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# An Experimental Comparison of Conventional and Final Offer Arbitration*

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Abstract

When conventional arbitration (CA) is the dispute resolution mechanism, the arbitrator is free to impose her preferred settlement on the disputants, should they fail to reach an agreement. By contrast, under final offer arbitration (FOA), in the event of a dispute, the arbitrator chooses one of two proposals submitted by the parties to the dispute. Settlement negotiations can occur before proposal submission ($FOA_B$) or after proposal submission ($FOA_A$). A line of papers in the experimental literature has found lower dispute rates in CA compared to FOA. Most of these experiments feature symmetric information between the bargaining parties, while the theoretical literature emphasizes asymmetric information as a cause of disputes. In addition, most of this work features a comparison of CA with $FOA_B$. We analyze arbitration in a screening model under which the recipient of the settlement demand is a better informed party. In addition, we include $FOA_A$ in our treatment. We find similar dispute rates in $FOA_A$ and CA, with the point estimate of $FOA_A$ being 4 percentage points lower. This contrasts with previous results which suggest a systematic advantage for CA over FOA. By contrast, $FOA_B$ has a dispute rate which is 19 percentage points higher than $FOA_A$.

Keywords: Arbitration, Asymmetric Information, Screening, Experimental Bargaining

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## 1. Introduction

A persistent finding in the experimental literature is that conventional arbitration (CA) yields a lower dispute rate than final offer arbitration (FOA). Since disputes are costly, these results suggest an important advantage for CA relative to FOA. Much of the prior literature consists of experiments with symmetric information between the bargaining parties, even though asymmetric information is a leading theoretical explanation for bargaining failure.[1] Our experiment incorporates asymmetric information in a screening model and considers a realistic variation of FOA not considered in much of the prior experimental work. We find similar dispute rates between CA and our realistic version of FOA with the point estimate indicating a four-percentage point lower dispute rate for FOA. We also include the version of FOA typically considered in the prior literature and find a dispute rate which is fifteen percentage points *higher* than CA. Thus, prior results in the literature which indicate a lower dispute rate for CA may result from the form of FOA being tested as well as the absence of asymmetric information.

Arbitration is widely used and the details of the procedure are often subject to contractual negotiation. This, in part, drives the academic interest in comparing dispute rates between CA and FOA. Under CA, an arbitrator is free to impose what she views as an appropriate outcome, given the facts of the case. By contrast, under FOA, the arbitrator must choose from the proposals for settlement which are submitted by the parties to the dispute. In the "before" model of FOA (hereafter $FOA_B$), all settlement negotiation takes place prior to the submission of these potentially binding proposals. Much of the prior experimental literature has utilized this version of the model, and we find that $FOA_B$ yields the highest dispute rate among the procedures we consider. In the "after" model (hereafter $FOA_A$), settlement negotiation takes place after

[1] See Spier (2007), Daughety and Reinganum (2012) and Wickelgren (2013) for surveys of the related literature on civil litigation.

potentially binding proposals are submitted to the arbitrator. This version of the procedure corresponds to the default rules promulgated by the International Centre for Dispute Resolution and the American Arbitration Association, under which proposals are to be exchanged between the parties two weeks prior to the arbitration hearing.[2] This leaves ample time for negotiation in the face of these proposals and so corresponds to $FOA_A$. Thus, by including $FOA_A$, we are considering a form of FOA which corresponds to the default rules for the procedure. The parties may contract around these default rules with proposals being exchanged as late as the start of the hearing. This corresponds to $FOA_B$, as the late exchange does not allow for subsequent bargaining.

The use of FOA has spread in recent years, which seems at odds with the experimental findings that it exhibits a higher dispute rate than CA. As of 2022, FOA has been used to adjudicate out-of-network billing disputes as provided by the U.S. 'No Surprises Act'.[3] Prior to this act, FOA had been used in medical billing disputes in New York (Cooper et al. 2020). The procedure has also figured prominently in antitrust cases involving the telecommunications industry in the United States. For example, FOA was prescribed to address rate setting disputes as part of the agreement to allow the NBC – Universal, News Corp – Direct TV and Time Warner/Comcast – Adelphia mergers.[4] Some have raised concerns about FOA related to the issue of asymmetric information. For example, when FOA was considered during the AT&T – Time Warner merger, the following concerns were raised: "Video distributors are reluctant to invoke arbitration for a variety of reasons, including the existence of risk and informational

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[2] See their document, entitled "Final Offer Arbitration Supplementary Rules", here: https://www.adr.org/sites/default/files/Final%20Offer%20Supplementary%20Arbitration%20Procedures.pdf.

[3] Information on this act is provided here: https://www.natlawreview.com/article/no-surprises-act-final-checklist-2022.

[4] See FCC orders 11-4, 03-330 and 06-105. FOA is also utilized in the Canadian telecommunications and rail industries. See the Canadian telecommunications industry at https://crtc.gc.ca/eng/industr/rddr/arbitra.htm. For the rail industry, see the Canadian Transportation agency at https://otc-cta.gc.ca/eng/arbitration-final-offer-arbitration.

asymmetries that favor Turner" and "Distributors must submit final offers without knowing what other MVPDs of similar stature and size pay to Turner".[5] Older uses of FOA include public sector labor disputes (Carrell et al. 2013) and major league baseball where it has been utilized since the 1970s.[6]

Our results show that institutional details are important. $FOA_A$ corresponds to the default rules for arbitration and this is the version of FOA which has a dispute rate comparable to CA. $FOA_B$ performs significantly worse than $FOA_A$, but this version of the procedure does not correspond to the default rules. Nevertheless, it is the version of the procedure which has been most often utilized in past experimental studies.

## 2. Background

In our stylized setting, there are no significant differences between CA and a simple model of civil litigation.[7] Thus, our model of CA may be considered a two-type version of the Bebchuk (1984), model which introduced the screening model to the civil litigation literature. The screening model of FOA was developed in Curry and Pecorino (1993) and Farmer and Pecorino (1998, 2003, 2022).[8] The Farmer and Pecorino papers provide the theoretical context for the FOA portion of our experiment.

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[5] MVPD stands for multichannel video programming distributors. The quoted material is from Case 1:17-cv-02511-RJL Document 128, p. 154 found here: https://www.justice.gov/atr/case-document/file/1061071/download.

[6] In contrast with the telecommunications examples we have given, the relevant information in major league baseball, namely player statistics and the contracts of similar players, is public information. Thus, asymmetric information may not be important in this context (Farmer, Pecorino and Stango 2004).

[7] The differences between CA and civil litigation may be reflected in parameter values rather than in the structure of the game itself. If CA is less expensive, this is reflected in a lower sum of the plaintiff and defendant dispute costs. To the extent that arbitrators have more expertise than judges, this will be reflected in the shape of the distribution of the arbitrator's preferred settlement. Since arbitration is private, cases may not have much precedential value. Generally, however, the literature on pretrial bargaining does not consider this aspect of litigation.

[8] In the litigation literature, Reinganum and Wilde (1986) introduce the signaling model. Farmer and Pecorino (2021, 2023) develop the signaling model of FOA.

The recommendations in Stevens (1966) provide the basis for the FOA procedure. An important theoretical contribution is Farber (1980), who derives the optimal submitted proposals under FOA.[9] A key assumption of his model is that the arbitrator's most preferred settlement can be described by a distribution, which is common knowledge for the parties to the dispute. We use his framework to derive the optimal submitted proposals within our model. Ashenfelter (1987) and Ashenfelter and Dahl (2012) provide support for Farber's model of arbitrator behavior.[10]

There has been a consistent finding in the experimental literature that the dispute rate in CA is lower than the dispute rate in FOA. A key early paper is Ashenfelter et al. (1992) who find dispute rates to be 10 percentage points lower in CA compared with FOA.[11] Dispute rates for CA are 5-7 percentage points lower than FOA in Dickinson (2004, 2005). In Deck et al. (2007), the dispute rate in CA is 12 percentage points lower than in FOA.[12] In each of these papers, there is symmetric information between the bargaining parties. In addition, they each only consider $FOA_B$, where negotiations are prior to the submission of proposals to the arbitrator. In the current paper, we include asymmetric information and include $FOA_A$ in the analysis, where this version of the procedure conforms to the default rules for FOA.

Pecorino and Van Boening (2018) conduct an experiment utilizing a screening model of litigation, but CA is indistinguishable from this simple model.[13] Two previous experimental

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[9] Another important early analysis of proposal submission is Brams and Merrill (1983). Also see Farber (1981) in which offers in CA affect the arbitrator's imposed settlement. In our experiment, offers do not affect the arbitrator's decision. If Farber (1981) is correct, then CA is more similar to FOA than our simple framework would suggest.

[10] For models where the arbitrator learns from the submitted proposals of the parties to the dispute see Gibbons (1988) and Olszewski (2011). Chatterjee (1981) and Samuelson (1991) model the submission of proposals in the face of asymmetric information.

[11] See their Table 1 comparison of FOA to the high variance CA. There are three different CA treatments, but only the high variance CA treatment has the same distribution of the arbitrator's preferred value as FOA.

[12] See also Deck and Farmer (2007). For an analysis of the narcotic effect, under which utilizing the arbitration procedure today makes a future use of the procedure more likely, see Bolton and Katok (1998).

