Pre-Trial Bargaining and Litigation: The Search for Fairness and Efficiency

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The formal literature on pre-trial bargaining offers considerable insight on how different bargaining procedures asymmetric information affect efficiency. Less attention has been paid to fairness, despite the fact that fairness is an essential component of any system of justice. We address this state of affairs by analyzing the equilibria of a pre-trial bargaining model for both fairness and efficiency. This analysis involves ascertaining whether fair and efficient equilibria are possible and whether they occur for common parameter values, and characterizing their behavioral and distributional properties. We conclude that fairness is a paramount concern to litigants and society and that fair and efficient equilibria are possible.

1. Introduction

When do parties in a legal dispute go to trial, and when do they settle out of court? This basic question has motivated an extensive formal literature on pre-trial bargaining. On the whole, this literature is concerned with efficiency, as scholars have sought to understand how different bargaining procedures and types of asymmetric information affect the way litigants resolve disputes.

Scholars have devoted considerably less attention to fairness concerns, however. While undoubtedly efficiency is an important concern, fairness is perhaps a paramount concern not only of litigants and the legal community but also of society and for the acceptance of the rule of law. Legal systems are traditionally evaluated in terms of fairness (Cooter & Rubinfeld 1989). For our purposes, we believe that fairness under the law can be thought of as a process that fully compensates the plaintiff if and only if

the defendant is at fault, although for the defendant, fairness dictates that the compensation is limited to the true amount of the damage. We define this further in section two, and formalize fairness in section four. This notion is one that the U.S. Supreme Court has expressed on numerous occasions in its cases interpreting the Due Process Clauses of the Fifth and Fourteenth Amendments.[1]

If the process were not fair litigants would have little reason to litigate or accept settlement terms or trial outcomes. Citizens use and obey the outcomes of fair institutions. The legitimacy of trial courts as dispute resolution mechanisms is premised on fairness. As Tyler (1990) notes, regardless of the outcome, if litigants perceive the process as fair, then there is general acceptance of the outcome, and hence compliance with the law.

Even if the court process is efficient in allocating reward and punishment, litigation might have little to offer society in ensuring compliance and using courts to achieve outcomes. Ultimately, in terms of regulation of behavior, social control solely through reward and punishment might actually be inefficient (Tyler 1990). Most litigation models have examined individual litigant behavior and then have proposed modifications or adjustments to ensure greater efficiency at the individual trial level.

Our concern, however, is not only efficiency or reward or punishment at the individual level. Through this examination we wish to address the broader concerns of litigation and its impact on peoples' compliance and acceptance of rules and law. We propose to examine the issue of whether there is a trade-off between fairness and efficiency or whether equilibrium outcomes can be both fair and efficient. If the latter is true, what are the behavioral and distributional properties of these outcomes? If there are trade-offs involved in pursuing fairness and efficiency, what are they and how do they vary across different bargaining environments?

In this article, we present a pre-trial bargaining model that examines strategic litigant behavior through both the fairness and efficiency of the model's equilibria. We extend a well-known model (Bebchuk 1984) and identify new relationships between

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[1] For example, with regard to civil lawsuits, the Court has recently considered the fairness of punitive damages assessed against an insurance company for the misdeeds of its agent without a showing that the company was in any way culpable. The Court held that "imposing liability without independent fault . . . is not fundamentally unfair and does not in itself violate the Due Process Clause" (*Pacific Mutual Life Insurance Co. v. Haslip,* citing *American Society of Mechanical Engineers, Inc. v. Hydrolevel Corp*). In its analysis of the bases of the punitive damage awards in the case, the Court held that it could not find that "the common law method for assessing punitive damages is so inherently unfair as to deny due process and be per se unconstitutional" (*Pacific Mutual v. Haslip* 18). The Court then considered the actual damages awarded in this case. Essential to its determination that the award was not unfair was that the process by which damages were awarded consisted of a fair trial, fair jury instructions, fair deliberations, and a fair appeals process (*Pacific Mutual v. Haslip* 19).

litigation costs, parties to the litigation, and outcomes. Specifically, we show how settlement amounts, the likelihood of trial, and equilibrium payoffs can vary monotonically and non-monotonically with litigation costs. We also examine equity and efficiency of predicted outcomes and find that there are fair equilibria that are inefficient; efficient equilibria that are unfair; equilibria that are neither fair nor efficient; and, encouragingly, equilibria that are both fair and efficient.

We present our model for readers both familiar and unfamiliar with formal theory. We present our propositions, formulas, and mathematical calculations for those interested in the mathematics and technical logic of the formal model. In the Appendix we present the formal proofs of our propositions. However, one can understand and follow our model and argument without reference to the mathematics and formal theory. After each proposition and formula we provide commonsense explanations and definitions for terms and formulas used herein.

2. Fairness Versus Efficiency

We define "efficiency" using the Pareto notion: thus, efficiency is that condition in which no one can be made better off without making someone worse off. Specifically, efficiency is the situation in which the plaintiff is only compensated for the injury and the defendant pays merely what is due the plaintiff.

We conceptualize "fairness" in two ways: First, having one's "day in court," if desired; and second, having rewards and penalties based on actual damages. This idea fits within the notion of courts acting as a mechanism not only to make a plaintiff whole—if the need is there—but also to exonerate an innocent defendant. We formally operationalize these definitions in section four.

Formal models of pre-trial bargaining have focused on the Pareto notion of efficiency. The first models were non-strategic, decision theoretic models that portrayed the incentives of players to settle out of court prior to trial (e.g., Landes 1971; Posner 1973; Gould 1973; Shavell 1982). While these models represented important first steps, they were limited in a number of respects. For instance, since the bargaining process was not explicitly depicted, these models could only predict pre-trial settlement amounts up to feasible sets. Second, because settlement amounts were not precisely defined, it was impossible to evaluate how litigants fared from particular outcomes. Third, these models did not rigorously treat the asymmetric information that existed between litigants. Finally, these models could not assess fairness concerns because outcomes were indeterminate.

Game theoretic models that emerged in the 1980s expanded these early decision theoretic models. Early game theoretic mod-

els explicitly modeled strategic interaction and information asymmetries, but restrictively assumed that settlement amounts were exogenous (e.g., Ordover & Rubinstein 1986; P'ng 1983; Salant & Rest 1982). Subsequent models relaxed this exogenous assumption by allowing both settlement demands and the likelihood of trial to be endogenous. Bebchuk (1984), for instance, offers a screening model with these characteristics. In a civil litigation context, an uninformed plaintiff makes a take-it-or-leave-it settlement demand to a completely informed defendant; if the defendant rejects the demand, players go to court. Nalebuff (1987) extends Bebchuk's model by endogenizing the plaintiff's decision to go to court if the defendant refuses the ultimatum and derives comparative statics that are the opposite of those from Bebchuk's model.

