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Multi-Offer Litigation: An Empirical Analysis of Alternative Mechanisms

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ABSTRACT

This experiment analyzes multi-offer versions of the single-offer signaling and screening litigation games, as well as a bilateral multi-offer game. A plaintiff has either a low or a high claim on an uninformed defendant, and the two negotiate in an attempt to reach a pre-trial settlement. Trial is costly, and settlement generates surplus over which the two parties can bargain. In previous experiments, excess disputes occur even though offers contain surplus not predicted under the theory, and fairness appears to be important in explaining deviations from theory. This experiment examines whether renegotiation in the form of successive sequential offers can yield efficiency gains. There are four main findings. One, under the multi-offer structure the excess dispute rate is 23 percentage points lower in the screening game and the high-offer dispute rate is 31 percentage points lower in signaling game. The bilateral game yields an additional 15 percentage point reduction in the high-offer dispute rate, but excess disputes persist. Two, players take advantage of the multi-offer opportunity and make around 3 to 4 offers per negotiation. Three, across games the surplus in a fair offer remains constant at about one-sixth of the surplus, but the benchmark from which this is measured varies according to which player has the power to make the offer. Fourth, dynamic behavior in the multi-offer games play an important but complex role in observed outcomes. Multi-offer mechanisms may be alternatives to costly information transmission like disclosure or discovery.

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1. Introduction

Asymmetric information can yield costly disputes in bilateral negotiations. An example is civil litigation. In that situation, one party (the plaintiff) has a claim on the other (the defendant). If they cannot reach settlement, the dispute is resolved by a neutral third party (e.g., a judge) but both the plaintiff and the defendant then incur settlement costs. Consider the simple case where the plaintiff has either a high claim or a low claim, and the size of the claim is the plaintiff's private information. The uninformed defendant only knows the probability distribution over the possible claim sizes. If the dispute is litigated by the neutral third party, both plaintiff and defendant incur legal fees. At judgment, the plaintiff is assured her type-specific damages minus the legal fee she incurs, while the defendant's cost equals the plaintiff's damages plus the legal fee he incurs. Consequently, the plaintiff and defendant can generate surplus by settling prior to the costly litigation, with the amount of surplus equal to the sum of avoided litigation costs. The negotiated settlement distributes this surplus between the two. In the law and economics literature, both theoretical and experimental work has primarily focused on negotiations where one party has the power to make a single take-or-leave-it pre-trial offer. If the offer is accepted, the plaintiff and defendant split the settlement surplus according to the offer. If they do not, they litigate and incur the judgement and fees as described above. In the screening game, the uniformed defendant makes the offer. In the signaling game, the informed plaintiff makes the offer. In both games, the two parties are essentially playing an ultimatum game over the settlement surplus, i.e., an ultimatum game is embedded within the legal bargaining context.

Bebchuck (1984) describes the screening game, where the uninformed defendant makes the single take-or-leave-it offer. Under the appropriate conditions, the optimal offer is a screening offer that is accepted by a plaintiff with a weak case (the low claim in the example above) and rejected by a plaintiff with a strong case (or the high claim). Thus, the predicted dispute rate is equal to the probability of a plaintiff having a strong case. Reinganum and Wilde (1986) analyze a signaling game when the informed plaintiff makes the offer. Under the right conditions, a semi-pooling equilibrium will emerge in which plaintiffs with a weak case will sometimes reveal their type with a low offer, and sometimes bluff with a high offer. Plaintiffs with a strong case will pool with the bluffing weak case plaintiffs on the high offer. Disputes occur because in equilibrium, the defendant rejects the high offer at a rate that makes a weak plaintiff indifferent between bluffing and making a revealing offer. Pecorino and Van Boening (2018, henceforth PVB 2018), conduct an experimental study on the screening and signaling games. They find reasonably strong empirical support for theory. However, they also find that in both games there are excess disputes (i.e., the empirical dispute rate is above the theoretically predicted rate) and offers contain positive surplus where theory predicts zero surplus. The main source of the excess disputes is disagreement over small quantities of surplus, which PVB 2018 attribute to fairness concerns.

One potential way to signal a willingness to settle and reach consensus as to what constitutes a fair offer is via offers and counteroffers. This has not yet been addressed in either the theoretical or empirical law and economics literature. This experiment examines this type of dispute resolution mechanism in a stylized legal bargaining context. The experimental treatment consists of two novel frameworks. The first is a multi-offer analog to each of the single-offer screening and signaling games. One party has the power to make the offer, but the proposer can make as many take-it-or-leave-it offers as she/he wants in a specified time period. This allows a proposer to change the offer if the previous one is not accepted. The second framework is bilateral negotiation in which both players can submit offers and counteroffers within a specified time period, and either player can accept the other's offer. The experiment is designed to investigate whether or not these different mechanisms can lower the incidence of disputes and thereby lead to efficiency gains.[1]

Section 2 reviews the literature and the theory, and section 3 describes the experimental design. Section 4 presents the data in the form of eight separate results. Collectively, the results indicate that the multi-offer mechanisms do lead to efficiency gains in the form of reduced excess disputes involving weak plaintiffs in the screening game, and reduce disputes involving strong plaintiffs in the signaling game. Specifically, the weak-plaintiff excess dispute rate is 23 percentage points lower in the multi-offer screening game, and the strong-plaintiff dispute rate is 27 percentage points lower in the multi-offer signaling game. (Including bluffing weak plaintiffs, this latter reduction is 31 percentage-points). Strong plaintiffs and bluffing weak plaintiffs are also better able to pool in the multi-offer signaling game, yielding outcomes closer to the semi-pooling equilibrium predictions than those in the single-offer game. Also, empirically a fair offer is one that contains about one-sixth of the surplus from settlement, but the benchmark from which this is measured varies across according to the power to make the offer. In the one-sided games, the benchmark is all of the surplus (i.e., five-sixths for the proposer and one-sixth for the recipient). In the bilateral game where both players have the power to make an offer, it is the surplus midpoint. Demands from both players average around one-half of the surplus, and offers that demand an additional one-sixth or more are unlikely to be accepted. Section 4 also discusses some behavioral dynamics. Section 5 concludes, and places the results within the context of law and economics experiments on voluntary discovery and mandatory disclosure.

[1] This study is, in spirit, analogous to early market institution experiments, e.g., Smith and Williams' (1983) empirical study of alternative bid/ask queue mechanisms in the double auction, or the Plott and Smith (1978) empirical evaluation of posted-offer markets relative to the double auction.

2. Background

The literature on the ultimatum game extends across economics, psychology, and law. Güth, Schmittberger, and Schwarze (1982) first examined the behavior of subjects in a simple ultimatum game. Relevant surveys of the literature include Thaler (1988), Roth (1995), Camerer and Thaler (1995), and Fehr and Schmidt (2000). The well-known and oft-replicated findings are that human players make frequently make offers in excess of the smallest possible positive offer and sometimes reject those offers. Both behaviors contradict the theoretically predicted actions of a strictly rational player.

Both the Bebchuck (1984) screening game and Reinganum and Wilde (1986) signaling game can both be thought of as litigation games with an ultimatum game embedded within them. In each, two parties negotiate over the surplus from settlement (the "pie") and one player has the power to make an ultimatum offer while the other either accepts or rejects the offer. Pecorino and Van Boening (PVB 2018) conduct an experiment that directly compares these two games. They find that screening behavior by the defendant leads to outcomes consistent with the theory, but as in the ultimatum game, players tend to offer surplus not predicted by theory and the disputes with weak plaintiffs exceed the theoretically predicted rate. The signaling game presents a more cognitively challenging environment for their subjects, as the defendant needs to discriminate between legitimate offers from a high-claim plaintiff and bluffs from a low-claim plaintiff, and simultaneously, the weak and strong plaintiffs need to pool on a single high offer. Consequently, while their results generally support the theoretical semi-pooling predictions, their signaling game data are less congruent with theory than are their screening game data.

As the laboratory game in this study uses the same parameterization as PVB 2018, it is instructive to summarize their setting and key findings. Table 1 summarizes the PVB 2018 parameters. The subjects are either player A (the informed plaintiff) or player B (the uninformed defendant). The probability that the plaintiff is type A_H with a strong (high-claim) case is p = 1/3 and the probability she has is type A_L with a weak (low-claim) case is $1–p$ = 2/3. All claims and offers are denoted in US cents. In the screening game player B makes the take-or-leave-it offer, and in the signaling game player A makes the take-or-leave-it offer. The high claim is J^H = 450 (or \$4.50) and the low claim is J^L = 150 (or \$1.50). In both games, if the offer is accepted, the round ends and B's cost and A's payoff both equal the amount of the offer. If the offer is rejected, the dispute is litigated and both players incur a fee of $F_A = F_B = 75$. At judgement A's dispute payoff equals her type-dependent judgement minus her fee: A_H receives 450 – 75 = 375 and A_L receives 150 – 75 = 75. B's dispute cost equals the type-dependent judgement plus his fee: he pays 450 + 75 = 525 against A_H and 150 + 75 = 225 against A_L. Under these parameters, the settlement surplus that the two players negotiate over is the sum of the fees: 75 + 75 = 150.

Table 1. Dispute Payoffs and Costs at Trial

Negotiation[a]	Judgement at Trial J^i	A's Dispute Fee F_A	B's Dispute Fee F_B	A's Dispute Payoff	B's Dispute Cost
B vs. A_L	150	75	75	75	225
B vs. A_H	450	75	75	375	525

[a] B does not know A's type at the time of the offer: $p(L)$ = 2/3 and $p(H)$ = 1/3.

