Estimating a Bargaining Model with Asymmetric Information: Evidence from Medical Malpractice Disputes

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This article uses a unique data set on medical malpractice disputes in Florida to estimate the parameters of a bargaining game with asymmetric information. The main findings of the article suggest that the bargaining game can replicate most of the qualitative and quantitative features of the data. The article also simulates alternative policy regimes to quantify the effects of possible tort reforms, such as imposing limits on contingency fees and caps on jury awards.

I. Introduction

Medical malpractice has been at the center of a policy debate for a number of years. There have been frequent claims in the media and public forums that liability law unduly favors plaintiffs, resulting in compensations that substantially exceed the damages incurred by the injured parties. This article uses a unique data set on medical malpractice disputes in Florida to estimate the parameters of a bargaining game with asymmetric information. The main findings of the article suggest that the bargaining game can replicate most of the qualitative and quantitative features of the data. The article also simulates alternative policy

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regimes to quantify the effects of possible tort reforms, such as imposing limits on contingency fees and caps on jury awards.

Under tort law, a medical practitioner is liable for damages if a patient suffers an injury caused by medical treatment, or lack thereof, that falls short of the "due standard of care." A plaintiff must, therefore, prove that he or she suffered an injury linked causally to substandard medical care. If the verdict favors the plaintiff, the compensation awarded in court has two components: economic losses, consisting of wage loss and medical expenses, and nonpecuniary or "noneconomic" losses. Because litigation is costly, both parties have incentives to settle out of court (Cooter and Rubinfeld 1989). A settlement occurs when both parties agree on conditions that are favorable to both in comparison to their (expected) alternative settlement in court. Since out-of-court settlements are guided by, but not constrained by, legal rules, there is a broad scope for negotiation and bargaining.

This article follows Nalebuff (1987) and models a malpractice dispute as a bargaining game with asymmetric information.¹ In the first stage of the game, the plaintiff makes a settlement demand, which is either accepted or rejected by the defendant. If the demand is accepted, the case is settled out of court. Otherwise the case is taken to court and decided by a jury. This article introduces a parameterization of the model and characterizes the equilibrium strategies by almost-closed-form solutions. The parameters of the model are estimated using a simulated method of moments estimator.

The existing empirical evidence on medical malpractice disputes reveals two stylized facts that require explanation (see Danzon and Lillard 1983; Fournier and Zuehlke 1989; Farber and White 1991; Sloan and Hoerger 1991). First, the vast majority of the claims that are filed are settled out of court. The second empirical regularity relates to the outcome of court verdicts. The majority of cases actually brought to verdict result in a judgment in favor of the defense. Consequently, the jury does not award any compensation in these cases. At first glance, these two empirical regularities seem to be inconsistent with rational behavior. One might argue that rational defendants should not settle with such high frequency if courts are not very likely to find in favor of the plaintiff.

This article shows that the bargaining game used in the analysis can explain both stylized facts. The results reveal that defendants can basically be classified as one of two types. The first type will receive a favorable verdict and will never settle out of court. The second type of defendant expects a verdict for the plaintiff and has strong incentives to settle out of court. The plaintiff faces only limited uncertainty about

¹ An excellent review of bargaining under asymmetric information is given by Kennan and Wilson (1993).
the degree of liability of the second type, allowing him to propose settlement demands that will be accepted with a high probability. Provided that most defendants are of the second type, most cases will be settled out of court, thus explaining the first puzzle. However, the plaintiff needs a credible threat to take a case to court if the settlement demand is rejected. If taking cases to court is not credible, even cases involving verdicts for the plaintiff would not be settled out of court. To retain a credible threat, the plaintiff must make sure that going to court is profitable in equilibrium. To guarantee this profitability restriction, the plaintiff needs to adopt a strategy such that a type 2 defendant will reject the settlement demand with high enough probability and face a verdict for the plaintiff. In equilibrium, the plaintiff is still more likely to face a verdict for the defendant in court than a verdict for the plaintiff, which explains why plaintiffs lose most cases in court.²

The remainder of the article is organized as follows. Section II discusses the data used in the empirical analysis and provides some key facts of medical malpractice disputes. The game-theoretic framework on which the empirical analysis is based is presented in Section III. Section IV introduces the parameterization of the model and briefly discusses the estimation strategy. Section V presents the empirical findings of this article. Finally, Section VI concludes the analysis.

