MODELS OF ARBITRATOR BEHAVIOR: THEORY AND EVIDENCE

by

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and

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ABSTRACT

Our purpose in this paper is to open up the empirical analysis of some simple models of arbitrator behavior under alternative mechanisms and in different economic environments. We do this by studying the outcomes of the first two years of operation of a New Jersey statute that mandates the arbitration of unsettled pay disputes by New Jersey police officers and the municipalities that employ them. This remarkable statute provides for conventional arbitration of pay disputes if the two parties can agree to this, but requires the use of final-offer arbitration if they cannot. Consequently, the results of both mechanisms may be analyzed and compared.

Although further evidence from the New Jersey experience with an arbitration statute is necessary before firm conclusions should be drawn, several preliminary results of the empirical analysis are worth emphasizing. First, the New Jersey system does seem to confront the parties with considerable uncertainty about the arbitration decisions they can expect. The mean of arbitrator’s preferred awards is apparently closely related to alternative local wage settlements, but these decisions still contain considerable variability around this mean. Second, the union final offers have thus far been very conservative relative to the distribution of arbitrator’s preferred settlements. This is demonstrated both by (a) the low values of union and employer final offers relative to the mean of conventionally arbitrated settlements, and by (b) the high correlation between the incidence of employer victories and the mean of union and employer final offers. The result is that a high proportion of union offers are being accepted by arbitrators and this proportion is predictable from the data on conventionally arbitrated outcomes alone. Whether this state of affairs
simply reflects the risk aversion of the parties or a mistaken view by the parties of what arbitrators will allow is an important subject for further research. If the latter is the case the central tendency of future arbitrated settlements may be considerably greater than has heretofore been seen, but employer victories are also likely to become considerably more numerous. In either case, our empirical results suggest that the form of the arbitration system adopted may have a considerable impact on the size of arbitration awards.

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The arbitration of disputes by third-party neutrals has become a major industry in the U.S. Arbitration's use in the settlement of disputes within existing contracts ranges from the settlement of grievances in union-management contracts to the settlement of highly complex disputes between buyers and sellers in commercial contracts. Arbitration is also now widely used to arrive at the terms of new contracts. The use of these provisions for interest arbitration ranges from the highly public disputes between baseball players and club owners to the settlement of public sector labor disputes and the fashioning of divorce settlements.

Since arbitration mechanisms may be designed in several ways, their increased-use makes it increasingly important to understand how the difference in arbitration systems may affect outcomes. Our purpose in this paper is to open up the empirical analysis of some simple models of arbitrator behavior under alternative mechanisms and in different economic environments. We do this by studying the outcomes in the first two years of operation of a New Jersey statute that mandates the arbitration of unsettled pay disputes by New Jersey police officers and the municipalities that employ them. This

* We have benefitted from useful discussions of the material in this paper with Henry Farber, Richard Lester, Daniel McFadden and Jeffrey Tener, from its presentation at the Center for Law and Economics, University of Miami, and from comments by John Pencavel on an early draft.
remarkable statute provides for conventional arbitration of pay disputes if the two parties can agree to this, but requires the use of final-offer arbitration if they cannot. Consequently, the results of both mechanisms may be analyzed and compared.

In proceeding this way we hope to shed light on two related issues. First, arbitration mechanisms are simply one specialized type of legal setting for the settlement of disputes. The setting is analogous to a civil suit with the arbitrator acting as judge. Indeed, each side's "case" is often presented to the arbitrator by the parties' attorneys, and the arbitrator produces a written decision after hearing the case. Negotiated settlements are entirely analogous to "out of court" settlements in civil suits, and arbitrated cases are the ones that "go to trial." What is unusual about arbitration agreements is that the arbitrator's decisions, and sometimes the proposals by the parties, are both publicly obtainable and easily reduced to a single numerical magnitude. Consequently, we suspect that a great deal may be learned about the general nature of legal decision-making by quantitative studies of the simpler arbitration prototypes.\footnote{For a similar view see especially Landes and Posner's [11] wide ranging discussion of private adjudication systems.}