In both the screening and signaling games, the uninformed player B knows only the probabilities with which A is type A_L (p = 2/3) or type A_H ($1–p$ = 1/3). (Dispute payoffs, costs, and fees are common information). Under the PVB 2018 screening game parameters, B is predicted to make a screening offer of 75 that A_L accepts but A_H rejects. The predicted dispute rate is 0% for A_L and 100% for A_H, yielding an overall dispute rate of 33%. Empirically, any offer 75–225 is consistent with screening type behavior, as B makes an offer that theoretically only A_L would accept, but any screening offer exceeding 75 contains positive surplus for A_L. Theory predicts *B* will extract all the surplus from settlement with his screening offer of 75.[2]

In the signaling game, the informed player *A* makes the offer, and she can signal her type by the offer she makes to *B*. One characteristic of signaling games is that there are generally multiple equilibria. In the PVB 2018 semi-pooling equilibrium, *A* can signal that she is type A_L with a revealing offer of 225, which extracts all of the settlement surplus from *B* (i.e., the offer equals *B*'s dispute cost versus her type). Alternatively, she can bluff by making a high offer that mimics A_H. Knowing that a high offer is untrustworthy, *B* rejects it with probability *r* that makes A_L indifferent between bluffing and making a revealing offer. Simultaneously, A_L bluffs at a rate *b* which makes *B* indifferent between accepting and rejecting the bluff. A_H makes a separating offer between 375 and 525 (which separates her from a revealing A_L). However, in the semi-pooling equilibrium, A_H and a bluffing A_L will pool on the same high offer between (and including) 375 and 525, with the specific offer jointly contingent on the rate *r* at which *B* rejects the high offer and the rate *b* at which A_L bluffs. PVB 2018 conclude that the simultaneous determination of these three (*r*, *b*, and the high offer) makes the signaling game cognitively more challenging for experimental subjects relative to the screening game.

PVB 2018 report two empirical regularities across these two games, both related to the notion of a fair offer. First, in both games, players make offers that contain positive surplus for the other player, which is not predicted by theory. The median offer typically contains about 1/6 of the surplus from settlement. Second, excess disputes occur whereby players reject some of these "positive surplus" offers, which is likewise inconsistent with theory. The excess dispute

[2] An offer of 375 would constitute a pooling offer that is theoretically acceptable to both A_L and A_H and one that extracts all of the settlement surplus from A_H. Pooling is not predicted under the PVB parameters. Empirically, any offer 375 – 525 is consistent with pooling.

rate is usually about 20-25%. A mechanism that helps players resolve fairness concerns can potentially facilitate settlement and thereby increase efficiency.

3. Experimental Design

Table 2 presents the experimental design for the one-sided single-offer and multi-offer games, as well as the two-sided bilateral multi-offer game. The design addresses two research questions motivated by the PVB 2018 results. First, are excess disputes an empirical artifact of the single take-or-leave-it offer setting? One offer is sufficient to avoid excess disputes, provided the player with the right to make the offer knows the exact amount of surplus necessary to reach settlement. (Under the theory, the proposer is able to extract all of the surplus from settlement, i.e., offers zero surplus.) Behaviorally, the proposer typically does not know this amount prior to the initial offer, and the opportunity to revise the offer may reduce or eliminate excess disputes. Second, can bilateral negotiation similarly (or further) reduce the excess dispute rate? Giving both parties the right to make and update offers can potentially resolve disagreements about what constitutes a fair offer.

Sessions ScrS-1 and SigS-1 are computerized replications of the hand-run PVB 2018 screening and signaling games, respectively. As discussed below, these one-sided single-offer sessions generally replicated the PVB 2018 results and hence only one session of each is conducted. The one-sided multi-offer games parallel the one-sided single-offer games, but allow for multiple offers from the proposer. Sessions ScrM-1 and ScrM-2 are multi-offer versions of the screening game, where the uninformed player *B* can sequentially make as many settlement offers as he wishes in the allotted 30-second time period. Player *A* can either accept *B*'s latest offer, or remain silent. If an offer is accepted, the negotiation round ends. If no offer is accepted before time expires, the ensuing dispute is resolved as in PVB 2018 with type-dependent dispute payoffs and costs and the imposition of dispute fees (see Table 1 above). Likewise, sessions SigM-1 and SigM-2 are multi-offer versions of the signaling game. The informed player *A* is allowed to make sequential offers, while *B* can accept her latest offer or remain silent. If time expires with no agreement, the dispute is resolved as in PVB 2018. In the bilateral multi-offer sessions BMO-1 through BMO-4, both informed *A* and uninformed *B* can make sequential offers and either party can accept the most recent offer from the other party. Again, if time expires with no agreement, the dispute is resolved as in PVB 2018.

Table 2. Experimental Design

Game	Pairs	Rounds	Negotiations				Average Earnings
			n	B v. A_L	B v. A_H	% A_H	(min, max)
One-Sided Single-offer							
ScrS-1	4	30	120	92	28	23%	\$24.42 (17.75, 31.05)
SigS-1	7	30	210	161	49	23%	\$23.19 (12.21, 39.68)
One-Sided Multi-offer							
ScrM-1	6	30	180	126	54	30%	\$25.15 (12.21, 34.30)
ScrM-2	5	30	150	85	65	43%	\$23.97 (10.25, 30.59)
SigM-1	6	30	180	132	48	27%	\$24.60 (6.31, 34.02)
SigM-2	5	30	150	100	50	33%	\$25.69 (15.55, 30.16)
Bilateral Multi-offer							
BMO-1	8	30	240	136	104	43%	\$25.44 (17.35, 35.75)
BMO-2	8	30	240	136	104	43%	\$23.63 (10.09, 36.45)
BMO-3	4	30	120	84	36	30%	\$21.80 (5.50, 41.75)
BMO-4	5	30	150	120	30	20%	\$24.45 (10.45, 33.20)

All sessions last 30 rounds.[3] Subjects remain in the same player role (*A* or *B*) throughout the session, and *A* and *B* players are randomly re-paired prior to the start of each round. This generates a total of 860 observations in the one-sided games and 750 observations in the bilateral game. In all games, the ex-ante probability of Player *A* being type A_H is 33%. The ex-post

[3] Participants are not told the number of rounds in advance.

probabilities are 36% in the ScrM game, 30% in the SigM game, and 37% in the BMO game. The instructions and z-Tree (Fischbacher, 2007) interface refer only to "Player A" and "Player B" and do not utilize legal terminology such as plaintiff, defendant, or trial.

All sessions were conducted in the Mississippi Experimental Research Laboratory at the University of Mississippi. Subjects were recruited via classroom visits, bulletin-board flyers, and word of mouth during the spring and summer 2019 terms; no subject participated in more than one session. Typical earnings were around $25 (US) for a 90-120 minute session and ranged from $5.50 to $41.75. Subjects were paid from 12 randomly selected rounds out of the 30 in which they participated.[4]

A round of the single-offer games is identical to the multi-offer games, except that only one offer is allowed and the round is not timed (so as to parallel PVB 2018). In the multi-offer games, the steps of a round are as follows.

1. At the start of each round, *A* and *B* are randomly and anonymously paired. New pairs are redrawn at the start of each new round.
2. A random number between 1 and 100 is generated by the computer for each pair. If the random number is less than or equal to 67, outcome *L* applies for the round. If the number exceeds 67, outcome *H* applies. Only player *A* knows the outcome that applies in the round.
3. A 30-second clock begins its countdown. In the one-sided games, the proposer makes an offer to the responder. The recipient can accept the offer, wait for another offer, or wait for time to expire. The proposer is free to make a new offer if the latest offer has not been accepted and if time permits. Only the proposer's most recent offer can be accepted by

[4] This method allows the use the PVB 2018 parameters in the computerized version of their hand-run experiment, so that the results compare more directly with PVB 2018. It (and z-Tree code) is based on Wills (2018). Thirty rounds of the computerized games are completed in roughly the same time period as the PVB 2018 12-14 round sessions. Player *A* subjects are paid the sum of their payoffs from the 12 selected rounds. For player *B* subjects, costs are summed across the 12 selected rounds and then subtracted from a lump sum of $55, and *B* is paid the balance. *B*'s lump sum is private information known to *B* prior to the start of Round 1; see Pecorino and Van Boening (2018).

the recipient. In the bilateral game, both players can make offers and counteroffers, and either player can accept the other player's most recent offer. In all games, once an offer is accepted, or time expires, the negotiation ends.[5]

4. Payoffs and costs are assigned for both players as described in Table 1. If an offer is accepted, then the *A* payoff and *B* cost equal the amount of the offer. If time expires without an acceptance, the *A* payoff and *B* cost depend on the outcome *L* or *H* that was determined in Step 1, and both players incur a fee of 75. The fee reduces *A*'s payoff and increases *B*'s cost. Each player is privately informed as to their payoff or cost. *B* is informed of the outcome (*L* or *H*) that applied to the just-completed round.
5. Each player's screen displays a history of their decisions and payoffs or costs from previous rounds.
6. After all pairs have completed the round, new random and anonymous pairings are made, and the next round begins.

4. Results

The primary research question is the empirical effect of the multi-offer mechanisms on the incidence of dispute. The analysis here addresses disputes across all negotiations (or all offers) and in those negotiations where offers are in the 75-225 or 375-525 intervals. These latter intervals identify offers which are consistent with the theory above in Section 2, subject to the caveat that for the bilateral game the theoretical predictions serve as only benchmarks.[6] The intervals also facilitate direct comparison with PVB 2018 results, which are included in the tables and figures below labeled as Scr-PVB and Sig-PVB.

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[5] The multi-offer mechanisms do not include an "offer improvement" rule, whereby successive *B* offers have to be higher and/or successive *A* offers have to be lower. This design choice is motivated in part by the possibility of A_L bluffs. For example, consider the bilateral case where initially *A* offers 500 and *B* counters with 400. If, in the course of further negotiation, *B* decides that he is negotiating with a bluffing A_L, an improvement rule would prohibit him from lowering his offer to (say) 220. After considering this and various other scenarios across the three multi-offer games (e.g., cases where a system message or an offer restriction might inadvertently reveal *A*'s type), and seeking to maintain comparability across games, the decision was made to not place any restrictions on subjects' offer behavior. The impact of offer restrictions in the multi-offer games is left as an area of further research.

[6] The theoretical predictions for the bilateral game have not been formally derived. The theoretical predictions for the one-sided games are not affected by multiple offers per se. However, the 30-second time limit may induce a new game with some sort of "war of attrition" element.

Below are eight empirical results, each followed by a supporting discussion. Throughout, a "final offer" refers to one that is either an accepted offer or the most recent unaccepted offer when time expires. Arguably the most significant finding is the reduction in the strong plaintiff A_H dispute rate under the multi-offer mechanisms, so this result is presented first. The second result is the persistence of excess disputes involving weak plaintiffs A_L. As the empirical dispute rates are directly linked to the empirical offers, the next four results detail the observed offer behavior. Notably, players make frequent use of the multi-offer feature, averaging three to five offers per round. The last two results identify some observed dynamics in the multi-offer games.[7]

4.1. Dispute Behavior

4.1.1. B v. A_H and Semi-Pooling Negotiations

Result 1. The multi-offer games have substantially lower incidence of dispute between B v. A_H. In ScrM, the 43 percentage-point difference is largely due to anomalous acceptance behavior. In SigM, the 27 percentage-point difference is primarily due to a 31 percentage-point reduction in the B v. A high-offer dispute rate. The bilateral BMO game is associated in an additional 15 percentage-point reduction in the B v. A high-offer dispute rate.