II. Medical Malpractice Disputes: Some Key Facts

Since 1975, the State of Florida has required malpractice insurers to complete a closed claim form at the conclusion of a filed claim regardless of whether the claimant receives compensation or not. These forms provide considerable information about individual cases and their settlement processes, with special focus on malpractice insurers. The data identify the physician or the hospital being sued, the insurer’s assessment of the severity of the sustained injury, and a brief description of the nature of the injury and its potential causes. From an economic perspective, the important variables are the costs to the insurer of handling the claim, the dates on which the claim was filed and concluded, the stage at which the claim was resolved, the financial terms of the settlement, and an evaluation of the plaintiff’s economic losses. Table 1 reports descriptive statistics of the data set used in this study.

One of the most striking features of the data is that approximately 92.6 percent of all cases are settled out of court. Most settlements (78.8

² An alternative to the bargaining model is the model due to Priest and Klein (1984), which predicts that a case will go to court only if the subjective probabilities of obtaining a favorable verdict of the two parties differ significantly. As a limiting case, the model gives rise to the 50-50 rule. See also Waldfogel (1995) for an empirical analysis and Shavell (1996) for more theoretical work on the Priest-Klein model.
percent) are favorable to the plaintiff, and 13.8 percent are dropped and result in no compensation. The remaining 7.4 percent of the total number of cases filed go to court. A majority of these cases result in a verdict in favor of the defense. Only 2 percent of all cases in the sample result in a verdict for the plaintiff. These stylized facts appear to be somewhat inconsistent with each other at first glance. In particular, they raise the question why so many cases are settled out of court, resulting in substantial payments to the plaintiff, if most verdicts favor the defense. One of the main tasks of this analysis is to investigate whether these empirical regularities can be explained by a bargaining model with asymmetric information. Plaintiffs receive higher mean compensation in private settlements than at verdict. On average, private settlements are around $210,000, whereas the average jury award is only $115,000. This difference is not surprising. Plaintiffs lose more than two-thirds of all cases in court. However, if they win the case, they receive higher compensation. The mean court verdict in favor of the plaintiff is $416,000. Court verdicts have a larger variance than private settlements.

There are substantial costs associated with each stage of the dispute. Defense lawyers typically bill by the hour. Mean costs of the defense of cases that result in a private settlement are approximately $28,390. Even when cases are dropped by the plaintiff, mean defense costs are $13,510. If the case goes to court, average litigation costs for the defense are approximately $60,366. Ignoring potential self-selection problems, one can approximate the defendant’s benefits of avoiding a trial by the

\[\text{Cost and compensation are measured in 1990 dollars. Estimated standard errors are given in parentheses.}\]

<table>
<thead>
<tr>
<th></th>
<th>Number of Observations</th>
<th>Resolution Probability</th>
<th>Mean Compensation</th>
<th>Mean Defense Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dropped</td>
<td>1,071</td>
<td>.138 (.001)</td>
<td>0</td>
<td>13,510 (.898)</td>
</tr>
<tr>
<td>Settled before trial</td>
<td>6,095</td>
<td>.788 (.002)</td>
<td>209,942 (.423)</td>
<td>28,390 (298)</td>
</tr>
<tr>
<td>Tried</td>
<td>570</td>
<td>.074 (.001)</td>
<td>114,671 (3,932)</td>
<td>114,671 (28,390)</td>
</tr>
<tr>
<td>Got money</td>
<td>157</td>
<td>.054 (.001)</td>
<td>416,321 (3,932)</td>
<td>13,510 (298)</td>
</tr>
<tr>
<td>No money</td>
<td>413</td>
<td>0</td>
<td>62,178 (298)</td>
<td>60,366 (298)</td>
</tr>
</tbody>
</table>

5 Small claims in which the defendant’s costs are less than $1,000 are excluded from the sample. Most of these claims are also dropped.