[13] Pecorino and Van Boening utilize a degenerate distribution of outcomes at trial, but to analyze FOA requires a nondegenerate distribution. Hence, in the current paper, we use a uniform distribution to describe the arbitrator's preferred settlement. Otherwise, our model of CA is similar to the model used in their paper.

papers have utilized a screening model in the context of FOA. Pecorino, Solomon and Van Boening (2021) find that voluntary disclosures are more likely to occur after the submission of potentially binding proposals to the arbitrator than before.[14] While the timing of disclosures is altered, in both the treatment and control they consider a model of $FOA_A$. Thus, there is no comparison across mechanisms. Pecorino and Van Boening (2001) test a prediction from Farmer and Pecorino (1998) that dispute rates will be lower in $FOA_A$ than in $FOA_B$. This prediction is borne out in their data but they do not analyze CA.[15] Thus, a key aspect of the current paper is to compare CA to $FOA_A$. This has not previously been done in an experimental setting utilizing a screening model.

Pecorino, Solomon and Van Boening (2024) is a companion paper which uses a signaling model to compare CA, $FOA_A$ and $FOA_B$. In the signaling game, the informed party presents a settlement demand to the uninformed party. We utilize the same parameters and experimental procedures as this paper except that we analyze a screening game in which the uninformed party makes the offer. In the conclusion we compare the two papers and draw some broad insights about CA and FOA based on these two canonical models of disputes.

## 3. Theory

We will briefly outline the theory behind the experiments. The CA model is simple and quite standard. A fuller exposition of the analysis of FOA may be found in Farmer and Pecorino

[14] This proposition is found in Farmer and Pecorino (2003).

[15] In addition to the absence of CA from the analysis in Pecorino and Van Boening (2001) there are several other important differences from this earlier paper. Aside from the generation of random numbers, this earlier experiment was run by hand. Partly as a result of this, the analysis is based on a very low number of subjects. Finally, the uniform distributions describing the arbitrator's preferred settlement both had a lower support at 0. As a result, the uninformed player's optimal submitted proposal to the arbitrator was independent of the informed player's type. Thus, the type of informational rents (Farmer and Pecorino 2022) that we discuss below in the theory section could not arise in this setting.

(1998, 2003, 2022). Our main focus is to compare dispute rates across mechanisms. The theoretical predictions can help us understand differences in dispute rates which might emerge, especially if anomalous behavior differs across mechanisms. We are also interested in possible distributional affects across the three mechanisms. Both the quotes in Section 2 and the theory suggest that the uninformed party to the dispute is disadvantaged in FOA, so we also focus on the expected costs of player *B* across the three mechanisms.

First, we discuss factors which are common across the three models. Both players are risk neutral, and *B* makes a payment to *A*. Should the parties fail to settle, they each incur an arbitration cost of 75 ($C_A = C_B = 75$). Here and elsewhere (unless otherwise noted) we state numbers in pennies, so this cost is \$0.75. We use a uniform distribution to determine the arbitrator's preferred settlement *x*, where *x* is drawn from distribution *L* with probability $1 - p = 2/3$ and distribution *H* with probability $p = 1/3$. These uniform distributions are as follows:

$$\text{Distribution } L\text{: } x \sim U[\alpha, \beta] = U[50, 300], \tag{1a}$$

$$\text{Distribution } H\text{: } x \sim U[\alpha + \delta, \beta + \delta] = U[250, 500], \tag{1b}$$

where $\alpha = 50$, $\beta = 300$, and $\delta = 200$. The value of $\delta = 200$ implies that the *H* distribution is a rightward shift of the *L* distribution by 200. This shift is not due to arbitrator bias, but instead occurs due to differences in the facts of the case which will be revealed at the arbitration hearings. This corresponds to the assumption in the litigation literature that asymmetric information concerning the expected outcome at trial concerns the facts of the case.

In CA, no proposals are submitted to the arbitrator. Rather, in the event of a dispute, the arbitrator imposes her preferred settlement *x* on the bargaining parties. For the uniform distributions in equation (1a, b), $E(x|L) = 175$ and $E(x|H) = 375$.

Following Farber (1980), in FOA each player submits a proposal, $b_A$ and $b_B$, to the arbitrator who subsequently chooses the proposal closest to her most preferred settlement. Denote the *cdf* of the arbitrator's preferred settlement $F^i$, $i = H, L$. Under the assumption on arbitrator behavior and with the uniform distribution, player $B$'s proposal $b_B$ is chosen with the following probabilities:

$$F^L = \left(\frac{0.5(b_A + b_B) - \alpha}{\beta - \alpha}\right) = \left(\frac{0.5(b_A + b_B) - 50}{250}\right) \tag{2a}$$

$$F^L = \left(\frac{0.5(b_A + b_B) - (\alpha + \delta)}{\beta - \alpha}\right) = \left(\frac{0.5(b_A + b_B) - 250}{250}\right). \tag{2b}$$

When both parties know which distribution applies $F^L = F^H = 0.50$, as it is optimal for both players to submit an endpoint of the uniform distribution, where $A$ submits the upper support and $B$ submits the lower support. Because $A$ knows her own type (which we denote as either $A_L$ or $A_H$), this continues to be the case for her in the game with asymmetric information, with one exception we discuss below. However, $B$ may be uncertain about $A$'s type at the point where he submits a proposal to the arbitrator. Thus, he may submit a compromise proposal which is a function of his updated belief $q$ that player $A$ is type $A_H$. Absent bluffing (discussed below), for FOA we have the following proposals being submitted to the arbitrator:

$$b_A^L = \beta = 300 \tag{3a}$$

$$b_A^H = \beta + \delta = 500, \tag{3b}$$

$$b_B = \alpha + q\delta = 50 + 200q. \tag{3c}$$

From equation (2a, b), under asymmetric information the probabilities that $b_B$ is chosen by the arbitrator are $F^L = 0.5 + .4q$ and $F^H = 0.1 + .4q$. For example, if $B$'s updated belief is $q = .6$ then $B$ submits proposal $b_B = 170$ which is chosen with probability $F^L = 0.74$ if $B$'s dispute is with $A_L$

and $F^H = 0.34$ if the dispute is with $A_H$. In $FOA_A$, an $A_L$ will bluff with some probability by submitting (3b) rather than (3a). In doing this, she is mimicking $A_H$ behavior.

We will now proceed with the formal description of the games. The following step is common to all three mechanisms:

> 0. Nature determines the facts of the case. Player *A* is $A_H$ with probability $p = 1/3$, and $A_L$ with probability $1 - p = 2/3$, where these types correspond to the distributions given in (1a-b). *A* knows her type, but *B* only knows the probability that each type is drawn.

The asymmetric information reflected in step 0 is the source of disputes within the theory. In the presence of symmetric information, there is a prediction of 100% settlement across all three mechanisms. Note that the information in question concerns facts relevant for the disposition of the case. These facts will be established by *A* for the arbitrator, should the hearing phase be reached.

The remaining game description differs across mechanisms and has been summarize in Table 1. CA and $FOA_B$ are identical at steps 1 and 2 where a settlement demand and an accept/reject decision are made. If *A* accepts the demand, the game ends. Otherwise both players proceed to arbitration. With CA, the arbitrator imposes her preferred settlement *x* as the payment from *B* to *A*. Player *A*'s payoff is $x - C_A$ and player *B*'s payoff is $-x - C_B$. Step 3 for $FOA_B$ has each player submitting an arbitration proposal. One of these proposals is chosen by the arbitrator at step 4. Under $FOA_A$, proposals are submitted (step 1) prior to *B*'s offer and *A*'s subsequent acceptance or rejection (steps 2 and 3).[16] Step 4 is identical for $FOA_B$ and $FOA_A$. The arbitrator

[16] We allow one settlement demand for each mechanism in our experiment. Thus, there is no opportunity to settle prior to the exchange of proposals in $FOA_A$. Farmer and Pecorino (2003) show, theoretically, that early settlement should not occur in this model. This follows from sequential rationality. It may be of interest for future experimental work to test this prediction, but we take it as given and only allow one settlement demand within each experimental game.

chooses the proposal ($b_A$ or $b_B$) closest to her preferred settlement $x$. Operationally, a computer was used to generate $x$ from the distribution determined at step 0.

Table 1. Negotiation Steps Under Each Arbitration Mechanism

<table>
<tr><th>Step</th><th>CA</th><th>FOA<sub>B</sub></th><th>FOA<sub>A</sub></th></tr>
<tr><td>1[a]</td><td colspan="2">Player $B$ makes a settlement offer $O$ to player $A$.</td><td>Both players submit proposals to the arbitrator. $A$ submits proposal $b_A$ and $B$ submits proposal $b_B$. After submission, proposals are observable by both players.</td></tr>
<tr><td>2[a]</td><td colspan="2">$A$ chooses to accept or reject $O$. If $O$ is accepted, the game ends with $A$ receiving payoff $O$ and $B$ receiving payoff $–O$. If $O$ is rejected, both players proceed to arbitration in step 3.</td><td>Player $B$ makes a settlement offer $O$ to player $A$.</td></tr>
<tr><td>3</td><td>The arbitrator identifies her preferred settlement $x$. $A$ receives payoff $x – C_A$ and $B$ receives payoff $–x – C_B$.</td><td>Both players submit proposals to the arbitrator. $A$ submits proposal $b_A$ and $B$ submits proposal $b_B$. After submission, proposals are observable by both players. Both players then proceed to the arbitration hearing in step 4.</td><td>$A$ chooses to accept or reject $O$. If $O$ is accepted, the game ends with $A$ receiving payoff $O$ and $B$ receiving payoff $–O$. If $O$ is rejected, both players proceed to arbitration in step 4.</td></tr>
<tr><td>4[b]</td><td></td><td colspan="2">The arbitrator identifies her preferred settlement $x$, and then determines $Y$, where $Y$ = the proposal which is closest to $x$: $Y = \arg\min_{b_i}\{|x - b_i|, i = A, B\}$. $A$ receives payoff $Y – C_A$ and $B$ receives payoff $–Y – C_B$.</td></tr>
</table>

[a] The settlement offer step and the accept/reject step are identical across CA and $FOA_B$, so the Step 1 and Step 2 descriptions are combined across those two mechanisms.
[b] The arbitration step (if invoked) is identical across $FOA_B$ and $FOA_A$, so the Step 4 description is combined across those two mechanisms.