Cave (1987), Meurer (1989), Reinganum and Wilde (1986), and Salant (1984) offer signaling models of this variety and analyze how settlement demands and the probability of trial change with various parameters and equilibrium refinements. Cooter et al. (1982) and Samuelson (1983) provide models in which players possess different types of private information and make simultaneous settlement demands. In Sobel's (1989) model, both plaintiff and defendant have private information about the quality of their case, and both make take-it-or-leave-it settlement demands.[2] Spier (1992), however, develops a multiperiod extension of Bebchuk's model. Cheung (1988) and Wang et al. (1994) present infinite-horizon, alternating-offer models in which only the plaintiff has the outside option of going to court. Both models yield unique equilibria in which bargaining is short-lived.

Daughety and Reinganum (1993) and Watts (1994) offer models that substantially depart from the two-player models described previously. They identify conditions under which screening and signaling game forms can be sustained by equilibrium play. Watts (1994) analyzes pre-trial bargaining in a principal-agent context. In her model, an uninformed plaintiff can hire an "expert" attorney, who can acquire information about the defendant's private information. Watts identifies a range of contingency fees that are mutually advantageous for plaintiff and attorney and studies how players' utilities are affected by the presence of such an attorney.

Finally, Bebchuk and Chang (1998) reexamine the settlement dilemma, studying how offer-of-settlement rules affect the possibilities of settlement. Offer-of-settlement rules allow litigation parties to make specific settlement demands, the rejection of which would allow the court to allocate litigation costs to the rejecting party. Bebchuk assumes that the reason settlement

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[2] Also see Schweizer (1989) for a model with two-sided incomplete information and ultimatum bargaining.

terms differ from the expected judgment in this model is due to the asymmetric costs of litigation and because it identifies settlement amounts under any offer-of-settlement rule. The author points out that there is a tendency for such rules to neutralize the bargaining advantage possessed by the party facing lower litigation costs. Bebchuk also raises the problem of whether one's use of the rules will move settlement offers closer to expected judgments. (See also Bebchuk & Guzman 1997.)

Taken together, these models address a variety of issues and illuminate many aspects of the pre-trial bargaining process, particularly how different bargaining procedures and informational conditions affect settlement amounts and the likelihood of trial. Most scholarly research has analyzed the efficiency of the equilibria of these models. We know considerably less, however, about fairness and the likelihood of trade-offs between fairness and efficiency.

In their review article, Cooter and Rubinfeld (1989:1086–87) acknowledge this gap in the literature, noting that the primary normative standard in economic models is efficiency, despite the fact that legal policy has been traditionally evaluated by standards of fairness.[3] Tyler and Lind (1992) concluded that one of the most important aspects of one's decision to follow the directives of authority is the belief that the mandates emanated from an authority that was using procedures that were fair. Lind et al. (1993) argued that in almost all cases procedural fairness judgments seemed to exert as strong, or stronger, an influence on the acceptance of an arbitration award than other subjective or objective outcomes.

This is not to say that the issue of fairness has not been examined in game theoretic or formal contexts. These treatments address broader concerns of both fairness and efficiency than the specific concept of fairness and efficiency in litigatory and pre-trial outcomes. For example, using two-person games, Rabin (1993) develops the "kindness principle," but notes that optimal fairness in these games might lead to inefficient solutions. Brams and Taylor (1996) speak of fairness as an outcome in which participants are "envy free," that is, each participant believes he or she received more than half of the total. They note that efficiency is also an important "desiderata" and that while trade-offs between fairness and efficiency often occur in their two-person "adjusted winner" procedure, outcomes are both envy free and efficient. Young (1994) argues that, given differences in human needs and taste and wants, fairness should be guided by twin

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[3] However, there are pre-trial bargaining models that address fairness in a criminal law context. For instance, in studies of plea bargaining, Grossman and Katz (1983) and Reinganum (1988) analyze situations in which innocent parties are wrongfully convicted and guilty parties go free. These scholars have different substantive concerns, however, and do not assess the fairness and efficiency of outcomes.

principles of impartiality and consistency. In contrast to Rabin, but along with Brams and Taylor, Young argues that it is possible to achieve fair and efficient outcomes.

Other scholars outside of litigation and formal models have addressed both fairness and efficiency concerns; most note the potential for trade-offs between the two. Okun (1975), in a general examination of bureaucratic behavior, argued that agencies usually have to decide between the competing normative values of efficiency and fairness in policymaking activities. In a specific example of agency behavior, Scholz and Wood (1998) noted that the Internal Revenue Service often trades off efficiency and fairness in its pursuit of tax revenue, and that the trade-off can depend on partisan control.

Our commonsense definition of fairness comports with the broader definitions offered by Brams, Taylor, Rabin, and Young. Our field of inquiry—litigation—is narrower, and therefore our definition is narrower. Broad fairness notions of lack of envy, kindness, impartiality, and consistency all depend on some mechanism to get individuals "whole" should there be an injury. Our definition presupposes some potential injury and provides a mechanism for determining fair compensation for the injury.

Thus, for the specific area of litigation and pre-trial bargaining, we do not know whether fair and efficient outcomes can occur, whether they occur for common parameter values, and what their behavioral and distributional properties are. In this article, we take up the question of whether these trade-offs can be shown in litigation, whether it is possible to model the decision calculus that leads to such trade-offs, and how they affect the outcome. We agree with Young, that fair and efficient outcomes are possible.

Recall that we rely on the Pareto definition of efficiency. For our purposes, outcomes are efficient only when the plaintiff is only compensated for the damage and the defendant pays only the damage amount. Thus, when using this definition, going to court is always a non-efficient outcome because of the cost of going to court. However, as we will show, the loss of efficiency that arises by going to court often results in greater fairness. Recall that our definition of fairness is a just allocation of reward and punishment—such that "the plaintiff is made whole" and the defendant pays solely the amount to make the plaintiff whole plus the costs of going to court.

3. Model

In this section, we extend a civil litigation model (Bebchuk 1984) and uncover new insights with regard to strategic litigant behavior. Overall, we focus on the trade-off between fairness of process and efficiency of outcome in the extension of this model.