4 Note that these probabilities are not in line with the 50-50 rule implied by the Priest-Klein model.

3 As pointed out by a referee, costs do not include nonpecuniary costs, which are hard to measure.
difference in mean costs, which is approximately $32,000. Hence litigation is costly relative to private settlement (Cooter and Rubinfeld 1989). There is broad scope for negotiation and bargaining. There are practically no cost differences between cases that result in a verdict in favor of the defense and those that are decided in favor of the plaintiff. Compensation obtained in private settlements and defense costs are positively correlated. The Pearson correlation coefficient is approximately .25. Trial outcomes and litigation costs are also positively correlated. This suggests that the unobserved damages and litigation costs are positively correlated as well.

The data set does not contain information about the contractual arrangement between the plaintiff and his or her lawyer. However, plaintiffs’ lawyers are overwhelmingly paid a contingency fee, mostly at 33–40 percent of the compensation that is awarded (Sloan et al. 1993). While the costs of the plaintiffs’ lawyers are unobserved, one can infer the average magnitude of these costs by looking at the outcomes of the disputes. Under the assumption that there is free entry into the market, lawyers of plaintiffs will not make systematic profits in long-run equilibrium. Under these assumptions, the expected revenues from taking on a case equal the average costs. Table 1 implies that expected revenues are

\[
0.33 \times (0.78 \times 209,942 + 0.02 \times 416,321) = 56,787.
\]

This calculation indicates that the costs of the plaintiff’s lawyer are of a magnitude similar to that of the costs of the defense. If law firms make systematic profits, then the estimate above should be interpreted as an upper bound for the average costs.

It is possible that the plaintiff and his or her lawyer may have different incentives, which potentially give rise to complicated agency problems. First, economic incentives may not be perfectly aligned. The pervasive use of the contingency fee system, however, reduces the risk of serious misalignments. Most of the empirical evidence suggests that deviations in economic interests are likely to have second-order importance. Second, the plaintiff may also pursue some noneconomic aims. There is ample evidence that the filing of a “nonmeritorious” claim, which is usually dropped reasonably quickly after the plaintiff’s lawyer evaluates the claim, is driven by noneconomic aims. There is also evidence that noneconomic aims play a smaller role during subsequent stages of the bargaining process and have only minor effects on its outcome (Sloan et al. 1993). Since the evidence regarding these types of principal-agent problems is weak and the data available do not provide much additional

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6 For a theoretical treatment, see, e.g., Rubinfeld and Scotchmer (1993) and Hay (1996).
information, this article follows the literature on bargaining and abstracts from these problems.

In sum, the vast majority of all filed cases result in a settlement that involves substantial compensation for the plaintiff. Only a small fraction of all cases are taken to court. Most of these cases result in a verdict in favor of the defense. However, if the plaintiff wins at verdict, compensation is likely to be substantial. There are significant costs associated with the dispute resolution. These costs are monotonically increasing in the stage of the resolution of the dispute. Since the qualitative and quantitative features observed in the data seem to be in line with a general bargaining story, the next step is to develop a more structural analysis of the underlying theory by constructing a bargaining model that can replicate these stylized facts as equilibrium outcomes and by devising a strategy to estimate the parameters of the underlying model. The next two sections address these issues in turn.

III. A Bargaining Game with Private Information

Consider the following model of bargaining between a plaintiff and a defendant, which is based on the game analyzed in Nalebuff (1987). The two parties—the plaintiff \( p \) and the defendant \( d \)—are assumed to be risk neutral. Let \( W \) denote the size of the damage that was inflicted on the plaintiff, and assume that \( W \) is public knowledge. The defendant’s liability is captured by the parameter \( q \), which is generated by a mixed distribution. There is a discrete probability \( P \) that \( q \) is equal to zero. If \( q \) is positive, the distribution of \( q \) is characterized by its density \( f(q) \) with support \([0, \bar{q}]\). This assumption guarantees that a verdict in favor of the defendant has a strictly positive probability. A central assumption is that the realization of \( q \) is known to the defendant but not to the plaintiff, which gives rise to the asymmetric distribution of information.