### 3.1 Conventional Arbitration (CA)

The analysis of CA is completely standard. This is a two-type version of the Bebchuk (1984) model. Player $B$ decides whether to make a high pooling offer $O^H = 0.5(\alpha + \beta) + \delta – C_A = 300$

both player types would accept, or a low screening offer $O^L = 0.5(\alpha + \beta) - C_A = 100$ which $A_L$ accepts and $A_H$ rejects. If $B$ makes the low offer and subsequent to the rejection by $A_H$, both parties proceed to arbitration where player $B$ pays $450 = O^H + C_A + C_B = E(x|H) + C_B$ on average. Since player $A$ is type $A_H$ with $p = 1/3$, $B$ makes the low sorting offer $O^L$ when

$$(1 - p)O^L + p(O^H + C_A + C_B) = 217 < O^H = 300. \tag{4}$$

Under our parameters, the condition above holds. Thus the predicton for the experiment is that $B$ makes the screening offer $O^L = 100$, which is accepted by $A_L$ and rejected by $A_H$, resulting in a 33% dispute rate. Player $B$'s expected cost of 217 is 83 lower when he screens compared to when he makes the high pooling offer $O^H = 300$.

3.2 The 'Before' Model of FOA ($FOA_B$)

A screening equilibrium similar to what is described above can occur in this model, but there is one major difference. In such an equilibrium the low offer acceptable to $A_L$ must give her the expected earnings she would receive if she refused the offer and proceeded to arbitration. In equilibrium, however, only $A_H$ actually proceeds to arbitration implying that $B$'s belief $q = 1$ and that he therefore submits (from (3b)) $b_B = 250$ to the arbitrator, while $A_L$ would submit $b_A^L = 300$. From (2a), $A_L$ receives on average $0.9(250) + 0.1(300) - 75 = 180$. This compares to $E(x|L) - C_A = 100$ under CA with the difference of 80 being what Farmer and Pecorino (2022) term informational rents. These rents arise because of $B$'s imperfect information regarding $A$'s type. Note that the informational issue is arising out of equilibrium, but is important because it determines how high $B$'s offer needs to be in order to get $A_L$ to accept it in a screening equilibrium. The $FOA_B$ equilibrium dispute rate is 33%, the same as under CA.

The other relevant payoffs are the same as in CA. In equilibrium, when $A_H$ rejects, she submits $b_A^H = 500$ and $B$ submits $b_B = 250$ to the arbitrator where these are equally likely to be chosen. Thus, $B$'s expected cost is $E(x|H) + C_B = 450$ against $A_H$ who reject, where this occurs with probability $p = 1/3$. Alternatively, $B$ can offer 300 and settle with everyone.[17] Thus $B$'s expected cost under screening is

$$(2/3)(180) + (1/3)(450) = 270 < 300, \quad (5)$$

where 300 is $B$'s cost under pooling. In $FOA_B$ player $B$'s cost associated with screening is only 30 lower than his cost under pooling, compared with 83 under CA. This reduced incentive to screen results from the informational rents of 80 received by $A_L$ in a screening offer.[18]

3.3. The 'After' Model of FOA ($FOA_A$)

Settlement demands are now made after potentially binding proposals have been submitted to the arbitrator. Our parameters rule out a pooling equilibrium under which $A_L$ and $A_H$ both submit $b_A^H$ and receive a high settlement offer. As in CA and $FOA_B$, this pooling offer equals 300.[19] Absent a pooling equilibrium, the game exhibits an equilibrium in mixed strategies. If all $A_L$ submit $b_A^L$ and all $A_H$ submit $b_A^H$, then proposal submission would be fully informative and all cases would settle. This implies that $A_H$ receives a high offer, but this gives $A_L$ an incentive to bluff by submitting the same proposal as $A_H$. Thus, in equilibrium, all $A_H$ submit $b_A^H$ and $A_L$ bluffs with probability $\Omega$ by submitting this same high proposal. With probability $1-\Omega$, $A_L$ makes the revealing proposal $b_A^L$.

[17] Under pooling, rejections only occur out of equilibrium. We are assuming that $B$ believes such a rejection to be by $A_H$. Thus, if such a rejection did occur, $B$ would submit a proposal of 250. If $A_H$ did deviate, she would submit 500 and earn 375 – 75 = 300 in expected value.
[18] Farmer and Pecorino (2003) show that "settle with none" is also a possible equilibrium. This possibility does not arise under CA, but can under $FOA_B$, due to the informational rents we have been discussing. Under this outcome, $q = 1/3$, and $B$ submits a proposal of 117 to the arbitrator. Using equations (2) and (3), it can be shown that the expected cost of this strategy is 334.5. Thus, under our parameters, player $B$ would not pursue this strategy.
[19] Both $A_L$ and $A_H$ submit a proposal of 500, while $B$ submits 250. The expected award for $A_H$ is 375 and the pooling offer is 375 – 75 = 300.

When $B$ views the high proposal $b_A^H$, he makes a low sorting offer, which only $A_L$ will accept, with probability $\Gamma$. With the complementary probability, $B$ makes a high offer which both player $A$ types accept. Relative to making a revealing proposal, $A_L$ benefits when the bluff succeeds (a high offer is made) and is hurt when the low offer is made. The reason the low offer harms her is that $b_A^H$ is the "wrong" proposal given her type so that she receives a lower offer when she is caught bluffing compared to when she makes a revealing proposal $b_A^L$.[20] The equilibrium values of $\Omega$ and $\Gamma$ make $A_L$ indifferent between the revealing proposal $b_A^L$ and the bluff of $b_A^H$ and make $B$ indifferent between making a high or low offer when he encounters the high proposal $b_A^H$.

In the mixed strategy equilibrium, all $A_L$ settle, even those caught bluffing. The $A_H$ players proceed to arbitration with a probability $\Gamma < 1$, so the overall dispute rate is $p\Gamma < p$ which is the predicted dispute rate in CA and $FOA_B$. Using our parameter values and equations (A7), (A8), and (A9) from Pecorino, Solomon and Van Boening (2021), it is possible to solve for $\Gamma = 0.75$. Thus, the unconditional dispute rate is predicted to be (1/3)(0.75) or 25%.

Since we also care about the distributional aspect of each mechnism, we can use equation (15b) in Farmer and Pecorino (2022) and our parameter values to compute player $B$'s expected costs in $FOA_A$. These are approximately 222 per round. This is almost indistinguishable from 217 under CA but much lower than 270 under $FOA_B$. Under $FOA_A$, player $B$ submits a

[20] By construction, $b_A^L$ maxmizes her expected payoff in arbitration so that submitting any other proposal, including $b_A^H$, lowers her expected payoff in arbitration. With our parameters, $A_L$'s expected payoff in arbitration is 109 when she submits $b_A^L$ versus 42 when she submits $b_A^H$. These represent $B$'s low sorting offers when he encounters $b_A^L$ and $b_A^H$, respectively, while $B$'s high offer when he encounters $b_A^H$ is 320.

compromise proposal to the arbitrator which results in some informational rents being earned by player $A$ but these are largely offset by the lower dispute rate.[21]

3.4. Risk aversion

The general flavor of our results are preserved in the presence of risk aversion. A very high degree of risk aversion could lead to a pooling equilibrium under our parameters. While we see a limited prevalence of pooling offers in our data (roughly 14% of offers averaged over the three games), an important aspect of behavior is strongly at odds with the idea that risk aversion drives subject behavior. The most straightforward prediction of risk aversion is that a player will accept all offers with a positive expected value compared with arbitration. Prior litigation and arbitration experiments (Pecorino and Van Boening 2001, 2018, among many others) have shown this is not the case. In a setting such as this, rejection of positive expected value offers is common. This suggests that risk aversion is not playing a major role in these settings.

## 4. Experimental Design

We provide a summary of our experimental sessions in Table 2, while Table A1 in the appendix describes the twelve experimental sessions more fully.[22] Each session lasted 15 rounds and we

[21] The proposal submitted depends on whether $B$ intends to sort or not in the event he encounters a high proposal. From Farmer and Pecorino (2022: 7) and using our parameter values it can be seen that $B$ will submit $\alpha + p\delta = 117$ if he intends to sort and $\alpha + (p + \Omega[1\text{–}p])\delta = 151$ if he does not intend to sort. Under full information he would submit 50 against $A_L$ and 250 against $A_H$. Thus, $B$ submits a compromise proposal relative to the full information game. When $B$ sorts, the $p\delta$ in the submitted proposal reflects the prevalence of $A_H$ players. When he does not sort, he treats bluffing $A_L$ players as if they are $A_H$. Thus, the term multiplying $\delta$ in the proposal includes $\Omega[1\text{–}p]$ which reflects the prevalence of bluffing $A_L$ players.