We start the examination with a review of the fairness and efficiency of the model's equilibria. We begin with Bebchuk's model not because we believe it is prototypical; indeed, given the diversity of models in the literature and the variety of substantive issues they address, we do not believe that any model can be called prototypical. Instead, we begin with this model, first, because it is well known and there is a precedent for using it as an analytical starting point.[4] While we realize Bebchuk's model assumes that the plaintiff always poses a credible threat to go to trial, we argue that this comports with real behavior. To paraphrase the lawyer's maxim, "If you want to settle, act like you are going to trial, if you want a trial, act like you want to settle." A good lawyer must always pose a credible threat; we assume that, at the very least, quality counsel represents the plaintiffs (and defendants) in our model.

Second, the equilibria of this model are easily solved for and characterized, which permits straightforward assessments of fairness and efficiency. Were we to analyze a more strategically complex model, parsimony and tractability would suffer without furthering our main goal; namely, to evaluate fairness of process and efficiency of outcome. Finally, using Bebchuk's framework enables us to show how a minor reconceptualization of player uncertainty produces significantly different results; that is, using Bebchuk's model may allow us to show pre-trial bargaining as both efficient and fair.

The model to be analyzed features a plaintiff (Player P) and a defendant (Player D) who interact in a civil litigation context. Prior to the beginning of the model, the plaintiff has suffered an injury. The defendant has private information about his or her own liability for this injury (i.e., its "type"), and the plaintiff has beliefs about the defendant's liability that can vary in precision. Players' interact in the following way: Player P issues a take-it-or-leave-it settlement demand to Player D; Player D then pays or refuses to pay the demand. If Player D refuses to pay the demand, players go to court, where "the truth comes out," and Player D pays Player P the amount of damages that the defendant truly owes, assuming that there is fairness of process and outcome.

However, court can also be costly for players. Hence, the strategic problem for the plaintiff is to optimally balance the incentives of demanding as much as possible and reducing his or her expected costs of going to court. For Player D's part, the completely informed defendant simply pays the settlement demand if he or she can do no better by going to court. These ideas are

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[4] For example, Daughety & Reinganum (1993), Nalebuff (1987), Spier (1992), and Watts (1994) extend Bebchuk's model to investigate a range of substantive concerns.

formalized in the following game, and we provide a simple expla-
nation following the introduction of the game:

1. Nature draws Player D's type from a common knowledge,
   uniform probability distribution with support $t = (x_L, x_H)$, $0 \leq x_L$
   $\leq x_H \leq 1$. Player D privately learns his or her type. Player P has
   beliefs about Player D's type, given by the probability density
   function $\mu(t) = 1 / (x_H - x_L)$.

2. Player P makes a settlement demand to Player D, $d \in (0, 1)$.

3. Player D either settles out of court with Player P by paying d,
   or rejects the demand. If Player D settles out of court, the game
   ends and players receive the following payoffs: U_P (settle) $= d$
   and U_D (settle) $= -d$.[5]

4. If Player D rejects the demand, players go to court and pay
   the following litigation costs: Player D pays $c \geq 0$ and Player P
   pays $wc \geq 0$, where $w \geq 0$ is a parameter that specifies the rela-
   tive costliness of court for players; e.g., $w = 1$ means that court
   is equally costly; $w > 1$ means that court is more costly for the
   plaintiff; and so forth. In addition, the court orders Player D to
   pay Player P the amount t in damages, and the game ends.[6]
   Thus, players' utilities from going to court are: U_P (court) $= t -
   wc$ and U_D (court) $= -t - c$.

To simplify, by chance Player D is completely innocent, com-
pletely liable, or with liability to some varying degree; D has an
equal chance of falling anywhere within this range of liability.
Based upon what P thinks D's liability is, P makes a settlement
demand. If the players settle, D pays the demand and P receives
what is demanded. If D rejects the demand, the players go to
court, and now must pay court costs. The costs change the utility
each player receives from the game.

The key difference between this model and Bebchuk's model
concerns the definition of the set of defendant types. In
Bebchuk's model, the set of defendant types is given by an un-
specified, continuous density function. It is positive in the open
interval (a, b), $0 < a < b < 1$, and zero elsewhere, meaning P
cannot know with certainty D's type. By contrast, since we assume
that defendant types are uniformly distributed in the closed in-
terval ($t = [x_L, x_H]$, where $0 \leq x_L \leq x_H \leq 1$), P can sometimes know
D's type. Hence our model allows the plaintiff to have complete
or incomplete information ($x_L \leq x_H$), whereas Bebchuk's assump-
tion only permits incomplete information.[7]

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[5] As settlement costs are generally much lower than trial costs, for parsimony, we
normalize settlement costs to zero.

[6] Hence, "the truth comes out in court" and the defendant pays the plaintiff what
he or she truly owes. This assumption should not bother the reader since assuming cer-
tain liability with unknown damages is isomorphic to assuming an unknown chance of
winning a known level of damages. For parsimony, we chose the present construction.

[7] The assumption of a uniform probability distribution of litigant types serves to
make our model more strenuous, given that we allow for uninformed and partially in-
formed plaintiffs who operate strategically and fully informed plaintiffs who pursue fair-
ness.

A second, more important, implication concerns the comparative statics produced by these assumptions. When Bebchuk's model defines the set of defendant types as open, it only allows solutions for a completely liable D, or a totally innocent defendant. In contrast, our assumption about defendant types yields both interior and corner solutions for different parameter values, meaning our model allows for different levels of culpability. Because of these assumptions we have solutions that depend on the parameter values rather than on a static assumption of behavior, given a certain type of defendant. Hence, our comparative statics reflect how both types of solutions change—in some cases, resulting in non-monotonic relationships. This flexibility allows for simultaneous comparison of any number of defendant types and a range of court costs.

We solve the game we presented previously by finding perfect Bayesian equilibria (PBEs). PBEs require players to play optimally; that is, to play the best strategy they can and to update their strategy as more information is revealed. To define these PBEs, let $d \in [0, 1]$ be the demand Player P makes in Move 2 and $a \in \{0, 1\}$ be Player D's decision to accept d in Move 3, $a = 1$ denoting acceptance and $a = 0$ denoting rejection. A PBE is thus a strategy-pair (d^*, a^*) such that

i. $d^* = \arg \max_d EU_P[d, a^*, \mu(t), w, c]$

ii. $a^* = \begin{cases} 1 & \text{if } EU_D(d^*) \geq EU_D(t, c) \\ 0 & \text{otherwise} \end{cases}$

This means that the actual damages are the maximized utility function for the plaintiff, and the plaintiff will want to settle if he or she can do no better by going to court; and D will accept the settlement if he or she can do no better by going to court.

