Conventional versus Final-Offer Arbitration

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Abstract

We compare conventional and final-offer arbitration in terms of the trade-off between influence costs and adjudication error. Informed parties with conflicting interests attempt to influence a sophisticated arbitrator. The arbitrator rationally corrects for the parties' incentives to boost their claims. In the Perfect Bayesian equilibria, misrepresentation expenditures are smaller under final-offer arbitration but adjudication error is larger. Conventional arbitration is the best procedure if adjudication accuracy is highly valuable or if the parties do not differ too much in their capacity to boost their claims.

Keywords: Arbitration, Adjudication, Bargaining, Asymmetric information.

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1 Introduction

The present paper compares conventional and final-offer arbitration in terms of the trade-off between influence costs and adjudication error. We consider a situation where informed parties with conflicting interests attempt to influence a sophisticated arbitrator. The disputants share knowledge of the case merits, while the arbitrator is uninformed, and may choose to boost their claims at a given cost in order to get a more favorable award. In equilibrium, the parties make optimal use of private information in their offers, and the arbitrator rationally corrects for the parties' incentives to distort their offers in order to adjudicate as truthfully as possible. In this setting, it is shown that conventional arbitration is the best procedure if adjudication accuracy is highly valuable socially or if the disputants do not differ too much in their ability to boost their claims.

This result challenges an important conclusion of the previous literature in which final-offer arbitration (FOA) is generally considered as superior to conventional arbitration (CA) by inducing the parties to converge toward a negotiated settlement. CA mimics civil litigation in form since the arbitrator is free to impose any award of his choice, while FOA requires that parties submit a final offer and the arbitrator must choose one of the two. A long-standing critique of CA mechanisms in literature argues they tend to "chill" pre-arbitration negotiations and increase the likelihood of arbitrator-determined settlements: to the extent that arbitrators are inclined or perceived to compromise between the parties' final positions, disputants are encouraged to exaggerate claims and avoid concessions (Farber, 1981). In contrast, FOA should incite the disputants to stake out more reasonable bargaining positions since no compromise is possible (see, for example, Armstrong and Hurley, 2002). The crux of this literature is that the arbitrator is presumed to know more about the case as the disputants themselves: the arbitrator is considered to construct an "appropriate award" as a function of the merits of the case, while disputants' offers are based on their beliefs about this appropriate settlement. Our approach differs in that the parties themselves, and not the arbitrator, have substantive information bearing on the dispute, following the intuition that the arbitrator may learn from the parties' offers. In our setup, decisions are part of a perfect bayesian equilibrium: the arbitrator is a sophisticated decision-maker (*i.e.*, capable of game-theoretic reasoning) who understands the parties' natural incentives to boost their claims, while the parties take into account the effect their offers have on the arbitrator's inference about the ideal settlement.

Most closely related to our paper is the article by Gibbons (1988) who emphasizes the role of learning by the arbitrator from the parties' offers in a similar asymmetric information setting. The analysis focuses on strategic communication in CA and FOA, respectively. However, this approach differs from our work in the extent to which CA is modeled as a cheap-talk communication game, following the seminal analysis by Crawford and Sobel (1982): the disputants can misrepresent their private information and distort their claims in order to influence the arbitrator without direct costs[1]. While the basic Crawford-Sobel model has been widely applied, an outstanding problem is that this kind of approach is typically plagued by a multiplicity of equilibria: standard theory for equilibrium selection in signaling games does not apply because the signals are costless to the parties. Gibbons weakens this problem by focusing on the ex-ante Pareto dominant (most-informative) equilibria, implying that CA is the best procedure since the arbitrator's award is unconstrained and based on full information. However, although such a refinement follows the common approach taken in the applied literature, applying a cooperative solution concept (*i.e.*, the Pareto criterium) in equilibrium selection for non-cooperative games is not fully satisfactory from a theoretical perspective (Kartik, 2005). Furthermore, from a more practical standpoint, it seems reasonable to consider that distorting the truth is costly for the parties in the arbitration process: these costs may stem from evidence fabrication, exogenous experts, or even internal ethics. Indeed, recent experimental works suggest that people have an intrinsic aversion to lying, even though messages are *prima facie* cheap talk (Gneezy, 2005; Hurkens and Kartik, 2009; Sánchez-Pagés and Vorsatz, 2009)[2]. In this situation, by considering influence costs and adjudication error, our paper mitigates both the result of Gibbons which emphasizes the superiority of CA, and the previous literature based on the Farber's model which highlights the superiority of FOA.

