Final Offer Arbitration and the Incentive to Bargain: A Principal-Agent Approach

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Abstract

This paper presents a model of final-offer arbitration that distinguishes between the union rank and file and their negotiator. If the union negotiator has better information than the rank and file with regard to the bargaining environment and the negotiated wage depends not only on this environment but also the effort exerted by the negotiator, then the rank and file may not be able to tell whether a poor wage outcome resulted from a poor bargaining environment or because the negotiator was shirking. This is the classic principal-agent problem with asymmetric information.

Through contract design the union rank and file could elicit the correct behavior from the negotiator without resort to arbitration. But, as is shown in this paper, under certain circumstances the rank and file could do better by having the union negotiator go to arbitration some of the time. In a two state, model it is shown that arbitration will occur only in the 'bad' state (where the bargaining environment is unfavorable to the union). Arbitration is more likely to serve a useful purpose in contract design the less risk averse the rank and file, the smaller the direct costs of arbitration to the union, the more likely the 'good' state of nature and the more difficult it is to induce 'truth telling' in the absence of arbitration.
1. Introduction

The notion that the union acts as its members' agent is not new (see Faith and Reid (1983)). More recent is the idea that arbitration might best be viewed in light of this principal-agent relationship (see Bloom and Cavanaugh (1987)). Is arbitration a rational response to the incentive problems which arise in these relationships? The purpose of this paper is to try and answer this question by constructing a formal model of this principal-agent relationship in the context of wage negotiations where arbitration is the dispute settlement mechanism. Many types of arbitration mechanisms now exist in the public sector1. This paper will specifically concentrate on final offer arbitration (FOA)2. However, the arguments set forth here could also apply to conventional arbitration.3

Farber (1980) has shown, in the context of FOA, that when agents are uncertain as to the arbitrator's notion of a fair settlement (or, in general, uncertain about the arbitrator's actions with any set of final offers) then risk averse agents have incentives to negotiate. Under Farber's assumption that negotiator's beliefs about the 'distribution of arbitrators' are identical, rational agents would never resort to arbitration. There always exists a 'contract zone' of preferred negotiated settlements.4

Figure 1 summarizes Farber's argument. This figure shows wage settlements on the horizontal axis, and the parties valuation of these settlements on the vertical axis. \( U^R \) and \( U^E \) are the utility functions of the union and employer, respectively. The assumption that both parties are risk averse is exhibited by the concavity of the utility functions. The (equilibrium) final offers for the union and employer, assuming that they proceed to arbitration, are \( w^R \) and 

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Assuming that beliefs are such that the expected wage of going to arbitration is $E(w) = p^Rw^R + p^Ew^E$, then there exists an interval of wages, $C_Z$, determined by the intersection of $\{w: U^R(w) > EU^R(w)\}$ and $\{w: U^E(w) > EU^E(w)\}$ which is preferred by both parties to arbitration.

However, Farber (1980) noted that if beliefs did diverge (negotiators were both overly optimistic) then a negotiated settlement might not be possible. Crawford (1982) on the other hand suggests that disagreements in bargaining might result when bargainers commit to untenable positions in an effort to get the upper hand. Farber and Bazerman (1987a) propose that disagreement may be a result of one's unwillingness to concede for fear of being unable to 'retrench' if arbitration actually occurs. Other models (see Card (1983) and Farber and Bazerman (1987)) assume that an informational asymmetry lies between negotiators and that the arbitrators act as 'lie detectors' or 'punishers' to enforce truth-telling. These asymmetric information models are analogous to the asymmetric information models of strikes (see Kennan (1986)).

Here, I posit that it is a break-down in the relationship between the union rank and file and its negotiator that may lead to arbitration in some cases. This approach is similar in spirit to that taken by Ashenfeiter and Johnson (1969) in their analysis of strikes. Fiorito et al. (1988) have shown that both member-union relations and union performance on bread and butter issues effect the rank and file's satisfaction with its union. Given that union members care about leadership's performance, it is not unreasonable to assume that they will try and control the union leaders behavior to their benefit.