Second, the growing theoretical literature on the nature of alternative arbitration mechanisms has raised a number of issues whose resolution requires empirical inquiry. In conventional arbitration, for example, the arbitrator fashions an award based on an analysis of the relevant facts and the arbitrator's external judgment of what would comprise a fair award. It
has often been suggested that this arbitration system generates little useful information from the parties, and causes the parties' settlement offers to diverge, because to do otherwise might prejudice the arbitrator's judgment against the parties' self interests. To remedy this potential difficulty, Carl Stevens [12] suggested a system of final-offer arbitration nearly two decades ago. Stevens suggested that in order to induce settlement each party should be required to submit to the arbitrator a single final offer, and the arbitrator would then be required to select one or the other of these offers without compromise.2/  

In early theoretical work, Crawford [5] observed that if the arbitrator's (exogenously determined) notion of a fair settlement were known to the two parties, then both arbitration mechanisms would almost certainly lead to the same outcome in a zero-sum setting. In conventional arbitration this would happen because whatever negotiated settlement was proposed by one party, the other party would always do better by holding out for the arbitrator's "fair" decision. Thus, all outcomes would coincide with the arbitrator's preference either through negotiation under the threat of arbitration or by arbitrator decision. Assuming the arbitrator selects the final offer closest to his notion of a fair settlement, this would also be the case with final-offer arbitration. Again, whatever proposal was made by one party, the other party could always do better by holding out for the arbitrator's preferred outcome and both parties would inevitably be led to  

2/ Stevens' [12] remarkable paper raises most of the important issues relevant to the analysis of this arbitration scheme. This system has subsequently been adopted for the settlement of certain public sector labor disputes in six U.S. states and in Chile and has also been used in settling disputes in major league baseball. James Meade, a prominent member of Britain's new Social Democratic Party, has suggested it's use in Great Britain as the enforcement mechanism for a new wage and price monitoring system.
agree on this outcome or see it imposed by the arbitrator. In this scenario, the threat of arbitration effectively determines the outcome of all settlements and, if the parties bear the arbitration costs, the actual arbitration of cases would wither away.\footnote{2} Although this might appear to the outsider as the great success of the arbitration system in encouraging the parties to bargain on their own, precisely the contrary would be the case. The parties would merely be agreeing to the outcome that is already a foregone conclusion and saving themselves the cost of arbitration.

The key to Crawford's conclusion is, of course, the assumption that both parties know with certainty the arbitrator's preferred outcome. In a series of papers Farber and Katz [10] and Farber [8, 9] have explored the case where the parties are uncertain as to the arbitrator's preferences. In this setting the outcomes under conventional and final-offer arbitration will generally differ. Negotiated settlements and whether these will occur will then depend, in different ways under the two arbitration systems, on the parties' attitudes toward risk, their prior views on the distribution of arbitrator preferences, and other variables.

Distinguishing whether it is more or less reasonable to assume that the parties are certain about arbitrator preferences is equivalent to testing whether the arbitrator's decisions under a final-offer statute are predictable once information on the final offers and the environment of the bargaining unit is known. In this paper we put these issues to an empirical test in an effort to discriminate between the implications of these two

\footnote{2}{See Bloom [3] for a more complete analysis of the role of arbitration costs.}
theoretical setups. In order to do this we set out simple models of arbitrator behavior under both final-offer and conventional arbitration and provide a method for testing the empirical implications of these models for observed arbitration awards and for the "fairness" of arbitrator behavior.

I. Models of Arbitrator Behavior

The New Jersey Fire and Police Arbitration Act was approved in May of 1977. The establishment of some kind of arbitration statute followed almost inevitably from the passage in 1968 of legislation that granted New Jersey's public sector employees the right to organize and bargain collectively, but not the right to strike. The difficulty was that in the absence of the right to strike negotiations often went on long after annual municipal budget cycles had been closed. The purpose of the arbitration statute was to ensure that contract negotiations were final by the time of the employer's budget submission date.