Figure 1 shows the empirical overall dispute rates on ex post *B* v. A_H pairings across all games, and it shows the empirical *B* v. *A* dispute rates on offers 375-525 in the signaling games and the bilateral game. (Appendix Tables A1 and A2 provide more detail. Tables A3 and A4 report logistic regressions with robust standard errors.) In the screening game the predicted *B* v. A_H dispute rate is 100%, as *B* makes a screening offer 75-225 which A_H rejects. In the signaling game semi-pooling equilibrium, A_H and bluffing A_L pool on a unique high offer within the 375-

[7] To evaluate any changes over time (including learning), nearly all of the section 4 figures and tables (including appendix tables) were replicated using data from the first fifteen periods and from the last fifteen periods. The appendix regressions were also estimated with round number included as a control variable. No systematic trends or effects were observed over time, and hence those results are not included here. The text below includes occasional discussion of noteworthy intertemporal findings.

525 range, and the predicted dispute rate is 50-67% with the point prediction conditional on the unique pooling offer.[8] As A_L can also bluff in the BMO game, the 375-225 dispute rate is shown for that game as well. (As *A* cannot make an offer in the screening games, *A* pooling and bluffing behaviors do not apply there.) The PVB 2018 screening and signaling games data are included as reference points.

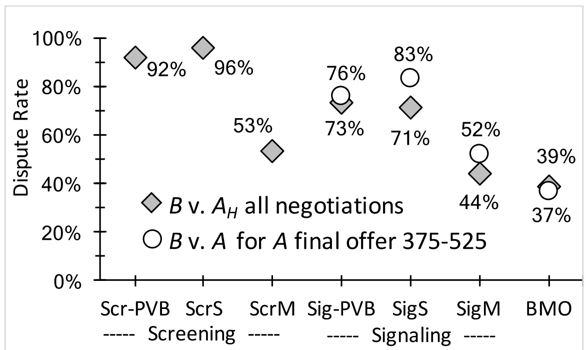


Figure 1. Disputes in *B* v. A_H and *B* v. *A* Semi-Pooling Negotiations

In both the screening and the signaling games, the ex post *B* v. A_H overall dispute rates are substantially lower in the multi-offer game relative to the corresponding single-offer game. In the screening games, the single-offer Scr-PVB and ScrS have A_H dispute rates that exceed 90% (the prediction is 100%) compared to 53% in the multi-offer ScrM. Appendix Table A3 reports statistical difference between ScrS and ScrM (p = .002), but Table A1 shows the ScrM dispute rate is due largely to an inexplicably low 54% (58/107) rejection rate by A_H when *B* offers less than 375. These offers are less than A_H's dispute payoff and hence should be rejected 100% of the time. Consequently, the 43 percentage-point difference in the *B* v. A_H dispute rate is attributed to anomalous ScrM acceptance behavior. In the signaling games, the single-offer Sig-

[8] The point prediction is contingent upon the particular semi-pooling offer that A_H and bluffing A_L choose, as theoretically *B* rejects the high offer at the rate which makes A_L indifferent between bluffing and revealing her type. The predicted rejection rate is 50% when A_H and A_L pool on 375, and 67% when they pool on 525; intermediate choices have corresponding intermediate rejection rates (see PVB 2018).

PVB and SigS A_H dispute rates exceed 70% while the multi-offer SigM rate is only 44%. The 27 percentage-point difference between SigS and SigM is both economically and statistically significant (the Table A3 comparison has $p = .002$). The bilateral BMO game yields a 39% *B* v. A_H dispute rate, which is an additional five percentage points lower than SigM, but this difference is not statistically significant ($p = .369$ in Table A3).

Figure 2 shows that the *B* v. A_H reductions in the SigM and BMO games are likely due to the similarly lower incidence of dispute when *A* makes a final offer 375-525. Recall that *B* does not know *A*'s type at the time of the offer and that in the semi-pooling equilibrium he is predicted to reject the high pooling offer 50-67% of the time. In Sig-PVB and SigS the empirical *B* v. *A* 375-525 dispute rates are 76% and 83%, respectively, while in SigM it is 52% ($p = .001$ in Table A4). The 31 percentage-point difference between SigS and SigM on *B* v. *A* offers 375-525 is similar to their 27 percentage-point *B* v. A_H all-negotiations difference identified in the previous paragraph. The bilateral BMO game has a 37% *B* v. *A* 375-525 dispute rate[9], which is 15 percentage points less than in SigM ($p = .019$ in Table A4). This difference is three times larger than, but in the same direction as the five percentage-point *B* v. A_H difference. Collectively, in the signaling game the empirical high-offer dispute rate is about 30 percentage points lower under the multi-offer regime. In the bilateral multi-offer game, the empirical high-offer dispute rate is an additional 15 percentage points lower.

4.1.2. B v. A_L Negotiations

Result 2. Excess disputes arise when B and A_L cannot agree on what constitutes a fair offer. Across games, a fair offer appears be one which contains about 1/6 of the surplus for the recipient. In the one-sided games, excess disputes arise when the proposer demands 5/6 or more

[9] Player *A* makes 259 offers 375-525 in SigM, and *B* rejects 97. See the Table A2 and A6 375-525 column totals.

of the surplus from settlement. In the two-sided BMO game, excess disputes arise when the B and A_L demands exceed the surplus midpoint by more than about 1/6 of the settlement surplus.

Figure 2 summarizes the *B* v. A_L dispute behavior across games. (Appendix Tables A5 and A6 provide more detail. Table A7 reports a logistic regression with robust standard errors for offers 75-225.) The figure shows dispute rates both for *B* v. A_L over all negotiations, and for those negotiations in which the final offer is 75-225. For reference, the corresponding dispute rates from Scr-PVB and Scr-PVB are also included (and reported in Table A5). In the one-sided games, a dispute that occurs between *B* and A_L when the final offer is 75-225 is considered an "excess dispute" as theory predicts the offer will always be accepted. This applies to *B* screening offers in Scr-PVB, ScrS and ScrM, and to A_L revealing offers in Sig-PVB, SigS and SigM. Here, the excess-dispute designation is also applied here to BMO disputes where both *B* and A_L make final offers 75-225, as this "as if" *B* is making a screening offer while A_L is simultaneously making a revealing offer. However, the designation is for comparative purposes only.

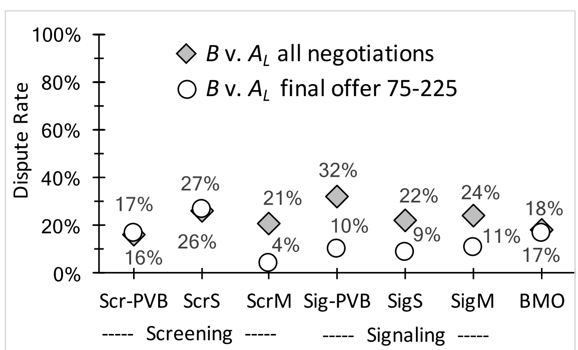


Figure 2. *B* v. A_L Disputes Rates

In the single-offer screening game ScrS, the overall dispute rate is 26% and the excess dispute rate on offers 75-225 is 27%. Thus, almost all of the overall disputes are due to excess disputes. In Scr-PVB the overall (17%) and excess (16%) dispute rates have a similar implication. In the multi-offer ScrM, the 21% overall dispute rate is due primarily to anomalous offers (see Table A5). Notably, the ScrM excess dispute rate is only 4%, which is 23 percentage-points less than ScrS. This difference is economically and statistically significant (p = .000 in the Table A7 logit regression). The 4% SigM rate is also well below the 17% excess dispute rate in Scr-PVB. Review of the data finds that all the excess disputes in both ScrS and ScrM occur on offers in the subinterval 75-100. These screening offers demand five-sixths or more of the 150 settlement surplus (i.e., they offer A_L one-sixth or less). In ScrS the B v. A_L dispute rate over the subinterval 75-100 is 30% (23/76), but in ScrM it is only 7% (5/70). For whatever reason, A_L is relatively more willing to settle for one-sixth or less of the surplus in ScrM, resulting in a substantially lower excess dispute rate. This finding is revisited below in section 4.4.

In the single-offer signaling game SigS, the overall dispute rate is 22% and the excess dispute rate is 9%. The rates are similar in the multi-offer SigM at 24% and 11%, respectively. The 22% and 24% overall rates are within the predicted 0-25% interval (recall that the predicted overall rate includes rejections on A_L bluffs) but below the 32% overall rate in Sig-PVB. The 9% and 11% excess dispute rates parallel the 10% rate in Sig-PVB, and there is no apparent statistical difference across the SigS and SigM structures (Table A7 has logit p = .510). Review of the data finds that A_L revealing offers in the subinterval 200-225 – which demand five-sixths or more of the surplus – also have dispute rates around 10%: when B is offered one-sixth or less of the surplus, his rejection rate is 10% (6/63) in SigS and 8% (5/65) in SigM.

In the two-sided multi-offer BMO game, the B v. A_L dispute rates are 18% overall and 17% when both B and A_L make final offers 75-225. Analysis of the data provides some insight in this latter dispute rate.[10] There are 150 BMO negotiations in which B and A_L both make final

[10] The following discussion based on a panel regression with robust standard errors. Estimated model: BMO Offer 75-225 = 134.29 + 27.17×ALacc – 10.81×Brej + 41.31×ALrej (s.e. 3.58, 5.31, 8.19, and 8.52, respectively), n = 300, R^2 = .137, F = 16.68 (p = .000). Dummy variables are ALacc = 1 if the offer is made by A_L and the case settles,

offers 75-225. In the 125 cases which settle, the mean *B* offer is 134 and the mean A_L offer is 161, with a midpoint of 147.5.[11] Each of the means represents a demand for about three-fifths of the surplus, and their midpoint represents nearly one-half. In the 25 disputes, the mean *B* offer is 123 and the mean A_L offer is 176, with midpoint 149.5. These means represent demands for nearly two-thirds of the surplus, and the midpoint again represents one-half. On average, if an offer demands two-thirds or more of the surplus – offering the rival party one-third or less – the offer is unlikely to be accepted. That is, excess disputes tend to arise in the bilateral game when demands exceed half plus one-sixth of the surplus.