The remainder of the paper is organized as follows. Section 2 lays down our theoretical framework, while Sections 3 and 4 analyze the equilibrium and welfare implications of CA and FOA. Section 5 discusses the main results and concludes.

[1]Notice that FOA is not a pure cheap-talk game in the Gibbons analysis since, when submitting his offer, each party faces the possibility that the arbitrator chooses the other's side proposal. Misleading the arbitrator is hence indirectly costly.

[2]See also Kartik (2009) who analyses the implications of costly lying in information transmission in a purely game-theoretical context.

2 The Model

There are two risk-neutral parties denoted A and B and an arbitrator. The contested issue is the value of $x \in \mathbb{R}$. Party A would like the adjudicated value to be large, party B would like it to be small. For instance, x is the amount that B should pay to A. The true value of x is known to both parties but not to the arbitrator, whose prior beliefs are represented by the density $g(x)$ with support over the real line. The parties move first, simultaneously stating their claims about the realization of x. Party A claims that the quantity at issue equals x_A, party B claims that it equals x_B. After hearing the parties' claims, the arbitrator updates his beliefs and adjudicates some quantity $\widehat{x}$.

Stating a claim is costly for the parties to the extent that it differs from the true value. The interpretation is that a claim x_i is a story together with supporting documents, experts and the like rendering $x = x_i$ plausible. The more a claim differs from the true value, the more elaborate and costly the argumentative story needs to be. When the true value is x, the cost of claiming x_i is

$$c_i(x_i, x) = \tfrac{1}{2}\gamma_i(x_i - x)^2, \quad i = A, B.$$

Parties may differ in their ability to boost claims, a feature captured by the parameter γ_i. For instance, one party has better access to persuasive documents or has greater rhetorical skills. The parties' ability in this respect is common knowledge.

A party' net payoff depends on the arbitrator's decision $\widehat{x}$ and on his submission costs. For party A, the payoff is

$$\pi_A = \widehat{x} - \tfrac{1}{2}\gamma_A(x_A - x)^2.$$

For party B, it is

$$\pi_B = -\widehat{x} - \tfrac{1}{2}\gamma_B(x_B - x)^2.$$

Each party chooses his claim by trading off the cost of exaggeration against the effect exaggeration may have on the arbitrator's decision.

The arbitrator wants to adjudicate as truthfully as possible, i.e., he would like to minimize the discrepancy between adjudicated and true value. His payoff is minus the loss function defined by the quadratic error

$$l = (\widehat{x} - x)^2.$$

After hearing the parties, he therefore chooses $\widehat{x}$ to minimize the expected quadratic error, given his updated beliefs about x. The arbitrator's posterior beliefs are denoted by the conditional cumulative distribution $G(x \mid x_A, x_B)$.

However, the arbitrator's decision is constrained by the procedure. When the procedure is *conventional arbitration*, we take it that the adjudicated value must lie within the interval defined by the parties' claims. Specifically, the arbitrator's action space is then

$$A_N = \{\widehat{x} : \widehat{x} = \lambda x_A + (1 - \lambda)x_B,\ \lambda \in [0, 1]\},$$

where the subscript N stands for conventional arbitration. When the procedure is *final-offer arbitration*, the arbitrator is restricted to adjudicate one claim or the other. His action space is then

$$A_F = \{x_A, x_B\},$$

where the subscript F stands for final-offer arbitration. The arbitrator chooses $\widehat{x}$ to minimize expected quadratic error given the restrictions entailed by the procedure. The outcome under the two procedures will differ in the influence costs incurred by the parties and the adjudication error. The social payoff is assumed to be evaluated by

$$L = C + \theta l$$

where $C = c_A + c_B$ represents total influence costs, l is the quadratic error in adjudication and θ is the rate at which society trades off influence costs against error. The two procedures are compared on the basis of the prior expected value of$L$.