That union leaders respond to the demands of the rank and file was noted by Reilly (1963) in reference to grievance arbitration:
Arbitration became very popular but expensive. But their cost, the
union believed, was offset by the advantage of 'passing the buck' to
the arbitrator rather than making a decision unpopular to their
members. 6

It is not unreasonable to assume that this 'pass the buck' phenomena also
exists for interest arbitration too. One way to represent this behavior is by
characterizing the negotiator's utility function as state dependent. 7 Union
negotiators might receive a low utility for negotiating a low wage settlement
(eg they might be replaced) and a very high utility for a high negotiated wage
(eg they get a bonus). By comparison they may take less blame for a poor
outcome under arbitration, but also not take any credit for a good outcome (eg
they are kept on but don't get a bonus no matter what the outcome). This state
dependent utility function is portrayed in Figure 2. \( U^{NA} \) is the union negotiator
utility function for arbitrated wage settlements and \( U^{NN} \) is the negotiators
utility function for negotiated wage settlements.

With this utility function arbitration may now be the optimal from the
union negotiator's point of view. This occurs because the expected utility of
the arbitrated wage must be evaluated using \( U^{NN} \) when determining preferred
negotiated wages. It is quite possible that CZ of Figure 1 'collapses' in this
case so that no negotiated wage is preferable to both parties. This will happen
when \( U^{NN}(\bar{W}^E) < E U^{NA} \) where \( \bar{W}^E \) is the maximum wage the employer is willing to
offer \( (U^E(\bar{W}^E)=EU^E) \).

This explanation, while intuitive, lacks a strong theoretical foundation.
If the union negotiator's rewards (and utility) can be influenced by the rank
and file, then the rank and file will structure these payoffs to their benefit.
Thus, it is necessary to describe how these state dependencies might still occur
with this influence.

In this paper it is shown that when the negotiator possesses useful information about the bargaining environment that the rank and file does not, and this information directly affects his ability to bargain, then the optimal response of the rank and file may be to design a contract which calls for the union negotiator to go to arbitration in some cases. Intuitively, this may arise because the rank and file can't tell whether the union negotiator is shirking or if the bargaining environment relatively unfavorable. Here, with a sufficient bribe, the rank and file may be able to ensure that the union negotiator behaves appropriately. However, requiring the negotiator to resort to arbitration in such cases may be more economical.

In Section 2 of the paper, Farber's model of FOA will be reviewed and some comparative static results derived. These will be useful in the sequel.

Section 3 builds a simple asymmetric information, incentive contract, model of FOA. There are only two states of nature, the 'good' and 'bad' states, with the bargaining environment being much more favorable to the union in the 'good' state. It is assumed that all agents, the union negotiator, the employer negotiator, and the arbitrator, observe the state of nature but that the union rank and file doesn't. Under these conditions I show that if arbitration is rational, then it occurs only in the bad state. Whether the rank and file would ever wish the union negotiator to go to arbitration depends on many things. Arbitration is more likely to occur the less risk averse the rank and file are, the lower the out of pocket costs of going to arbitration, the smaller the probability of the 'bad' state occurring, and the more costly it is to get the union negotiator to behave appropriately when arbitration is not used.

Finally, Section 4 contains a summary and conclusions.
2. A Full Information Model of Final Offer Arbitration:

This section sketches Farber's (1980) model of final offer arbitration. Final offer arbitration is a dispute resolution method often used in the public sector. If parties can't reach agreement then both sides make their 'final' offers and the arbitrator is constrained to choose one of them. This differs from conventional arbitration where the arbitrator can make any settlement he or she deems fair.

Farber's model implicitly assumed that the preferences and information sets of the union rank and file and the union negotiator were identical. Thus, no incentive problems arose. In essence the rank and file negotiate for themselves.

Farber assumed that the arbitrator had some notion of a fair settlement and that both the union and employer were uncertain as to what that fair wage was. The basic insight of Farber's model was that this uncertainty in conjunction with the structure of final offer arbitration promoted negotiated settlements in risk averse agents. In resorting to arbitration each side ran the risk that the arbitrator would choose the other's final offer.

Formally, assume that in final offer arbitration the arbitrator always chooses the offer closest to his/her notion of a fair wage settlement denoted by $w^f$. If we assume that the rank and file's optimal final offer is $w^{R*}$ and the employers is $w^{E*}$ then the arbitrator will choose the employers offer iff $w^f < (w^{R*} + w^{E*})/2$.