To accomplish this purpose employees and employers covered by the Act (mainly police and fire department workers) must begin collective bargaining at least 120 days before the employer's budget submission date. If the parties do not settle any dispute by 60 days prior to this date they may select the conventional arbitration mechanism for settlement of the dispute. If the parties cannot or prefer not to agree to conventional arbitration they are then compelled to have their dispute resolved by final-offer arbitration, with the economic issues taken as a single package.\footnote{We analyze only disputes in police work in this paper, as many of New Jersey's five departments are volunteer companies. Other details of the statute are discussed by Bloom [2].}
Arbitrators are assigned to cases by the New Jersey Public Employment Relations Commission (PERC), which is responsible for administration of the Act. A list of seven members from the PERC's special panel of arbitrators is first circulated to the parties for comment. One of the seven is then appointed to the case, with all arbitration fees borne jointly by the parties (subject to a fee schedule approved by the PERC).

A. Arbitrator Behavior Under Final-Offer Arbitration

Under final-offer arbitration the arbitrator is required to select either the union's final offer \( w^u \) or the employer's final offer \( w^e \) as the settlement.\(^2\) In order to do this we suppose that the arbitrator has in mind a preferred settlement \( w^a \). The value of \( w^a \) is presumably based on the application of subjective principles of equity to the objective considerations of a particular case.\(^6\) The value of \( w^a \) in any particular arbitration case is, of course, unknown to outside observers. Moreover, in a case resolved by final-offer arbitration \( w^a \) will never be revealed.

\(^2\)Under the New Jersey statute those issues that may be reduced to a single numerical award are the "economic" issues, and it is these that we examine throughout. "Noneconomic" issues are handled as a separate item under the New Jersey statute, and their analysis raises some difficult issues. In fact, however, most disputes involving police workers in New Jersey have been over pay, so that our focus on economic issues is probably the appropriate one there.

\(^6\)In New Jersey arbitrators are directed to give due weight to an enormously broad variety of factors that includes (1) the interests of the public, (2) relevant comparisons of wages and working conditions, (3) the overall level of compensation already received, (4) the financial impact on the municipality, (5) the cost of living, and (6) the continuity of employment. Considerable discretion is obviously left to individual arbitrators.
The preferred settlements of arbitrators \( w^a \) will presumably vary across arbitration cases both because of unobserved variations in economic environments and differences in arbitrator's assessments of these circumstances. We shall suppose that in a given year \( w^a \) may be thought of as drawn from an as yet unspecified distribution function. The simplest mechanism by which an arbitrator in a particular case might select an offer is to choose that party's offer that is closest to \( w^a \). In these circumstances the arbitrator would select the employer's offer if

\[
(1) \quad |w^a - w^e| \leq |w^a - w^u|,
\]

and select the union's offer if this equality were reversed. Since \( w^e < w^u \) or there would be no need for arbitration, (1) implies that the employer's offer is selected if

\[
(2) \quad w^a \leq (w^e + w^u)/2.
\]

Given the established values of the employer and union final offers, (2) implies that the employer's offer will be chosen if an arbitrator is selected for the case whose preferred settlement is less than the simple average of \( w^e \) and \( w^u \). It follows that the probability of an employer victory, \( P \), is simply

\[
(3) \quad P = \text{Prob} \left[ w^a \leq (w^e + w^u)/2 \right] = \Phi \left[ (w^e + w^u)/2 \right]
\]

where \( \Phi(\cdot) \) indicates the value of the cumulative distribution function that
describes arbitrator preferences. If we take the distribution of arbitrator preferences to be Normal with mean $\mu^P$ and standard deviation $\sigma^P$, as we shall do in our empirical work, (3) is simply

\[ P = N((w^s + w^u)/2\sigma^P - (\mu^P/\sigma^P)) \]

where $N(\cdot)$ indicates the value of the cumulative normal standard distribution function. Expression (4) is nothing more than a simple probit function, and its parameters are straightforward to estimate by standard maximum likelihood methods.\(^2\) The constant in this probit function is an estimate of $\mu^P/\sigma^P$, while the coefficient of $(w^s + w^u)/2$ is an estimate of $1/\sigma^P$. It follows that although the various realized values of $w^s$ may not be observed, the parameters of the distribution function from which the arbitrator’s preferences are drawn may be estimated from a series of observations on union and employer final offers and arbitrator choices from these offers.

