Arbitration Using the Closest Offer Principle of Arbitrator Behavior[1]

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Abstract

In this paper we introduce a model of arbitration decision making which generalizes several previous models of both conventional arbitration and final offer arbitration. We derive the equilibrium offers that risk neutral disputants would propose, and show how these offers would vary under different arbitration procedures. In particular, we show that optimal offers made under conventional arbitration will always be more extreme than those made under final offer arbitration.

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JEL Codes: C70 – Game Theory; J52 - Dispute Resolution: Strikes, Arbitration, Mediation.

Introduction

Although bargaining is central to the operation of a free market economy, there are times

when two sides are unable to come to an agreement, especially in the case of wage bargaining

between management and labor. The traditional alternative to an agreement is a strike or lockout,

but this can impose considerable costs not only on the disputants but also on other parties who have

a stake in the outcome (such as investors, customers and suppliers). Hence dispute resolution

mechanisms which provide alternatives to strike action are of considerable practical interest,

especially in key industries, in the public sector, and in professional sports (see e.g. Marburger &

Scoggins 1996). One of the most common of these alternatives is arbitration.

In Conventional Arbitration (CA), a third party arbitrator listens to the two sides propose

settlements, and then based upon these two offers and the arbitrator's own view of the facts of the

case, the arbitrator imposes what he sees as a fair settlement. This settlement may be the same as

one of the disputant's proposals, or it may be a compromise between the two, or it may be some

completely different value; in principle, almost any result is possible. Most models of arbitrator

behavior in this context (e.g. Farber & Bazerman 1986, Bloom 1986) view the arbitrator decision

process as some form of averaging of the two disputant's offers along with the arbitrator's notion of

a fair settlement. Thus the arbitrated settlement could be formulated as

$$y = w\left[\frac{y_a + y_b}{2}\right] + (1-w)y_0 \tag{1}$$

where y_a and y_b are the suggestions of the disputants, y_0 is the arbitrator's notion of a fair settlement

based on the publicly observable facts of the dispute, and $0 \le w \le 1$ is a weighting factor. Note

that the settlements suggested by the disputants are each given equal consideration in this model.

Another commonly used arbitration process is Final Offer Arbitration (FOA), introduced in

part to correct some of the perceived deficiencies of CA, especially for public sector labor disputes.

Stevens (1966) was the first to argue that the offers of the disputants in CA seemed to matter too much, in that a disputant might make an extreme offer to try to sway an arbitration award in their favor. He suggested FOA as a way to pressure the parties to make more reasonable offers and thereby settle. The resolution process in this type of arbitration is simple: each disputant proposes a settlement (their "best and final" offer) and then the arbitrator chooses the one that seems to be the most fair (i.e. the one that is closest to the arbitrator's opinion of a fair settlement). The arbitrator is not permitted to assign any compromise of the two offers, but must choose one or the other "as-is". Thus the settlement could be modeled as

$$
y = \begin{cases} y_a & \text{if} \quad |y_0 - y_a| < |y_0 - y_b| \\ y_b & \text{if} \quad |y_0 - y_a| > |y_0 - y_b| \end{cases}
\tag{2}
$$

The proponents of FOA had originally argued that the threat of having the other party's offer chosen would be sufficient to force the disputants' offers to converge to an agreement. However, the work by Farber (1980), Crawford (1982) and Brams & Merrill (1983) showed that the final offers would typically not converge. As a result FOA appeared to lose some of its original appeal, although it continued to be used in practice and to be studied both empirically (Marburger & Scoggins 1996) and analytically (Samuelson 1991).

Aside from FOA and CA, a number of other arbitration methods have been proposed in the literature. The main goal has been to find an arbitration procedure that would encourage the two disputants to converge to an agreement, without requiring the arbitrator to impose one. For example, Zeng et al (1996) suggested a procedure in which each side would submit two "final" offers to the arbitrator, who would then compare them according to a specified procedure. While this and other novel methods (see Zeng et al 1996 for a partial listing) do have some future

potential, their actual use has been rather limited to date. FOA and CA still seem to predominate in practice and so are worthy of continued academic attention.