[22] The first two sessions of CA which we ran had an incorrect computation of the lump sum payment which $B$ uses to finance his payment to $A$. This lump sum was set too low at 5500 when it should have been 6300. The residual amount after these payments determine $B$'s payoff from the experiment. The lump sum was set to give $A$ and $B$ similar chances to earn money based on the theoretical predictions of the model. Theoretically, the lower lump sum should have no effect, but we reran the sessions on the chance that it would have a behavioral impact. The four sessions of CA which we analyze have a lump sum of 6300, but our results are robust to the inclusion of the two CA sessions with the lump sum of 5500. The average overall dispute rate across the two excluded CA sessions is 43.3% which compares to 41.5% for the four included CA sessions with the 6300 lump sum.

had four sessions for each of three treatments. Within each session we had fourteen to twenty subjects (seven to ten pairs). The experiment was conducted via computer using *z*-Tree (Fischbacher, 2007). All subjects were provided with a set of paper instructions, a pencil, and a simple calculator. Subjects participated in only one session and all were undergraduate students at the University of Alabama. The instructions were read out loud by an experimenter while the subjects followed along on their paper copy. Subjects were given ample opportunity to ask questions about the instructions. The experiment was run at The Interactive Decision Experiment (TIDE) Lab.

Table 2. Experimental Design

| Treatment | Number of sessions[a] | Number of Subjects | Number of Negotiations | | |
|---|---|---|---|---|---|
| | | | | By pairing | |
| | | | $A$ v. $B$ | $A_H$ v. $B$ | $A_L$ v. $B$ |
| CA | 4 | 70 | 525 | 154 | 371 |
| $FOA_B$ | 4 | 66 | 495 | 176 | 319 |
| $FOA_A$ | 4 | 68 | 510 | 167 | 343 |
| Total | 12 | 204 | 1530 | 497 | 1033 |

[a] Each session had 15 negotiation rounds; see Table A1 for session-level data.

The experiment follows the game descriptions provided in Section 3. The uniform *H* and *L* distributions are described by equation (1), where the *H* distribution occurs with probability $p = 1/3$. Each party faces the same cost of a dispute: $C_A = C_B = 75$. Recall that in dollar terms this is \$0.75. For CA, the computer determines the outcome of a round in the event of a dispute by drawing a random number $x$ from the appropriate distribution. Player *A* receives $x - 75$ and player *B* pays $x + 75$. By contrast, under FOA, the computer draws a random number $x$ but then chooses the submitted proposal closest to $x$. Under $FOA_A$, settlement negotiation takes place after proposals are submitted to the arbitrator and under $FOA_B$ these negotiations take place prior to this submission. Note that under FOA, once the proposals are submitted they become common information to the two players.

The *A* and *B* players were separated into adjacent rooms and maintained their player identities throughout the experiment. We used the strangers matching protocol under which the *A*s and *B*s were randomly and anonymously paired every round. Each round, player *A* received a payment from player *B*, where *B*'s payments were financed via a lump sum.[23] The amount of the lump sum was known to *B*, but not *A* and varied across treatments to keep the earnings opportunities roughly equal across player roles.[24] The respective lump sums for CA, $FOA_B$, and $FOA_A$ were 6300, 7350 and 6700. The higher figure for $FOA_B$ reflects the informational rents paid by *B* and received by *A* in that game. The lump sum, which is revealed to *B* prior to the first round of the experiment, applies for the entirety of the experiment. It was not announced ahead of time that the experiment would last 15 rounds.

Each round, player *A* was informed of her randomly determined type, $A_H$ or $A_L$. Player *B* only knew that the unconditional probability that distribution *H* applied was $p = 1/3$. Player *A* received the sum of her payoffs over all rounds while player *B* received the difference between the lump sum and the sum of his costs over all rounds. In addition, all players received a $5 show up fee. All payments were made in cash. Not including the show up fee, average earnings were $29.47 (median $29.30), with a low of $5.20 and high of $52.73. The experiment typically lasted 60-75 minutes.

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[23] Given the feedback players receive each round (about their own and their opponents payoff/cost) paying for one round only would not satisfy the Azrieli et al. (2018) conditions for incentive compatibility (see pp. 1489-90). We also note that many of the concerns they discuss in relation to the method of payment do not arise in our experiment. These concerns relate to cross-task contamination whereby subjects may, for example, hedge across tasks. In addition, there are concerns about how measurements of risk aversion might be affected by the method of payment. There is only one task in each of our treatments and we are not attempting to measure risk preferences. Thus, the potential rationales for paying for only one round at random do not apply in our setting.

[24] We did not want the players to view their task as splitting the lump sum. In theory, *A*'s knowledge of the lump sum has no effect on behavior, but we cannot rule out behavioral effects a priori. Moreover, in naturally occurring bargaining, the recipient of the payment will not have exact information on the financial position of her bargaining partner.

Prior to the data rounds which are reported in this paper, all subjects played ten practice rounds for which they were not paid. The ten rounds were subdivided into two sets of five rounds each. In all practice rounds, player *A* learned which distribution would be used when the computer was used to resolve the dispute. For the first five practice rounds under FOA, both players submitted proposals to the computer and observed the computer choosing a proposal. This included observing the preferred settlement chosen by the computer from the appropriate distribution as well as the proposal chosen given this preferred settlement. No proposals were submitted under CA. Rather, the subjects simply observed how the computer generated a random number from the appropriate distribution to determine the outcome of a round. For all three treatments, settlement bargaining was included in practice rounds 6-10 with the computer used to determine the outcome only if *B* rejected *A's* demand. After each practice round, *A*'s payoff and *B'*s cost for the round were displayed to both players. After each of the two sets of practice rounds, players were told what their total earnings would have been if these rounds counted towards their earnings for the experiment.[25] Subjects were given ample opportunity to ask questions during the practice period.

**5. Results**

We center our analysis on overall dispute rates and player *B* costs, while we use the theory to help us understand the differences in dispute rates across mechanisms. For example, we expect that "excess disputes", that is disputes not predicted by the theory, will occur, but these may differ across mechanisms. From above, the theoretical dispute rates are CA 33%, $FOA_B$ 33%,

[25] At the beginning of each set of practice rounds, player *B* was given a lump sum but was informed that this would be used for an illustrative calculation only and that he would not be paid for the practice rounds.

and $FOA_A$ 25% while the corresponding player *B* costs are 217, 270, and 222. We have five main results that focus on dispute rates, settlement offers and distributional properties.

> *Result 1. The observed dispute rates are CA 41%, $FOA_B$ 56%, and $FOA_A$ 37%. The fifteen percentage-point difference between CA and $FOA_B$ and the nineteen percentage-point difference between $FOA_B$ and $FOA_A$ are both economically and statistically significant. The CA and $FOA_A$ dispute rates do not differ statistically from one another.*

Table 3. Dispute Rates by Treatment and Pairwise Tests

| Treatments and pairwise tests | Overall dispute rate (ratio) | Mean session-level dispute rate |
|---|---|---|
| CA | .413 (217/525) | .415 |
| $FOA_B$ | .556 (275/495) | .556 |
| $FOA_A$ | .369 (188/510) | .374 |
| $H_0$: CA = $FOA_B$ | | |
| Difference | –.143 | –.141 |
| Test statistic | $\chi^2_2 = 21.05$ | $z = -2.32$ |
| (*p*-value) | ($p = .000$) [a] | ($p = .020$) [b] |
| $H_0$: CA = $FOA_A$ | | |
| Difference | .044 | .041 |
| Test statistic | $\chi^2_2 = 2.18$ | $z = 0.87$ |
| (*p*-value) | ($p = .337$) [a] | ($p = .384$) [b] |
| $H_0$: $FOA_B = FOA_A$ | | |
| Difference | .187 | .182 |
| Test statistic | $\chi^2_2 = 36.58$ | $z = 2.31$ |
| (*p*-value) | ($p = .000$) [a] | ($p = .021$) [b] |

[a] Pairwise difference-in-proportions tests using the Mariscuilo multiple-comparisons procedure. Pearson goodness-of-fit test for $H_0$: CA = $FOA_B$ = $FOA_A$ has $\chi^2_2 = 38.68$ ($p = .000$).

[b] Pairwise Mann-Whitney rank-sum tests using session-level dispute rates. Kruskal-Wallis rank-sum equality-of-medians test for $H_0$: CA = $FOA_B$ = $FOA_A$ has $\chi^2_2 = 8.91$ ($p = .012$).