It is worth observing that the even-handed arbitrator treatment of union and employer offers embedded in the decision rule (1) has some immediate superficial plausibility, at least under the New Jersey statute. After all, arbitrator fees are borne by the parties and the parties' choices are taken into account in the selection of an arbitrator from the panel of seven arbitrators initially proposed. Since arbitrators derive considerable income from these fees the decision rule (1) may be the best viable strategy for maximizing an arbitrator’s income over any long-run period.\(^3\)

\(^2\) Although his interpretation is different, equation (3) is identical to Farber’s [2] formulation of a similar problem. Our procedure was to some extent inspired by his.

\(^3\) This view of the arbitrator is also suggested by Davis [6].
A major objection to the decision rule (1) is that it implies that arbitrator notions of fairness do not explicitly take account of the parties' final offers. It is not hard to see, however, that so long as the arbitrator weights the employer and union offers symmetrically the decision rule (1) is observationally equivalent to an entire class of rules where the arbitrator does take these offers explicitly into account. Suppose for example, that the arbitrator's preference \( \tilde{w}^a \) is formed as

\[
\tilde{w}^a = \gamma w^a + (1-\gamma)(w^e + w^u)/2 ,
\]

with \( 0 < \gamma < 1 \). Here \( \tilde{w}^a \) is a weighted average of \( w^a \), the arbitrator's preference in the absence of information on the offers, and the midpoint of the final offers. The employer's offer is accepted if

\[
|\tilde{w}^a - w^e| < |w^u - \tilde{w}^a|
\]

which will be the case if

\[
\tilde{w}^a = \gamma w^a + (1-\gamma)(w^e + w^u)/2 < (w^e + w^u)/2 ,
\]

or if

\[
\gamma w^a < \gamma(w^e + w^u)/2 .
\]

The condition (7) is, of course, identical to (1). From an empirical point of view, therefore, there is an infinite set of symmetric arbitrator decision-making processes that all lead to the same observationally equivalent decisions. In this sense the decision rule (1) may be a very robust empirical device.

An alternative objection to the even-handed arbitrator treatment implied by (1) is that it rules out arbitrator bias as might be indicated by
the asymmetric treatment of union and employer final offers. As it turns out, this form of arbitrator bias may be tested for empirically. Suppose, for example, that the employer's offer is accepted if

\[(8) \quad \alpha |w^u - w^s| < |w^u - w^a|,\]

where \( \alpha > 0 \). In this setup arbitrators demonstrate a pro-union, pro-employer, or no bias as \( \alpha > 1, \alpha < 1, \) or \( \alpha = 1 \). With this specification the probability that an employer's offer is accepted is

\[(4a) \quad P = N \left\{ \left[ \alpha / (1 + \alpha) \sigma^u \right] w^s + \left[ 1 / (1 + \alpha) \sigma^u \right] w^u - \mu^u / \sigma^u \right\}.\]

Equation (4a) does nothing more than free up the coefficients on \( w^s \) and \( w^u \) in the probit function. The ratio of these coefficients is an estimate of \( \alpha \), while their sum is an estimate of \( 1 / \sigma^u \). We shall estimate \( \alpha \) and test the hypothesis \( \alpha = 1 \) below.