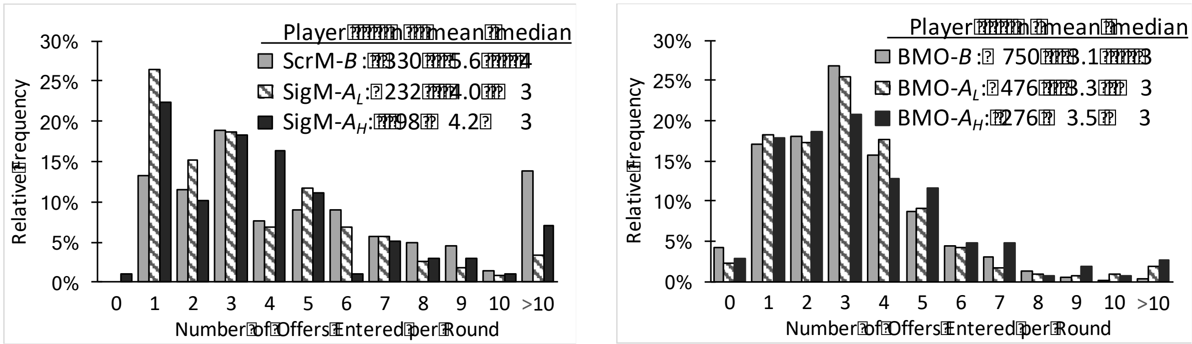
4.2. Offer Frequency in the Multi-Offer Games

Result 3. Players make frequent use of the multi-offer opportunity. In the one-sided ScrM and SigM games, proposers typically make 4-5 offers per round. In the two-sided BMO game, each player typically makes about 3 offers per round.

Figure 3 provides frequency distributions of offers per round in the multi-offer games. Figure 3(a) shows the one-sided ScrM and SigM games, and the distributions for players *B*, A_L and A_H are fairly similar. A closer analysis yields a similar finding. In 87% (286/330) of the ScrM rounds *B* makes more than one offer, and in 56% (185/330) he makes two to six offers. These percentages are similar for both *A* types in SigM: A_L makes more than one offer 74% (170/231) of the time and two to six 59% (137/231) of the time, while A_H makes more than one 77% (75/98) of the time and two to six offers 57% (56/98) of the time. There is a small difference in central tendency across ScrM and SigM, as *B* averages 5.6 offers per round in ScrM compared to 4.0 for A_L and 4.2 for A_H in SigM. The corresponding medians are 4, 3 and 3.

Brej = 1 if the offer is made by *B* and the case ends in dispute, and ALrej = 1 if the offer is made by A_L and case ends in dispute (all variables = 0 otherwise).

[11] In 57% (71) of the 125 settlements *B* accepts A_L's offer, and in 43% (54) A_L accepts *B*'s offer.



(a) One-sided ScrM and ScrS Games (b) Two-sided BMO Game

Figure 3. Offers per Round in the Multi-Offer Games by Player Type

Figure 3(b) shows the per-round offer frequency distributions from the two-sided BMO game. There the three players have nearly identical distributions. Player *B* averages 3.1 offers per round while A_L and A_H average 3.3 and 3.5, respectively, and all three players have medians of 3 offers. In Figure 3(b), all three also have modes of 3. Closer analysis reveals that each player makes more than one offer in 79% percent of the rounds (*B* 590/750, A_L 378/476, and A_H 217/274) and that each makes two to six offers about 70% of the time (*B* 73% = 590/750, A_L 74% = 350/476, and A_H 69% = 188/274).[12]

4.3. Offer Behavior

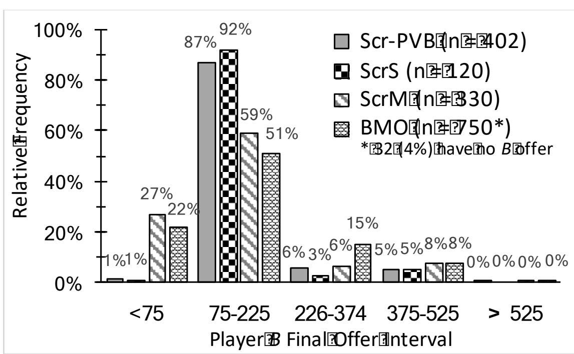
4.3.1. Offer Distributions

Result 4. For each player type, final offer distributions are largely robust across games and generally consistent with the applicable theory. Most of the anomalous final offers occur in the multi-offer games.

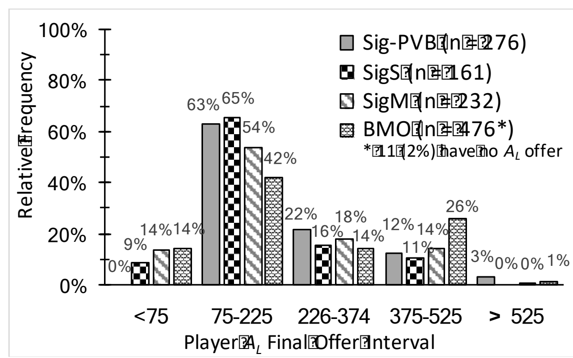
Figure 4 shows the frequency distributions of the final offers by player type and game. For comparison, the PVB 2018 distributions are also included (PVB 2018 Table 3, pg. 230). In

[12] In BMO, players do have the option of sending no offer at all, but Figure 4 below shows that this occurs only 4% of the time for *B*, 2% for A_L, and 3% for A_H. In all 750 BMO negotiations, at least one of the players sent at least one offer. Nearly all of the "no offers by one player" occur in the early rounds R1-R10.

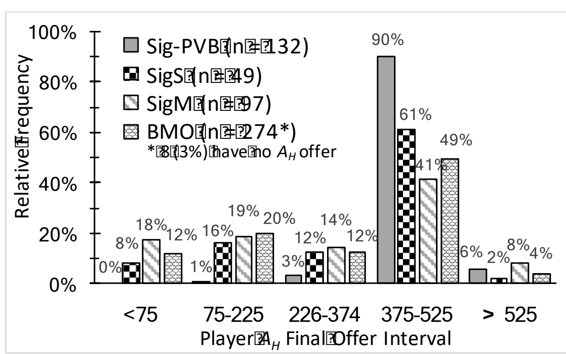
Figure 4(a), the player *B* distribution in ScrS mimics the distribution from Scr-PVB. In both, about 90% of *B*'s final offers are screening offers 75-225. This contrasts with ScrM and BMO where the 75-225 frequencies are 59% and 51%, respectively. In these two multi-offer games, most of the anomalous offers are <75, which are offers less than the A_L dispute payoff. Only 1% of the Scr-PVB and ScrS offers fall in this range, compared to 27% in ScrM and 22% in BMO. Further analysis finds that these latter two frequencies fall to 19% and 12% in rounds 21-30, but this behavior is nonetheless puzzling. The frequencies of ScrM and BMO offers 226-374, 375-525 and >525 are very similar to those in Scr-PVB and ScrS.



(a) Player *B*



(b) Player A_L



(c) Player A_H

Figure 4. Final Offer Distributions by Player Type and Game

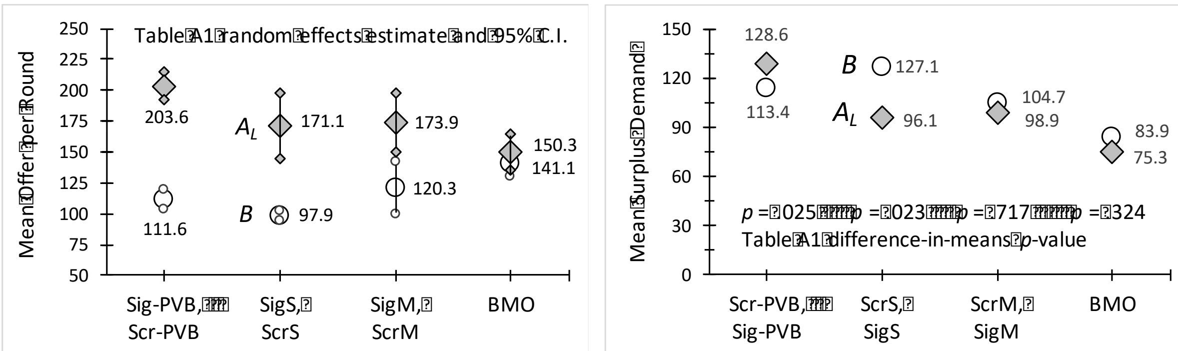
The player A_L distributions in Figure 4(b) also show similarity between the single-offer control and PVB 2018. In both Sig-PVB and SigS over 60% of the A_L final offers are revealing offers 75-225 and about 12% are bluffs 375-525. In the multi-offer SigM and BMO games, revealing offers are somewhat less frequent at 54% and 42%, respectively. This is due in part to relatively more bluffs 375-525, particularly in the BMO game where bluffs constitute over one-quarter of the A_L final offers. It is worth noting that in BMO, A_L has the option of avoiding a dispute even while maintaining her bluff by accepting *B*'s offer. This is revisited in section 4.4 below.

In Figure 4(c), 90% of the Sig-PVB A_H final offers are separating offers 375-525, but in ScrS the frequency is only 61%. In both the multi-offer ScrM and BMO games, the frequency is less than 50%. Virtually all of the anomalous A_H offers in SigS, SigM and BMO are less than the A_H dispute payoff is 375. At this time, we have no parsimonious explanation for the frequencies of these anomalous A_H offers.

4.3.2. Screening and Revealing Offers

Result 5. The mean demand of a screening player B decreases from about five-sixths of the surplus from settlement in ScrS to about two-thirds in ScrM. In both the SigS and the SigM signaling games, a revealing player A_L's mean demand is about two-thirds of the surplus. In the BMO game, where both players have the power to make multiple offers, both screening B and revealing A_L mean demands are about one-half of the surplus.

In the screening game, theory predicts *B* will attempt to settle with A_L by making a screening offer 75-225. Likewise, in the signaling game, an A_L player who reveals her type attempts to settle via a revealing offer 75-225. The point predictions (75 and 225, respectively) assume that the offer extracts all of the surplus from settlement. Figure 5(a) graphs the mean final offers 75-225 by *B* and A_L in the various games. The means are estimated from a random effect regression with individual subjects as the random effects and with robust standard errors (see appendix Table A8). For comparison, the figure includes the corresponding single-offer game values from PVB 2018.