Table 3 presents the overall dispute rates by treatment using two alternative units of observation. First, we report dispute rates for the 1,530 individual negotiations, along with pairwise parametric tests using the Mariscuilo (1966) procedure for comparisons of multiple proportions. Second, we use a conservative approach for addressing the independence issue by treating each of the 12 sessions as a single observation and report the four-session treatment mean dispute rates (appendix Table A1 reports the individual session dispute rates) along with pairwise nonparametric Mann-Whitney rank sum tests for treatment differences. The two methods yield similar results. The dispute rate is lowest in $FOA_A$ (37%), second lowest in CA (41%), and highest in $FOA_B$ (56%). Consistent with theory, the dispute rate is lowest in $FOA_A$, but contrary to theory the CA and $FOA_B$ dispute rates diverge. The differences in dispute rates for both CA v. $FOA_B$ and $FOA_B$ v. $FOA_A$ are statistically different from zero (difference-in-proportions $p$ =.00, rank sum $p$ = .02), while the difference for CA v. $FOA_A$ is statistically insignificant ($p$ > .33). Across all three mechanisms, the average dispute rate is about 45% (680/1530). The fifteen percentage-point difference between CA and $FOA_B$ represents about 1/3 of the average dispute rate, while the nineteen percentage-point difference between $FOA_B$ and $FOA_A$ represents about 2/5. Thus, both differences are clearly economically significant. Appendix Table A2 compares dispute rates estimated from a random effects logit regression with the 1,530 individual accept/reject decisions regressed on treatment dummy variables, with standard errors clustered on sessions and the individual *A* subjects as random effects. The analysis provides results very similar to those in Table 3.

> *Result 2. Player B offer behavior is generally consistent with the screening equilibrium, but there is considerable variation across models. For CA and $FOA_A$ about 65% of offers are in the screening interval, while for $FOA_B$ this figure is 50-52%. For $FOA_B$, 35% of offers fall below the screening interval where the corresponding percentages are 5% for CA and 11% for $FOA_A$. The higher percentage of offers below the screening interval in $FOA_B$ underscores how informational rents may affect bargaining outcomes.*

Under all three mechanisms, the observed dispute rates are a function of the empirical player *B* settlement offers and the corresponding player *A* rejection behavior. In the following analysis, offer frequencies and dispute rates are reported for intervals based around the screening intervals (100-250 for CA, 180-330 for $FOA_B$ and 112-262 for $FOA_A$) and the pooling intervals

(300-450 for CA and $FOA_B$ and 332-482 for $FOA_A$).[26] The screening intervals reflect offers which are acceptable to $A_L$, but not $A_H$ and which provide nonnegative surplus to both $A_L$ and *B*. Thus, the intervals are 150 in length.[27] The pooling range is defined in an analogous way with offers that are acceptable to $A_H$ and which provide positive surplus for $A_H$ and *B*. Anomalous demands are those that are either below the screening range, between the screening and pooling intervals or above the pooling interval. The informational rents earned by $A_L$ in $FOA_B$ imply that the screening range covers 180-330, where this overlaps with the pooling range of 300-450. As Figure 1 shows, only 4% of offers are in the overlap region of 300-330.

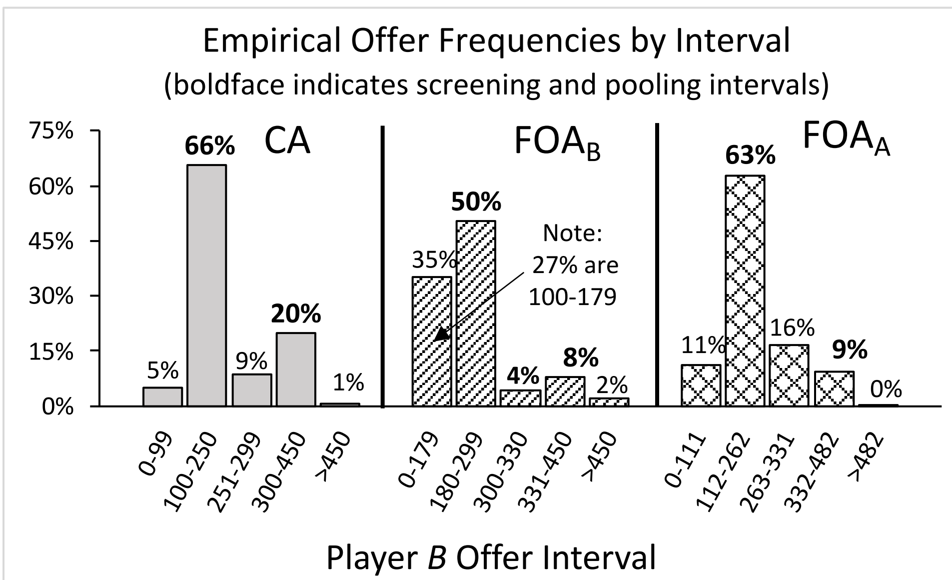


Figure 1. Histograms of Player *B* Settlement Offers

[26] Pooling offers are not predicted under our parameters, but some observed offers are consistent with pooling. Should player *A* receive such an offer, theory predicts that both *A* types would accept the offer.
[27] Under the theory, a screening offer $O^L$ should be the lower support of our screening interval, perhaps plus 1 unit of surplus. We know from the ultimatum game literature and from the experimental literature on litigation bargaining (e.g., Pecorino and Van Boening 2018) that positive amounts of surplus tend to be offered and that very low offers of surplus are frequently rejected. Thus, we consider the entire interval $[O^L, O^L + (C_A + C_B)]$ which yields both players non-negative surplus as the relevant screening intervals, and $[O^H, O^H + (C_A + C_B)]$ as pooling intervals.

Figure 1 shows the relative frequency histograms of player *B* offers by selected intervals under each of the three mechanisms (see appendix Tables A3-A5 upper panels). For reference, the frequencies for the screening and pooling offer intervals are shown in boldface. Sixty-six percent of the player *B* offers are consistent with screening under CA, 50-54% under $FOA_B$, and 63% under $FOA_A$.[28] About 20% of *B*'s offers are consistent with pooling in CA, 9% in $FOA_A$ and 8-13% in $FOA_B$. Combining screening and pooling offers, 86% of the *B*'s offers are non-anomalous under CA, 63% under $FOA_B$, and 72% under $FOA_A$.

Clearly, there are many more anomalous offers under FOA compared with CA and this is particularly true for $FOA_B$. FOA is a more complex procedure from the perspective of the experimental subjects. The large informational rents in $FOA_B$ make locating the contract zone between $A_L$ and *B* much more computationally demanding compared with CA. As seen in Figure 1, most of the anomalous demands in $FOA_B$ fall below the screening interval and many of these (27%/35% = 77%) are in the 100-179 subinterval which is part of the contract zone in CA. This issue does not arise in Pecorino and Van Boening (2001) because both the *L* and *H* distributions are anchored at zero. When the lower support of the uniform distribution is constant, informational rents do not arise. However, they do arise when the lower support shifts, and the current experiment underscores how these rents may affect bargaining outcomes in $FOA_B$.

*Result 3. Under all three arbitration mechanisms, excess disputes occur between $A_L$ and B. These excess dispute rates are very similar across mechanisms: CA 26%, $FOA_B$ 25%, and $FOA_A$ 27%. Pooling offers are rare and except for $FOA_B$, they are almost always accepted by $A_L$.*

Figure 2 show the conditional player $A_L$ rejection rates using the same offer intervals as Figure 1 (see appendix Tables A3-A5 lower panels). The $A_L$ dispute rates over the screening

[28] The 50-52% range for $FOA_B$ reflects the 2% of offers in the overlap interval 300-330.

intervals are shown in boldface, as these indicate excess disputes between $A_L$ and $B$. Under the theory, the screening offer is one which $A_L$ should always accept, so a rejection by $A_L$ constitutes an "excess dispute." Empirically, excess disputes occur under all three mechanisms, and across mechanisms the rates are quite similar: CA at 26%, $FOA_B$ at 25% and $FOA_A$ at 26%. Rejections rates within this range do not explain differences in dispute rates across these mechanisms. Except for the overlap region of 300-330 for $FOA_B$, $A_L$ dispute rates in the pooling range are low (1%, 9%, and 0%). Moreover, few offers fall within this range. For offers below the screening range, dispute rates are high corresponding to a theoretical prediction of 100% dispute within this range. The key in understanding differences across the three mechanisms is to note from Figure 1, that many more offers fall within this low-offer range under $FOA_B$ compared to CA or $FOA_A$. We revisit this below.