Litigation costs of the plaintiff and the defendant in a trial are given by \( C_p \) and \( C_d \), respectively. If the case is decided by verdict, the relevant information will be disclosed in the discovery process and the jury will award compensation to the plaintiff that equals \( T = qW \). The payoffs to the plaintiff and the defendant in court are given by \((1 - \gamma)qW - C_p^t \) and \(-qW - C_d^t \). Note that the plaintiff receives only a fraction \( 1 - \gamma \) of the compensation. The lawyer receives as compensation a contingency fee with rate \( \gamma \). As discussed in Section II, this arrangement is by far the most common arrangement between a plaintiff and the plaintiff’s lawyer. This specification also abstracts from principal-agent problems between the plaintiff and the lawyer. Before going to court, the two parties can agree on a settlement amount, \( S \). The respective payoffs for this scenario are \((1 - \gamma)S - C_p^s \) and \(-S - C_d^s \), where \( C_p^s \) and \( C_d^s \) are costs...
incurred in the bargaining process. Figure 1 illustrates the game and
the respective payoffs.

A case has merit if the plaintiff's expected value of litigation is positive,
given his prior distribution of $q$. If a case does not have merit, then the
optimal strategy of the plaintiff is to drop the case, since he cannot back
up his bargaining demands with a credible threat of taking the case to
court. Dropped claims are treated in the empirical analysis as cases
without merit. Consider a case with merit. The strategy of the plaintiff
is given by $(S, \alpha(S))$, where $\alpha(S)$ denotes the conditional probability of
litigation. A defendant with liability $q$ compares the payoffs under the
two possible scenarios and chooses an optimal response to the plaintiff's
strategy. Indifference occurs when

\[ S + C_d^h = \alpha(S)(qW + C_d^h) + [1 - \alpha(S)]C_d^l. \]  

\textsuperscript{7} Nalebuff (1987) implicitly assumes that $C_d^h = 0 = C_d^l$, $P = 0$, and $\gamma = 0$. The terms
$C_d^h$ and $C_d^l$ are costs that are directly borne by the plaintiff and hence exclude costs of the
plaintiff's lawyer, which are implicitly covered by the contingency fee.

\textsuperscript{8} One could add another stage to the game in which the plaintiff first files the claim,
then learns the realization of $W$, and decides whether to drop the case or not. The following
analysis extends then to the more general game.
When equation (1) is rearranged, the cutoff point

$$q(S) = \frac{[S/\alpha(S)] + C_d^i - C_d^l}{W}$$

characterizes the defendant who is indifferent between accepting and rejecting the settlement demand $S$. If $q > q(S)$, the defendant accepts the demand. Otherwise it is rejected. If a settlement is rejected, the plaintiff updates the beliefs about $q$ according to Bayes's rule, and the posterior distribution of $q$ is given by

$$\text{Pr}(q|q \leq q(S)) = \begin{cases} \frac{P}{P + (1-P)f(q(S))} & \text{if } q = 0 \\ \frac{(1-P)f(q)}{P + (1-P)f(q(S))} & \text{if } 0 < q < q(S) \\ 0 & \text{otherwise.} \end{cases}$$

Let $q^*$ be the value at which the plaintiff is indifferent between litigating and not litigating:

$$(1 - \gamma)W \int_0^{q^*} \frac{(1-P)f(x)}{P + (1-P)f(q^*)} dx = C_p^i - C_p^b.$$  

In equilibrium, $\alpha(S)$ must be the best response to the cutoff strategy $q(S)$, that is,

- if $q(S) < q^*$ then $\alpha(S) = 0$,
- if $q(S) > q^*$ then $\alpha(S) = 1$,
- if $q(S) = q^*$ then $\alpha(S) \in [0, 1]$.