(a) Mean Final Offer 75-225 (b) Mean Surplus Demand 75-225

Figure 5. Mean *B* and A_L Final Offers and Surplus Demands 75-225

In Figure 5(b), these means are expressed as demands for a share of the 150 settlement surplus, and the *p*-values are for difference-in-means tests between the *B* and A_L mean surplus demands (see Table A8). The demand implied by a *B* screening offer is 225 minus offer, and for a A_L revealing offer it is the offer minus 75.

In the ScrS and ScrM screening games, the mean player *B* screening offers are in the direction predicted by theory but they demand less than all of the 150 settlement surplus. The ScrS *B* mean of 98 in Figure 5(a) is towards the lower bound of the 75-225 interval, and in Figure 5(b) it represents a demand for 127 or about 5/6 of the 150 of the surplus. These are similar to the values shown for Scr-PVB. In the multi-offer ScrM, the mean of 120 represents a demand for 105 or about 2/3 of the available surplus, which is about 1/6 less surplus than in ScrS. In the signaling games SigS and SigM, the mean A_L revealing offers are nearly equal to one another at 171 and 174, respectively, and translate into demands of 105 and 99 or about 2/3 of the surplus. These are similar to, but somewhat less than the Sig-PVB values. Across the single-offer ScrS and SigS games the *B* and A_L mean demands in Figure 5(b) differ economically and statistically[13], but across the multi-offer ScrM and SigM games these demands are neither statistically nor economically different. In the BMO game, the *B* screening mean of 141 is close to, and the A_L revealing mean of 150 is equal to the mid-point of the 75-225 interval. In Figure 5(b), the corresponding mean demands of 84 and 75 are not statistically different from one another, and they both represent demands for about 1/2 of the surplus from settlement.

4.3.3. Semi-Pooling Offers

Result 6. In the one-sided SigS and SigM signaling games, bluffing A_L and separating A_H are unable to successfully pool on a unique high offer. In the two-sided BMO game, these two players are more successful at pooling as their mean high offers are not statistically different.

In the signaling game semi-pooling equilibrium, bluffing A_L and separating A_H pool on the same high offer. Empirically, PVB 2018 find that the two player *A* types are generally unable to coordinate on a unique high offer, with A_L bluffs typically less than A_H separating offers. Figure 6 shows that the one-sided SigS and SigM games yield a similar result, but in the bilateral BMO game A_L and *A* do (on average) appear to successfully pool on the same high offer. The figure shows A_L and A_H means for final offers 375-525 in the various games, as offers in this range are consistent with A_L bluffs and A_H separating offers. The means are again obtained from random effects regressions with robust standard errors (see appendix Table A9). The Sig-PVB results are provided for comparison.

In the SigS and SigM games, the mean A_L bluff is around 415-425 and the mean A_H separating offer is around 450-460, and in both games the A_L and A_H means are statistically different. These point estimates and their differences are similar to their Sig-PVB counterparts. In the two-sided BMO game, the A_L and A_H means are both in the 430-435 range. They do

[13] In ScrS and SigS, *B* is the relatively stingier party (on average). In PVB-Scr and PVB-Sig the demands are also statistically different, but there A_L (on average) demands about 6/7 of the surplus while *B* demands about 3/4.

follow the pattern that the A_L mean bluff (429) is less than the mean A_H separating offer (436), but their difference is neither economically nor statistically significant. These results suggest that the bilateral feature can enable (but not necessarily guarantee) semi-pooling by the *A* players. Notably, the multi-offer feature alone is not a sufficient condition for successful pooling, as the opportunity to make multiple offers is present in the one-sided SigM but there successful pooling fails to occur.[14]

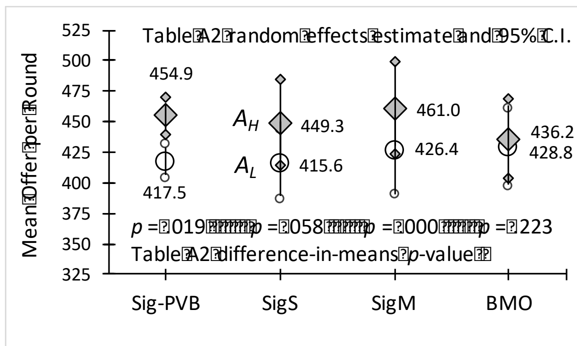


Figure 6. Mean A_L and A_H Final Offers 375-525

4.4. Intra-period Dynamics

4.4.1. Screening Games

Result 7. Excess disputes between B and A_L are less likely in the multi-offer screening game. However, the difference cannot be solely attributed to the multi-offer feature, as the empirical screening offer distributions also differ across the single- and multi-offer games.

As discussed above in section 4.1.2, in both ScrS and ScrM excess disputes between *B* and A_L only occur when *B* demand five-sixth or more of the surplus, and the 23 percentage-point difference arises because in ScrM A_L rejects these high-demand offers much less often.

[14] An empirical regularity observed across these games is that A_L and A_H rarely make final offers in the 426-449 interval. Consequently, both A_L bluffs and A_H separating offers effectively have bimodal distributions, as offers are almost exclusively in either the 375-425 or 450-525 ranges. (This is also true in Sig-PVB, using data provided via personal correspondence.) In SigS and SigM (and Sig-PVB) the empirical distributions are near-mirror images: about 60% of the A_L bluffs are 375-425 and about 40% are 450-525, while the A_H separating offers are about 40% in 375-425 and 60% in 450-525. In BMO, the A_L bluff and A_H separating distributions are very similar, as both A_L and A_H offers 375-525 have about 50% in 375-425 and about 50% in 450-525.

Screening offers 75-225 that demand five-sixths or more of surplus are those in the subinterval 75-100. Additional analysis finds that the empirical distributions of *B* screening offers differ across the two games, as nearly all of them are high-demand offers in ScrS whereas only about half are high-demand in ScrM. Specifically, in ScrS, 89% (76/85) of the final offers 75-225 are in the 75-100 subinterval while 56% (70/126) are 75-100 in ScrM.[15] Thus, A_L in much more likely to receive a high-demand offer in ScrS and her observed dispute rate on those offers is much higher.

Two questions arise. One is whether or not the bargaining structure affects the empirical offer distribution. The data above hint that it may, but this is by no means conclusive. The present experimental design did not anticipate the emergence of these different *B* screening offer distributions, and consequently the lower *B* v. A_L excess dispute rate cannot be attributed solely to the multi-offer feature.[16] A second question is whether or not there could be a dynamic interaction between the offer distribution and A_L's propensity to reject high-demand offers. Her dispute behavior suggests this is a possibility. Further analysis finds that in ScrS, the frequency of high-demand offers is persistent but essentially constant over the first fifteen and the last fifteen of the thirty rounds, yet this coincides with a near-doubling of the excess dispute rate. The frequency of offers 75-100 is 88% (35/40) in rounds 1-14 and 91% (41/45) in rounds 15-30. A_L rejection rate on these high-demand offers is 20% (7/35) in rounds 1-14 and rises to 39% (16/41) in rounds 15-30. In ScrM, the high-demand frequency is also fairly constant over time but less, and the A_L rejection rate is substantially lower. There, the frequency of offers 75-100 is

[15] A Kolmorogrov-Smirnov difference-in-distribution test has D = 0.342 (p = .000) on offers 75-225. These are screening offers that A_L receives, as the discussion focuses on *B* v. A_L excess disputes. Of course, *B* does not know *A*'s type when he makes the offer. For all offers 75-225, the 75-100 percentages are 90% (99/110) in ScrS and 53% (103/195) in ScrM with K-S D = 0.380 (p = .000).

[16] Various forms of the structure-surplus-dispute relationship were investigated to gain additional insight, including regressions and logit estimations using the number of offers, timing of offers, surplus contained in the offers, etc., but no systematic statistical relationship was identified.

60% (35/58) in rounds 1-14 and 51% (35/68) in rounds 15-30, and the corresponding A_L dispute rates are 6% (2/35) and 9% (3/35). The separate or collective dynamic interplays between bargaining structure, offer distributions, and dispute behavior remain areas of future inquiry.

4.4.2. Signaling and Bilateral Games

Result 8. In the signaling games, deviations from the semi-pooling predictions are less in the multi-offer game. Intra-period A_L "bluff abandonment" is a possible contributing factor.

In the signaling games, the empirical outcomes are closer to the semi-pooling point predictions when multiple offers are allowed. Conditional on the unique high offer on which A_H and a bluffing A_L pool, the semi-pooling equilibrium identifies *B*'s rejection rate on the high offer as well as A_L's bluffing rate. Table 3 provides the conditional predicted bluffing and rejection rates along with the observed rates. The pooled random-effects mean *A* offer 375-525 is used for the high offer, as it approximates the offer *B* sees at the time of his rejection decision.[17] Despite the similarity in the mean pooled offers across the games (Table 3 note *a* reports $p = .603$), the deviations from the predicted bluffing and rejection rates are larger in the single-offer game. The Sig-PVB and SigS empirical bluffing rates are less than predicted while the empirical rejection rates are much higher than predicted, and the corresponding binomial proportions tests all have $p \leq .01$.

Given the complexity of the semi-pooling equilibrium and the "one-shot" nature of the single offer game, deviations from the predictions are not surprising. In the multi-offer SigM game, the observed bluffing and rejection rates are closer to their predicted values and do not differ statistically from them (both have $p > .10$). Note that *B*'s 52% rejection rate is now

[17] See Table 3 note *a* for the random effects regression with robust standard errors. Similar point predictions for bluffing and rejection rates are obtained if the 375-525 median *A* offer, the mean or median A_L offer, or the median or mean A_H offer is used. The reader will note that Figure 6 and Table A9 imply that A_L and A_H are unsuccessful in pooling, but this is from *A*'s perspective and not *B*'s. Analyses of *B*'s rejections on offers 375-525 (see Tables A1 and A4) suggest that *B* is not able to successfully differentiate between A_L bluffs and A_H separating offers.

slightly less than the predicted 60%. Bluffing by A_L is also possible in the BMO game. Those results are provided for comparison, although the semi-pooling predictions serve only as benchmarks.