In this paper our objective is to develop an improved model of arbitrator behavior that is more general than previous models of arbitration. In particular, our model incorporates what we call the *Closest Offer Principle* (COP), in which we permit an arbitrator to put a higher weight on the disputant's offer which is closest to the arbitrator's own assessment. In effect, the arbitrator may choose to reward the disputant who comes closest to his opinion of a fair settlement and punish the disputant who is furthest away. We believe that this model is more reflective of the decision making of real arbitrators, who might quite reasonably wish to give more consideration to "reasonable" offers while largely discounting those seen as too "extreme". More importantly, this innovation allows our model to generalize previous models of both CA and FOA, and so permits us to directly compare their behavior analytically.

Our work is most similar to that of Brams & Merrill (1983), who performed a thorough analytical study of the equilibrium offers under FOA for risk neutral disputants. Our analysis goes a step further however to examine the equilibrium offers of both FOA and CA, and to subsequently compare their relative convergence properties. In making this comparison, our analytical work complements the empirical work by Ashenfelter et al (1992), which studied the performance of FOA and CA in an experimental context. We do not address the important question of how the impending use of an arbitration procedure might affect the preceding bargaining sessions (as in Farber & Bazerman 1989). We also ignore the issue of whether a given arbitration method encourages a settlement that is truly "economically efficient" as opposed to being merely a pragmatic compromise (see Crawford 1979).

In the next section of the paper, we define more precisely our model and show how it is a generalization of both previous CA models and also of FOA models. After that, we derive the equilibrium offers that disputants would make under the assumptions that the arbitrator is unbiased and the disputants are risk neutral. We then compare these equilibrium offers to those of FOA, and show that although FOA generally does not guarantee complete convergence of offers to a single point, in all cases it does at least induce more convergence than CA would. We conclude with a discussion of our results.

The Model

Two parties, Disputant A and Disputant B, are entering arbitration. As with most other treatments of this topic, we assume here that there is only one issue in dispute, and that it can be described by a single number (as in e.g. the proposed salary of a professional athlete); we do not consider arbitration over multiple issues (see Crawford 1979). Disputant A would like the settlement to be as small as possible, while Disputant B would like it as large as possible. In the arbitration hearing, each disputant proposes a settlement for the dispute (presumably along with a variety of supporting arguments and other discussion). We denote the settlement suggested by Disputant A with a, and that of Disputant B with b.

We assume that the arbitrator's initial idea of a fair settlement, s_0, is a random variable having a density function $f(x)$, cumulative distribution $F(x)$, and mean μ. Both parties know that the arbitrator's opinion is drawn from $f(x)$. Moreover, both parties know that the arbitrator will choose a final settlement S according to

$$S = \begin{cases} \lambda s_0 + (1-\lambda)[\gamma a + (1-\gamma)b] & \text{if} \quad |a - s_0| < |b - s_0| \\ \lambda s_0 + (1-\lambda)[(1-\gamma)a + \gamma b] & \text{if} \quad |a - s_0| > |b - s_0| \end{cases} \tag{3}$$

That is, the arbitrator will choose the final settlement to be a weighted average of

(a) the initial assessment s_0, which is given a weight $\lambda \in [0,1]$; and

(b) a weighted average of the settlements a and b suggested by the parties, where the weight $\gamma \in [1/2,1]$ is assigned to the party whose offer is closest to the arbitrator's initial assessment.

This model of arbitrator behavior is of interest because it includes several other previous models as special cases:

(a) if we set $\lambda = 0$ and $\gamma = 1$ so that all of the weight is given to the closest disputant's offer, our model reduces to that of regular FOA (as in Farber 1980);

(b) if we let $\lambda \in (0,1)$ and $\gamma = 0.5$ so that the two disputants' offers are given equal weight and then averaged with the arbitrator opinion, our model reduces to equation 1, which has been used in many previous CA models (e.g. Farber & Bazerman 1986);

(c) if we set $\lambda = 1$ then the disputants' offers are ignored and the arbitrator imposes her own opinion as the final settlement ("autocratic arbitration"). This has also been used as a model of CA (see Ashenfelter et al 1992); and,

(d) if we set $\lambda = 0$ and $\gamma = 0.5$ so that the disputants' offers are given equal weight while the arbitrator's opinion is ignored, our model simplifies to a compromise "splitting of the difference".

Our model also has some resemblance to (but does not quite generalize) a variation of FOA proposed by Brams & Merrill (1986). In this variant the arbitrator will choose offer a, or offer b, or her own opinion s_0, but never a compromise or average of any of these. In terms of our model, this would be equivalent to setting $\gamma = 1$ and then having λ take a value of either 0 or 1 depending on the relative position of the offers.

