair" offer, the dispute rate between them is 0%.

15. For example, see Pecorino and Van Boening (2001, 2004) for the embedded game, and the literature cited in Section 2 for the simple game.

(ii) Player B's "fair" offer to type A_H is (\$4.00 – \$0.75) + ½(\$0.75 + \$0.75) = \$4.00. A "fair" type A_H rejects any offer less than, and accepts any offer that equals or exceeds \$4.00. If both A_H and B consider this a "fair" offer, the dispute rate between them is 0%.

And for the simple game, the equal-split predictions are:

(iii) Player B's "fair" offer to player A is ½(\$1.50) = \$0.75. A "fair" player A rejects any offer less than, and accepts any offer that equals or exceeds \$0.75. If both A_L and B consider \$0.75 a "fair" offer, the dispute rate between them is 0%.

Before proceeding is worth consider whether our predictions would be affected if one or both players are risk averse. The outcome in the event of a dispute is common information before player B makes an offer. Thus, this is not a source of uncertainty. This implies that risk aversion will have no effect on player A's behavior. Risk aversion could affect player B's behavior since player A's taste for fairness is not directly observable, i.e., B cannot be sure if a given offer of surplus will be accepted or rejected. If B is risk averse, this may cause him to increase the amount of surplus he offers so as to avoid this "rejection risk". This type of risk is present in both our embedded ultimatum game and in the simple ultimatum game we run as a control. As the rejection risk is similar in both games, comparisons across the two largely control for the effects of risk aversion.

4. Results

Our analysis focuses on player B's offer to player A, and A's subsequent accept/reject decision. We first analyze behavior in the embedded game, and we then compare the embedded ultimatum game with the simple ultimatum game. Throughout this section, we express player

B's offers to player *A* in terms of the amount surplus contained in the offer, so as to focus on the amount of the $1.50 surplus that player *B* offers to player *A*. For example, when outcome L applies in the embedded game, a subject's offer of 175 is reported here as 175 – 125 = 50. Similarly, when outcome H applies a subject's offer of 375 is reported as 375 – 325 = 50. Under this convention, offers equal to the strictly rational theoretical prediction are reported as zero, those above the rational prediction are reported as positive numbers, and those below are reported as negative numbers.[16]

4.1 Offers and Disputes in the Embedded Game

In the embedded game, is the amount of the surplus offered a function of the recipient's (player *A*'s) type? Figure 1 displays histograms of *B*'s offers by player *A* type in selected intervals; offers to A_L are depicted with hatched bars and those to A_H are depicted in solid bars.

There are three things to note in the figure. First, the two offer distributions are quite similar. The only apparent difference is in the adjacent intervals 0 to 25 and 26 to 50, as 9% more of the offers to A_H fall in the former, and 11% more of the offers to A_L fall in the latter. This suggests that player *B* may be slightly more generous to type A_L, but the data in Table 2 below implies that there is little or no difference in the surplus player *B* offers to the two player *A* types. Second, the clear majority of offers lie in the 0 to 25 range, and there are few offers above 50. Eighty-eight percent of the offers to A_L and 86% of the offers to A_H are in the closed interval [0,50]. Roughly three-quarters of all the offers (261/351) contain between zero and one-sixth of the embedded pie: 70% (119/170) of those to A_L and 79% (142/181) of those to A_H are in the 0 to 25 range. Further analysis of the data reveals that only 2% and 3% of the offers to A_L and A_H, respectively, are in the 75 to 150 range, i.e. contain one-half or more of the surplus.

[16] Recall that subjects were only allowed make offers from the interval [0,599], i.e., the "negative offers" discussed below are due to our convention.

The third thing to notice in Figure 1 is the < 0 interval. One aspect present in our embedded game, but not the simple ultimatum game, is that player *B* can make a "negative offer" (relative to the strictly rational prediction) and attempt to extract more than player *A*'s cost of dispute. For example, an offer of 100 to an A_L player would be 100 – 125 = – 25 when expressed in terms of the amount of surplus contained in the offer. Of course, theory predicts that player *A* would never accept a "negative" offer. Six percent (21/351) of the offers in our embedded game are less than the strictly rational prediction. These offers tend to occur in early rounds (fourteen occur in rounds 1–3), tend to be offered by the same players (three subjects account for twelve of them), and are independent of player *A*'s type (ten are to A_L and eleven are to A_H.) Only two were accepted, both by a type A_H and both in early rounds (an offer of –10 in round 2 of session S2 and an offer of –25 in round 1 of session S3). It is also possible for player *B* to offer more than the embedded pie, i.e., make an offer of more than 150. We observed only two such offers, both occurring in round 1 and both made to an A_L player (an offer of +250 in session S4, and +375 in session S5). As theory predicts, both of these offers were accepted. In Figure 1, these two observations are included in the > 50 interval. Overall, 7% (23/351) of the observed offers were outside the 0–150 range.

Table 2 reports analysis on *B*'s offers in the embedded ultimatum game. The upper panel of the table shows summary statistics, which are calculated using different units of observation on player *B*'s offers. In the first four columns, the unit of observation is the individual player *B* offers to player *A*. The first two columns include all 351 of *B*'s offers, 170 to A_L and 181 to A_H. The third and fourth columns include only those 328 offers with a surplus of 0 – 150 (158 offers to A_L and 170 offers to A_H). Recall that in our simple ultimatum game, the surplus offered must necessarily fall in the range 0 – 150. Thus the middle two columns provide the comparable data from our embedded game. Ninety-three percent (328/351) of *B*'s offers in the embedded game fall in the range 0 – 150; the 7% outside this range are discussed above with Figure 1. The multiple individual offers made by each player *B* across rounds are not strictly independent observations (even though *A* and *B* are randomly and anonymously paired at the start of each round). To address this lack of independence, the unit of observation in the two far right-hand columns of Table 2 is the median surplus offered per player *B*. That is, for each of the twenty-seven players *B*, two medians are calculated: his median surplus offered to A_L players and his median surplus offered to A_H players.[17] This calculation provides one observation per player *B* on offers to the two player *A* types. The summary statistics presented in the last two columns of Table 2 are computed using the twenty-seven medians.