The equilibrium is computed using backward induction. The continuation subgame consists of the second stage of the game, that is, the game that results after a settlement demand has been made by the plaintiff. Nalebuff (1987) shows that this continuation subgame has a unique Nash equilibrium if $S > C_d^l - C_d^b$. The equilibrium has the following structure: if $S$ is above a threshold level $S + C_d^i \geq q^*W + C_d^l$ and therefore $q(S) > q^*$, then defendants of the type $q > (S + C_d^i - C_d^l)/W$ accept the settlement $S$, and the others reject it and are brought to trial with probability one. If $S$ is below the threshold $S + C_d^i < q^*W + C_d^l$, then the defendants of the type $q \geq q^* = q(S)$ accept the demand, and the others reject it and are brought to trial with probability $\alpha(S) = S/(q^*W + C_d^i - C_d^l)$. Broadly speaking, the plaintiff has to make sure that going to court still remains profitable in expectation after a demand has been rejected. If $S$ is sufficiently high, the cutoff point $q(S)$ will be
higher than $q^*$ and taking rejected cases to court with probability one is profitable. If $S$ is low, the plaintiff needs to increase the cutoff point by lowering the litigation probability below one.

Given that the equilibrium of the continuation subgame has been characterized, the expected payoff from making a settlement demand $S$ is given by

$$V(S) = [(1 - \gamma)S - C^b_p] \int_{q(S)}^q (1 - P)f(x)dx - \alpha(S)PC^i_p$$

$$+ \alpha(S)[(1 - \gamma)W - C^i_d](1 - P)f(x)dx$$

$$- [1 - \alpha(S)][P + (1 - P)F(q(S))]C^b_p.$$  \hfill (6)

The plaintiff's strategy is to choose the settlement demand $S$ that maximizes the expression above. Nalebuff (1987) shows that no demand $S \in (C^i_d - C^b_d, q^*W + C^i_d - C^b_d)$ can be a sequential equilibrium of the pre-trial negotiation game. Under the additional assumption that the hazard rate, $f(q)/[1 - F(q)]$, is monotonically increasing, $V(S)$ obtains a unique maximum $S \in [q^*W + C^i_d - C^b_d, q^*W + C^i_d - C^b_d]$, which satisfies

$$[1 - F(q(S))] - f(q(S)) \frac{C^i_d - C^b_d + [(C^i_p - C^b_p)/(1 - \gamma)]}{W} = 0.$$  \hfill (7)

However, the settlement amount that maximizes $V(S)$ might not be feasible. In that event the plaintiff faces a binding credibility constraint. The optimal choice in this case is $S^* = q^*W + C^i_d - C^b_d$. The plaintiff needs a credible threat of taking the defendant to court. Settlements that imply that $q(S) < q^*$ are therefore not optimal in equilibrium.

In summary, the game-theoretic model allows for private information by assuming that the defense has initially better information about the outcome in a potential trial. But once the dispute reaches the trial level, private information is no longer relevant since the jury will by assumption impute the value of $q$ correctly. The model specification is therefore consistent with the notion that the uncertainty will be resolved in the discovery process. However, it is crucial that the defense is better informed than the plaintiff at the stage in which settlement demands are made, which is a plausible assumption. The model predicts that the plaintiff will demand a high settlement in equilibrium. Low demands would be rejected since they lack credibility; that is, a settlement demand has to be high enough to make litigation profitable in equilibrium. If the demand is rejected, the plaintiff proceeds to go to court with probability one. In equilibrium, there is a strong self-selection mechanism.
Cases that look unfavorable for the defense will be settled out of court, and the remaining cases will be decided in court.

IV. Estimation

Additional assumptions on the distribution of the exogenous variables are necessary to estimate the parameters of the model. First, consider the distribution of the liability parameter $q$. As seen above, the plaintiff's optimization problem has a unique solution if the hazard rate of the distribution of $q$ is monotonically increasing. There are numerous distributions that are characterized by increasing hazard rates, including the Weibull distribution with parameters $a$ and $c$. The density function of $q$ is given by

$$f(q) = \frac{c}{a} \left( \frac{q}{a} \right)^{c-1} \exp \left[ - \left( \frac{q}{a} \right)^c \right].$$

(8)