The test of the hypothesis \( \alpha = 1 \) is mainly a test of the decision rule (1) under the maintained hypothesis that the distribution function characterizing the \( w^a \) may be taken to be Normal. To this point, however, we have not attempted to characterize this distribution in any more detail. For many observers however, a test of the fairness of arbitrators is really a test of whether \( \mu^u \) is "fair," or of whether arbitrators have the "correct" preferences. Of course, it is difficult to specify the value for \( \mu^u \) that would be fair, but it is not difficult to make \( \mu^u \) a function of some specified set of variables whose coefficients are to be estimated. For the \( i^{th} \) observation we may write \( \mu^u_i = \mu^u + \beta^u x_i \) to get the probit function
(hb) \[ P_i = N \left( \frac{\alpha}{1+\alpha} \sigma^P \right) w_i^P + \left[ \frac{1}{1+\alpha} \sigma^P \right] w_i^U - \mu^P / \sigma^P - (\beta^P / \sigma^P) x_i \]

for the \(i^{th}\) case. This merely introduces the variables \(x_i\) into the probit function. Our estimates of the coefficients in the vector \(\beta^P\) will indicate how the variables in the vector \(x\) determine the arbitrators' notions of what is fair. These estimates may, of course, be compared by the outside observer against any proposed definition of what should determine a "fair" award. The main candidate variable for \(x_i\) that we shall consider below is a measure of the wage rate in some alternative occupation. If the relative supply of workers to police departments were very elastic with respect to this alternative wage, the wage structure determined in a competitive market would, of course, guarantee one-to-one movements in the wage rates of police workers and the wage rates in their alternative occupations. For a variety of reasons we doubt that the relative supply of police workers is highly elastic in the short run, but the hypothesis that arbitrators form their notions of a fair award as if it were true has considerable intuitive appeal and seems worth empirical testing.

B. Arbitrator Behavior Under Conventional Arbitration

Under conventional arbitration the arbitrator is free to fashion a settlement of his own choosing. As before, we assume that \(w^A\) represents the arbitrator's preferred award in the absence of information on the parties' proposed offers. We consider two alternative schemes by which the arbitrator may fashion and then impose a settlement.\(^2\)

\(^2\)Both of these are possibilities suggested by Farber [8].
The simplest scheme would be for the arbitrator to simply impose his preferred award \( w^a \) as the settlement. In this case observations on conventional arbitration awards would directly reveal arbitrator preferences. For the \( i \)th arbitration case we would then have

\[
(9) \quad v_i^a = \mu^r + \varepsilon_i^r,
\]

where \( \varepsilon_i^r \) has standard deviation \( \sigma^r \). If the arbitrator's preferred settlements vary with some variable \( x_i \) whose coefficient is \( \beta^r \) this would lead to nothing more than the regression function

\[
(10) \quad v_i^a = \mu^r + \beta^r x_i + \varepsilon_i^r,
\]

which is easily fit to the data on conventional arbitration awards.

Alternatively, it may be supposed that the arbitrator attempts to fashion a compromise based on \( w^a \) and the cases presented to him by the parties. Suppose that the last offers presented by the parties to each other are \( w^e \) and \( w^u \) and that these are made known to the arbitrator. A natural compromise arbitration award would then be

\[
(11) \quad v_i^a = \delta w_i^a + (1-\delta)(w_i^e + w_i^u)/2
\]

\[
= \delta \mu^r + (1-\delta)(\mu^e + \mu^u)/2 + \delta \varepsilon_i
\]

\[
= \delta \mu^r + \gamma_i^r,
\]

where \( \gamma_i = (1-\delta)(\mu^e + \mu^u)/2 + \delta \varepsilon_i \), and \( 0 < \delta < 1 \).

The second line of (11) might also be fit directly as a regression function to the data if \( w^e \) and \( w^u \) were observed. In conventional arbitration
proceedings, however, these offers are not generally known to outside observers, and they may never be stated explicitly by either party in any case.