We now present the game's equilibria:

Proposition 1: The following strategies constitute PBE[8];

$$\text{Player P: } d^* = \begin{cases} [t, 1] & \text{for } c = 0 \text{ and } x_L = x_H = t \\ x_H - wc & \text{for } c \in \left[0, \dfrac{x_H - x_L}{1+w} \right) \\ \min\,[x_L + c, 1] & \text{for } c \in \left[\dfrac{x_H - x_L}{1+w}, 1 \right] \end{cases}$$

$$\text{Player D: } a^* = \begin{cases} 1 & \text{if } t \geq d^* - c \\ 0 & \text{otherwise} \end{cases}$$

To summarize, for both players, costs determine when to go to court. When costs are zero, both players will want to go to

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court. As costs increase, players will only want to go to court if they can do better than to demand or accept a settlement offer. The comparative statics for the model are summarized in Table 1. Table 1 indicates how, in equilibrium, the plaintiff's demand, the probability of trial, and the players' utilities change with various parameters in the model. We present these relationships first with the plaintiff having complete information, and then incomplete information, about the defendant's level of liability.

First, consider the complete information case in which the plaintiff knows the defendant's type with certainty $(x_L = x_H = t)$. In this situation, the plaintiff should demand damages when court costs equal zero $(d^* \geq t$ for $c = 0)$ and damages plus court costs when costs are greater than zero $(d^* = t + c$ for $c > 0)$. For the defendant's part, he or she should agree to pay all settlement demands if he or she can do no better by going to court. This means that D should reject demands greater than actual liability when costs equal zero $(d^* > t$ when $c = 0)$ and pay demands of actual liability plus costs when costs are greater than zero $(d^* = t + c$ when $c \geq 0)$. We illustrate these behaviors in Figure 1 by graphing the plaintiff's equilibrium demands and players' equilibrium utilities as a function of litigation costs. We assume that the defendant's type is $t = 0.50$.

Figure 1 shows the ability of the plaintiff (P) to "exploit" the defendant (D). Given P's complete information and ability to make an ultimatum, he or she incorporates the costs of trial into the settlement demand, so that, with the exception of the situation in which the cost equals zero $(c = 0)$, the plaintiff always extracts more from the defendant than he or she truly owes. Since the defendant always pays the plaintiff's demands when the costs are greater than zero $(c > 0)$, the plaintiff's equilibrium demand is also his or her equilibrium utility, and, as shown in the figure, it is maximized when costs equal or exceed .50 $(c \geq 1 - x_L = 0.50)$. For D's part, the defendant generally does not owe what is being demanded of him or her in equilibrium. However, when $c > 0$, Player D can do no better by rejecting the demand and going to court, given the litigation costs he or she must pay. Consequently, the defendant always settles out of court, and, with the exception of the case when $c = 0$, D pays more than he or she truly owes. In Figure 1, Player D's equilibrium utility is the mirror image of Player P's and is maximized at the cost level of $c = 0$.

Substantively, this situation resembles the case of resource-poor defendants who are forced to accept unfair settlements because they cannot afford to fight in court. Even though they may win at trial (and do in our model), the litigation costs they face remove the incentive to go to court simply to be vindicated. Thus, both efficiency and fairness are lost in this solution. The defendant is made worse off whether he or she pursues fairness or not.

Table 1. Comparative Statics Concerning How Plaintiff's Demand, Probability of Trial, and Players' Utilities Change in Equilibrium

	Eqm Demands		Eqm Probability of Trial	Plaintiff's Eqm Utility			Defendant's Eqm Utility		
	$x_H - wc$	$x_L + c$	$\dfrac{x_H - c(1+w) - x_L}{x_H - x_L}$	$x_H - wc + \dfrac{c^2(1+w)^2 - (x_H-x_L)^2}{2(x_H-x_L)}$		$x_L + c$	$-t - c$	$-x_H + wc$	$-x_L - c$
	$c < \dfrac{x_H - x_L}{1+w}$	$c \geq \dfrac{x_H - x_L}{1+w}$	$c < \dfrac{x_H - x_L}{1+w}$	$c < \dfrac{x_H - x_L}{(1+w)^2}$	$\dfrac{x_H - x_L}{(1+w)^2} \leq c < \dfrac{x_H - x_L}{1+w}$	$c \geq \dfrac{x_H - x_L}{1+w}$	$c < \dfrac{x_H - x_L}{1+w}$; $t < x_H - c(1+w)$	$c < \dfrac{x_H - x_L}{1+w}$; $t \geq x_H - c(1+w)$	$c \geq \dfrac{x_H - x_L}{1+w}$; $\forall t \in [x_L, x_H]$
c	−	+	−	−	+	+	−	+	−
w	−	0	−	−	−	0	0	+	0
x_H	+	0	+	+	+	0	0	−	0
x_L	0	+	−	−	−	+	0	0	−

Figure 1. Plaintiff's Equilibrium Demands and Player's Equilibrium Given Complete Information
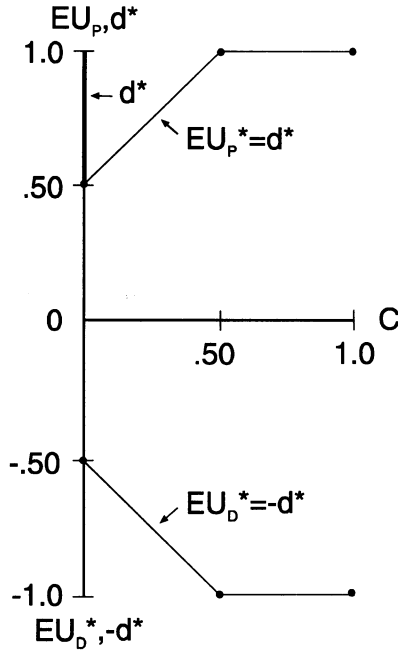
Next, consider the incomplete information case in which the plaintiff is uncertain about the defendant's type; there can be low or high culpability: $t \in [x_L, x_H]$, $x_L < x_H$. In contrast to the previous case, P's settlement demands should be sensitive to court costs. Demands will not necessarily increase monotonically. As shown in Table 1, P should decrease his or her demands as court costs initially rise [$d^* = x_H - wc$ for $c < (x_H - x_L) / (1 + w)$], but then increase the demands once costs surpass a particular cutoff [$d^* = x_L + c$ for $c \geq (x_H - x_L) / (1 + w)$].[9] Given these demands, certain defendant types will go to trial, but others will settle prior to trial when litigation costs are sufficiently low.[10]

For example, a defendant will go to trial if and only if he or she derives a greater benefit from going to trial than he or she would derive from a settlement [U_D (trial) > U_D (settle), or $-t - c > - d^* \Leftrightarrow t < d^* - c$]. Substituting Player P's equilibrium demands into this rule and simplifying, we find that lower culpability defendants [types $t < x_H - c(1 + w)$] will go to trial, although more-culpable D's [types $t \geq x_H - c(1 + w)$] will settle out of court. Given Nature's rule for drawing t, the equilibrium probability of trial (see Table 1)[11] decreases when litigation costs for $0 \leq c < (x_H$

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9 At the cutoff, equilibrium demands are the same: $d^* = (x_H - wc) = (x_L + c) = (x_H + wx_L) / (1 + w)$.