The hazard function of a Weibull distribution is increasing if the shape parameter $c$ exceeds one. Substituting the Weibull distribution into the optimality conditions yields equilibrium strategies of the plaintiff and the defendant that can be computed numerically. In particular, a line search is needed to compute $q^*$, and the other parts of the equilibrium strategies have closed-form solutions. The remaining exogenous variables are the damages, $W$, and the costs, $C = (C_p^l - C_p^h, C_d^l, C_d^h)$. As shown in Section II, the mean costs of the defense are monotonically increasing in the stage of conflict resolution. It is therefore reasonable to assume that $C_d^l \geq C_d^h$ or, equivalently, that the following holds:

$$C_d^l = (1 + Z)C_d^h$$

(9)

for some $Z \geq 0$. For computational convenience, it is assumed that the random vector $(\ln(W), \ln(C_p^l - C_p^h), \ln(C_d^l), \ln(Z))$ follows a multivariate normal distribution. On the basis of the distributional assumptions of the exogenous variables, we can simulate the first two moments of the observed outcome variables, which include the defendant's bargaining costs ($C_d^l$), the defendant's litigation costs ($C_d^h$), the compensation awarded in private settlements ($S$), and the compensation awarded at trial ($T$). Furthermore, we can simulate the probabilities associated with the stage of conflict resolution. The simulated moments are the counterparts to the sample moments in the data. The parameters of the model are then estimated by matching the empirical and simulated

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9 The costs of the plaintiff are unobserved, and the solution to the game depends only on $C_p^l - C_p^h$. Therefore, one can identify only the distribution of $C_p^l - C_p^h$ and not its components. I also cannot identify the mean of $q$ since I do not have reliable data on damages, $W$. I therefore set $a = 1$. 

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moments using a generalized method of moments estimator (Hansen 1982).\(^\text{10}\) There are two features of this approach that are worth mentioning. First, this approach acknowledges the fact that the variables of interest are only partially observed by the econometrician (Danzon and Lillard 1983). This is the fundamental problem of empirical game theory. The equilibrium outcome crucially depends on what happens outside the equilibrium, which is typically not observed by the econometrician. For example, if a claim is settled privately, we observe the compensation \((S)\) but not the costs in the second stage of the game \((C_d, C_p)\) and the potential jury verdict \((T)\). If a case is decided in court, we typically observe the jury verdict \((T)\) and not the settlement demand \((S)\), which has been rejected by the defendant. We do not observe the private information \((q)\) and the underlying damages \((W)\). Second, this approach toward estimation, in principle, can be implemented for any bargaining model, as long as the parameters are identified and the equilibrium strategies can be computed efficiently.

V. Empirical Results

Two different specifications of the bargaining game developed in Section III are estimated in this article. The baseline specification is built on the assumption that the exogenous variables are independent of each other. The independence assumption is restrictive but establishes a benchmark case that can be used to compare alternative specifications. The extended model incorporates a richer correlation structure of the exogenous variables and allows for correlation between damages and costs of the defense. Other correlations either are insignificant or are not identified. Table 2 reports the estimated parameter values obtained for both model specifications.\(^\text{11}\)

An inspection of table 2 shows that the parameters of the underlying distribution of \(q, W, C_b, C_d,\) and \(C_p - C_b\) are estimated reasonably precisely for both specifications. Not surprisingly, the parameters characterizing the distributions of latent variables are estimated with larger errors. A comparison of the parameter estimates of the two different specifications shows that the estimates are reasonably robust with respect to small changes in the model specification. Allowing for correlation between damages and costs of the defense improves the fit of the model significantly.

The estimated mean of the damages \(W\) is roughly $190,000, which is slightly smaller than the average settlement amount observed in the

\(^{10}\) For the role of simulation in a generalized method of moments framework, see Pakes and Pollard (1989) and Newey and McFadden (1994).

\(^{11}\) The value of \(\gamma\) is not estimated but is set equal to 0.33 in both specifications; \(P\) is estimated to be 0.062.
TABLE 2
ESTIMATED PARAMETERS