The question naturally arises as to how the models of conventional arbitration behavior in (10) and (11) might be distinguished empirically. It should be clear that this will not generally be possible without observations on \( w^e \) and \( w^u \) when all arbitrators are assigned to conventional arbitration cases. In New Jersey, however, the same panel of arbitrators is used in both conventional arbitration and final-offer arbitration cases. It follows that for this group of arbitrators we may assume \( \mu^r = \mu^p \), \( \sigma^r = \sigma^p \), and \( \beta^r = \beta^p \). Under these assumptions we may fit equations (4b) and (10) separately and use a test for the equality of these parameters as evidence to favor one or the other of the formulations of (10) or (11). If, for example, the inverse of the standard deviation of conventionally arbitrated awards is equal to the slope of the probit function in (4) we have evidence that arbitrators simply impose upon the parties their notion of a fair award, as in (10). If, on the other hand, this equality is not satisfied in the data we may have evidence that the arbitrators take some account of the unobserved offers of the parties, as in (11).

II. Empirical Results

The likelihood function for the final-offer arbitration sample is simply

\[
\mathcal{L}_1 = \prod_{i \in \text{ecu}} p_i \prod_{i \in \text{cu}} (1 - p_i),
\]

where \( p_i \) is given by (4b) and the first product \( \prod_{i \in \text{ecu}} p_i \) is taken over employer victories and the second product \( \prod_{i \in \text{cu}} (1-p_i) \) is taken over union victories. The likelihood function for the conventional arbitration sample
is simply the likelihood for a conventional regression,  

\[ \mathcal{L}^2 = \prod_{i=1}^{n}(1/\pi^{r}) n[(x_i^r - \mu^r - \beta^r x_i)/\sigma^r], \]

where \( n(*) \) indicates the unit normal density function. So long as the parameters \( \mu^j, \beta^j, \) and \( \sigma^j \) (\( j = r, p \)) are taken to be different (12) and (13) may be maximized independently by the usual procedures. In the case where \( \mu = \mu^r = \mu^p, \beta = \beta^r = \beta^p, \) and \( \sigma = \sigma^r = \sigma^p, \) however, the likelihood of the combined sample is  

\[ \mathcal{L} = \mathcal{L}^1 \cdot \mathcal{L}^2 \]

and the parameters \( \mu, \beta, \) and \( \sigma \) are common to all parts of the likelihood function. In this case it is necessary to maximize (14) with respect to these parameters by numerical methods.  

Sample statistics for the basic data are given in Table I. These data were collected directly from written arbitration reports. In a few cases all the necessary data were not available in a given report and the observation had to be deleted. Arbitration awards and final offers are given throughout in the form of percentage salary increases. The variable \( x_i \) is meant therefore to be the percentage increase in an alternative wage rate. At the level of the municipality to which these data refer, however, the best measure of this quantity that we could obtain was the percentage change in municipal per capita income. This averaged about 11 percent in

\[10/\] The likelihood function (14) is identical to that used by Ashenfelter [1] for an altogether different purpose, and its maximization was carried out by similar methods.
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1979 in both cities where final-offer arbitration and conventional arbitration was used, while it averaged about 7.5 percent in 1978 in both groups of cities.

The sample statistics in Table I reveal much of what the econometric analysis will confirm. First, the mean of the union and employer final offers is quite low when compared to the mean of the conventionally arbitrated settlements. In 1979 the mean of the union offers is about equal to the mean of the conventionally arbitrated settlements, while the mean of the employer offers is about two percentage points lower. Although not quite so extreme in the data for 1978, this phenomenon shows up there also. If the mean of the conventionally arbitrated cases is taken to indicate the mean of the distribution of arbitrators preferred settlements, this suggests that the union groups were behaving very conservatively indeed. Second, consistent with this presumption is the fact that in both years the union offers were accepted in about two-thirds of the cases. The result was that actual awards under conventional and final-offer arbitration were not nearly so far apart as the parties final offers might indicate. Finally, the number of cases reaching arbitration dropped considerably between 1978 and 1979. Although this is consistent with the notion that the use of arbitration will wither away as more is learned by the parties about arbitrator preferences, we are reluctant to draw any such conclusion here. The difficulty is that 1978 was the first year of operation of the New Jersey statute and considerable confusion surrounded its inception. It will be necessary to wait for at least another year of data collection before any conclusions should be drawn.11/