Table 3. Conditional Semi-Pooling Predictions and Empirical Rates

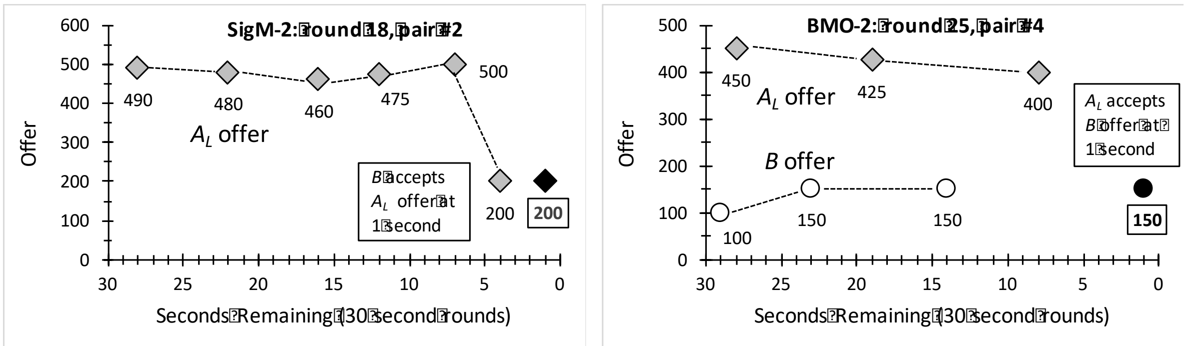
	Offers 375-525				
	Semi-pooling offer	A_L bluffing rate		B rejection rate	
	R.E. pooled mean A offer[a]	Predicted	Observed (p-value)[b]	Predicted	Observed (p-value)[b]
Sig-PVB	447	.18	.12 (.010)	.60	.76 (.000)
SigS	439	.20	.11 (.003)	.59	.83 (.000)
SigM	446	.18	.14 (.113)	.60	.52 (.186)
BMO	433	.22[c]	.26	.58[c]	.37

[a] Estimated using random effects panel regression $Offer375\text{-}525_{i,j,t} = \alpha_0 + \alpha_1 SigM_{i,j,t} + \alpha_2 BMO_{i,j,t} + \sum_{i=1}^{37} \gamma_i Subject_i + \varepsilon_{i,j,t}$, with robust standard errors. $n = 379$, $R^2 = .003$ and $\chi^2 = 1.01$ ($p = .603$). For subject i in session j round t, $SigM_{i,j,t} = 1$ if game is ScrM and $BMO_{i,j,t} = 1$ game is BMO (both variables = 0 otherwise). Sig-PVB offer calculated as weighted average of values in Pecorino and Van Boening Table 4 (2018, pg. 231).

[b] See Figure 4(b) A_L 375-525 offer frequencies and Figure 1 *B* v. *A* final offer 375-525 dispute rates. Binomial proportion test p-values for H_0: Observed rate = Predicted rate. Sig-PVB bluff rate from Pecorino and Van Boening (2018) Table 3 on pg. 230 and rejection rate from text on pg. 234.

[c] One-sided signaling game prediction provided as a benchmark.

An important feature of the multi-offer games is that players can revise their current offer as long as time remains in the negotiation round. In the SigM signaling game and the bilateral BMO game, this provides an opportunity for a bluffing A_L to "abandon" her bluff. In ScrM, A_L can initially bluff with one or more high offers 375-525, but if time nears expiration and the bluff remains unaccepted, she can (if she wishes) submit a revealing offer 75-225 which is empirically more likely to settle. Figure 7(a) illustrates this scenario with a *B* v. A_L negotiation from round 18 of session SigM-2. There, A_L makes a series five bluffs in the 460-500 range, none of which are accepted by *B*. With four seconds remaining, A_L abandons her bluff and makes a revealing offer of 200, which *B* accepts with one second remaining. The SigM data reveal that in 14% (32/232) of the B v. A_L negotiations, A_L submits at least one offer 375-525 but makes a final offer 75-225 (28 of which B accepts).



(a) SigM Game (b) BMO Game

Figure 7. Examples of Abandoned A_L Bluffs in SigM and BMO

In BMO, A_L has the additional option of maintaining her bluff 375-525 but "crossing over" and accepting B's outstanding offer 75-225. Figure 7(b) shows this case using a B v. A_L pair from round 25 of session BMO-2. In that negotiation, B makes three sequential screening offers, and A_L counters each one with a gradually decreasing bluff. They reach an apparent impasse, but with one second on the clock A_L relinquishes and accepts B's offer of 150. Analysis of the BMO data finds that in 12% (57/476) of the B v. A_L negotiations, A_L either submits at least one bluff 375-525 prior to a final offer 75-225 (24 times, 18 of which B accepts) or her final offer is a bluff 375-525 but she accepts a B offer 75-225 (33 times).[18]

The intra-period dynamics of the multi-offer games are possible contributing factors to the closer conformity with the semi-pooling predictions. The A_L bluff abandonment is one possibility, although the rate at which it occurs (14% of the B v. A_L SigM negotiations) seems

[18] Other cases might be considered instances where A_L abandons her bluff, but they are difficult to definitively categorize because they include anomalous final offers 226-375 or < 75. In 25% (58/232) of the SigM rounds in which A is type A_L, she submits at least one offer 375-525 prior to making a final offer less than 375; this includes the 14% which are 75-225. In 25% (117/476) of the BMO rounds in which A is type A_L, she either submits at least one offer 375-525 prior to making a final offer less than 375 (65 times) or her final offer is 375-525 while accepting a B offer less than 375 (52 times); this includes the 12% stated in the text.

insufficient to account for the entire 31 percentage-point difference between the SigS and SigM high-offer dispute rates. The bilateral feature of the BMO allows for an additional form of bluff abandonment and the combined abandonment rate (12% of the *B* v. A_L BMO negotiations) is similar to SigM, yet the high-offer dispute rate is another 15 percentage points lower. It is worth noting that A_L and A_H are also better able to successfully pool in the BMO game, so perhaps bluff abandonment plays a role there as well. Both the one-sided and two-sided versions of the multi-offer game offer rich sets of intra-period dynamics, and both are areas of future research.

5. Conclusion

This multi-offer legal bargaining experiment is a computerized extension of the single-offer Pecorino and Van Boening 2018 experimental screening and signaling games. A bilateral multi-offer bargaining structure is also analyzed. The screening and signaling games are one-sided, whereby either the player *B* defendant (screening game) or the player *A* plaintiff (signaling game) makes a take-or-leave offer to their counterpart. The privately-informed plaintiff has either a weak case (A_L with a low claim) or a strong case (A_H with a strong claim). The defendant *B* knows only the distribution of types. In these new multi-offer games, the proposer can continually update the offer within a round. In the bilateral game, both parties can submit offers and/or accept a counterpart's offer, and both parties are free to update their offer as frequently as they wish.

The empirical findings can be categorized under the broad headings of dispute behavior, offer behavior, and dynamics. Dispute vary across bargaining structures. In the signaling games, the dispute rate for strong plaintiffs and bluffing weak plaintiffs is 31 percentage points lower in the multi-offer game. The bilateral game yields an additional 15 percentage-point decline in the high-offer dispute rate. The dispute rate for revealing weak plaintiffs is in line with the theory and roughly constant across signaling games. In the screening games, the excess dispute rate for weak plaintiffs is 23 percentage-points lower in the multi-offer game.

In the multi-offer games, players typically make three to five offers per round and their final offers are generally consistent with the applicable theory. Offers in the single-offer game are also generally consistent with theory. However, demands also vary across the bargaining structures. In the one-sided games the player with the power to make the offer typically demands two-thirds to five-sixths of the surplus from settlement but in the two-sided game each player demands about one-half. In the signaling games, strong plaintiffs (high-value claim A_H) and bluffing weak plaintiffs (low-value claim A_L) are unable to successfully pool on a unique semi-pooling high offer, but in the bilateral game they are better able to do so.

The combination of the dispute and offer behavior across all games implies that a fair offer contains about one-sixth of the surplus from settlement for the recipient. However, the benchmark for this surplus varies according to the power to make an offer. In one-sided games, one-sixth for the recipient means five-sixths for the proposer. In the bilateral game, where both players have the power to make an offer, the one-sixth share is relative to half of the surplus from settlement. An offer is unlikely to be accepted if it contains less than one-third (or less than one-half minus one-sixth) of the surplus for the rival party.

The dispute and offer behaviors appear to be dynamically intertwined with the bargaining structure. In screening games, the frequency with which weak plaintiffs receive high-demand offers is much less in the multi-offer game (56% compared to 88% in the single-offer game). A combination of the bargaining structure and the high-demand frequency coincides with a 23 percentage-point reduction in the excess dispute rate, but this relationship remains an area of further study. In the screening and bilateral games, the multi-offer game outcomes have better conformity with the semi-pooling equilibrium predictions. A contributing factor appears to be intra-period "bluff abandonment" by weak plaintiffs, an option which is not available to them in the single-offer game. But the empirical frequency at which this occurs seems insufficient to account for all of the 31 percentage-point decrease in the high-offer dispute rate under the multi-offer game and/or the additional 15 percentage-point decrease in the bilateral game. These dynamics are also areas of further study.

The multi-offer games are potential "mechanism design" solutions where disputes arise due to information asymmetry. Two other naturally occurring solutions are costly information transmission in the form of disclosure and discovery. Pecorino and Van Boening (2015, 2019a, 2019b) study costly voluntary disclosure and costly discovery in the laboratory, also using the PVB 2018 design, protocol, and parameters. One comparison with those results is particularly useful, and that is a comparison of dispute rates for strong plaintiffs (A_H) in the signaling game. If the disclosure or discovery procedure is invoked, it is predicted to yield a 0% dispute rate for these plaintiffs. Disclosure yields a 50 percentage-point decrease from 73% to 23%, and discovery yields a 47 percentage-point decline from 68% to 21% (Pecorino and Van Boening, 2019b and 2019a, respectively). The multi-offer structure yields a 27 percentage-point decrease from 71% to 44% when no effect is predicted to occur. Empirically, the multi-offer structure appears to be about as successful as costly information revelation in reducing strong plaintiff dispute rates in the signaling game. As such, it is a potential alternative to these procedures.[19]

[19] A second comparison involves excess dispute rates for weak plaintiffs (A_L). In the screening game, where the predicted rate is 0%, disclosure yields a six percentage-point increase from 18% to 24% and discovery yields a two percentage-point decline from 27% to 25% (Pecorino and Van Boening, 2015 and 2019a, respectively). Here, the multi-offer structure yields a 23 percentage-point decrease from 27% to 4%. In the signaling game, where the predicted weak-plaintiff dispute rate is 0-25%, disclosure yields a three percentage-point increase from 14% to 17% while discovery yields a five percentage-point increase from 15% to 20% (Pecorino and Van Boening 2019b and 2019a, respectively). The multi-offer structure yields a two percentage-point increase from 9% to 11%.