The data in the upper panel of Table 2 reinforce the view that in the embedded game, the proposer (player *B*) makes relatively low offers. Summarizing across all units of observation in Table 2, the mean offer of about 20 implies that the typical offer contains roughly 13% of the available surplus. Furthermore, the median offer of 10 or 12.5 indicates that half of the offers contain 7–8 % or less of the surplus; the modal offer of 5 equates to 3% of the surplus, and about one quarter of the observations occur at the mode.

The lower panel of Table 2 reports parametric tests for differences in central tendency and dispersion, as well as nonparametric tests for differences in central tendency and distribution.[18] Regardless of the unit of observation or the type of statistical test, we find virtually no evidence suggesting that *B* offers a different amount of surplus to A_L than he does to

---

[17] The medians are calculated using all offers, including those with surplus outside the 0–150 range.

[18] We include both parametric and nonparametric tests as robustness checks on our statistical analysis; see Conover (1999) for discussion of their relative efficiency. Using G*Power 3 (Faul et al., 2007) as described in Mayr et al. (2007), our Table 2 *t*-tests will reject H_0 at $\alpha = 0.5$ with power $1–\beta = 0.95$ if observed differences in average offers are as small as 16.5, 8.4 and 18.3 (from left to right), i.e., the tests are sensitive to differences that constitutes as little

A_H. Across the board, we fail to reject the null hypothesis of no difference. This is especially true of the two tests of central tendency. The lowest *p*-value for the parametric difference-in-means *t* tests is .1854, and for the nonparametric Wilcoxon tests the lowest is .6368. The parametric *F* tests for equal variances have *p*-values of .1323, .1033 and .0643, which one could interpret as marginally statistically significant. However, no corresponding difference is observed under the nonparametric Kolmorogrov-Smirnov tests for identical distributions (*p*-values of .4481, .5499 and .9284), so any difference in dispersion does not appear to be substantial.

Collectively, the data in Figure 1 and Table 2 provide compelling evidence that player *B* does not discriminate between the two player *A* types when making his offer. We conclude that the amount of the surplus offered is not a function of the recipient's type. This conclusion is not altered if we omit data from the early rounds to control for learning.[19]

We next ask, does the recipient's (player *A*'s) dispute rate vary with her type, when controlling for the amount of surplus offered? Figure 2 shows the dispute rates by player *A* type for the same offer-intervals as Figure 1. Player A_L is depicted with hatched bars and A_H with solid bars; for reference, the percent of total offers that occur in the given interval are shown in parentheses above each bar. The figure suggests that the dispute rates do not differ substantially or systematically across player *A* types.[20] Each type received roughly the same percentage of offers per interval, and the dispute rates per interval are similar. In particular, 70% of the offers to A_L and 79% of the offers to A_H fall in the 0 to 25 interval, and the respective dispute rates are

---

as 11%, 6% or 12% (respectively) of the available surplus. Our reported differences of 6.0, 0.8 and 0.7 are well below these thresholds and represent 6%, 0.5% and 0.5% of the surplus.

[19] Learning is further discussed below. Here we note that if the first five rounds of data are deleted from the computations in Table 2, the mean and median offers increase slightly (but the mode remains constant at 5), and the dispute rates drop slightly. However, it continues to be the case that we fail to reject all four null hypotheses tested on Table 2.

21% and 25%. As shown above in Table 2 (last row in the upper panel), the overall dispute rates are similar at 22% for A_L and 25% for A_H. If the twenty-three offers outside the 0–150 range are excluded, the overall dispute rates drop to 17% and 21%, respectively. In Figure 2, we note that neither A_L nor A_H ever reject any offer greater than 50 (i.e., both dispute rates are 0% in that interval), and A_H never rejects an offer greater than 25. Our interpretation of the data is that while the A_L dispute rate is about 3–4% lower than the A_H rate, the difference in A_L and A_H rejection behavior does not appear to be of major economic significance. We conclude that dispute rates do not vary substantively by the recipient type in the embedded game.

Previous work (e.g., Hoffman and Spitzer 1985 and Hoffman et al. 1994) has shown that when a player earns the right to be the sender (our player *B*) in the simple ultimatum game, outcomes move away from the equal-split tendency and towards the fully rational outcome. In particular the sender makes, and the receiver is willing to accept, offers that are 20-25% less generous when the person making the offer has earned this right versus when it is randomly assigned.[21] By contrast, in our experiment, player *A* (the receiver) obtains a random windfall when the die roll determines her type as A_H instead of A_L. Extrapolating the previous results to our environment, one might reasonably expect player *B* to be less generous to (or extract more surplus from) the relatively fortunate A_H than he is to A_L. However, we find that the unearned windfall of A_H has no significant effect on *B*'s offers: he is equally stingy to both player *A* types. The unearned windfall has no apparent effect on *A*'s behavior, either, as both types appear willing to accept comparable amounts of surplus. The lack of response to A_H's windfall reflects the small role of fairness behaviors in the experiment as a whole.

[20] In the < 0 interval, A_H did accept two of the eleven "negative" offers (see the discussion of Figure 1 above), but otherwise those offers were rejected as theory predicts.

[21] These percentage estimates are based on Figures 3(a) and 3(b) of Hoffman et al. (1994); their Tables 2 and 3 provide test statistics and *p*-values, but not point estimates of the (statistically significant) effect.