10 When $c < (X_H - X_L) / (1 + w)$.

11 $[\{x_H - c(1 + w)\} - x_L] / [x_H - x_L]$.

$- x_L) / (1 + w)$. That is, when court costs decline, the most-culpable Ds will settle, while the less-culpable Ds will go to court.

However, when costs are sufficiently large, $c \geq (x_H - x_L) / (1 + w)$, *all* defendant types will settle out of court, as even the "most innocent" defendant type (i.e., $t = x_L$) cannot afford to go to trial. The cost of going to court exceeds the actual damage caused by the defendant. The defendant will be forced to pay the settlement demand, even if it is in excess of the damage.[12]

We illustrate this situation in Figure 2. In contrast to the complete-information example, assume that P has no idea of the D

Figure 2. Equilibrium Behavior & Utilities Given Incomplete Information
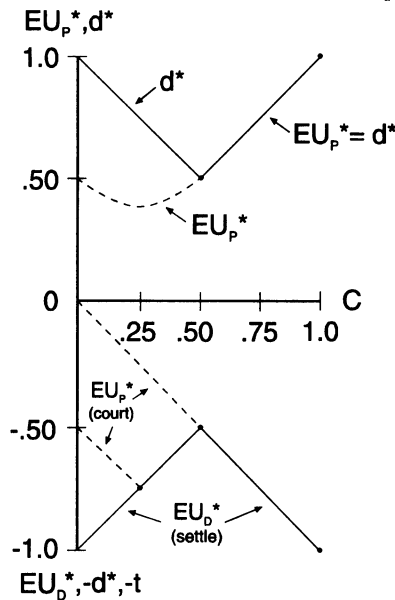
type. (Nature selects $t \in [0, 1]$ and hence Player P's beliefs are given by $\mu (t) = 1$). Hence, in both the current and previous example, Player P has the same estimate of Player D's type, $E (t) = 0.50$. Furthermore, assume that court is equally costly for both players. These assumptions produce the non-monotonic "V-shape" in the upper-half of Figure 2[13]:

As shown in the figure, Player P will make the largest demand possible $[d^* = (x_H - wc) = 1]$ when court costs are 0, will decrease his or her demands to .50 when court costs equal .50. $[c = (x_H -$

x_L) / $(1 + w) = 0.50$], but then will increase the demands as court costs increase to the maximum [$d^* = (x_L + c) = 1$ at $c = 1$]. When fighting in court is costless, P might as well make the maximum demand, notwithstanding the fact that P does not know what type of defendant he or she is facing. All defendant types, except $t = 1$, will go to court and win. Hence, Player P's equilibrium utility from demanding $d^* = 1$ is $EU_P^* = 0.50$, which is given by the broken curve at $c = 0$. As fighting in court becomes increasingly costly, P should decrease his or her demands equal to court costs, $d^* = 1 - c$, which reflects the optimal balance between demanding as much as possible and reducing the number of defendant types that will fight and win in court. The plaintiff's equilibrium utility in this cost region is given by the broken parabola centered at $c = (x_H - x_L) / (1 + w)^2 = 0.25$. The plaintiff's utility declines as costs approach the low-to-moderate point of .25, because many defendant types go to court and win, which overwhelms P's gains from relatively high demands and low court costs. However, as costs continue to rise to .50, enough types settle, so that, on balance, P's utility increases, despite the fact that P is demanding less and paying more to fight in court.

Finally, as costs surpass .50 and continue to rise, the plaintiff should increase his or her demands. In this cost region, even the "most innocent" defendant ($t = x_L = 0$) cannot afford to fight in court. Thus, with costs greater than .50, all defendant types will settle out of court, and Player P's equilibrium utility will be the same as his or her equilibrium demands. From this point on, fairness and efficiency are lost. Thus, the model shows that moderate costs restrain the plaintiff from making outrageous demands. There is an inverse relationship between demand and court costs until the midpoint of costs. Once costs increase, P can exploit D.

Turning to the defendant's situation, as in the complete-information case, the defendant simply accepts the plaintiff's offer if he or she can do no better by going to court. As derived previously for costs leading up to .50, defendants who are less-culpable [$t < x_H - c (1 + w) = 1 - 2c$] go to trial, while more-culpable D's ($t \geq 1 - 2c$) settle out of court. When costs are greater than or equal to .50 ($c \geq .50$), all defendant types settle out-of-court. This is shown in the lower half of Figure 2. First, the equilibrium utility for types who settle is the mirror image of the plaintiff's equilibrium demand. The inverted-V gives the equilibrium utility of more-culpable D's ($t \geq 1 - 2c$ below costs of .50 and of all types of defendants for costs equal to or exceeding that point. Second, the equilibrium utility for defendants who go to court is shown in Figure 2, with downward-sloping broken lines for non-liable and mid-level liability D's.

For example, consider the case of a middle-liability defendant ($t = 0.50$). As litigation costs increase from zero to .25, the defendant should reject the plaintiff's settlement demands of d^*

$= (1 - c)$ and go to court.[14] Once court costs surpass .25, however, this defendant can do no better by going to court and should accept the plaintiff's settlement demands. Hence, as shown by the inverted-V, the defendant's utility actually *increases* as court costs rise from $c = 0.25$ to $c = 0.50$. *Thus, contrary to what one might expect, a defendant facing a take-it-or-leave-it demand may actually prefer higher to lower litigation costs.* While higher costs do hurt the defendant, they act as a greater restraint on the demands of the plaintiff. The plaintiff will settle for a lower amount rather than pay the increased costs, leaving the defendant better off than with a greater demand due to low costs. Finally, as court costs continue to rise, the defendant's expected utility decreases.[15] The defendant is being exploited, and the plaintiff uses high court costs to extract more from D than D truly owes.