For simplicity, it is assumed that both the employer and union have identical beliefs as to the arbitrator's notion of a fair wage settlement represented by the c.d.f. $F(w^f)$. We hypothesize that $F$ is absolutely
continuous over some compact interval and has density function f.

Let $U^R(w)$ be the utility function of the rank and file and $-U^E(w)$ be the utility function of the employer with $U^R > 0$, $U^E < 0$, $U^{E>} > 0$, and $U^{E<} < 0$. Both agents are risk averse and the unions (employers) utility increases (decreases) in the negotiated wage. Here, the wage is the only the only aspect of employment which is negotiated.

In general, $U^R$ and $U^E$ will differ. However, to keep the analytics simple, we assume $U^R = U^E = U$. If the parties resort to final offer arbitration, then the Nash equilibrium final offers are the two offers, $w^E*$ and $w^R*$, which satisfy:

$$\begin{align*}
\text{Max} & \quad U(w^R) (1-F(W)) + U(w^E) F(W) \\
\text{Min} & \quad U(w^R) (1-F(W)) - U(w^E) F(W)
\end{align*}$$

(2.1) (2.2)

where $W = (w^E + w^R)/2$.

The First Order Necessary conditions for this problem imply that the Nash equilibrium final offers, $w^E*$ and $w^R*$, satisfy:

$$\begin{align*}
(U(w^R^*) - U(w^E^*)) / U'(w^R^*) = 2(1-F(W^*)) / f(W^*) \\
(U(w^R^*) - U(w^E^*)) / U'(w^E^*) = 2F(W^*) / f(W^*)
\end{align*}$$

(2.3) (2.4)

where $W^* = (w^E^* + w^R^*)/2$.

If we let $w^E$ and $w^R$ be the certainty equivalent wages for the employer and rank and file, respectively, of the Nash equilibrium final offers, $w^E*$ and $w^R*$, then it is easily shown that $w^E < w^R$. The interval $[w^E, w^R]$ is Farber's contract zone. Any wage in that zone is preferable to final offer arbitration. This zone exists whenever agents have identical beliefs ($F$) and are risk averse. Under these circumstances one should not expect rational agents to
resort to arbitration. If beliefs differ (i.e., both are overly optimistic with respect to the arbitrator's notion of fair) then arbitration may result. It must be the case, though, under these circumstances that the two parties information sets don't converge sufficiently in the negotiation phase as bargaining may reveal the opponent's beliefs. In the next section we will analyze another circumstance which may lead rational agents to opt for arbitration, at least in some states of the world. But before proceeding with this, it will be useful (and relevant to subsequent analysis) to do some comparative statics for the equilibrium characterized by (2.3) and (2.4).

Let $\Theta$ be a parameter of the arbitrator distribution $F$ such that $\partial F / \partial \Theta < 0$ for all $w$. Thus for $\Theta^1 > \Theta^2$, $F(w, \Theta^1)$ (first order) stochastically dominates $F(w, \Theta^2)$. Then we have:

**Proposition 2.1** Let $w_R$ and $w_E$ be the certainty equivalent wages of the Nash equilibrium final offers, $w_R^*$ and $w_E^*$, characterized by equations (2.3) and (2.4). Then $\partial w_R / \partial \Theta > 0$ and $\partial w_E / \partial \Theta > 0$.

**Proof:** The result follows by the usual envelope theorem type of arguments. Differentiating the (optimal) expected utility function of the rank and file we have:

$$\partial \text{EU}(w_R^*, w_E^*, \Theta) / \partial \Theta = (U'(w_R^*) (1 - F(W^*)) \partial w_R^* / \partial \Theta - (U(w_R^*) F(W^*) / 2) \partial w_R^* / \partial \Theta + (U(w_E^*) F(W^*) / 2) \partial w_E^* / \partial \Theta + U(w_E^*) \partial F / \partial \Theta + U'(w_E^*) F(W^*) \partial w_E^* / \partial \Theta.$$  

Using equations (2.4) and (2.5) and simplifying gives

$$\partial \text{EU}(w_R^*, w_E^*, \Theta) / \partial \Theta = - (U(w_R^*) - U(w_E^*)) \partial F / \partial \Theta > 0.$$  

But by definition $w_R = U^{-1}(\text{EU}(w_R^*, w_E^*, \Theta))$ hence $\partial w_R / \partial \Theta > 0$. Similar arguments
yield $\partial \omega / \partial \theta > 0$. Q.E.D.