4.2. The Embedded Game v. the Simple Game

We now compare our embedded ultimatum game with our simple ultimatum game. To preview our findings, we find that player *B* makes much lower offers in the embedded game than in the simple game. In addition, player *A* exhibits a much greater willingness to accept low offers in the embedded game than she does in the simple game. These results constitute two of the main findings of our paper.

In the embedded game, we did not observe any substantive difference in offers player *B* makes to the two player *A* types, nor any substantive difference in *A*'s dispute rates across her two types, so we pool those data in the analysis here. Also, as offers in the simple game must necessarily lie in the 0–150 range, and because our embedded game results are robust to the inclusion or exclusion of the twenty-three offers outside this range (see Table 2), we only consider embedded game offers in the 0–150 range in the following analysis.

Does the percentage of the joint surplus from settlement that player *B* offers differ substantially across the two games? Figure 3 shows histograms of the offers in the two games for selected intervals. The data for the simple ultimatum game (solid bars) are very much in line with results reported elsewhere in the literature: the offers are exceptionally generous relative to the strictly rational prediction of zero. Eighty-eight percent of the offers in the simple game contain over one third of the surplus (i.e., exceed 50), and 71% contain between one third and one half of the surplus (i.e., are in the 51 to 75 range). As Table 3 below shows, the median and modal offers in our simple game are both 75, and the mean offer is 73.6, so the equal-split outcome is quite pervasive. Based on these data, we conclude that the typical result in ultimatum games is robust to our experimental protocol. Figure 3 also shows that offers in the embedded game (hatched bars) are much more selfish than offers in the simple game. Ninety-three percent of the embedded game offers contain one-third or less of the surplus (i.e., are 50 or less) and only 2% contain more than half the surplus (i.e., exceed 75). Embedding the ultimatum game within a larger bargaining context moves the player *B* offers sharply in the direction predicted by the model of narrow rationality.

Table 3 reports analysis on player *B*'s offers in the two games. As in Table 2, the upper panel of the table shows summary statistics that are calculated using different units of observation on *B*'s offers. In the first two columns the unit of observation is the individual offers in the 0–150 range.[22] In the two far right-hand columns, the unit of observation is the median offer per player *B*; as in Table 2 this level of observation compensates for the lack of independence across the multiple offers made by each player *B*. That is, the median computation yields one observation per individual player *B*, totaling 27 observations in the embedded game and 12 in the simple ultimatum game.

In the embedded game, depending on the unit of observation, the mean offer either contains 13% (20/150) or 11% (17.1/150) of the surplus. This compares to 49% (73.6/150) of the surplus contained in the mean offer in the simple ultimatum game. The difference is even more pronounced if one compares the medians and modes. In the embedded game, the median offer contains 7–8% of the surplus (medians 10, 12.5), while the median offer in the simple game contains 49–50% of the surplus (medians 75, 73.7). The embedded game modal offer of 5 contains 3% of the surplus compared to 50% in the simple game where the modal offer is 75. In each game, a significant number of observations occur at the mode: over one-quarter in the embedded game, and about one-third in the simple game. The statistical tests in the lower panel

[22] The results are very similar if we use all offers. If all offers are used, the mean and median in column 1 are 16.1 and 10.0 respectively. The mean and median in column 3 are 16.0 and 10.0 respectively. None of the hypothesis tests are affected by including all offers rather than just those in the 0–150 range. Similarly, none of the hypothesis tests are affected if we drop data from rounds 1–5 to control for learning.

of Table 3 confirm that the typical surplus offered in the embedded game is lower than in the simple game, irrespective of whether the unit of observation is all offers or median offers. The *t*-test and Wilcoxon tests soundly reject the null hypotheses of equal central tendencies (all four *p*-values < .0000), and the negative signs on the test statistics clearly indicate that the typical embedded game offer is substantially less than the typical simple game offer.[23] Although the parametric *F*-tests do not reject the null of equal variances, the nonparametric K-S tests for identical distributions clearly reject H_0. Together with the tests for central tendency, this implies that the cumulative distribution of the embedded game offers lies to the left of the distribution for the simple game. Based on the data in Figure 3 and Table 3, we conclude that yes, the percentage of the joint surplus from settlement that player *B* offers does differ substantially across the two games.

Finally, does *A's* rejection behavior in the two games differ substantially, when controlling for the amount of surplus offered? The histograms in Figure 4 show the dispute rates across the two games, using the same offer intervals as Figure 3. There is only one interval where there is a substantial overlap in the offer distributions, as each game has a little over 10% of the offers in the 26 to 50 interval (see either Figure 3 or the percentages in parentheses in Figure 4). The dispute rate is much higher in the simple game than in the embedded game (77% v. 5%) in that interval. This suggests that player *A* is much more likely to reject comparable offers in the simple game. In the embedded game, the rejection rate is 23% in the 0 to 25 interval; we note that this is almost identical to the simple game rejection rate of 24% in the 51 to 75 interval. Similarly, the embedded game has a rejection rate of 5% in the 26 to 50 interval,

[23] As in Table 2, both the parametric and nonparametric tests are provided as robustness checks. Using the technique identified in fn. 18, our Table 3 *t*-tests will reject H_0 at $\alpha = 0.05$ with power $1-\beta = 0.95$ for observed differences as small as 8.0 and 17.0 (from left to right), i.e., the tests are sensitive to differences as little as 5% or

while the simple game has a rejection rate of 5% in the 76 to 150 interval. Additionally, the last row in the upper panel of Table 3 shows that the overall dispute rate is 19% in the embedded game and 28% in the simple game.[24] This is true despite the fact that the average offer in the embedded game contains 13% of the surplus compared to 49% in the simple game.