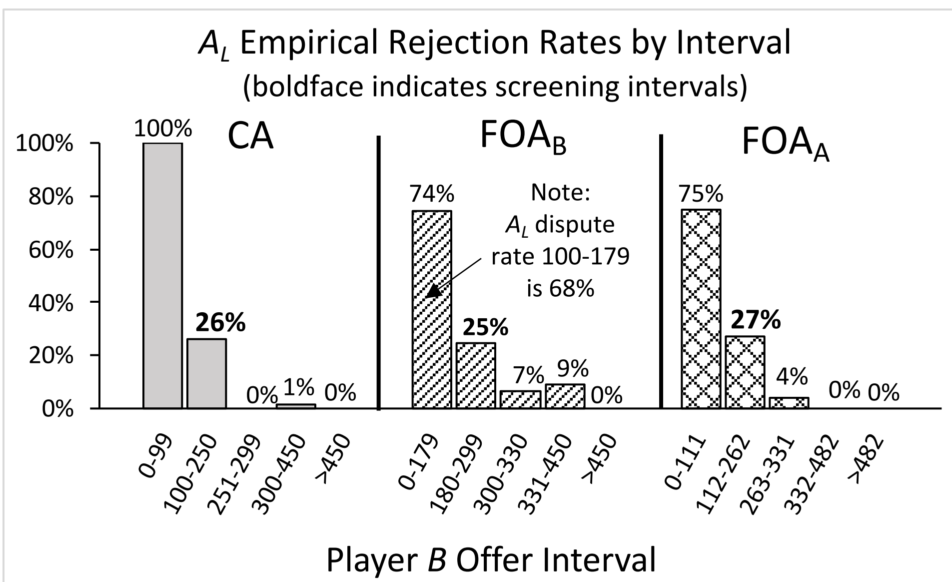


Figure 2. Player $A_L$ Rejection Rates Conditional on Player $B$ Offer Intervals

Appendix Tables A3-A5 provide insight on the player $A_H$ rejection behavior. With our parameters, pooling offers should not occur, but under the theory $A_H$ would accept them. From

Figure 1 above, these high offers occur about 9-20% of the time, but analysis of the data reveals that $A_H$ does not always accept them. The high-offer rejection rates are 67% (18/27) in CA, 14% (1/7) in $FOA_B$ and 26% (10/39) in $FOA_A$. This suggests that like $A_L$, empirically $A_H$ sometimes rejects offers that contain positive surplus.[29] Cross-mechanism comparisons of these high-offer rejection rates must be tempered by the fact that there are relatively few observations on $A_H$ in each of these three intervals.

*Result 4. The two key factors for explaining differences in dispute rates across mechanisms are the high dispute rate under $FOA_B$ for $A_L$ and the low dispute rate under $FOA_A$ for $A_H$. Under the theory, the predicted $A_L$ dispute rate is 0% for all three mechanisms, while the theory correctly predicts that $FOA_A$ will have the lowest dispute rate for $A_H$.*

Under the theory, the dispute rate for $A_L$ is predicted to be 0% under all three mechanisms, while the dispute rate for $A_H$ is predicted to be 100% for CA and $FOA_B$ and 75% for $FOA_A$. Table 4 reports dispute rates by player $A$ type and decomposition of the overall dispute rates by player $A$ type. A small portion of the differences in observed dispute rates is due to variation in the empirical frequency of player $A$ types across mechanisms (predicted at 67% $A_L$ and 33% $A_H$ in each). More importantly, the $A_L$ dispute rate for $FOA_B$ is 38% compared with 27% for CA and 29% for $FOA_B$. Many of these disputes occur on offers in the screening range which are theoretically acceptable to $A_L$, but prior work (e.g., Pecorino and Van Boening 2018) has shown that disputes typically do occur in this range as the players fight over the joint surplus from settlement. Crucially, Figure 1 above shows that a much larger percentage of offers in $FOA_B$ fall below the screening range compared to the other two games. Thirty-five percent of $FOA_B$ offers fall below this range compared with 5% in CA and 11% for $FOA_A$. As seen above in Figure 2,

[29] As noted in Section 3.4, this contradicts a basic prediction implied by risk aversion which is that individuals accept all offers which have a greater expected value than arbitration.

the dispute rate in this region is high for all three mechanisms. This is a key explanatory factor in the high $FOA_B$ dispute rate for $A_L$ players.

Table 4. Dispute Rate Decomposition by Player *A* type

| | Player *A* frequency and dispute rate by type | | | | Overall dispute rate and decomposition by player *A* type | | |
|---|---|---|---|---|---|---|---|
| | Frequency [a] | | Dispute rate [b] | | Dispute rate | Portion due to [c] | |
| | $A_L$ | $A_H$ | $A_L$ | $A_H$ | | $A_L$ | $A_H$ |
| CA | .707 | .293 | .226 | .864 | .413 | .160 | .253 |
| $FOA_B$ | .644 | .356 | .379 | .875 | .556 | .245 | .311 |
| $FOA_A$ | .673 | .327 | .286 | .539 | .369 | .192 | .177 |

[a] See Table 2 above.
[b] See Appendix Tables A3-A5.
[c] Player *A* type frequency × player *A* type dispute rate.

Figure 1 indicates that player *B* is better able to find the screening region in CA and $FOA_A$ compared to $FOA_B$. This is likely due to the large amount (= 80) of informational rents present in $FOA_B$. This drives the bottom of the screening interval from 100 in CA to 180 in $FOA_B$. It is relatively easy to compute the 100 for CA, by taking the mean of the *L* distribution and subtracting $C_A$ = 75. Computing the 180 for $FOA_B$ is much less straightforward. Clearly, there is some understanding by $A_L$ that in $FOA_B$ she should receive more than the 100 implied by CA and but much less understanding by *B* that more needs to be offered in this game. As a result, many offers which are unacceptable to $A_L$ under the theory are made and these offers are rejected a very high rate (the note on Figure 1 shows the 100-179 *B* offer rate at 27% and the note on Figure 2 shows the 100-179 $A_L$ dispute rate at 68%).[30]

For all three games, the dispute rate for $A_H$ is below the predicted value. The deviation is about 15 percentage points in CA and $FOA_B$ and about 21 percentage points in $FOA_A$.

[30] By contrast, the corresponding *B* offer and $A_L$ dispute rates for CA 100-179 are 36% and 47%, and for $FOA_A$ 112-179 they are 24% and 42%. The reader will note that Figure 2 implies a small amount of informational rents present (= 12) in the $FOA_A$ game. Only 2% (12/510) of player *B* offers in $FOA_A$ are 100-111, eight of which ex post went to $A_L$ who subsequently rejected six (75%) of them.

Consequently, the gap between $FOA_A$ and the other two mechanisms is a bit larger empirically relative to the theoretical prediction. The predicted $FOA_A$ gap is 25 percentage points (= 100% – 75%) but, from Table 4, the empirical gap is about 33 percentage points (= 87% – 54%). The last two columns of Table 4 show the percentage point contribution of disputes with $A_L$ and $A_H$ to the overall dispute rate for each mechanism. For $FOA_A$, the contribution of disputes with $A_H$ is 7 percentage points lower compared with CA and 13 percentage points lower compared with $FOA_B$. Meanwhile, in $FOA_A$ disputes with $A_L$ contribute 3 more percentage points to the dispute rate compared with CA, and 5 fewer percentage points compared with $FOA_B$. Collectively, these differences yield overall dispute rates that are 4 percentage points lower in $FOA_A$ compared to CA and 19 percentage points lower compared to $FOA_B$. Empirically, the relatively low incidence of $A_H$ disputes in $FOA_A$ and a relatively high incidence of $A_L$ disputes in $FOA_B$ are two key factors for explaining the large difference between their respective overall dispute rates.

*Result 5. There is some evidence that $FOA_B$ disadvantages the uninformed player, as B incurs a 7% higher average cost in $FOA_B$ v. CA, and a 12% higher average cost in $FOA_B$ v. $FOA_A$. There is some evidence that $A_H$ does better under $FOA_A$, as the average $A_H$ payoff is 9% higher in $FOA_A$ v. $FOA_B$. Otherwise, differences in payoffs and costs do not appear to be statistically or economically significant.*

Our final result relates to the distributional impact of the choice of the dispute resolution mechanism. Table 5 reports average per-round player *B* and average per-round player *A* payoffs by player *A* type for each mechanism, estimated using dummy variable regressions with robust standard errors clustered on sessions. The dummy variables identify the mechanism treatments and the *p*-values on pairwise tests are adjusted for multiple simultaneous tests (see table notes for model specifications). Table A6 in the appendix reports means and nonparametric pairwise tests using session-level data, and those results are similar to those in Table 5. From section 3, the theoretical predictions for player *B* costs are 217 CA, 270 $FOA_B$, and 222 $FOA_A$, which imply an increase in costs of about 22-24% moving to $FOA_B$ either from CA or $FOA_A$. Table 5 provides some support for that prediction that *B*'s costs will be highest under $FOA_B$, but the evidence is not strong. Based on the point estimate, player *B*'s cost is indeed highest for $FOA_B$ (318), but the difference is 20 with CA ($p$ = .714) and 33 with $FOA_A$ ($p$ = .120). In Table A6, the differences are 20 ($p$ = .25) and 30 ($p$ = .04), respectively. The former represents a 7% increase in costs (at the point estimates) when moving from CA to $FOA_B$, while the latter represents a 12% increase moving from $FOA_A$ to $FOA_B$. The observed differences are consistent with there being an economically significant disadvantage to the uninformed player from utilizing the $FOA_B$ process relative to using the CA or the $FOA_A$ process.