Therefore, players' equilibrium behaviors and utilities vary substantially between the complete- and incomplete-information environments. When the plaintiff knows the defendant's liability with certainty, trials only occur when costs equal zero, and the plaintiff generally exploits the defendant by extracting more from the defendant than he or she truly owes. Furthermore, settlement demands and players' payoffs vary *monotonically* with the court costs. In contrast, when the plaintiff is uncertain about the defendant's level of guilt, trials occur over a range of litigation costs, and settlement demands and players' utilities vary *nonmonotonically* with court costs. In the next section, we take a step back from these individual-level considerations and interpret our results in a broader context.

Given the desirability of efficiency and fairness, we want legal outcomes to be "fair" as well as relatively "efficient." However, given the plaintiff's bargaining advantage and his or her potential uncertainty, can such outcomes occur? While various scholars have examined the efficiency of their model predictions, there has been far less of an examination of the fairness of the process, and how each relates to one another in specific bargaining environments.

4. Litigation Costs and the Common Good: In Search of Fairness and Efficiency

In this section, we operationalize fairness and efficiency and use these criteria to evaluate the equilibria derived in the previous section. We find that there are fair equilibria that are inefficient; efficient equilibria that are unfair; equilibria that are neither fair nor efficient; and, encouragingly, equilibria that are both fair and efficient. We will identify the parameter values that

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[14] As shown by the broken line, the equilibrium utility for this defendant will be U_D* $= -0.50$ at $c = 0$, and will decrease to $U_D* = -0.75$ at $c = 0.25$.

[15] This is shown when $U_D* = -1.00$ at $c = 1$

yield such equilibria and examine their behavioral and distribu-
tional properties.

We begin by formally operationalizing fairness. Recall that
the set of defendant types include innocent to fully liable in
terms of the damages owed to the plaintiff. Given a specific de-
fendant of type t, we define *fairness for the plaintiff* as existing
when the plaintiff's equilibrium payoff is equal to t, or to what
actually is owed. Correspondingly, we let *fairness for a type t defen-
dant* exist when the defendant's equilibrium payoff is equal to $-t$,
or to what he or she actually owes. A fair process is one that fully
compensates the damaged party if the defendant is at fault. A fair
situation is one wherein P demands exactly what D owes.[16] This
probability is $D_D = (x_H - d^*) / (x_H - x_L)$. This fairness condition
can be solved for any parameter or parameters; given our focus
on litigation costs, we solve this condition for c:

> Proposition 2: Given the equilibrium behavior described in
> Proposition 1, the following litigation costs yield fair situations
> in the sense that $D_P = D_D$:

$$
c = \begin{cases}
0 & < \\
\left[0, \dfrac{x_H - x_L}{2} \right] & \text{for } w = 1 \\
0, \dfrac{x_H - x_L}{2} & >
\end{cases}
$$

> where w is the weight that defines the relative cost of going to
> court. The cost can range from zero (low) to one (high). A
> contingent fee arrangement, for example, would keep the cost
> low and closer to zero for a plaintiff.

Before we discuss the implications of this proposition, we
now operationalize efficiency. Previous models of civil litigation
depicted players as having zero-sum interests, with the exception
of avoiding litigation costs. Hence, outcomes where players do
not pay such costs are called Pareto optimal. We adopt this view
of efficiency, but also specify a measure that will allow us to quan-
tify the relative inefficiency of the equilibria.[17]

In Proposition 3, we identify court costs that maximize and
minimize efficiency:

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16 Hence a fair situation is $D_P = D_D \Leftrightarrow c / (x_H - x_L) = (x_H - d^*) / (x_H - x_L)$. A
defendant whose type is $t \geq d^*$ settles prior to trial and pays what he or she owes, or less.
In contrast, a defendant whose type is $t < d^*$ either settles out of court and pays more than
he or she owes, or goes to court and pays what he or she owes plus court costs.

17 The measure is $E = 1 - $ [equilibrium probability of trial] [total costs of trial] or $E =
1 - $ [total expected trial costs], which can range from zero to one. Given the equilibrium
probability of trial derived previously, and the total costs of trial being $[c + wc]$, this mea-
sure can be written as

$$
E = 1 - [c + wc] \left[\frac{x_H - c(1 + w) - x_L}{x_H - x_L} \right].
$$

Proposition 3: Given the equilibrium behavior described in Proposition 1 and the measure of efficiency previously described

A. The following court costs maximize efficiency: $c = \begin{cases} 0 \\ \left[\dfrac{x_H - x_L}{1+w}, 1\right] \end{cases}$

B. Efficiency is minimized at $c = \dfrac{x_H - x_L}{2w+2}$

Efficiency is maximized at low or zero court costs, and minimized when costs are high.

Having defined and operationalized fairness and efficiency, we will now evaluate the equilibria derived in the previous section. Grouping together the relevant parameter values from Propositions 2 and 3 yields the following two-by-two typology (see Table 2).

Table 2. Normative Properties of Equilibria with Varying Parameters for Efficiency and Equity

	Efficient	**Inefficient**
Fair	Complete or Incomplete Information and $c = 0$ or Incomplete Information and $c = \dfrac{x_H - x_L}{1+w}$	Incomplete Information, $c \in \left(0, \dfrac{x_H - x_L}{1+w}\right)$, and $w = 1$
Unfair	Complete Information and $c > 0$ or Incomplete Information and $c > \dfrac{x_H - x_L}{1+w}$	Incomplete Information, $c \in \left(0, \dfrac{x_H - x_L}{1+w}\right)$, and $w \neq 1$

First, consider the equilibria that are fair but inefficient. These conditions exist when players have the same probability of obtaining desirable outcomes and there is a positive probability of trial. Fair but inefficient equilibria occur when the plaintiff has incomplete information about the defendant's liability and when both players face the same low costs of going to court. Given the plaintiff's uncertainty, his or her best response is to reduce the settlement demands as court costs initially rise to prevent "too many" defendant types from going to court. Furthermore, the relative costliness of court for players, given by w, determines the rate at which the plaintiff reduces his or her demands—i.e., the plaintiff's "aggressiveness" in bargaining with the defendant.