Analysis

Having defined a model of the arbitration process, we now determine its properties; in particular, we want to derive the equilibrium offers that each disputant would suggest, and see how

these offers would vary in different types of arbitration. To do so we shall make two additional

assumptions that are commonly used in this kind of modeling:

(a) the arbitrator is unbiased, in the sense that the density function for his opinion is symmetric

about the mean, i.e. $f(\mu - x) = f(\mu + x)$ for all x; and,

(b) both parties are risk-neutral and hence, Disputant A simply wants to minimize the expected

value of the settlement while Disputant B wants to maximize it.

We begin by defining the indicator variable ψ as

$$\psi(a,b) = \begin{cases} 1 & \text{if} \quad s_0 \le (a+b)/2 \\ 0 & \text{if} \quad s_0 > (a+b)/2 \end{cases} \tag{4}$$

Thus ψ indicates which of the two offers is closest to the arbitrator's opinion. For convenience, we

also define $F_m = F([a+b]/2)$ and $f_m = f([a+b]/2)$. The arbitration settlement S can now be written

as

$$S = \lambda s_0 + (1-\lambda)\{[\gamma a + (1-\gamma)b]\psi(a,b) + [(1-\gamma)a + \gamma b](1 - \psi(a,b))\}. \tag{5}$$

Taking expectations leads to an expression for the expected arbitration settlement:

$$E[S] = \lambda \mu + (1-\lambda)\{[\gamma a + (1-\gamma)b]F_m + [(1-\gamma)a + \gamma b](1 - F_m)\}. \tag{6}$$

Disputant A would like to minimize this expectation, while Disputant B would like to maximize it.

To determine the equilibrium offers, we solve the first-order conditions $\partial/\partial a \, E[S] = 0$ and

$\partial/\partial b \, E[S] = 0$ to get

$$1 - \gamma + (2\gamma - 1)\left[\frac{1}{2}(a-b)f_m - F_m\right] = 0 \tag{7}$$

and

$$\gamma + (2\gamma - 1)\left[\frac{1}{2}(a-b)f_m + F_m\right] = 0. \tag{8}$$

Adding and subtracting these equations gives

$$b - a = \frac{1}{(2\gamma - 1)f_m} \quad \text{and} \quad F_m = \frac{1}{2}. \tag{9}$$

Given our the assumption that s_0 follows a symmetric distribution, these equations imply that

$$\mu = \frac{a + b}{2} \quad \text{and} \quad b - a = \frac{1}{(2\gamma - 1)f(\mu)}. \tag{10}$$

Solving these for optimal values $a*$ and $b*$ yields

$$a* = \mu - \frac{1}{2(2\gamma - 1)f(\mu)} \quad \text{and} \quad b* = \mu + \frac{1}{2(2\gamma - 1)f(\mu)}. \tag{11}$$

Using second-order conditions, it is straightforward to verify (as in Brams & Merrill 1983) that this pair of values is in fact a saddle point. Note that these equilibrium offers are equidistant from the mean μ of the arbitrator's distribution, and that γ must be strictly larger than 1/2 if these optimal values are to be finite. The range R between them is

$$R = b* - a* = \frac{1}{(2\gamma - 1)f(\mu)}. \tag{12}$$

This range $R \to 0$ only in the degenerate case where $f(\mu) \to \infty$; i.e. the offers fully converge only in the case where the arbitrator's opinion is known with certainty.

In the particular case where s_0 follows a normal distribution with standard deviation σ, the equilibrium offers are

$$a* = \mu - \frac{1}{2(2\gamma - 1)}\sqrt{\frac{\pi\sigma^2}{2}} \quad \text{and} \quad b* = \mu + \frac{1}{2(2\gamma - 1)}\sqrt{\frac{\pi\sigma^2}{2}}. \tag{13}$$

These offers have several interesting implications. Firstly, as previous authors have noted in their own studies of FOA, the presence of the term $f(\mu)$ in the denominator of the above equations suggests that offers will tend to be closer together when the disputants have good knowledge about the arbitrator's likely opinion (i.e. the density at the mean is relatively high and so there is less probability mass in the tails of the distribution). Conversely, they will generally be

farther apart when the arbitrator's opinion is difficult to predict (i.e. the density at the mean is low and there is more mass in the tails). This might be the case where an arbitrator is new to the industry or has a reputation for wildly varying awards.