<table>
<thead>
<tr>
<th></th>
<th>BASELINE MODEL</th>
<th>EXTENDED MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameter Estimates</td>
<td>Standard Errors</td>
</tr>
<tr>
<td>Shape parameter (c) of distribution of q</td>
<td>105.54</td>
<td>9.409</td>
</tr>
<tr>
<td>Mean of ln(W)</td>
<td>11.626</td>
<td>.002</td>
</tr>
<tr>
<td>Standard deviation of ln(W)</td>
<td>1.158</td>
<td>.007</td>
</tr>
<tr>
<td>Mean of ln(C_p)</td>
<td>9.898</td>
<td>.002</td>
</tr>
<tr>
<td>Standard deviation of ln(C_p)</td>
<td>.591</td>
<td>.019</td>
</tr>
<tr>
<td>Mean of ln(Z)</td>
<td>.462</td>
<td>.025</td>
</tr>
<tr>
<td>Standard deviation of ln(Z)</td>
<td>.040</td>
<td>.228</td>
</tr>
<tr>
<td>Mean of ln(C_p - C_d)</td>
<td>9.471</td>
<td>.042</td>
</tr>
<tr>
<td>Standard deviation of ln(C_p - C_d)</td>
<td>.758</td>
<td>.108</td>
</tr>
<tr>
<td>Correlation between ln(C_p) and ln(W)</td>
<td>.000</td>
<td>.618</td>
</tr>
</tbody>
</table>

Note.—Notation: q is the liability parameter; W denotes damages; C_p and C_d are the defendant’s bargaining and litigation costs, which are related by C_p = (1 + Z) C_d; C_p - C_d denotes the difference between the plaintiff’s litigation and bargaining costs.

data. The estimated mean bargaining costs for the defense are $26,800 and the estimated mean litigation costs are roughly $56,700. These values are similar in magnitude to the observed means in the sample. However, sample means are subject to the self-selection mechanism induced by the bargaining process, whereas the estimated population means are unconditional means. The estimated mean difference in bargaining and litigation costs, which are borne directly by the plaintiff, is $9,100. As discussed above, bargaining and litigation costs are positively correlated with settlements in the data set. This suggests that a similar relationship should hold between costs and (unobserved) damages. The estimated correlation between bargaining costs and damages is .62, indicating a strong positive comovement of these variables.

A comparison of the estimated and the predicted moments of the observed variables helps to understand which dimensions of the data are not captured by the model. The model evidently matches the relative frequencies that relate to the stage of the conflict resolution reasonably well. The model predicts very accurately that the vast majority of cases (78.2 percent) are settled out of court. It slightly underestimates the number of cases that are dropped (11.3 percent) and overestimates the number of cases decided in court in favor of the plaintiff (5.1 percent). In sum, the model replicates fairly accurately the relative frequencies that relate to the stage of conflict resolution.

Next consider the first moments of the observed cost and outcome variables. The model predicts mean bargaining costs for cases being dropped equal to $10,900, which is slightly lower than the corresponding
value observed in the data. Bargaining costs for cases settled out of court are predicted to be $29,000, which is approximately 2.3 percent higher than actually observed. The model predicts the average settlement amount out of court to be $233,000 compared to $210,000 in the data. Predicted litigation costs are $56,200 for cases resulting in a verdict for the defense and $63,300 for cases in which the plaintiff wins. These first moments are about the same magnitude as the ones observed in the sample. Mean jury awards are $348,000 compared to the sample estimate of $416,000. With respect to the second moments, the model significantly underpredicts the variance of the bargaining costs of cases that are dropped; however, it matches the other variances of costs reasonably well. It slightly overpredicts the variability of settlement and trial outcomes. The differences between the estimated and predicted covariance between costs and settlements are small.

The parameter estimates imply that the distribution of the liability parameter \( q \) is fairly concentrated around its mean. This suggests that plaintiffs have only limited uncertainty about the type of opponent they face. Underlying this result is a strong relationship between the distribution of \( q \) and the probability that a case will result in a favorable court verdict for the plaintiff. Intuitively, if there is a lot of uncertainty about the type of defendant faced by the plaintiff, then there is a high probability that the case will end in court since the plaintiff is likely to demand too much in the first stage of the bargaining process. If there is a small amount of uncertainty, the plaintiff can make precise demands, which are likely to be accepted. Since this probability is small in the sample and is estimated very precisely, the estimated distribution of \( q \) of the bargaining game must have a small variance.