There are four possible extensions to this study. The first is a bilateral single-offer game where each player can make (only) one offer as well as accept the offer made by the other player. This could help isolate whether the critical element is the multi-offer nature of the game, or the bilateral nature of the game. The second is a turn-based or alternating multi-offer mechanism where players can make multiple offers, but players must take alternating turns in making offers. Making a new offer would be tantamount to rejecting the offer just proposed by one's counterpart. These first two extensions would approximate some structural features of naturally occurring bargaining mechanisms. The third extension is to alter the length of the negotiating period. In this study, subjects had 30 seconds to make, evaluate, and respond to offers. A shorter or a longer timer could influence the results. A fourth extension is, as mentioned above, an experiment or experiments designed to study the dynamic interactions between the bargain structure, offers, and disputes in these various games. One possibility is a within-subjects design, possibly with an appropriate questionnaire, to investigate how changes in the bargaining structures affect decisions.

In naturally occurring legal bargaining, there are situations where contracts are negotiated on a take-or-leave-it basis, but repeated negotiation and counteroffers are arguably more common and therefore interesting to study in the laboratory. Such mechanisms could lead to efficiency gains by reducing the incidence of dispute, especially when plaintiffs have a strong case. This experimental study finds that multiple offer mechanisms are a possible step in that direction.

REFERENCES

Bebchuk, L. A. (1984). Litigation and settlement under imperfect information. *The RAND Journal of Economics, 15*(3), 404-415.

Camerer, C., & Thaler, R. H. 1995. Ultimatums, dictators and manners. *Journal of Economic Perspectives* 9: 209-219.

Davis, D. D., & Holt, C. A. (1993). *Experimental economics*. Princeton, N.J: Princeton University Press.

Dreber, A., Ellingsen, T., Johannesson, M., & Rand, D. G. (2013). Do people care about social context? framing effects in dictator games. *Experimental Economics, 16*(3), 349-371. doi:10.1007/s10683-012-9341-9

Farmer, Amy & Paul Pecorino. 2004. Pretrial Bargaining with Fairness. *Journal of Economic Behavior and Organization* 54:287-96.

Fehr, E. & Schmidt, K.M. 1999. A Theory of Fairness, Competition and Cooperation. *Quarterly Journal of Economics* 114: 817-68.

Fischbacher, Urs 2007. z-Tree: Zurich Toolbox for Ready-Made Economic Experiments. Experimental Economics 10: 171-178.

Forsythe, R., Horowitz, J. L., Savin, N. E., & Sefton, M. (1994). Fairness in simple bargaining experiments. *Games and Economic Behavior, 6*(3), 347-369. doi:10.1006/game.1994.1021

Güth, W., Schmittberger, R., & Schwarze, B. 1982. An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior and Organization* 3: 367-388.

Hoffman, E., & Spitzer, M. Ž. 1985. Entitlements, Rights, and Fairness: An Experimental Examination of Subjects' Concepts of Distributive Justice. *J. Legal Stud*. 14, 259-297

Hoffman, E., McCabe, K., Shachat, K., & Smith, V. 1994. Preferences, property-rights, and anonymity in bargaining games. *Games and Economic Behavior* 7:346-380.

Massey, F. J. (1951). The Kolmogorov-Smirnov test for goodness of fit. *Journal of the American Statistical Association, 46*(253), 68-78. doi:10.1080/01621459.1951.10500769

Pecorino, P., & Van Boening, M. (2004). An empirical analysis of bargaining with voluntary transmission of private information. *The Journal of Legal Studies, 33*(1), 131-156. doi:10.1086/381287

Pecorino, P., & Van Boening, M. (2010). Fairness in an embedded ultimatum game. *The Journal of Law & Economics, 53*(2), 263-287. doi:10.1086/599622

Pecorino, P., & Van Boening, M. (2015). Costly voluntary disclosure in a screening game. *International Review of Law & Economics, 44*, 16-28. doi:10.1016/j.irle.2015.08.002

Pecorino, P., & Van Boening, M. (2018). An Empirical Analysis of the Signaling and Screening Models of Litigation. *American Law and Economics Review*, vol. 20, no. 1, April 2018, pp. 214–244

Pecorino, P., & Van Boening, M. (2019a). An Empirical Analysis of Litigation With Discovery: The Role of Fairness. *Journal of Behavioral and Experimental Economics*, 81: 172-184, https://doi.org/10.1016/j.socec.2019.06.009.

Pecorino, P., & Van Boening, M. (2019b). Costly voluntary disclosure in a signaling game. *Review of Law and Economics*, 15(2):1-32, https://doi.org/10.1515/rle-2016-0074.

Plott, Charles, & Vernon L. Smith. (1978). An Experimental Examination of Two Exchange Institutions. *Review of Economic Studies*. 45:133-153.

Reinganum, Jennifer F., & Louis L. Wilde. 1986. Settlement, Litigation, and the Allocation of Litigation Costs. *RAND Journal of Economics*. 17:557-66.

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

Roth, Alvin E. 1995. Bargaining Experiments. Pp. 253–348 in *The Handbook of Experimental Economics*, edited by John H. Kagel and Alvin E. Roth. Princeton, N.J.: Princeton University Press.

Shavell, S. (1989). Sharing of information prior to settlement or litigation. *The RAND Journal of Economics, 20*(2), 183-195. doi:10.2307/2555688

Slonim, R., & Roth, A. E. (1998). Learning in high stakes ultimatum games: An experiment in the slovak republic. *Econometrica, 66*(3), 569-596. doi:10.2307/2998575

Smith, Vernon L., & Williams, Arlington W. (1983). An Experimental Comparison of Alternative Rules for Competitive Market Exchange, in Englebrecht-Wiggins et al., *Auctions, Bidding and Contracting: Uses and Theory*. New York: New York University Press, 307-334.

Thaler, R. H. (1988). Anomalies: The ultimatum game. *The Journal of Economic Perspectives, 2*(4), 195-206. doi:10.1257/jep.2.4.195

Vasios Sivvopoulos, Alexandros. (2019). *Limited Negotiation in Embedded Ultimatum Games*. Unpublished dissertation, University of Mississippi. (ProQuest ID umiss12120)

Wills, J. (2018). *Demands and offers in ultimatum games*. Unpublished dissertation, University of Mississippi. Retrieved from ProQuest Database (No. 10815648)

Appendix Tables

Table A1. Ex post B v. A_H Dispute Rates in One-Sided Scr and Sig Games

	Proportion of disputes (number of negotiations) by offer interval[a]					
	All offers	<75	75-225	226-374	375-525	>525
Screening						
Scr-PVB[b]	.92 (129)	1.0 (3)	*.98 (109)*	.89 (9)	.13 (8)	--
ScrS	.96 (28)	--	*1.0 (25)*	1.0 (1)	.50 (2)	--
ScrM	.53 (119)	.58 (31)	*.52 (69)*	.57 (7)	.42 (12)	--
Signaling						
Sig-PVB[b]	.73 (132)	--	1.0 (1)	.50 (4)	*.73 (119)*	1.0 (8)
SigS	.71 (49)	.25 (4)	.13 (8)	.83 (6)	*.90 (30)*	1.0 (1)
SigM	.44 (98)	.12 (17)	.33 (18)	.50 (14)	*.50 (40)*	.89 (9)

[a] Italicized entries indicate dispute rates on offers consistent with theory.

[b] Values as reported in Pecorino and Van Boening (2018, pg. 233) Table 6.

Table A2. Ex post B v. A_H Dispute Rates in Two-Sided BMO Game

Proportion of disputes (number of negotiations) by joint offer intervals							
Player B final	Player A_H final offer interval						
offer interval	No offer	<75	75-225	226-374	375-525	>525	Row total
No offer	--	.5 (4)	.33 (3)	.00 (1)	.00 (2)	--	.30 (10)
<75	--	.19 (26)	.24 (17)	.00 (1)	.68 (19)	1.0 (2)	.37 (65)
75-225	.00 (7)	.00 (2)	.09 (35)	.33 (24)	.64 (55)	.67 (3)	.38 (126)
226-374	.00 (1)	--	--	.14 (7)	.51 (45)	--	.45 (53)
375-525	--	--	--	1.0 (1)	.31 (13)	.40 (5)	.37 (19)
>525	--	--	--	--	.00 (1)	--	.00 (1)
Column total	.00 (8)	.22 (32)	.15 (55)	.29 (34)	.56 (135)	.60 (10)	.39 (274)[a]

[a] B v. A_H dispute rate shown in Figure 1.

Table A3. B v. A_H All Offers Logit Regressions

Coefficient	Estimate (robust s.e.)[b]	Comparison	Test statistic (p-level)
Constant[a]	3.30 (1.02) .964		
ScrM	–3.18 (1.04) .529	ScrM and ScrS	χ^2 = 9.42 (p = .002)
SigS	–2.38 (1.07) .714	SigM and SigS	χ^2 = 9.54 (p = .002)
SigM	–3.54 (1.04) .439	BMO and ScrM	χ^2 = 6.80 (p = .009)
BMO	–3.76 (1.03) .387	BMO and SigM	χ^2 = 0.81 (p = .369)

[a] Logit panel regression for B v. A_H offers with dispute=1 and settlement=0: $Dispute_{i,j,t} = \delta_0 + \delta_1 ScrM_{i,j,t} + \delta_2 SigS_{i,j,t} + \delta_3 SigM_{i,j,t} + \delta_4 BMO_{i,j,t} + \varepsilon_{i,j,t}$, with robust standard errors. Summary statistics: n = 568, pseudo-R^2 = .070 and χ^2 = 31.38 (p = .000). For negotiation i in session j round t, $ScrM_{i,j,t}$ = 1 if game is ScrM, $SigS_{i,j,t}$ = 1 if game is SigS, $SigM_{i,j,t}$ = 1 if game is SigM, and $BMO_{i,j,t}$ = 1 if game is BMO (all variables = 0 otherwise).

[b] Comparison hypothesis tests are H_0: $\delta_1 = 0$ for ScrM and ScrS, H_0: $\delta_3 = \delta_2$ for SigM and SigS, H_0: $\delta_4 = \delta_2$ for BMO and SigM, and H_0: $\delta_4 = \delta_3$ for BMO and SigM.