Here as $\theta$ increases the rank and file are essentially in a more favorable position if they resort to arbitration and both they and the employer know it. Thus, the maximum wage the employer would be willing to pay to avoid arbitration is higher as well as the minimum wage demanded by the rank and file. It should be noted that the proof relies upon the fact that $U^R = U^L = U$.

In general, this result may not hold. However, we assume below that it does.
A Principal-Agent Model of Final Offer Arbitration.

In this section I derive a model of union—employer wage negotiation based on these assumptions: first, that the union negotiator's preferences differ from those of the rank and file; second, that the negotiator has better information than the rank and file about the bargaining environment, and third, that the option always exists to resort to final offer arbitration. Specifically, I assume throughout that the union negotiator, employer and arbitrator know the state of nature at the time of their decisions are made and that there are just two states of nature, the good and bad state (where the reference point is with respect to the union). In the good state of nature negotiating a particular wage will be much easier than in the bad state. For example, in public sector negotiations, the good state might be when tax revenues are high, 'cap' laws aren't binding, or perhaps when unions have fared well in similar negotiations in other localities.

If arbitration is not possible (or desirable) then the union rank and file must design a contract for its negotiator to elicit the optimal behavior. The problem here is that if the reward for negotiating a high wage (which presumably the rank and file would want in the good state) is not sufficient then the negotiator may economize on effort and settle for the lower wage even though the state is good.

In this case arbitration may play a distinct role from that drawn in Section 2. Recall that there, in resorting to final offer arbitration, the negotiator ran the risk that the other's offer may be chosen. It was implicitly assumed that the rank and file and employer both knew the state of nature beforehand. This risk promoted negotiated settlement. In this section
we will see that arbitration may serve another purpose. It may prove useful in contract design when the rank and file lacks complete information.

Here, as in Section 2, I will assume that the rank and file have identical risk averse preferences represented by utility function $U^R$ with $U^R_{1} > 0$ and $U^R_{-1} < 0$. For simplicity I will also assume that the union negotiator has a utility function a separable function of his remuneration and effort. Thus

$$U^R(w) = r(w) - e^i(w) i = g, b,$$

where $r(w)$ is the compensation for negotiating wage $w$ and the effort taken to negotiate $e^i(w)$ depends on whether or not the state is good (g) or bad (b). Assume that the former state occurs with probability $p^g$ and the latter with probability $p^b = 1 - p^g$.

To simplify matters I will not explicitly model the bargaining process. This is done so as to concentrate on the informational aspects of the problem. I will assume that any wage inside the contract zone, which is the set of wages that both parties prefer to arbitration, can be obtained by the union negotiator with sufficient effort.

Formally, assume that the only consequence of a bad state is to shift down the union’s and employer’s beliefs as to the distribution of the arbitrator’s notion of a fair settlement (I continue to assume that both sides have identical beliefs in both states). That is, $P^b(w) > P^g(w)$ for all $w$,

where $P^i i = g, b$ is defined similarly to $P$ in section 2. Let $\bar{W}^g$ and $\bar{W}^b$ represent the maximum wages that the employer is willing to settle for rather than resort to FOA, in the good and bad states respectively (ie the upper bounds of the contract zone). Under the conditions of Section 2 we have $\bar{W}^g >$
$W^0$. Similarly, let $U^b$ be the minimum wage that the union would accept in the bad state rather than resort to arbitration and $U^g$ the minimum acceptable wage in the good state. I assume that

$$e^g(U^b) = e^b(U^b) = 0$$

$$e^g(w) < e^b(w) \text{ for all } w > U^b$$

$$e^b(w) > 0 \text{ and } e^g(w) > 0 \text{ for all } w > U^b$$

$$e^g(w) - 0, e^g(w) = 0 \text{ for } U^b < w \leq U^g$$ and $e^g(w) > 0, e^g(w) > 0 \text{ for } w > U^g$

$$\lim_{w \to U^g} e^g(w) = \infty \text{ and } \lim_{w \to U^g} e^b(w) = \infty.$$