One of the advantages of the estimation strategy developed in this article is that one recovers the structural parameters of the underlying bargaining model. These parameter estimates have clear interpretations and provide a basis for policy analysis. One can explicitly solve for the equilibrium of the bargaining game and therefore quantify the effects of possible tort reforms. There are a number of policy interventions that can be studied in this framework. The following three are of particular interest: (1) a limit on the share of the contingency fees attorneys get, (2) a cap on jury awards, and (3) a reduction of litigation costs.

The contingency fee system has been criticized because lawyers receive a large share of the compensation awarded by juries. There are frequent calls for limiting the amount of revenue lawyers can generate from lawsuits.\(^2\) To quantify the effects of such a mandate, the model is simulated under the assumption that the average contingency fee is reduced

\(^{12}\) The criticism is largely based on anecdotal evidence. See, e.g., the discussion of Fraser v. Buckle in the Wall Street Journal on November 11, 1997.
from 33 percent to 20 percent of the settlement amount. This policy results in uniformly higher payoffs for the plaintiff across possible outcomes, which has two consequences. First, the credibility constraint becomes less binding since the plaintiff’s expected payoffs from going to court increase significantly. Second, more cases have merit from the perspective of the plaintiff, and hence fewer cases are being dropped in the settlement stage. In general, redistributing income from lawyers to plaintiffs implies that plaintiffs have a stronger incentive to pursue claims.

While limiting lawyers’ fees is often driven by ethical considerations, there are compelling economic reasons to limit jury awards. A cap on jury awards, which in this analysis, for all practical purposes, is equivalent to a cap on damages, bounds the potential financial risks of a lawsuit and therefore of a settlement out of court. To study these effects, the model is simulated under the assumption that maximum damages cannot exceed $250,000. I find that this measure leads to a small reduction in the number of cases that go to court. However, it drastically reduces the average settlement amount from $233,000 to $151,000. This indicates that such a measure primarily redistributes income from the plaintiff to the defense while causing small changes in the incentive structure of the dispute.

Another question that has gained a lot of attention in public policy debates relates to the magnitude of the litigation costs. It has been argued that it would be beneficial to reduce total litigation expenditures. To address this question, the effects of a hypothetical cost reduction are simulated under the assumption that the mean and the variance of the litigation costs of the defendant are reduced by 25 percent. The findings suggest that such a measure has a moderate impact on the allocation of resources. The fraction of cases settled out of court goes down from 78.2 percent to 76.5 percent, whereas the number of court verdicts in favor of the plaintiff increases from 5.1 percent to 6.7 percent.

VI. Conclusions

This article has shown how to estimate a bargaining model with private information using data on medical malpractice disputes. The findings suggest that the model explains most qualitative and quantitative features observed in the data. In particular, I show that the estimated distribution of the unobserved liability parameter is concentrated

A cap on fees may have far-reaching general equilibrium effects, since it will most likely drive some law firms out of the market. Furthermore, if contracts between plaintiffs and lawyers are designed to be incentive compatible, then a significant reduction of the contingency fees may alter the incentives of the lawyers substantially. These issues are beyond the framework of this paper.
around its mean. The intuition behind this result is that agents will be more likely to exploit the gains from a settlement out of court if they face limited uncertainty about the type they are facing in the bargaining process. In that respect, the empirical analysis suggests that these bargaining processes are relatively efficient.

The analysis relies on a number of simplifying assumptions. In particular, the analysis assumes that both parties are risk neutral. This is probably a reasonable assumption for the defense. However, plaintiffs are likely to be risk averse, which would provide additional incentives to settle the dispute. Furthermore, the analysis abstracts from incentive problems between the plaintiff (defendant) and his or her lawyers. There is a need for more theoretical and empirical research that studies the role of agency problems in bargaining processes. This analysis also ignores reputation effects. While this seems to be a good assumption about the behavior of the plaintiff, it may not hold for the defense. If the strategies of the defense are dominated by long-term interests of insurance companies, reputation effects may well be important, which suggests that there are potential gains in modeling these kinds of disputes as repeated games. Nevertheless, the results from this study are quite promising for further work that combines formal game-theoretic analysis and estimation to address questions regarding the resolution of disputes that involve bargaining with private information.

References