3 Equilibria

For each procedure, we exhibit a separating Perfect Bayesian equilibrium. The arbitrator infers from the parties' claims the true value of x, which turns out to lie between the parties' claims. Under conventional arbitration, the arbitrator therefore adjudicates the inferred true value. Under final-offer arbitration, his best response is to pick the claim closest to the inferred true value. Under this procedure, however, both claims will be equidistant from the true value. Hence, the arbitrator is indifferent between adjudicating one claim or the other and simply randomizes between the two.

Conventional arbitration

Under conventional arbitration, given the parties' claims, the arbitrator must adjudicate $\widehat{x} = \lambda x_A + (1-\lambda)x_B$ for some $\lambda \in [0,1]$. In a pure strategy equilibrium, the arbitrator's best response can therefore be described by a function $\lambda(x_A, x_B)$ with values in the unit interval.

A Perfect Bayesian equilibrium is defined by the strategies $x_A(x)$, $x_B(x)$ and $\lambda(x_A, x_B)$ together with beliefs $G(x \mid x_A, x_B)$ such that

$$\begin{aligned} x_A(x) &= \max_{x_A} \lambda(x_A, x_B(x))x_A + [1-\lambda(x_A, x_B(x))]\, x_B(x) - \tfrac{1}{2}\gamma_A(x_A - x)^2, \\ x_B(x) &= \max_{x_B} -\lambda(x_A(x), x_B)x_A(x) - [1-\lambda(x_A(x), x_B)]\, x_B - \tfrac{1}{2}\gamma_B(x_B - x)^2, \\ \lambda(x_A, x_B) &= \min_{\lambda\in[0,1]} E\left[(\lambda x_A + (1-\lambda)x_B - x)^2 \mid x_A, x_B\right], \end{aligned}$$

where the posterior beliefs $G(x \mid x_A, x_B)$ satisfy Bayes' rule along the equilibrium path. We focus on the equilibrium where the arbitrator's best response function $\lambda(x_A, x_B)$ is a constant[3]. We refer to it as a constant weights equilibrium.

Proposition 1 *Under conventional arbitration, the unique constant weights equilibrium satisfies* $x_A(x) = x+\lambda/\gamma_A$, $x_B(x) = x-(1-\lambda)/\gamma_B$ *and* $\lambda = \sqrt{\gamma_A}/(\sqrt{\gamma_A}+\sqrt{\gamma_B})$. *The arbitrator infers that the true value is* $x = x_A(x) - \lambda/\gamma_A = x_B(x) + (1-\lambda)/\gamma_B$*; he adjudicates* $\lambda x_A(x) + (1-\lambda)x_B(x) \equiv x$.

The parties know that they can influence the arbitrator's decision. The influence possessed by party A is captured by λ, that of party B by $1-\lambda$. As a result, parties always boost their claims and chilling effect occurs. However, this is self-defeating at equilibrium. The arbitrator expects boosted claims, he rationally corrects for boosting and adjudicates the inferred true value.

To complete the description of the equilibrium, we need to specify the arbitrator's beliefs off the equilibrium path. The observation of a pair of claims such that $(x_A, x_B) \neq (x_A(x), x_B(x))$ for all x is out of equilibrium. The arbitrator then believes that at most one party deviated from his equilibrium strategy. He thinks that with probability λ party B deviated, in which case A did not so that the true value is $x_A - \lambda/\gamma_A$; alternatively, that with probability $1-\lambda$ party A deviated, in which case the true value is $x_B + (1-\lambda)/\gamma_B$. His mean posterior belief is therefore

$$\lambda\left(x_A - \lambda/\gamma_A\right) + (1-\lambda)\left(x_B + (1-\lambda)/\gamma_B\right) = \lambda x_A + (1-\lambda)x_B,$$

[3]Such a restriction has been deliberately chosen to enable us to develop our main results and insights in a focused and tractable manner.

which he adjudicates.