It is clear that embedding the ultimatum game leads to a large downward shift in what player *A* considers to be an acceptable offer of surplus. Our reading of the collective data is that *A's* rejection behavior does differ substantially across the two games when controlling for the amount of surplus offered. Our evidence is consistent with the hypothesis that the high offers observed in the simple ultimatum game result more from the sender's fear of rejection rather than a sense of fairness on the part of the sender. As the receiver's willingness to accept falls, the offer from the sender tends to fall along with it.

4.3. Discussion

It is temping to explain the "more self-interested" offers in the in the embedded game versus the simple game with the rationale that player *B* is less generous in the embedded game because there player *A* has a positive dispute payoff. But if *B*'s generosity is an inverse function of *A*'s dispute payoff, then he would offer more of the \$1.50 surplus to A_L than he would to A_H, as the \$3.25 A_H dispute payoff is more than two and one-half times the \$1.25 A_L dispute payoff. In fact, the \$2.00 difference between the A_L and A_H dispute payoffs in the embedded game is larger than the difference between the embedded game \$1.25 A_L dispute payoff and simple game \$0.00 player *A* dispute payoff. We find that the amount of surplus offered to A_L and A_H is very

11% (respectively) of the available surplus. Our reported differences of 53.6 and 56.5 (respectively) far exceed these thresholds and represent 36% and 38% of the surplus.

[24] Table 3 contains data on offers which contain 0–150 of the surplus. When all 351 embedded game offers are included, the dispute rate is 24%, which is close to the 28% dispute rate in the simple game.

similar, while the amount offered to *A* in the embedded game is much lower than the amount she is offered in the simple game.

Player *B* makes much lower offers in the embedded game in part because player *A* is much more likely to accept them than she is in the simple game. It is also tempting to explain the difference in *A*'s behavior across the two games with the positive embedded game dispute payoffs. But if *A*'s acceptance decision is inversely related to her dispute payoff, then holding the amount of surplus offered constant, A_L would reject offers that A_H would accept. We find very little if any difference in acceptance behavior between A_L and A_H in the embedded game, and we find a significant difference in acceptance behavior of player *A* in the simple game versus her behavior in the embedded game. The fact that our embedded game has positive dispute payoffs may be important, because it changes the framing of the bargaining game. What the discussion above makes clear, however, is that the magnitude of the dispute payoffs used in our experiment is not driving our results.

Knez and Camerer (1995) analyze an ultimatum game with outside options.[25] While there are many differences between the framing of our experiment and theirs, it is useful to compare our results with theirs.[26] In their experiment, it is common information that the total pie is $10. The proposer always has an outside option of $3.00, and the responder has either a $2 or $4 outside option. When the responder's outside option is $2.00, the joint surplus from settlement is $5.00 (= $10 – $3 – $2), and Knez and Camerer report that the median offer is $4.00. As that median offer is $2.00 above the responder's outside option, it contains 40% of the joint surplus from settlement – this is well above the 8% we find in our embedded game. When the responder has an outside option of $4, the joint surplus from settlement is $3.00, and they observe a median

---

[25] The discussion in this paragraph refers to their Table III.
[26] Some of the differences in framing are covered in Section 3.2.

offer of \$4.50. This is \$.50 above the responder's outside option and represents about 17% of the joint surplus from settlement. Thus when the responder's outside option is increased from \$2 to \$4, Knez and Camerer observe a small increase in the absolute amount of the median offer, but a substantial decrease in the percentage of surplus contained in that offer.

There are several things to note regarding their results. First, their median offers of \$4.00 and \$4.50 are close to half of the \$10 the two parties have been given to split; given the framing of their game, one or both players may have viewed this as an offer of 40–45% of the surplus. Second, in our experiment, we do not observe differences in the percentage of surplus offered as the outside option rises from \$1.25 to \$3.25. However, an important difference is that our joint surplus from settlement remains constant at \$1.50, while theirs changes from \$5 to \$3, i.e., they have the confounding influence that both the outside option and the joint surplus from settlement are changing. Third, Knez and Camerer report a dispute rate of around 50%, which is roughly twice that usually observed in ultimatum game experiments (including ours). The high dispute rate seems to revolve around inconsistent assessments by the players over whether they were engaged in the activity of splitting \$10 verses the smaller surplus from settlement which remained once the outside options were taken into account.

One other difference between our work and theirs (and from the outside option literature more generally) is that the outside option in our experiment is financed via a payment from the player in the role of the sender, rather than by the experimenters.

Finally, a natural question to ask is what role learning plays in player B's offers and player A's rejection behavior. Figure XX shows B's median offer per round in the embedded ultimatum game – to A_L and A_H, respectively – aggregated across all sessions, as well as B's median offer in the simple ultimatum game. The median offer to A_H is quite stable in rounds 1-11 (five of the eleven medians are 10, one is 11.5 two are 12.5, two are 5 and one is 2.5); there is an upward a blip up in the last two rounds. The median offer to A_L is constant at 5 over the first four rounds and then fluctuates fairly tightly around 12 in the final nine rounds (three medians are 10, two are 12.5, two are 15, one is 17.5, and one is 25). These results change very little if we omit offers that are (in deviation form) that are < 0 and/or outside the 0–150 range; recall that nearly all of the offers outside the 0–150 range occurred in early rounds. As we document in footnotes 19 and 22, the results in Tables 2 and 3 are robust to omitting data from rounds 1-5: None of the ten hypothesis tests (six in Table 2, four in Table 3) are affected, and while the Table 2 median offer to A_L rises from 10 to 15, none of our interpretations or conclusion are substantively altered.