Table 5. *B* Cost and *A* Payoff Regressions and Pairwise Tests

| Treatments and pairwise tests | Regression estimate of treatment mean (std. err.) [a] | | |
|---|---|---|---|
| | *B* cost | $A_H$ payoff | $A_L$ payoff |
| CA | 298.09 (10.88) | 298.03 (7.35) | 210.38 (12.66) |
| $FOA_B$ | 317.72 (15.72) | 288.24 (11.15) | 204.67 (23.94) |
| $FOA_A$ | 285.03 (13.67) | 317.53 (12.51) | 186.99 (14.01) |
| $H_0$: CA = $FOA_B$ | | | |
| Difference | –19.63 | 9.79 | 5.07 |
| Test statistic | $F$ = 1.56 | $F$ = 0.77 | $F$ = 0.06 |
| ($p$-value) | ($p$ = .714) | ($p$ = .999) | ($p$ = .999) |
| $H_0$: CA = $FOA_A$ | | | |
| Difference | 13.05 | –19.50 | 23.38 |
| Test statistic | $F$ = 0.91 | $F$ = 2.43 | $F$ = 2.77 |
| ($p$-value) | ($p$ = .999) | ($p$ = .440) | ($p$ = .372) |
| $H_0$: $FOA_B$ = $FOA_A$ | | | |
| Difference | 32.69 | –29.29 | 17.68 |
| Test statistic | $F$ = 5.41 | $F$ = 4.97 | $F$ = 0.70 |
| ($p$-value) | ($p$ = .120) | ($p$ = .143) | ($p$ = .999) |

[a] Estimated means from dummy-variable regressions with robust standard errors clustered on sessions. $Dep\_Var_{i,j,t} = \beta_0 + \beta_1 * FOAB_{i,j,t} + \beta_2 * FOAA_{i,j,t}$ where $Dep\_Var_{i,j,t}$ is either the player *B* cost, the player $A_H$ payoff, or the player $A_L$ payoff for subject *i* in session *j* round *t*. Dummy variables are *FOAB* = 1 if session *j* is a $FOA_B$ session (= 0 otherwise), and *FOAA* = 1 if session *j* is a $FOA_A$ session (= 0 otherwise). *B* cost regression: $n$ = 1530, $R^2$ = .012, and $F$ = 2.72 ($p$ = .110). $A_H$ payoff regression: $n$ = 497, $R^2$ = .017, and $F$ = 2.51 ($p$ = .127). $A_L$ payoff regression: $n$ = 1033, $R^2$ = .010, and $F$ = 1.59 ($p$ = .248). Statistical tests with Bonferroni-adjusted $p$-values are $H_0$: $\beta_1 = 0$ for CA = $FOA_B$, $H_0$: $\beta_2 = 0$ for CA = $FOA_A$, and $H_0$: $\beta_1 = \beta_2$ for $FOA_B$ = $FOA_A$.

The table also shows the $A_H$ payoff is about 29 higher in $FOA_A$ than in $FOA_B$, but the difference is only marginally significant ($p = .143$; the Table A6 difference is 31 with $p = .149$). Economically, this represents a 9% increase in payoffs (at the point estimates) when moving from $FOA_B$ to $FOA_A$.[31] This is consistent with theory as $A_H$ earns some informational rents in $FOA_A$ because player $B$ submits a proposal while putting only a 1/3 weight on the probability that $A$ is $A_H$. By contrast under $FOA_B$ he places a 100% weight on the probability that $A$ is $A_H$. In addition, $A_H$ is less likely to proceed to arbitration in $FOA_A$ compared with the other two games: theoretically 75% in $FOA_A$ vs. 100% in CA and $FOA_B$, and here empirically 54% in $FOA_B$ vs. about 87% in CA and $FOA_B$. To the extent that settlement offers contain positive surplus, this would raise $A_H$'s payoff. Other differences in payoffs are not statistically significant.

## 6. Conclusion

We experimentally compare dispute rates across two kinds of Final Offer Arbitration and a simple model of Conventional Arbitration. Our models are distinguished from most others in the experimental arbitration literature in that we have asymmetric information as a theoretical driver of disputes, whereas the previous experimental literature has typically utilized symmetric information between bargaining partners. In $FOA_A$, settlement negotiations succeed the submission of proposals to the arbitrator. Importantly, this setting parallels the default rules for arbitration promulgated by the International Centre for Dispute Resolution and the American Arbitration Association. Despite this, most previous work has compared CA to $FOA_B$ under which settlement negotiations take place prior to the submission of proposals the arbitrator. No

[31] Under our parameters, the offer that $B$ would have to make to settle with $A_H$ is 300 in $FOA_B$ and 332 in $FOA_A$. This represents an increase of approximately 11% moving from $FOA_B$ to $FOA_A$.

proposals are submitted under CA. Rather, the arbitrator simply imposes what she believes is the justified outcome given the facts.

One major result accords with the finding of Ashenfelter et al. (1992) and others in that we find the dispute rate in CA to be lower than $FOA_B$. Our point estimate of the difference in dispute rates between CA and $FOA_B$ is 15 percentage points, which represents about 1/3 of the average dispute rate across these mechanisms. Thus, this effect is economically and statistically significant. We find the lowest dispute rate occurs in $FOA_A$, although the estimated difference between CA and $FOA_A$ is only about 4-5 percentage points which is economically small and statistically insignificant. In contrast, we find the dispute rate is about 19 percentage points lower in $FOA_A$ compared to $FOA_B$, which is both economically and statistically significant. Empirically, the key factors explaining this difference are the relatively low incidence of high-claim disputes in $FOA_A$ and the relatively high incidence of low-claim disputes in $FOA_B$.

One concern with FOA, discussed in the introduction, is that it disadvantages the uninformed party to the dispute. Under our parameters, theory predicts that the uniformed party's costs should be similar in CA and $FOA_A$ but higher in $FOA_B$. Our results are consistent with these predictions. We find no evidence that the uninformed party performs worse in $FOA_A$ when compared to CA. When comparing CA to $FOA_B$, our point estimate indicates that the uninformed party has costs which are 7% lower in CA. This result is not statistically significant ($p$-value = 0.64), but it is at least weak evidence that the uninformed party is disadvantaged in the $FOA_B$ process. Additionally, when comparing $FOA_A$ with $FOA_B$ our point estimate indicates that the uninformed party has costs which are 12% lower in $FOA_A$ ($p$-value = 0.12), which is also in line with the theory. In addition to the lower dispute rate, this suggests a second possible advantage of $FOA_A$ over $FOA_B$.

A single set of experiments cannot be totally conclusive in evaluating the three mechanisms we consider in this paper. However, it is noteworthy that one of our main findings – that CA has a lower dispute rate than $FOA_B$ – agrees with an earlier literature where the experimental setting did not include asymmetric information. Moreover, the magnitude of this difference, 15 percentage points, is in line with the findings of the previous literature. This suggests a certain robustness to the result that lower dispute rates are found under CA when compared to $FOA_B$.

The screening model is one of the two canonical models of asymmetric information in the litigation/arbitration literature with the other being the signaling model under which the informed party makes the final settlement offer. Pecorino, Solomon and Van Boening (2024) conduct an arbitration experiment in the context of the signaling game. Their experimental protocol and parameters are the same as in this paper with the lone difference being that the informed player *A* makes a settlement demand rather than player *B*. They find that $FOA_B$ has a dispute rate which is 10 percentage points higher than CA, where this difference is statistically significant and represents about ¼ of the average dispute rate across the three mechanisms. They find the dispute rate in $FOA_A$ to be six percentage points higher than CA, with a marginal statistical significance.

Taken together, the current paper and Pecorino, Solomon and Van Boening (2024) find that $FOA_B$ has the highest dispute rate among the three mechanisms. There is not much difference between CA and $FOA_A$ with the point estimates indicating somewhat lower dispute rates for CA in the signaling game and somewhat higher dispute rates in the screening game. It is notable both that the literature which has found the higher dispute rates in FOA used $FOA_B$ and that $FOA_A$ corresponds to the default rules for final offer arbitration. The experimental evidence is consistent with the idea that default rules have been chosen correctly and that CA and $FOA_A$ are both reasonable choices for a dispute resolution mechanism.

A logical next step would be to allow for unstructured bargaining. The signaling and screening models each award all the bargaining power to one of the two parties to the dispute. Among other things, this allows for the derivation of explicit predictions within these models. Our expectation is that the results of free-form bargaining would fall in between the results in this paper and those in Pecorino, Solomon and Van Boening (2024).[32]

[32] For a paper along these lines in the civil litigation context, see Vassios Sivvipoulos and Van Boening (2022).

## Appendix

Table A1. Experimental Sessions, Negotiations and Disputes

| Session[a] | Number of subjects | Number of Negotiations | | | Number of Disputes (Rate) | | |
|---|---|---|---|---|---|---|---|
| | | | By pairings | | | By pairings | |
| | | *A v. B* | $A_H$ *v. B* | $A_L$ *v. B* | *A v. B* | $A_H$ *v. B* | $A_L$ *v. B* |
| CA-1 | 20 | 150 | 41 | 109 | 56 (.373) | 34 (.829) | 22 (.202) |
| CA-2 | 18 | 135 | 46 | 89 | 58 (.430) | 38 (.826) | 20 (.225) |
| CA-3 | 14 | 105 | 29 | 76 | 45 (.429) | 29 (1.00) | 16 (.211) |
| CA-4 | 18 | 135 | 38 | 97 | 58 (.430) | 32 (.842) | 26 (.268) |
| $FOA_B$-1 | 20 | 150 | 57 | 93 | 76 (.507) | 44 (.772) | 32 (.344) |
| $FOA_B$-2 | 16 | 120 | 47 | 73 | 87 (.725) | 44 (.936) | 43 (.589) |
| $FOA_B$-3 | 14 | 105 | 30 | 75 | 51 (.486) | 28 (.933) | 23 (.307) |
| $FOA_B$-4 | 16 | 120 | 42 | 78 | 61 (.508) | 38 (.905) | 23 (.295) |
| $FOA_A$-1 | 14 | 105 | 36 | 69 | 47 (.448) | 24 (.667) | 23 (.333) |
| $FOA_A$-2 | 20 | 150 | 51 | 99 | 53 (.353) | 26 (.510) | 27 (.273) |
| $FOA_A$-3 | 18 | 135 | 37 | 98 | 42 (.311) | 17 (.459) | 25 (.255) |
| $FOA_A$-4 | 16 | 120 | 43 | 77 | 46 (.383) | 23 (.535) | 23 (.299) |

[a] All sessions had 15 negotiation rounds. The four $FOA_A$ sessions were conducted first, followed by the four $FOA_B$ sessions, and then by the four CA sessions.