Figure 3 shows the relationships between these two effort functions.\(^{10}\)

Next, we shall formulate the union rank and files' optimal contract for its negotiator, assuming that the rank and file wishes to avoid arbitration. It is easy to see that these assumptions imply that the optimal policy will involve 'seperating' the good and bad states. Appealing to the Revelation Principle we can write the maximization problem as

$$\max_{w^g, w^b, r^g, r^b} U^g(w^g - r^g)p^g + U^b(w^b - r^b)p^b$$

subject to

$$r^g - e^g(w^g) \geq r^b - e^b(w^b) \quad (3.1)$$

$$r^b - e^b(w^b) \geq r^g - e^g(w^g) \quad (3.2)$$

$$r^g - e^g(w^g) \geq 0 \quad (3.3)$$

$$r^b - e^b(w^b) \geq 0 \quad (3.4)$$

Here, equations (3.1) and (3.2) are the incentive compatibility constraints (the union leader must not prefer to negotiate $w^b$ in the good state or $w^g$ in the bad state). Equations (3.3) and (3.4) represent the individual rationality constraints; which simply mean that the negotiator must be guaranteed a level of utility at least as great as his alternative
wage, which for simplicity I've set to zero. Solving this maximization problem yields

**Proposition 3.1** The optimal wage \((w^o, w^b)\) and reward levels \((r^o, r^b)\) are characterized by:

\[
e^o(w^o) = 1
\]

\[
e^b(w^o) < 1
\]

\[
r^o = e^o(w^o) + e^b(w^b) - e^q(w^b)
\]

\[
r^b = e^b(w^b)
\]

\[
w^o > w^b
\]

**Proof:** One of the individual rationality and one of the incentive compatibility constraints can be solved with equality and since the rank and file would like to minimize the rewards paid to the negotiator this will be done. It is easily shown that equations (3.1) and (3.4) will, in any optimum, be set to hold with equality.

This implies that:

\[
r^b = e^b(w^b)
\]

and

\[
r^o = e^o(w^o) + e^b(w^b) - e^q(w^b)
\]

In this case Equation (3.2) will be satisfied iff

\[
r^b - e^b(w^b) \geq r^o - e^b(w^b)
\] or using (3.5) and (3.6)

\[
0 \geq e^o(w^o) + e^b(w^b) - e^q(w^b) - e^b(w^b)
\] or

\[
e^b(w^o) - e^o(w^o) \geq e^b(w^b) - e^q(w^b) \text{ which is true iff}
\]

\[
w^o \geq w^b
\]

Thus the maximization problem can be reduced to:

\[
\max_{w^o, w^b} G(w^o, w^b) = U(w^o - e^o(w^o) - e^b(w^b))p^o + U(w^b - e^b(w^b))p^b
\]

The first order necessary conditions for an optimum are:

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\[ \frac{\partial F}{\partial w^g} = U'(w^g) - e^g(w^g) - o^g(w^b) + e^g(o^b(w^b))p^g(1 - o^g(w^g)) = 0 \] (3.7)

\[ \frac{\partial F}{\partial w^b} = U'(w^g) - e^g(w^g) - o^g(w^b) + e^g(o^b(w^b))p^g(-o^b(w^b)) + e^g(w^b)
+ U'(w^b) - e^b(w^b))p^b(1 - e^b(w^b)) = 0 \] (3.8)

Since \( U' > 0 \) throughout (3.7) implies that

\[ e^g(w^g) = 1 \]

Now by assumption \( e^b(w^b) > e^g(w^g) \) so that

\[ U'(w^g) - e^g(w^g) - e^b(w^b) + e^g(o^b(w^b))p^g(-e^b(w^b)) + e^g(w^b) < 0 \]

Thus, at the optimum we have \( e^b(w^b) < 1 \). We have maximized \( G \) without constraining \( w^b \) and \( w^g \). But recall that for the incentive compatibility constraint (3.2) to be satisfied we must have \( w^g > w^b \). But this follows from the fact that \( 1 - e^g(w^g) < e^b(w^b) \), \( e^b(w^b) < 1 \), and the fact that \( e^b > 0 \) throughout. Finally, substituting \( w^g \) and \( w^b \) into (3.5) and (3.6) gives us \( r^g \) and \( r^b \). Q.E.D.