5. Conclusion

Earlier, we posed two questions that our experiment was designed to answer. The first question concerned behavior within the embedded game:

1. *Does behavior differ by the recipient's type in the embedded ultimatum game?*

The answer to this question is a clear "no" and this conclusion is based on our first two main findings. First, the amount of surplus offered by player *B* differs very little by *A's* type. Both the central tendency and the distribution of offers across *A*'s type are virtually identical. Second, the rejection behavior of A_L and A_H players is very similar, even when controlling for the amount of surplus contained in *B*'s offer. Thus, the fact that the A_H players receive an unearned windfall has no significant effect on the behavior of either the *A* or *B* players.

The second question concerned behavior across the embedded and simple ultimatum games:

2. *Does behavior in the embedded ultimatum game differ substantially from behavior in the simple ultimatum game?*

Here the answer is a resounding "yes" and this conclusion is based on our other two main findings. Our third main finding is that offers in the embedded game are much more selfish than in the simple game. In the embedded game, the median offer contains 8% of the joint surplus from settlement compared with 50% in the simple game (using the mean, the comparison is 13% v. 49%). Our fourth main finding is that even though offers are lower in the embedded game, the overall rejection rate is similar in the two games, indicating *A's* greater willingness to accept low offers in the embedded game. Taken together, the results are consistent with the idea that the high offers of surplus in the simple ultimatum game are driven by a fear of rejection rather than by a sense of fairness on the part of player *B*; as player *A*'s willingness to accept falls, so does the offer from player *B*.

Why do our embedded game results differ so greatly from the standard results in the ultimatum game literature? Before addressing this question, it is worth pointing out several factors that are <u>not</u> driving our results. We are able to closely replicate the standard ultimatum game results using the same protocol as in the embedded ultimatum game. Thus, it should be clear that social distance, the repeated nature of the game, and the low stakes per round (a pie of $1.50) cannot explain the relatively selfish offers observed in the embedded game.

So what explains our results? As discussed earlier, the framing of our embedded game differs from the framing of a simple ultimatum game in several important ways. First, the player in the role of the defendant clearly makes payments to the player in the role of the plaintiff. (To reiterate, we do not use terms such as "plaintiff", "defendant", and "trial" when we describe this game to the players.) The defendant is endowed with a lump sum at the beginning of the experiment and the amount of this lump sum is not known by the plaintiff. This may create a property right in the minds of both players. This is reinforced by the fact that the entire bargained over amount does not disappear in the event of a dispute (i.e., the plaintiff receives a positive payment at “trial”). Given the framing of the game, the players almost certainly do not view themselves as engaged in the task of splitting $1.50 each period.

We believe that the differences in framing discussed above (partially) explain why our results differ dramatically from the standard results in the literature, but we also believe that these changes are entirely appropriate in a setting of stylized legal bargaining. It would be an interesting extension of this work to try and decompose the changes in framing between the simple ultimatum game and our embedded game to see how much each factor contributes towards the difference in results. Nevertheless, it is quite significant that when taken as a whole, these differences in framing cause the outcome of the stylized legal bargaining game to move sharply towards the predictions of the model of (narrow) rationality.

Fairness or other-regarding considerations are not totally absent in our stylized legal bargaining game, but our results suggest that these considerations are much less important than in a simple ultimatum game.

References

Andreoni, James, and Emily Blanchard. 2006. "Testing Subgame Perfection Apart from Fairness in Ultimatum Games." *Experimental Economics* 9: 307-321.

Bebchuk, Lucian Arye. 1984. "Litigation and Settlement Under Imperfect Information." *RAND Journal of Economics* 15 (Autumn): 404-415.

Binmore, Ken, Avner Shaked, and John Sutton. 1989. "An Outside Option Experiment." *Quarterly Journal of Economics* 104 (November): 753-770.

Blount, Sally. 1995. "When Social Outcomes Aren't Fair: The Effect of Causal Attributions on Preferences." *Organizational Behavior and Human Decision Processes* 63(2): 131-144.

Conover, W.J. 1999. *Practical Nonparametric Statistics*, 3rd ed. Wiley & Sons: New York.

Croson, Rachel, Terry Boles, and J. Keith Murnighan. 2003. "Cheap Talk in Bargaining Experiments: Lying and Threats in Ultimatum Games." *Journal of Economic Behavior and Organization*.

Farmer, Amy and Paul Pecorino. 2004. "Pretrial Bargaining with Fairness." *Journal of Economic Behavior and Organization* 54 (July): 287-296. .

Faul, Franz, Edgar Erdfelder, Albert-Georg Lang, and Axel Buchner. (2007). "G*Power 3: A Flexible Statistical Power Analysis Program for the Social, Behavioral, and Biomedical sciences," *Behavior Research Methods* 39: 175-191.

Fehr, Ernst and Klaus M. Schmidt. 2000. "Theories of Fairness and Reciprocity: Evidence and Economic Applications." CESifo Working Paper Series, Working Paper No. 403.

Güth, Werner and Steffen Huck. 1997. "From Ultimatum Bargaining to Dictatorship – An Experimental Study of Four Games Varying in Veto Power." *Metroeconomica* 48: 262-279.

Güth, Werner, Steffen Huck and Peter Ockenfels. 1996. “Two-Level Ultimatum Bargaining with Incomplete Information: An Experimental Study.” *Economic Journal* 106: 593-604.

Güth, Werner, Rolf Schmittberger, and Bernd Schwarze. 1982. "An Experimental Analysis of Ultimatum Bargaining." *Journal of Economic Behavior and Organization* 3: 367-88.

Hoffman, Elizabeth, Kevin A. McCabe, Keith Shachat, and Vernon L. Smith. 1994. "Preferences, Property Rights, and Anonymity in Bargaining Games." *Games and Economic Behavior* 7(3): 346-80.

Hoffman, Elizabeth, and Mathew Spitzer. 1985. “Entitlements, Rights, and Fairness: An Experimental Examination of Subjects’ Concepts of Distributive Justice.” *Journal of Legal Studies* 14: 259-297.