Table A2. Estimated Dispute Rates and Pairwise Tests from Random Effects Logit Regression [a]

| Treatments and pairwise tests | Coefficient estimate $\hat{\alpha}$ (std. err.), estimated dispute rate $\hat{r}$ |
|---|---|
| CA | $\hat{\alpha}_0$ = –.381 (.1403), $\hat{r}_{CA}$ = .406 |
| $FOA_B$ | $\hat{\alpha}_1$ = .622 (.2008), $\hat{r}_{FOA_B}$ = .560 |
| $FOA_A$ | $\hat{\alpha}_2$ = –.210 (.2010), $\hat{r}_{FOA_A}$ = .356 |
| $H_0$: CA = $FOA_B$ | |
| Estimated difference | $\hat{r}_{CA} - \hat{r}_{FOA_B}$ = –.154 |
| $H_0$: $\alpha_1 = 0$ | $\chi^2$ = 9.59 (*p*–value = .006) |
| $H_0$: CA = $FOA_A$ | |
| Estimated difference | $\hat{r}_{CA} - \hat{r}_{FOA_A}$ = .050 |
| $H_0$: $\alpha_2 = 0$ | $\chi^2$ = 2.19 (*p*–value = .888) |
| $H_0$: $FOA_B$ = $FOA_A$ | |
| Estimated difference | $\hat{r}_{FOA_B} - \hat{r}_{FOA_A}$ = .204 |
| $H_0$: $\alpha_1 = \alpha_2$ | $\chi^2$ = 16.66 (*p*–value = .000) |

[a] Random effects logit regression with robust standard errors clustered on sessions and individual player *A* subjects as random effects: $Reject_{i,j,t} = \alpha_0 + \alpha_1 FOAB_{i,i,t} + \alpha_2 FOAA_{i,j,t} + \sum_{i=1}^{102} \gamma_i * A\_Subject_i + \epsilon_{i,t}$. For player *A* subject *i* in session *j* round *t*, *Reject* = 1 if *A* rejects player *B*'s settlement offer (= 0 if *A* accepts), *FOAB* = 1 if session *j* is a $FOA_B$ session (= 0 otherwise), and *FOAA* = 1 if session *j* is a $FOA_A$ session (= 0 otherwise). *n* = 1530, log-likelihood = –1011.23, and $\chi^2$ = 18.08 (*p* = .000). Estimated probability $\hat{r} = e^{\hat{y}}/(1 + e^{\hat{y}})$: $\hat{y}_{CA} = \hat{\alpha}_0$, $\hat{y}_{FOA_B} = \hat{\alpha}_0 + \hat{\alpha}_1$, and $\hat{y}_{FOA_A} = \hat{\alpha}_0 + \hat{\alpha}_2$. Bonferroni-adjusted *p*-values are reported for the pairwise coefficient tests.

Table A3. CA Offer Frequencies and Dispute Rates

| | Offer interval | | | | | |
|---|---|---|---|---|---|---|
| | Overall | 0-99 | 100-250 [a] | 251-299 | 300-450 [a] | > 450 |
| I. Player *B* offers | | | | | | |
| Relative frequency | 1.0 | .050 | .655 | .088 | .200 | .008 |
| (number) | (525) | (26) | (344) | (46) | (105) | (4) |
| II. Dispute rates | | | | | | |
| *A v. B* | .413 | .962 | .474 | .217 | .181 | .000 |
| (dispute ratio) | (217/525) | (25/26) | (163/344) | (10/46) | (19/105) | (0/4) |
| $A_H$ *v. B* [b] | .864 | .800 | .935 | .714 | .667 | -- |
| (dispute ratio) | (133/154) | (4/5) | (101/108) | (10/14) | (18/27) | |
| $A_L$ *v. B* [b] | .226 | 1.0 | .263 | .000 | .013 | .000 |
| (dispute ratio) | (84/371) | (21/21) | (62/236) | (0/32) | (1/78) | (0/4) |

[a] Offers 100-250 are consistent with the screening model. Offers 300-450 are consistent with the pooling; pooling offers are not predicted under our parameters.

[b] Player *B* does not know player *A*'s type at the time of the *B* offer decision and *A*'s accept/reject decision.

Table A4. $FOA_B$ Offer Frequencies and Dispute Rates

| | Offer interval | | | | | |
|---|---|---|---|---|---|---|
| | Overall | 0-179 | 180-299 [a] | 300-330 [a] | 331-450 [a] | >450 |
| I. Player *B* offers | | | | | | |
| Relative frequency | 1.0 | .352 | .503 | .042 | .018 | .022 |
| (number) | (495) | (174) | (249) | (21) | (43) | (11) |
| II. Dispute rates | | | | | | |
| *A v. B* | .556 | .833 | .490 | .190 | .100 | .000 |
| (dispute ratio) | (275/495) | (145/174) | (122/249) | (4/21) | (4/40) | (0/11) |
| $A_H$ *v. B* [b] | .875 | .971 | .922 | .500 | .143 | .000 |
| (dispute ratio) | (154/176) | (67/69) | (83/90) | (3/6) | (1/7) | (0/4) |
| $A_L$ *v. B* [b] | .379 | .743 | .245 | .067 | .091 | .000 |
| (dispute ratio) | (121/319) | (78/105) | (39/159) | (1/15) | (3/33) | (0/7) |

[a] Offers 180-330 are consistent with the screening model. Offers 300-450 are consistent with the pooling; pooling offers are not predicted under our parameters. Offers 300-330 are indeterminant due to the overlap of the screening and pooling intervals.

[b] Player *B* does not know player *A*'s type at the time of the *B* offer decision and *A*'s accept/reject decision.

Table A5. $FOA_A$ Offer Frequencies and Dispute Rates

| | Overall | Offer interval | | | | |
|---|---|---|---|---|---|---|
| | | 0-111 | 112-262 [a] | 263-331 | 332-482 | > 482 |
| I. Player *B* offers | | | | | | |
| Relative frequency | 1.0 | .112 | .625 | .165 | .094 | .004 |
| (number) | (510) | (57) | (319) | (84) | (48) | (2) |
| II. Dispute rates | | | | | | |
| *A v. B* | .369 | .789 | .382 | .131 | .208 | .000 |
| (dispute ratio) | (188/510) | (45/57) | (122/319) | (11/84) | (10/48) | (0/2) |
| $A_H$ *v. B* [b] | .539 | .882 | .757 | .257 | .256 | .000 |
| (dispute ratio) | (90/167) | (15/17) | (56/74) | (9/35) | (10/39) | (0/2) |
| $A_L$ *v. B* [b] | .286 | .750 | .269 | .041 | .000 | -- |
| (dispute ratio) | (98/343) | (30/40) | (66/245) | (2/49) | (0/9) | |

[a] Offers 112-262 are consistent with the screening model. Offers 332-482 are consistent with the pooling; pooling offers are not predicted under our parameters.

[b] Player *B* does not know player *A*'s type at the time of the *B* offer decision and *A*'s accept/reject decision.

Table A6. Session-level Costs and Payoffs and Pairwise Tests

| Treatments and pairwise tests | Mean (median) session-level mean cost or payoff: [a] | | |
|---|---|---|---|
| | *B* cost | $A_H$ payoff | $A_L$ payoff |
| CA | 296.01 (297.50) | 295.96 (299.80) | 208.17 (213.15) |
| $FOA_B$ | 315.75 (309.52) | 287.61 (285.49) | 201.69 (205.53) |
| $FOA_A$ | 285.96 (291.95) | 318.36 (319.02) | 185.84 (180.95) |
| $H_0$: CA = $FOA_B$ | | | |
| Difference | –19.74 | 8.34 | 6.48 |
| Test statistic | $z = -1.15$ | $z = 0.58$ | $z = 0.29$ |
| (*p*-value) | ($p = .248$) | ($p = .564$) | ($p = .773$) |
| $H_0$: CA = $FOA_A$ | | | |
| Difference | 10.06 | –22.41 | 22.33 |
| Test statistic | $z = 1.15$ | $z = -1.16$ | $z = 0.87$ |
| (*p*-value) | ($p = .248$) | ($p = .248$) | ($p = .386$) |
| $H_0$: $FOA_B$ = $FOA_A$ | | | |
| Difference | 29.79 | –30.75 | 15.85 |
| Test statistic | $z = 2.02$ | $z = 1.44$ | $z = 0.87$ |
| (*p*-value) | ($p = .043$) | ($p = .149$) | ($p = .386$) |

[a] For each session, mean (median) cost and payoff across all negotiations is computed and the table value is the mean (median) of the $n = 4$ means (medians) per treatment. Pairwise Mann-Whitney rank-sum tests use session-level means.

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