When court is equally costly for both players, the plaintiff moderates his or her settlement demands just enough so that both players have the same equilibrium probability of obtaining a desirable outcome. Furthermore, this common probability, $D_P = [D_D = c / (x_H - x_L)]$, increases with costs. *Hence, while all equilibria for this cost interval are fair, those associated with larger costs are more likely to yield desirable outcomes.*

Regarding the efficiency of these equilibria, litigation costs are sufficiently low that there will always be defendant types that find it profitable to go to court. In terms of efficiency, as litigation costs rise from zero to .25, efficiency declines because a significant number of defendants ($t < x_H - 2c$) reject settlement demands and go to court, which is increasingly costly for all. In fact, at .25, efficiency is minimized because total expected costs are the highest at this level. Thus, equilibria can be fair, yet horribly inefficient. But once costs surpass .25, efficiency begins to rise because enough defendants settle to more than offset increasing litigation costs. As in other pre-trial bargaining models, the plaintiff's incomplete information is the reason disputes are resolved inefficiently through trials. What our model shows, however, is that if going to court is equally but not prohibitively costly for players, fair outcomes can nonetheless occur.[18]

Next, consider the efficient but unfair equilibria in the model. These are equilibria in which players settle out of court and the plaintiff has a relatively greater chance of obtaining a desirable outcome. Efficient but unfair equilibria occur in two ways: either the plaintiff has complete information and litigation costs are positive, or the plaintiff has incomplete information and litigation costs are sufficiently high. In both cases, the defendants pay the plaintiff's settlement demands as they can do no better by going to court. These equilibria clearly reflect the strategic bargaining advantage of the plaintiff.

There are also equilibria in the model that are neither fair nor efficient. They occur when the plaintiff has incomplete information and players face different, albeit low, costs of going to court. When these conditions obtain, one player will have a distributional advantage over the other, and certain defendant types will always find it profitable to go to court. For instance, when court is relatively less costly for the plaintiff, $w < 1$, given its uncertainty, the plaintiff should decrease his or her settlement demands as litigation costs rise to prevent "too many" defendant types from going to court. However, the plaintiff need not moderate the demands as much as he or she would if court were

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18 As an example, consider a situation in which two adjoining landowners have a good faith dispute over the property line boundary. Going to trial to resolve the issue might cost more than the disputed slice of property itself, hence the outcome is inefficient. However, if the truth comes out and the court awards title to the rightful owner, the outcome is fair, even if inefficient. Neither side can use costs to force an unfair outcome.

equally costly for players, or more costly for the plaintiff, $w \geq 1$. In other words, when court is relatively less costly for the plaintiff, he or she can bargain more aggressively with the defendant by making larger settlement demands, all else being equal. Although trials will be more frequent when $w < 1$, they will be less costly for the plaintiff; so that, on balance, the plaintiff will have a relatively higher probability of achieving a desirable outcome.

In contrast, the *defendant* will have a relatively higher probability of achieving a desirable outcome when court is more expensive for the plaintiff, $w > 1$. The reason for this is that the plaintiff will sharply reduce his or her settlement demands as court costs rise, producing a situation in which a majority of defendant types settle out of court and pay less than what they truly owe.[19] Hence, these equilibria demonstrate that resource advantages can more than offset bargaining advantages in terms of the payoff players ultimately receive. Contrary to what one might expect, it is the defendant—who receives the non-negotiable settlement demand—who is actually better off.

Finally, consider the last and most desirable set of equilibria in the model; that is, the fair and efficient equilibria. These equilibria also occur in several ways and exhibit a variety of behaviors and payoffs. For instance, fair and efficient outcomes always occur when litigation costs are zero. The reason for this is that the defendant will go to court if faced with an excessive settlement demand and pay the plaintiff what he or she truly owes. Hence, players will always pay or receive what they truly owe or deserve— a fair situation. Efficiency also obtains because parties either settle out of court or go to court, which is costless. Thus, when costs are zero, fair and efficient outcomes occur regardless of the plaintiff's information, the equilibrium demands, or whether trials occur.

Fair and efficient outcomes also obtain when the plaintiff has incomplete information and litigation costs are "moderate," at the .50 level. The idea behind this equilibrium is that if going to court is sufficiently unattractive to both players—but not too unattractive—the plaintiff will moderate his or her demands, and, given such demands, the defendant will settle out of court. Formally, the plaintiff will demand the optimal damages when litigation costs reach .50.[20] In fact, the defendant *will* pay this settlement demand because, at this cost level, even the "most innocent" defendant type (i.e., $t = x_L$) can do no better by going to court. Thus, this is fair in the sense that the defendant, expecta-

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[19] Think of a contract situation in which the defendant has agreed to pay x to the plaintiff in return for some good or service provided by the plaintiff, and the defendant breaches the contract by refusing to pay. The cost to the plaintiff of going to court might be more than what the plaintiff is owed. The defendant can use court costs to force the plaintiff to accept less than what the plaintiff is truly owed.

[20] We can say that $d^* = (x_H + wx_L) / (1 + w)$ at $c = (x_H - x_L) / 2$.

tionally, pays what he or she truly owes. Thus, the process is fair for the defendant. It is efficient in that all defendant types settle out of court.

We should note that all fair and efficient equilibria in the model are "knife-edge" with respect to litigation costs. That is, if litigation costs were to deviate slightly from zero or .50, fairness or efficiency would cease to obtain. In the next and final section, we will discuss the fragility of these equilibria and our belief that they are nonetheless useful for thinking about possible legal reforms.

5. Discussion and Policy Implications

Discussion

Over the past 25 years, an extensive formal literature has developed on pre-trial bargaining. While much has been learned about efficiency, less is known about the fairness of litigation, despite the societal importance of fairness and its treatment by game theoretic and other theorists. As a consequence, we know little about whether fair and efficient outcomes can occur; and, if they can occur, what their behavioral and distributional properties are. Therefore, the larger issue of law, obedience to rules, and compliance has remained in the background in the examination of the litigant bargaining calculus. This is no small matter. If litigation, and the outcomes from litigation, is not fair, then regardless of efficiency, citizens have little incentive to use the court system to resolve disputes or to comply with or obey the results from the litigation if they *have* gone to court. For aggrieved citizens, since proceeding to trial is ultimately inefficient, then they may be pursuing court outcomes to achieve a sense of fairness. Thus fairness must be examined in evaluating pre-trial bargaining.[21]

We take a step toward investigating these issues. We analyze a pre-trial bargaining model that offers new insights into strategic litigant behavior, and we examine the fairness and efficiency of the model's equilibria. We extend a well-known pre-trial bargaining model by showing how a minor reconceptualization of uncertainty leads to significantly different outcomes. Recall that the key difference between this model and Bebchuk's model con-