Kahn, Lawrence M. and J. Keith Murnighan. “A General Experiment on Bargaining in Demand Games with Outside Options.” *American Economic Review* 83: 1260-1280.

Knez, Mark J., and Colin F. Camerer. 1995. “Outside Options and Social Comparisons in Three Player Ultimatum Game Experiments.” *Games and Economic Behavior* 10: 65-94.

Mayr, Susanne, Axel Buchner, Edgar Erdfelder, and Franz Faul. (2007) “A Short Tutorial of GPower,” *Tutorials in Quantitative Methods for Psychology* 3(2): 51-59.

Nelson, William Robert Jr. 2002. "Equity or Intention: It is the Thought that Counts." *Journal of Economic Behavior And Organization* 48(4): 423-430

Pecorino, Paul and Mark Van Boening. 2001. “Bargaining and Information: An Empirical Analysis of a Multistage Arbitration Game.” *Journal of Labor Economics* 19: 922-48.

Pecorino, Paul and Mark Van Boening. 2004. “An Empirical Analysis of Bargaining with Voluntary Transmission of Private Information.” *Journal of Legal Studies* 33 (January): 131-156.

Reinganum, Jennifer F., and Louis L. Wilde. 1986. "Settlement, Litigation, and the Allocation of Litigation Costs." *RAND Journal of Economics* 17 (Winter): 557-566.

Roth, Alvin E. 1995. "Bargaining Experiments", in John H. Kagel and Alvin E. Roth eds., *The Handbook of Experimental Economics*. Princeton University Press, Princeton.

Roth, Alvin E., Vesna Prasnikar, Shmuel Zamir, and Masahiro Okuno-Fujiwara. 1991. "Bargaining and Market Behavior in Jerusalem, Ljubljana, Pittsburgh, and Tokyo: An Experimental Study." *American Economic Review* 81: 1068-1095.

SAS (2004). SAS OnlineDoc® 9.1.3. Cary, NC: SAS Institute Inc.

Schmitt, Pamela M. 2004. "On Perceptions of Fairness: The Role of Valuations, Outside Options, and Information in Ultimatum Bargaining Games." *Experimental Economics* 7: 49-73.

Schotter, Andrew, Avi Weiss, and Inigo Zapater. 1996. "Fairness and Survival in Ultimatum and Dictatorship Games." *Journal of Economic Behavior and Organization* 31(1): 37-56.

Shavell, Steven. 1989. "Sharing of Information Prior to Settlement or Litigation." *RAND Journal of Economics* 20 (Summer): 183-195.

Slonim, Robert, and Alvin Roth. 1998. "Learning in High Stakes Ultimatum Games." *Econometrica* 66: 569-96.

Thaler, Richard H. 1988. "Anomalies: The Ultimatum Game." *Journal of Economic Perspectives* 2: 195-206.

Zeiler, Kathryn, Charles Solver, Bernard Black, David A. Hyman, and William M. Sage. 2007. "Physicians' Insurance Limits and Malpractice Payments: Evidence from Texas Closed Claims, 1990-2003." *Journal of Legal Studies* 36: S9-S45.

Table 1. Experimental Design

Session	Number of pairs	Number of rounds	Location
I. Embedded Ultimatum game			
Joint surplus from settlement $F_A + F_B = 150$ with $F_A = F_B$			
S1	7	13	Univ. of Alabama
S2	7	13	Univ. of Alabama
S3	6	13	Univ. of Mississippi
S4	7	13	Univ. of Mississippi
II Simple Ultimatum Game			
Joint surplus from settlement or pie size = 150			
S5	5	10[a]	Univ. of Alabama
S6	7	10[a]	Univ. of Alabama

[a] In S5 there were an additional 5 rounds, and in S6 an additional 4 rounds with a pie size of 1500. Those rounds are not included in the data analysis reported here; see discussion in text.

Table 2. Amount of Surplus Offered by Player *B* in the Embedded Game

Unit of observation:	Individual offers		Individual offers with surplus 0–150		Median surplus offered per player *B*	
Surplus offered by *B* to:	A_L	A_H	A_L	A_H	A_L	A_H
I. Summary Statistics						
Number of observations	170	181	158	170	27	27
Mean	19.2	13.2	19.6	20.4	17.9	18.6
Median	10	10	10	10	10	12.5
Mode	5	5	5	5	5	5
(pct. of obs. at mode)	(25%)	(24%)	(27%)	(26%)	(26%)	(26%)
Standard deviation	40.1	45.0	19.6	22.3	14.8	21.5
Minimum	–124	–309	0	0	0	–4.5
Maximum	375	121	100	121	55	95
Number of rejected offers	37	45	27	36	---	---
(dispute rate)	(22%)	(25%)	(17%)	(21%)	---	---
II. Statistical Tests for differences between the surplus *B* offered to A_L and A_H [a]						
Parametric tests						
H_0: Equal means	$t = 1.33$ $p = .1854$		$t = –0.38$ $p = .7057$		$t = –0.14$ $p = .8621$	
H_0: Equal variances	$F = 1.26$ $p = .1323$		$F = 1.29$ $p = .1033$		$F = 2.10$ $p = .0643$	
Non-Parametric tests						
H_0: Equal central tendencies	$Z = 0.12$ $p = .9077$		$Z = –0.13$ $p = .8976$		$Z = –0.47$ $p = .6368$	
H_0: Identical distributions	$D = 0.09$ $p = .4481$		$D = 0.08$ $p = .5499$		$D = 0.15$ $p = .9284$	

[a] Computed using SAS (2004) software; non-parametric tests are the Wilcoxon rank sum test (central tendencies) and the Kolmorogrov–Smirnoff test (identical distributions).