Here we see that if the union rank and file wish to avoid arbitration then, in order to get the negotiator to act properly on their behalf, they must compensate him/her more in the good state then what his/her alternative opportunities yield (which I've assumed are 0). This in turn will lead the union rank and file to select a wage in the bad state that is less than that which they would have chosen under perfect information. Here, as they raise the wage in the bad state, they must not only raise the reward paid in that state (to compensate the leader for his/her extra effort) but they also must increase the reward in the good state in order to get the negotiator to act correctly. In effect, they are internalizing the externality created by asymmetric information.

The question that needs to be addressed is: is it possible to improve
matters by resorting to arbitration at least in some states of the world? Here I make the assumption that the effort expended by the negotiator in the case when he/she resorts to arbitration is 0 and that this effort is independent of the true state of the world. In this case the union rank and file can include arbitration into any reward structure since, I assume, it can observe whether or not the negotiator goes to arbitration and the final offer it submits.

The key point to notice is that if the negotiator goes to arbitration in the bad state of the world then the incentive compatibility problem is eliminated. This is because the negotiator has no incentive to say it is the bad state when in fact it is the good. In addition, the negotiator needs less compensation in the bad state since he expends less effort. These gains must be balanced against the direct cost of arbitration and the indirect costs generated through risk aversion, arbitrator uncertainty, and the difference in the union and employer's final offers.

Formally, let $r^a$ be the compensation given to the negotiator in the case where he resorts to arbitration. Then all that need be satisfied are the individual rationality constraints:

$$r^a = 0$$

$$r^a - e?w^a = 0$$

if the union rank and file desire the negotiator to go to arbitration in the bad state. Note that it certainly doesn't pay the negotiator to say it is the good state when it is in fact the bad. Also, saying that it is the bad state when it is the good doesn't achieve any gains because the effort expended in going to arbitration is the same for both states.

Before continuing, I will consider the possibility that the union rank and file might desire the negotiator to go to arbitration in the good as opposed
to the bad state. This scheme will be of use only if the negotiator won’t say it is the bad state when it is actually the good state. But we can see that if the individual rationality constraints are both satisfied with equality in this case:

\[ r^a = 0 \]
\[ r^b - e^b(w^b) = 0 \]

then the negotiator will say its the bad state when it is the good since \( e^b(w^b) > e^g(w^g) \). So, the contract that pays 0 if the negotiator goes to arbitration with the correct final offer in the good state, and pays \( e^b(w^b) \) if the negotiator negotiates \( w^b \), won’t satisfy incentive compatibility.

We see that if arbitration is used as a device to alleviate the incentive problem brought about by asymmetric information then it will be resorted to only in the bad state. The question which I would like to address now is under what conditions will arbitration be used for this purpose? Let \( c^a \) represent the direct costs of arbitration. Recall that \( w^b \) is the certainty equivalent wage for the union when it goes to arbitration in the bad state. Assuming for simplicity that the union rank and file exhibits constant absolute risk aversion we have:

**Proposition 3.2** The union rank and file will optimally go to arbitration in the bad state when

\[
U^R(w^b - c^b)p^b + U^R(w^g - e^g(w^g^*))p^g > U^R(w^b^* - e^b(w^b^*))p^b +
\]
\[
U^R(w^g^* - e^g(w^g^*)) - (e^b(w^b^*) - e^g(w^g^*))p^g \tag{3.9}
\]

**Proof:** The proof of this proposition is trivial. By definition \( w^b \) is the certainty equivalent of the (Nash equilibrium) final offer arbitration. It is the best one could do by resorting to arbitration in the bad state. If the union resorted to arbitration in the bad state it would still wish the negotiator to
bargain in the good state to the point where $e^g(w^g) = 1$. This is satisfied by $w^g$. So, the equation just states that it is optimal to go to arbitration in the bad state when the maximum expected utility you could achieve under these circumstances exceeds that achievable by negotiating in both states. Q.E.D.