Final-offer arbitration

Under this procedure, the arbitrator can only adjudicate either x_A or x_B. His best response is described by a function $\mu(x_A, x_B)$ defined as the probability that he adjudicates x_A. Given the parties' claims, the adjudicated value $\widehat{x} \in \{x_A, x_B\}$ is therefore a random variable with distribution $\mu(x_A, x_B)$.
A Perfect Bayesian equilibrium is defined by the strategies $x_A(x)$, $x_B(x)$, $\mu(x_A, x_B)$ and posterior beliefs $G(x \mid x_A, x_B)$ satisfying

$$x_A(x) = \max_{x_A} \mu(x_A, x_B(x))x_A + [1 - \mu(x_A, x_B(x))]\, x_B(x) - \tfrac{1}{2}\gamma_A(x_A - x)^2,$$

$$x_B(x) = \max_{x_B} -\mu(x_A(x), x_B)x_A(x) - [1 - \mu(x_A(x), x_B)]\, x_B - \tfrac{1}{2}\gamma_B(x_B - x)^2,$$

$$\mu(x_A, x_B) = \min_{\mu\in[0,1]} E\left[\mu(x_A - x)^2 + (1 - \mu)(x - x_B)^2 \mid x_A, x_B\right],$$

where $G(x \mid x_A, x_B)$ is obtained from Bayes' rule whenever possible. Again, we focus on the equilibrium where the arbitrator's best response function is a constant and refer to it as a constant weights equilibrium.

Proposition 2 *Under final-offer arbitration, the unique constant weights equilibrium satisfies* $x_A(x) = x + \mu/\gamma_A$, $x_B(x) = x - (1 - \mu)/\gamma_B$ *and* $\mu = \gamma_A/(\gamma_A + \gamma_B)$. *The arbitrator infers that the true value is* $x = x_A(x) - \mu/\gamma_A = x_B(x) + (1 - \mu)/\gamma_B$ *; he is indifferent between adjudicating* x_A *or* x_B *because* $x_A(x) - x = x - x_B(x)$.

As in the previous procedure, both parties boost their claims but the arbitrator nevertheless infers the true value. The difference is that the parties now boost equally. This a necessary feature at equilibrium. A party has no influence on the adjudicated quantity if his claim is believed to be the most unreasonable one. Because exaggeration is costly, exaggerating more than the other party can therefore not be part of an equilibrium when the true quantity is inferred. In turn, the arbitrator is indifferent between either claim because both entail the same adjudication error, which allows him to randomize.
The following out-of-equilibrium beliefs support the above strategies. Suppose a pair of claims is observed such that $(x_A, x_B) \neq (x_A(x), x_B(x))$ for all x. As before, the arbitrator then believes that at most one party deviated from his equilibrium strategy but does not know which one. He thinks that it is equally likely that party

A or party B is now closest to the true value. Hence, he is indifferent between adjudicating x_A or x_B, implying that randomizing with probability μ is sequentially rational.

4 Welfare

It is often held that, compared to conventional arbitration, the parties' claims under final-offer arbitration will diverge less from one another. The above shows that this is indeed the case even with a sophisticated arbitrator, at least when parties differ in their capacity to boost claims. For the same reason, influence expenditures will be smaller under final-offer arbitration.

The claims discrepancy is $\Delta = x_A - x_B$. Under conventional arbitration,

$$\Delta_N = \frac{\lambda}{\gamma_A} + \frac{1-\lambda}{\gamma_B} = \frac{1}{\sqrt{\gamma_A \gamma_B}}.$$

Under final-offer arbitration,

$$\Delta_F = \frac{\mu}{\gamma_A} + \frac{1-\mu}{\gamma_B} = \frac{2}{\gamma_A + \gamma_B}.$$

Substituting each party's claim boosting in the party's cost c_A or c_B yields the total influence costs

$$C_N = \frac{1}{\left(\sqrt{\gamma_A} + \sqrt{\gamma_B}\right)^2},$$

$$C_F = \frac{1}{2\left(\gamma_A + \gamma_B\right)}.$$

The next result is then straightforward.