Table 3. Amount of Surplus Offered by Player *B* in the Two Ultimatum Games

Unit of observation:	Offers with surplus of 0–150		Median surplus offered per player *B*	
Surplus offered by *B* to *A* in:	Embedded Game	Simple Game	Embedded Game	Simple Game
I. Summary Statistics				
Number of observations	328	120	27	12
Mean	20.0	73.6	17.1	73.6
Median	10	75	12.5	73.7
Mode	5	75	5	75
(pct. Of obs. at mode)	(26%)	(39%)	(30%)	(33%)
Standard deviation	21.0	20.2	13.4	13.0
Minimum	0	0	5	55
Maximum	121	150	50	110
Number of rejected offers	63	33	---	---
(dispute rate)	(19%)	(28%)	---	---
II. Statistical tests for differences between the surplus *B* offered in the two games [a]				
Parametric Tests				
H_0: Equal means	$t = -24.1$ $p = .0000$		$t = -12.2$ $p = .0000$	
H_0: Equal variances	$F = 1.08$ $p = .6484$		$F = 1.07$ $p = .9531$	
Non-Parametric Tests				
H_0: Equal central tendencies	$Z = -14.5$ $p = .0000$		$Z = -4.97$ $p = .0000$	
H_0: Identical distributions	$D = 0. 82$ $p = .0000$		$D = 1.00$ $p = .0000$	

[a] Computed using SAS (2004) software; non-parametric tests are the Wilcoxon rank sum test (central tendencies) and the Kolmorogrov–Smirnoff test (identical distributions).