Here, we see that arbitration is more likely the less risk averse the rank and file, the cheaper the direct costs of arbitration, the less effort expended by the negotiator when going to arbitration and the more serious the incentive problems, measured by $e^b(w^b) - e^g(w^g)$. Equation (3.9) can be rewritten as

$$U^g(w^g - c^g)p^g + U^b(w^b - e^g(w^g))p^* - U^g(w^b - e^b(w^b))p^g - U^b(w^b - e^g(w^g) - (e^b(w^b) - e^g(w^g)))p^g > 0. \quad (3.10)$$

Differentiation of the left hand side of (3.10), call it $H(p^g)$, with respect to $p^g$ (noting that $p^b = 1 - p^g$) yields (after some manipulation)

$$H'(p^g) = U^g(w^g - e^g(w^g)) - U^b(w^b - c^g) - [U^g(g) - U^b(b)] - [1 - p^g]U^g(b)dw^b/dp^g + p^g U^g(g) e^g(w^g) dw^b/dp^g + p^g U^b(b) - U^g(g) e^b(w^b) dw^b/dp^g \quad (3.11)$$

where $b = w^b - e^b(w^b)$ and $g = w^g - e^g(w^g) = (e^b(w^b) - e^g(w^g))$. If $e^b(w) \geq e^g(w)$, then it can be shown, by implicit differentiation of (3.8), that $dw^b/dp^g < 0$. This, along with the facts that $U$ is concave and that the good state yields a higher utility than the bad state, implies that $H'(p^g) > 0$. So, the more probable the good state, the more likely arbitration will be resorted to in the bad state.

It might be useful to take a moment to explore when one would expect $e^b(w^b) - e^g(w^g)$ to be large. Recently, many localities have been restrained by 'cap' laws to limit total expenditure increases. It seems likely that in these cases informational problems worsen. Before imposition of these laws, the employer (the local government) could always pass on these wage increases by either raising taxes or issuing bonds. Thus, other aspects of the localities page 16
expenditures didn't impact on the negotiations process. With a lid on total expenditures, there is now the uncertainty of whether the ceiling is 'binding' at the time of negotiations. The locality quite possibly might have already sunk other expenditure increases at the time of negotiations. Verification of this information may be too costly for individual members of the union (free rider problems might exist). So, it is likely that uncertainty, as to the true 'state of nature', is increased as well as the opportunity for shirking by the union negotiator. So, this model suggests that in those localities faced with 'lid' laws, arbitration is more likely.

In equation (3.9) I have implicitly assumed that the rank and file consists of one person. That is I have neglected the fact that the costs of arbitration and the negotiator are spread amongst the union members. If we let \( N \) represent the number of union members and assume that negotiator and arbitration costs are independent of the size of the union the equation (9) can be rewritten as

\[
U^R(w^b - c^b/N)p^b + U^R(w^g - e^y(w^g)/N)p^g > U^R(w^b - e^b(w^b)/N)p^b + U^R(w^g - e^y(w^g)/N - (e^b(w^b) - e^y(w^g)))/N)p^g.
\]

Here, as \( N \) grows, negotiation and arbitration costs grow less important but FOA risk, measured by \( w^b \), remains. For \( N \) sufficiently large, a risk averse rank and file would choose never to go to arbitration. This suggests that in large unions arbitration is less likely to occur. However, other factors may offset or even reverse this tendency. For example, it is quite likely that informational asymmetries grow worse with size.
4.Conclusion

It is quite plausible that union negotiators 'pass the buck' to the arbitrator in cases where they may be blamed for a poor outcome. Thus, the union negotiator may prefer arbitration for low wage settlements and to negotiate high wage settlements themselves. These state dependent preferences can easily lead to a 'collapse' of the contract zone in final offer arbitration. But where do these state dependent preferences come from?

In this paper a model of final offer arbitration was constructed which explicitly accounted for the principal-agent relationship between the union negotiator and the rank and file. It was shown that arbitration may be rational when the rank and file lacks crucial information about the bargaining environment that is available to the other parties. Thus, union negotiators 'pass the buck' because the rank and file may not believe them if they say 'times are tough'.