The next point of interest is the absence of the λ term in the equilibrium offers. That is, the weight the arbitrator attaches to her own opinion has no affect on these offers. This is evident in the structure of the equation for the expected settlement, which has the form

$$E[S] = \lambda\ constant + (1 - \lambda) g(a,b). \tag{14}$$

Clearly, values of a and b which optimize $g(a,b)$ also optimize the overall settlement. In effect, the fact that the arbitrator is going to allocate a certain portion of the available resources by fiat does not influence the strategies that risk neutral disputants will use in gaming for whatever resources remain "in play".

More importantly, note how the equilibrium offers change as the weight γ on the closest offer changes; as less weight is assigned to the closer offer, the offers become more extreme and the range R between them grows. In particular, under FOA (where $\gamma = 1$) the offers would be relatively close together (how close depends on $f(\mu)$); for example, in the case of a normal distribution the offers would be

$$a*_{FOA} = \mu - \sqrt{\frac{\pi\sigma^2}{2}} \quad \text{and} \quad b*_{FOA} = \mu + \sqrt{\frac{\pi\sigma^2}{2}} \quad . \tag{15}$$

to give a range of

$$R_{FOA} = b*_{FOA} - a*_{FOA} = 2\sqrt{\frac{\pi\sigma^2}{2}}. \tag{16}$$

In contrast, under the traditional model of CA (i.e. where $\gamma \equiv 0.5$), the range would in principle be

infinite. In fact, taking the ratio of the ranges for arbitration with any weight $\gamma < 1$ as compared to

FOA would give

$$\frac{R_{FOA}}{R_{CA}(\gamma)} = 2\gamma - 1 \leq 1 \qquad\qquad (17)$$

which shows that any value of $\gamma < 1$ will lead to more extreme offers than would FOA. Thus

although FOA does not completely succeed in inducing the two disputants to make convergent

offers, it none the less leads to closer offers than any other variation of CA would. More generally,

the less an arbitrator deliberately favors the closer offer, the less incentive disputants have to make

a reasonable offer, and so the more extreme those offers become.

We would like to emphasize here that this effect of the closest offer weight γ is obtained

without any requirement for risk aversion on the part of the disputants. A heavier weight, with FOA

as the extreme case, is sufficient to induce even risk neutral disputants to make more reasonable

offers than would be expected under a traditional CA model.

Conclusion

In this article we have introduced a model of arbitration which allows for what we call the

Closest Offer Principle, in which an arbitrator performing conventional arbitration is permitted to

give more consideration to what they consider the most reasonable of the two disputant's offers.

Under the assumptions that the arbitrator is unbiased and that the disputants are risk neutral, we

then derived the equilibrium offers that the disputants would propose, and showed how these offers

would vary as the structure of the arbitration procedure was varied. In particular, we showed that

the concluding offers made under Conventional Arbitration (CA) would always be more extreme

than those made under Final Offer Arbitration (FOA), even without assuming risk aversion on the part of the disputants.

Based upon the results of our analysis, in practice we would recommend the use of FOA in preference to CA because FOA should encourage the parties to make less extreme offers. In making this recommendation however we must note several limitations of our study. For one thing, our analysis assumes that both parties are risk neutral, whereas in reality each party is likely to show some degree of risk aversion (particularly employees involved in wage negotiations; see Marburger & Scoggins 1996). We believe that our results will extend naturally to cover the risk averse case, but this conjecture remains to be proven. It also unclear how the choice between these two arbitration procedures might affect (either rationally or emotionally) the negotiations that precede the (potential) arbitration process. Further study will be needed to address these questions.

We believe that our model does provide two main contributions to the study of arbitration. Firstly, although it is still quite simplistic, we think that it does provide a more reasonable description of how real arbitrators can and do make their decisions. They should not be thought to blindly give equal weight to both competing offers, but to instead use their judgement to give more consideration to what they perceive to be "reasonable" offers than to "unreasonable" ones. Secondly, the model is an improvement in that its structure is a generalization of existing models of both CA and also of FOA. This generalization allows a straightforward comparison of the equilibrium offers made under each type of arbitration and in any other intermediate variations thereof.

Acknowledgments

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