Figure 1. Offers in the Embedded Ultimatum Game

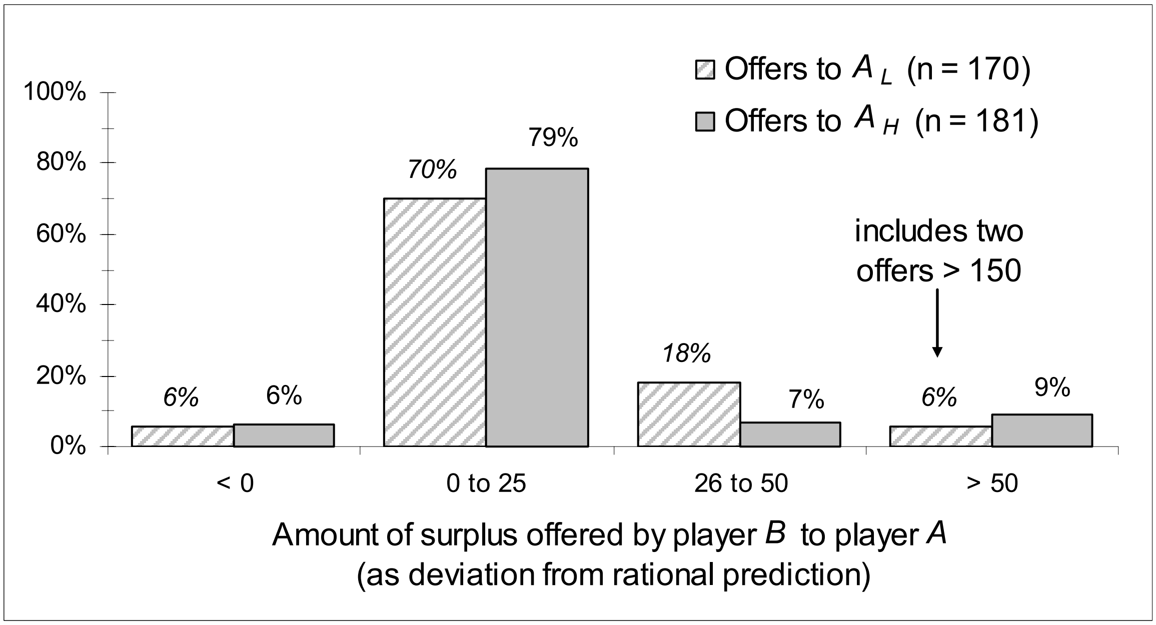

Figure 2. Dispute Rates in the Embedded Game by Player *A* type

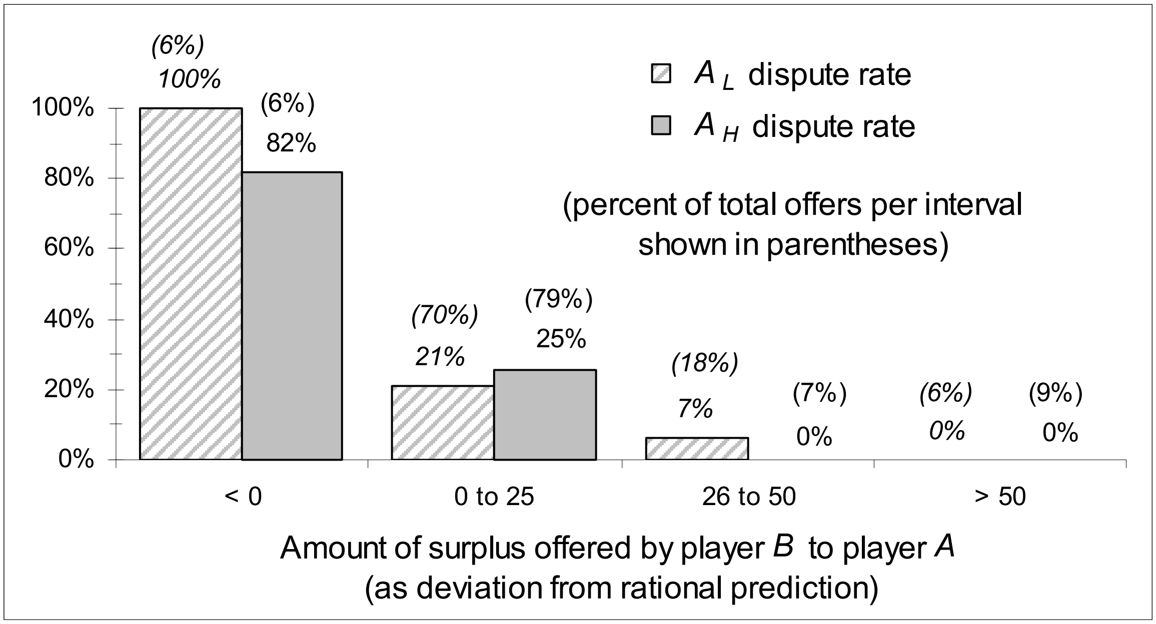

Figure 3. Comparison of Offers in the Simple and Embedded Ultimatum Games

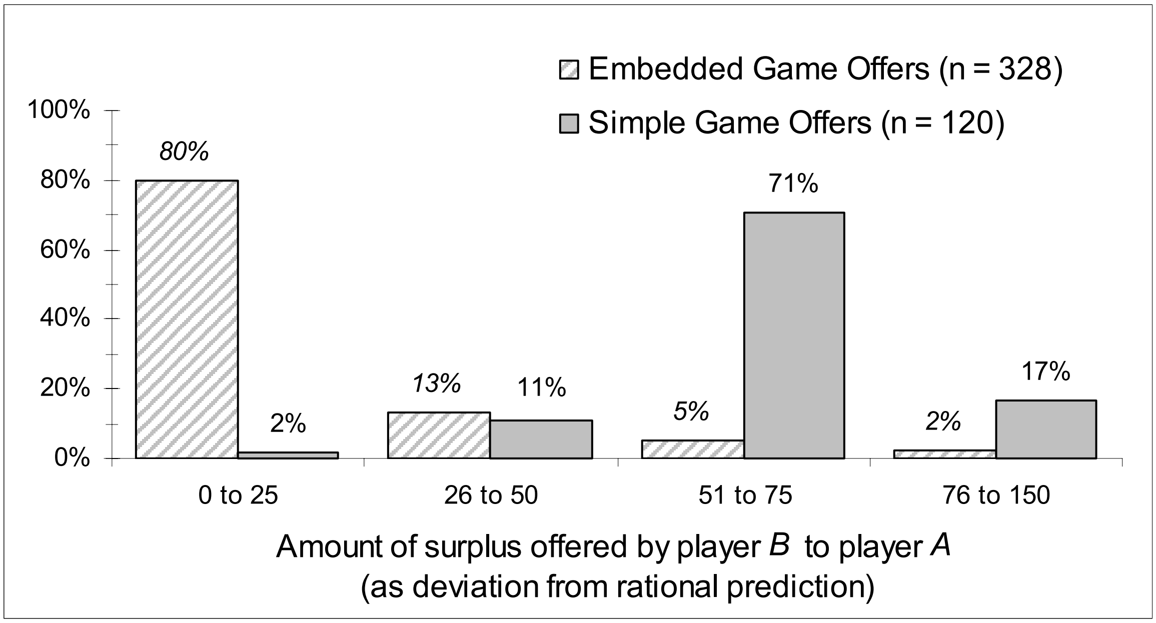

Figure 4. Comparison of *A*'s Rejection Behavior Across the Two Games

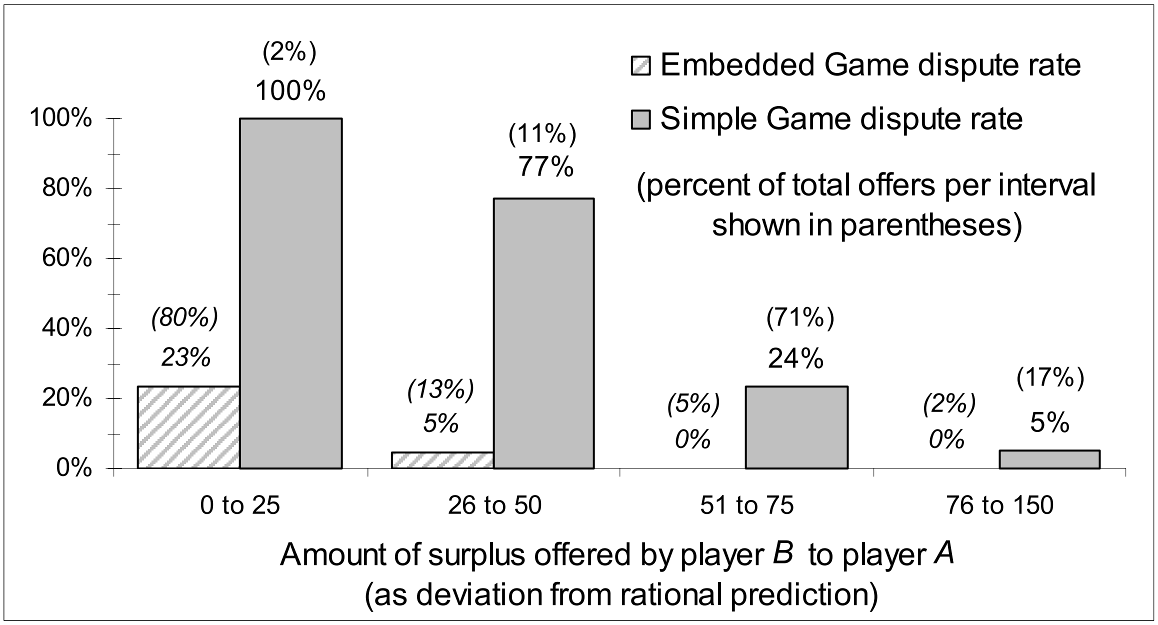

Figure 5. Player *B*'s Median Offers by Round