11/ The danger of drawing premature conclusions in this area of research is demonstrated by Butler and Ehrenberg [4].
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<td>( \sigma^r )</td>
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<td>(.394)</td>
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Log Likelihood: -90.76 -90.86 -80.82 -83.50 -21.82 -12.70 -171.1 -171.9 -170.3 -171.7

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\(^2/\) Estimated standard errors of estimated parameters in parentheses.
Table II contains the main empirical results obtained by maximizing various versions of the likelihood functions (12) - (14). In column (1) we present the simplest results for 1979 that correspond to the probit function (4b) and the regression equation (9). The estimate of $\alpha$ at .75 is not significantly different from unity at conventional test levels. This suggests that the unbiased decision rule (1) provides a very satisfactory fit to the data. The mean of arbitrator preferences from the final-offer arbitration cases ($\mu^F$) is estimated at 8.7 percent, which is considerably higher than the mean of the final offers of either the union or employer groups indicated in Table I. The standard deviation of arbitrator preferences from the final-offer arbitration cases ($\sigma^F$) is estimated at 2.6 percentage points and, as (4a) shows, this indicates a strong positive correlation in the data between the final offers and the incidence of employer victories. The remarkable result in column (1), however, is the extraordinary close match between the independent estimates of the mean and standard deviation of arbitrator preferences from the conventional and final-offer arbitration cases. This indicates that the coefficient of $(w^c + w^u)/2$ in the probit function (4b) is nearly identical to the reciprocal of the standard deviation of the regression errors in equation (9). Although not conclusive, this strongly suggests that the settlements in the conventionally arbitrated cases mainly reveal the underlying distribution of arbitrator preferences. The results in column (2) are obtained by maximizing the likelihood function (14) in order to test the joint hypothesis $\mu^F = \mu^P$ and $\sigma^F = \sigma^P$. As expected, a likelihood ratio test indicates that this hypothesis cannot be rejected.
There is another simple way to state these empirical results. Suppose that we take the mean and standard deviation of the conventional arbitration awards as measures of the mean and standard deviation of arbitrators' preferences ($\mu^R$). These assumptions imply that we may predict the actual fraction of employer victories from knowledge of the final offers, as Table II confirms. Likewise, these same assumptions imply that the correlation between the mean of the final offers and the incidence of employer victories may be predicted from the mean and standard deviation of the conventional arbitration awards, which, indeed, we also find to be the case.

The results in column (3) of Table II are the probit and regression function estimates for 1979 when the measured alternative wage is allowed to enter these equations. As can be seen from the table $\mu^R$ and $\beta^R$ are estimated from the conventional arbitration cases with very poor precision, although the latter's estimate is positive as expected. The estimates of $\mu^P$ and $\beta^P$ are better determined, with the former being negative and the latter positive, as expected. A comparison of the maximized likelihood in columns (4) and (3) indicates that the joint hypothesis $\sigma^R = \sigma^P$, $\mu^R = \mu^P$, and $\beta^R = \beta^P$ cannot be rejected. This suggests that the best estimates of the parameters of these equations are probably contained in column (4). Here the estimate of $\alpha$ is almost precisely unity. The estimate of $\beta = \beta^R = \beta^P$ is also near to unity in these results. Taken with the estimate of $\mu = \mu^R = \mu^P$ in the table this implies that the mean of arbitrator preferences was simply
equal to the growth of alternative wages in the local area shifted downward uniformly by about 3.3 percentage points.