This argument suggests that arbitration would be observed only in 'bad' states. So, one might predict that, on average, arbitrated wages are lower. It is quite possible, however, that this sort of principle-agent problem arises on the side of the management negotiator. In my simple two state model this could lead to a total 'chilling' of negotiations as the union negotiator wishes to go to arbitration in the bad state and the management negotiator wishes to arbitrate in the good state. More generally, this suggests that arbitration could result when times are either uncommonly good or bad. So, arbitrated wages need not be lower.

Though I have concentrated particularly on interest arbitration (and only final-offer arbitration at that), this argument may even be more convincing for grievance arbitration. Ross (1963) noted that in the 1950's severe backloads
of arbitration cases were the norm. This seemed to be the result of the fact that employees with grievances filed them (in writing) to their union representative rather than confront their supervisor directly. Union representatives and labor relation representatives of the firm frequently passed these grievances on to an arbitrator. It is quite possible that the worker never knew the supervisor's side of the story. Faced with increasing backlogs some firms (and unions) changed the procedure so that the worker, supervisor and a union representative would talk things out before filing a formal grievance. The amount of cases which ultimately went to arbitration declined dramatically.

One obvious extension of the model in this paper is to the multi-period context. There is evidence that a narcotic effect is associated with arbitration (see Neelin (1987)). Parties who resort to arbitration in the previous negotiation tend to use it again in current negotiations. One aspect of the bargaining environment which was not previously discussed was the actual ability of the union negotiator. It seems quite plausible that poor negotiators may try to 'hide' themselves by resorting to arbitration. This may work if the rank and file is unsure of whether it is the negotiator or 'times' which are 'bad'. But this success would only be temporary since 'times' aren't always 'bad'.15
Footnotes

1. The most common forms of interest arbitration in the public sector are conventional and final-offer though there are other varieties. While most may resort to only one form, New Jersey firefighters and policemen are allowed to choose from among six different types with the default being final-offer if the parties fail to agree upon the form (see Gershenfeld (1984) for a more complete discussion of the different forms of arbitration).

2. Final offer arbitration constrains the arbitrator to choose one of the final offers submitted by the two parties.

3. Farber and Katz (1979) showed that conventional arbitration promotes negotiated settlement through the negotiating parties risk aversion and their uncertainty as to the arbitrator's decision.

4. The explanation of how arbitral uncertainty promotes negotiated settlement in conventional arbitration is similar.

5. See Champlin and Bognanno (1986) or Farber and Bazerman (1987b) for a more complete discussion of these alternative explanations of disagreement.

6. Also see Feuille (1979).

7. Note that I now no longer require that the union negotiator and rank and file utility be identical.

8. If the negotiators have better information than the arbitrator, then through strategic design the arbitrator can extract this information via the final offers (see Gibbons (1988)).

9. 'Cap' or 'Lid' laws usually place ceilings on the amount of increase in total expenditures for a municipality, county or school district. They were first adopted in New Jersey in 1976 and many states have since followed suit (See
10. Assuming that the effort was increasing (at an increasing rate) in the percentage movement 'up the contract zone' would generate the relationship depicted in figure 3.

11. Only the assumption of independence is crucial to the analysis.

12. It by implicit differentiation of (3.8) we have \( \frac{dW^a}{dp^a} = -\left[ U^{R_a}(g) (e^{g'_a}(w) - e^{b'_a}(w)) - U^{R_a}(b) (1 - e^{b'_a}(w)) \right]/\left[ \left[ U^{R_a}(g) (e^{g'_a}(w) - e^{b'_a}(w)) \right]^2 + U^{R_a}(g) (e^{g'_a}(w) - e^{b'_a}(w)) \right] + (1-p^a) \left[ U^{R_a}(b) (1 - e^{b'_a}(w)) - U^{R_a}(b) e^{b'_a}(w) \right] < 0. \)

13. For example, when arbitrating a wage dispute between a town and its police department the arbitrator may consider the wage increases received by other police departments in other towns but it is unlikely that he/she would consider the towns expenditure on, say, school buses.

14. This implication is similar to that of asymmetric information strike models.

15. See Laffont and Tirole (forthcoming) for an analysis of incentive contracting in a dynamic context.
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Figure 3

\[ e^b(w) \quad e^g(w) \]

\[ w^b \quad w^g \quad \frac{w}{w} \quad \frac{w}{w} \]