Table A4. *B* v. *A* Offers 375-525 Logit Regressions

Coefficient	Estimate (robust s.e.)[b]	Comparison	Test statistic (*p*-level)
Constant[a]	1.58 (0.39)		
SigM	–1.50 (0.45)	SigM and SigS	χ^2 = 10.95 (p = .001)
BMO	–2.13 (0.41)	BMO and SigM	χ^2 = 5.50 (p = .019)

[a] Logit panel regression for *B* v. *A* offers 375-525 with dispute=1 and settlement=0: $Dispute_{i,j,t} = \delta_0 + \delta_1 SigM_{i,j,t} + \delta_2 BMO_{i,j,t} + \varepsilon_{i,j,t}$, with robust standard errors. Summary statistics: n = 379, pseudo-R^2 = .072 and χ^2 = 29.53 (p = .000). For negotiation i in session j round t, $SigM_{i,j,t}$ = 1 if game is SigM, and $BMO_{i,j,t}$ = 1 if game is BMO (all variables = 0 otherwise).

[b] Comparison hypothesis tests are H_0: $\delta_1 = 0$ for SigM and SigS, and H_0: $\delta_2 = \delta_1$ for BMO and SigM.

Table A5. Ex post *B* v. A_L Dispute Rates in One-Sided Scr and Sig Games

	Proportion of disputes (number of negotiations) by offer interval[a]					
	All offers[b]	<75	75-225[b]	226-374	375-525	>525
Screening						
Scr-PVB[c]	.16 (273)	1.0 (4)	*.17 (241)*	.00 (15)	.00 (13)	--
ScrS	.26 (92)	1.0 (1)	*.27 (85)*	.00 (2)	.00 (4)	--
ScrM	.21 (211)	.56 (57)	*.04 (126)*	.36 (14)	.23 (13)	.00 (1)
Signaling						
Sig-PVB[c]	.32 (276)	--	*.10 (173)*	.55 (60)	*.85 (34)*	1.0 (9)
SigS	.22 (161)	.21 (14)	*.09 (105)*	.48 (25)	*.71 (17)*	--
SigM	.24 (232)	.00 (32)	*.11 (125)*	.54 (41)	*.55 (33)*	1.0 (1)

[a] Italicized entries indicate dispute rates on offers consistent with theory.

[b] Dispute rates shown in Figure 2.

[c] Values as reported in Pecorino and Van Boening (2018, pg. 232) Table 5.

Table A6. Ex post *B* v. A_L Dispute Rates in Two-Sided BMO Game

Proportion of disputes (number of negotiations) by joint offer intervals							
Player *B* final	Player A_L final offer interval						
offer interval	No offer	<75	75-225	226-374	375-525	>525	Row total
No offer	--	.11 (9)	.09 (11)	--	.00 (2)	--	.09 (22)
<75	.50 (4)	.17 (48)	.39 (36)	1.0 (2)	.38 (8)	1.0 (1)	.30 (99)
75-225	.00 (6)	.00 (9)	.17 (150)[a]	.21 (42)	.17 (48)	.00 (1)	.16 (256)
226-374	1.0 (1)	.00 (1)	.00 (2)	.04 (25)	.20 (30)	.00 (1)	.13 (60)
375-525	--	--	--	--	.08 (36)	.33 (3)	.10 (39)
>525	--	--	--	--	--	--	--
Column total	.27 (11)	.13 (67)	.20 (199)	.17 (69)	.16 (124)	.33 (6)	.18 (476)[a]

[a] *B* v. A_L dispute rate shown in Figure 2.

Table A7. *B* v. A_L Final Offers 75-225 Logit Regressions

Coefficient	Estimate (robust s.e.)[a]	Comparison[b]	Test statistic (*p*-value)
Constant	–0.99 (.244)		
ScrM	–2.19 (.518)	H_0: ScrM = ScrS	χ^2 = 17.95 (*p* = .000)
SigS	–1.38 (.426)	H_0: SigM = SigS	χ^2 = 0.43 (*p* = .510)
SigM	–1.08 (.375)	H_0: BMO = ScrM	χ^2 = 9.69 (*p* = .002)
BMO	–0.62 (.328)	H_0: BMO = SigM	χ^2 = 1.65 (*p* = .199)

[a] Logit panel regression for *B* v. A_L offers 75-225 with dispute=1 and settlement=0: $Dispute75\text{-}225_{i,j,t} = \gamma_0 + \gamma_1 ScrM_{i,j,t} + \gamma_2 SigS_{i,j,t} + \gamma_3 SigM_{i,j,t} + \gamma_4 BMO_{i,j,t} + \varepsilon_{i,j,t}$, with robust standard errors. Summary statistics: n = 591, pseudo-R^2 = .062 and χ^2 = 24.33 (p = .000). For negotiation *i* in session *j* round *t*, $ScrM_{i,j,t}$ = 1 if game is ScrM, $SigS_{i,j,t}$ = 1 if game is SigS, $SigM_{i,j,t}$ = 1 if game is SigM, and $BMO_{i,j,t}$ = 1 if game is BMO (all variables = 0 otherwise).

[b] Comparison hypothesis tests are H_0: $\gamma_1 = 0$ for ScrM and ScrS, H_0: $\gamma_3 = \gamma_2$ for SigM and SigS, H_0: $\gamma_4 = \gamma_2$ for BMO and SigM, and H_0: $\gamma_4 = \gamma_3$ for BMO and SigM.

Table A8. *B* and A_L Final Offers 75-225 Random Effects Regressions

	R.E. mean (robust s.e.)[b]		Difference in means $A_L - B$		
	B screen	A_L signal	Predict.	Obs.	H_0: $A_L - B$ = Predict.[b]
Scr-PVB, Sig-PVB[a]	111.6	203.6	150	92.0	*F* = 105.5 (*p* = .000)
	(3.98)	(5.65)			
ScrS, SigS	97.9	171.1	150	73.2	χ^2 = 36.5 (*p* = .000)
	(1.97)	(13.59)			
ScrM, SigM	120.3	173.9	150	53.6	χ^2 = 36.0 (*p* = .000)
	(10.76)	(12.25)			
BMO	141.1	150.3	--	9.3	--
	(5.50)	(7.39)			
Surplus Demand[c]					
Scr-PVB, Sig-PVB[a]	113.4	128.6	0	15.2	*F* = 7.20 (*p* =.025)
ScrS, SigS	127.1	96.1	0	–31.0	χ^2 = 5.19 (*p* =.023)
ScrM, SigM	104.7	98.9	0	–5.8	χ^2 = 0.13 (*p* =.717)
BMO	83.9	75.3	0	–8.6	χ^2 = 0.97 (*p* =.324)

[a] Values as reported in Pecorino and Van Boening (2018, pg. 240) Table A8.

[b] Implied means from random effects panel regression $Offer75\text{-}225_{i,j,t} = \beta_0 + \beta_1 AL\text{-}SigS_{i,j,t} + \beta_2 B\text{-}ScrM_{i,j,t} + \beta_3 AL\text{-}SigM_{i,j,t} + \beta_4 B\text{-}BMO_{i,j,t} + \beta_5 AL\text{-}BMO_{i,j,t} + \sum_{i=1}^{81} \gamma_i\, Subject_i + \varepsilon_{i,j,t}$, with robust standard errors. Summary statistics: n = 1116, R^2 = .183 and χ^2 = 155.8 (p = .000). For subject *i* in session *j* round *t*, $AL\text{-}SigS_{i,j,t}$ = 1 if subject is player A_L in SigS, $B\text{-}ScrM_{i,j,t}$ = 1 if subject is player *B* in ScrM, $AL\text{-}SigM_{i,j,t}$ = 1 if A_L in SigM, $B\text{-}BMO_{i,j,t}$ = 1 if *B* in BMO, and $AL\text{-}BMO_{i,j,t}$ = 1 if A_L in BMO (all variables = 0 otherwise). Offer difference-in-means tests are H_0: $\beta_1 = 150$ for ScrS-SigS and H_0: $\beta_3 = \beta_2 + 150$ for ScrM-SigM. Surplus difference-in-means tests are H_0: $225 - \beta_0 = (\beta_0 + \beta_1) - 75$ for ScrS-SigS, H_0: $225 - (\beta_0 + \beta_2) = (\beta_0 + \beta_3) - 75$ for ScrM-SigM, and H_0: $225 - (\beta_0 + \beta_4) = (\beta_0 + \beta_3) - 75$ for BMO.

[c] For *B* screening offer, surplus demand = 225 – *B*. For A_L signaling offer, surplus demand = A_L mean – 75.

Table A9. A_L and A_H Final Offers 375-525 Random Effects Regressions

	R.E. mean (robust s.e.)[b]		Difference in means $A_H – A_L$		
	A_L	A_H	Predict.	Obs.	H_0: $A_H – A_L$ = Predict.[b]
PVB[a]	417.5	454.9	0	37.4	$F = 18.8$ ($p = .019$)
	(7.23)	(7.75)			
SigS	415.6	449.3	0	34.0	$\chi^2 = 3.60$ ($p = .058$)
	(14.54)	(17.75)			
SigM	426.4	461.0	0	34.8	$\chi^2 = 29.4$ ($p = .000$)
	(18.45)	(19.27)			
BMO	429.9	436.1	0	7.4	$\chi^2 = 1.49$ ($p = .223$)
	(16.16)	(16.35)			

[a] Values as reported in Pecorino and Van Boening (2018, pg. 240) Table A8.

[b] Implied means from random effects panel regression $Offer375\text{-}525_{i,j,t} = \alpha_0 + \alpha_1 AH\text{-}SigS_{i,j,t} + \alpha_2 AL\text{-}SigM_{i,j,t} + \alpha_3 AH\text{-}SigM_{i,j,t} + \alpha_4 AL\text{-}BMO_{i,j,t} + \alpha_5 AH\text{-}BMO_{i,j,t} + \sum_{i=1}^{37} \gamma_i \, Subject_i + \varepsilon_{i,j,t}$, with robust standard errors. $n = 379$, $R^2 = .028$ and $\chi^2 = 34.99$ ($p = .000$). For player A subject i in session j round t (all variables = 0 otherwise), $AH\text{-}SigS_{i,j,t} = 1$ if subject is player A_H in SigS, $AL\text{-}SigM_{i,j,t} = 1$ if subject is player A_L in ScrM, $AH\text{-}SigM_{i,j,t} = 1$ if A_H in SigM, $AL\text{-}BMO_{i,j,t} = 1$ if A_L in BMO, and $AH\text{-}BMO_{i,j,t} = 1$ if A_H in BMO. Difference-in-means tests are H_0: $\beta_1 = 0$ for SigS, H_0: $\beta_3 = \beta_2$ for SigM, and H_0: $\beta_4 = \beta_5$ for BMO.