In columns (5) and (6) we report a very strong test on the 1979 data of the hypothesis that more detailed information obtained by the parties will remove most of the uncertainty about arbitrator preferences. Almost half of the 1979 final-offer arbitration cases were decided by arbitrators who took on two or more cases and accepted both union and employer offers in one or more cases. For these 39 cases we could fit the probit function after inserting dummy variables to indicate who the arbitrator was and the rank (patrolman, detective, sergeant, lieutenant) of the police officers in the unit involved in the case. Thus, we could measure the presence of any correlation between \((w^u + w^e)/2\) and the incidence of employer victories within a single arbitrator's decisions. The estimate of \(\sigma^p\) provided by this procedure measures the variance in \(w^e\) that the parties could anticipate if they knew in advance who the arbitrator would be. Since this is as much information as the parties would generally have, this seems like a strong test of whether the parties are likely to anticipate some uncertainty about the outcome of the arbitration proceedings. As can be seen from the Table, the introduction of the arbitrator dummy variables does dramatically reduce the estimate of \(\sigma^p\) from around 3 percent for these 39 cases to around 1 percent. Nevertheless, the estimate of \(\sigma^p\) remains statistically and quantitatively significant. This provides strong evidence that models of the parties decision-making should realistically incorporate the presence of uncertainty about arbitrator preferences.

Columns (7) - (10) of Table II repeat the analysis in columns (1) - (4) for the data on arbitration cases for 1978. These results contain some
anomalies, but we are reluctant to place much emphasis on them because they represent the chaotic first year of operation of the New Jersey statute. The results may, however, be briefly summarized. First, as with the 1979 data the estimates of $\beta^T$ and $\beta^F$, of $\sigma^T$ and $\sigma^F$, and of $\delta^T$ and $\delta^F$ are remarkably similar. Second, the estimates of $\delta^T$ and $\delta^F$ are not significantly different from zero. This indicates that arbitrators did not appear to use alternative wage rates in any significant way to fashion arbitration settlements in 1978. An alternative explanation for this finding is that our crude measurement of alternative wage changes is weaker in the 1978 data than in the 1979 data. Finally, the estimate of $\alpha$ is negative and statistically significant. This suggests that the decision rule (1) is not a good characterization of the arbitrator decision rule in final-offer arbitration cases in 1978. The reason for this finding in the data may be stated in a different way. In particular, the results in column 7, for example, imply a coefficient (and standard error) for $w^G$ in the probit equation (4b) of .59 (.07). The estimated coefficient (and standard error) on $w^U$ in equation (4b) is -.15 (.04), however. These results indicate that the incidence of employer victories was positively correlated with the size of employer final offers in the 1978 data, as expected, but that the incidence of employer victories was negatively correlated with the size of union final offers, which was not expected.

III. Conclusion

The empirical models of arbitrator behavior in this paper are an important first step in the much needed empirical studies of arbitration outcomes that remain on the agenda for further research. More complete models must
ultimately take as data for explanation both the determination of the parties' final offers, whether they choose to engage in conventional or final-offer arbitration, and whether they choose to negotiate a settlement without arbitration. The simple models of arbitrator behavior presented and estimated with remarkable success here will presumably be a key ingredient to this further research.

Although further evidence from the New Jersey experience with an arbitration statute is necessary before firm conclusions should be drawn, several preliminary results of the empirical analysis are worth emphasizing. First, the New Jersey system does seem to confront the parties with considerable uncertainty about the arbitration decisions they can expect. The mean of arbitrator's preferred awards is apparently closely related to alternative local wage settlements, but these decisions still contain considerable variability around this mean. Second, the union final offers have thus far been very conservative relative to the distribution of arbitrator's preferred settlements. This is demonstrated both by (a) the low values of union and employer final offers relative to the mean of conventionally arbitrated settlements, and by (b) the high correlation between the incidence of employer victories and the mean of union and employer final offers. The result is that a high proportion of union offers are being accepted by arbitrators and this proportion is predictable from the data on conventionally arbitrated outcomes alone. Whether this state of affairs simply reflects the risk aversion of the parties or a mistaken view by the parties of what arbitrators will allow is an important subject for further research. If the latter is the case the central tendency of future arbitrated settlements may be considerably greater than has heretofore been
seen, but employer victories are also likely to become considerably more numerous. In either case, our empirical results suggest that the form of the arbitration system adopted may have a considerable impact on the size of arbitration awards. Further empirical and theoretical research on the operation of these mechanisms for dispute resolution may therefore have an equally important impact on the future design of both private and public systems of adjudication.
References