Proposition 3 $\Delta_N \geq \Delta_F$ *and* $C_N \geq C_F$ *with strict inequalities if* $\gamma_A \neq \gamma_B$.

The intuition for the result is that, under final-offer arbitration, adjudication is on average biased in favor of the party with the least capacity to boost his claim, i.e., the party with the largest γ_i. Specifically, $\mu > \lambda$ when $\gamma_A > \gamma_B$, the reverse inequalities hold otherwise. This induces the less capable party to exaggerate "slightly more" under final offer than under conventional arbitration; the benefit is that the more capable party exaggerates "much less". Under final-offer arbitration, the average bias in adjudication is

$$E\left[\mu x_A(x) + (1-\mu) x_B(x) - x\right] = \frac{\gamma_A - \gamma_B}{(\gamma_A + \gamma_B)^2}.$$

A full comparison of the two procedures depends on the weight accorded to adjudication accuracy versus influence costs. Under conventional arbitration, there is no adjudication error. Under final-offer arbitration, the mean quadratic error is

$$l_F = \mu \left(\frac{\mu}{\gamma_A} \right)^2 + (1 - \mu) \left(\frac{1 - \mu}{\gamma_B} \right)^2 = \frac{1}{(\gamma_A + \gamma_B)^2}.$$

The total social loss for each procedure is therefore

$$L_N = C_N = \frac{1}{\left(\sqrt{\gamma_A} + \sqrt{\gamma_B} \right)^2},$$

$$L_F = C_F + \theta l_F = \frac{1}{2(\gamma_A + \gamma_B)} + \frac{\theta}{(\gamma_A + \gamma_B)^2}.$$

Proposition 4 *Conventional arbitration has lower total costs than arbitration if (i) parties do not differ too much in their capacity to present boosted claims or (ii) if accuracy in adjudication has high value relative to influence costs.*

5 Concluding remarks

Considering a framework where the parties know the true merits of the case and the arbitrator is ignorant, this paper highlights that CA may be better than FOA in terms of the trade-off between influence costs and adjudication error. Indeed, in equilibria, misrepresentation expenditures are smaller under final-offer arbitration but adjudication error is larger. Conventional arbitration is then the best procedure if adjudication accuracy is highly valuable or if the disputants do not differ too much in their capacity to distort their claims. These results extend the main conclusions of the previous literature on the economic analysis of arbitration.

However, much more work needs to be done to improve our understanding of the strategic and efficiency implications of costly communication in arbitration. Several extensions and generalizations suggest themselves. A simplifying but somewhat restrictive assumption that underlies the model is that the disputants have symmetric information about the merits of the case. It seems likely, instead, that each of the parties will have private information about some aspects of the dispute (Samuelson, 1991). Such an informational asymmetry may influence the parties' strategic communication with the arbitrator, and hence, the welfare properties of CA and FOA respectively. Moreover, as noted in Introduction, Gibbons (1988) assumes that parties can misrepresent their information and distort their claims without direct costs, while we consider that influencing the arbitrator induces necessarily a positive cost for them. Reality probably lies between these two extremes: in addition to evidence fabrication and argumentative story supporting their boosted claims, it seems likely that parties in practice could make various verbal remarks which are not explicitly costly for them. A further step towards realism would be then to extend the above analysis in order to take into account such an "almost-cheap talk" situation, where communication between parties and arbitrator consists of both costless and costly messages[4]. Finally, it would be interesting to extend the above analysis by considering that the arbitrator may choose to conduct investigations himself and to adjudicate on the basis of the parties' offers and his own (costly) signal on the true value of the case[5]. It is an open question as to whether the arbitrator should choose to get this signal or to rely only on the claims submitted by the parties in order to take his decision, depending on the arbitration process (*i.e.*, CA or FOA).

A theoretical approach based on some of these extensions would allow us to improve the relevance of the present framework and to develop new insights about the strategic communication in arbitration.

[4]Such an extension could be based on the framework by Kartik (2005) who analyses an almost-cheap talk game between an informed sender and an uninformed receiver.

[5]In a different context, see Shin (1998) for an analysis of adversarial and inquisitorial procedures in arbitration.

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