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[21] Admittedly, those who benefit from biased or unfair outcomes might view such outcomes favorably and seek to continue a system that produces unfair outcomes. For example, a negligent medical practitioner might favor an outcome in which he or she pays less in damages than what he or she truly owes. However, given such an outcome, why would an injured plaintiff/patient seek legal recourse the next time that person is injured? In the long run, unfair outcomes leave parties with little incentive to use the legal system. The same medical practitioner might be accused of malpractice on another occasion, but this time he or she might not be liable. However, given the unfairness of the legal system, the practitioner might not have a chance to prove this in court.

cerns the definition of the set of defendant types. Our model allows the plaintiff to have complete or incomplete information, whereas Bebchuk's assumption only permits incomplete information. We believe that ours is a reasonable assumption. Often, cases settle very quickly because both parties know both the liability and the extent of damages. Insurance companies often use a formula premised on medical expenses and lost wages in calculating damages to pay an injured party on behalf of the insurance client/tortfeasor. In such a complete information situation there is often little bargaining and quick settlement and payment.

This seemingly minor change in the conceptualization of uncertainty has a wide-ranging impact on the findings, and indeed on the flexibility, of the model. Our comparative statics reflect how both types of solutions change—in some cases, resulting in non-monotonic relationships. Thus, these seemingly small differences in the way uncertainty is formalized produce substantially different results.

Specifically, we show how settlement demands, the probability of trial, and players' utilities can vary *monotonically and non-monotonically* with litigation costs. We also find that there are fair equilibria that are inefficient; efficient equilibria that are unfair; equilibria that are neither fair nor efficient; and, finally, equilibria that are both fair and efficient. We identify the conditions that yield these equilibria as well as the behaviors and payoffs associated with them. We view our analysis as an initial attempt to think rigorously about fairness and efficiency in pretrial bargaining.

Policy Implications

It is worth emphasizing that fair and efficient equilibria *do* exist in our model. These equilibria expose an important strategic logic that has implications for possible legal reforms. The model suggests two strategies for increasing fairness and efficiency in the legal process. One strategy is to decrease litigation costs to zero. The other strategy is to raise litigation costs on both parties to moderate levels. Although it is unrealistic to reduce litigation costs to zero, we believe that the second strategy holds promise as a possible guide to reform. The principle underlying the second strategy is to give plaintiffs sufficient freedom to pursue compensation for their injuries, but to also give them disincentives for making outlandish settlement demands. In the model, these goals are optimally balanced when litigation costs are moderate, resulting in fair and efficient outcomes.

We believe the ability to seek compensation within reasonable limits has some important policy implications in the so-called litigation explosion era. One possible solution to the problem of achieving this balance is to adopt the British system. In the Brit-

ish system of litigation, plaintiffs who have brought suits that are unsuccessful must pay at least a portion of the defendant's legal costs.[22] The British use this tactic as a policy tool designed to dissuade frivolous lawsuits. In our model, this practice would influence a plaintiff who knows the true value of damage from seeking more than is rightfully owed when there is uncertainty as to the type of defendant being faced. Thus such a system would promote fair and efficient outcomes in that defendants would have no incentive to cheat, given that with some probability they are facing a fully informed plaintiff who will pursue the case to court and may prevail in reimbursement of the costs of litigation.

Our model suggests that although it may be impossible to raise litigation costs to any precise cutoff in actual litigation, it is nonetheless desirable to attempt to do so, as both fairness and efficiency exhibit a weak increase as litigation costs approach this level. Such a prescription also runs counter to the pejorative view of litigation costs as dead-weight losses to society.[23] The model shows that when set to appropriate levels, litigation costs can be used to promote fairness and efficiency, which in turn should lead to overall greater compliance and respect for the rule of law, whatever the particular outcome.

Even if the United States fails to adopt any British model, the equilibria we have formulated herein have implications for the role of U.S. attorneys and court-imposed sanctions. Typically, an aggrieved client first approaches an attorney about taking a case. The client claims to have suffered some injury for which the client seeks compensation. The attorney forms some reasonable estimate of the liability of the defendant and the potential amount recoverable. If the liability is not sufficient and the amount recoverable is not financially worthwhile, the attorney will decline the case. The system depends upon the attorney acting as a gatekeeper. Yet we know that many low-liability cases are because of the potentially exploitive equilibria. The plaintiff can exploit the defendant; the attorney knows this and might accept cases even when confronted with a low-liability defendant.

The gatekeeper, the attorney, has a financial stake in the outcome of the case. This situation should act to restrain unfair demand. However, even if the case is ultimately unsuccessful, the attorney rarely suffers any loss other than opportunity costs. It is not a zero-sum game for the attorney. Litigation represents a chance to win, or at worst, stay the same as before. Although courts have the authority to impose sanctions for frivolous litiga-

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[22]   Our thanks to one reviewer of a previous version of this manuscript who noted that this practice is also the case with administrative law litigation, such as those involving Social Security claims in which the winner is awarded court costs.

[23]   Admittedly, this idea of raising litigation costs to a set level runs counter to the notion that contingent fees promote fair and efficient outcomes in that they allow less-affluent plaintiffs to sue tortfeasors.

tion, rarely do courts sanction an attorney or a plaintiff for bringing such actions. Perhaps courts should vigorously enforce sanctions for senseless litigation. Courts' enforcement of these sanctions would compel the gatekeepers to have a true stake in the outcome—win or lose—and may restrain plaintiffs' demands. Thus moderating costs could be imposed on either the party to the litigation through use of the British system, or on the attorney through the effective use of court sanctions.

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U.S. Const. Amend. XIV

Appendix

PROOF of Proposition 1

By backwards induction: At Move 4, Player D pays $c \geq 0$ and Player P pays $wc \geq 0$ to go to court. In addition, Player D pays Player P the court-ordered amount of t.

When Player D receives a demand of d at Move 3, he or she should accept it, $a = 1$, if U_D (settle) $\geq U_D$ (court) $\Leftrightarrow - d \geq - t - c \Leftrightarrow t \geq d - c$. Otherwise, Player D should reject the demand, $a = 0$.

Given his or her beliefs, $\mu(t) = 1 / (x_H - x_L)$, the cost of going to court, $wc \geq 0$, and Player D's strategy at Move 3, Player P issues a settlement demand at Move 2. To determine the optimal demand, note that Player P need not demand any less than $d = x_L + c$, as all $t \in [x_L, x_H]$ will accept $d \in [0, x_L + c]$ and Player P's utility is increasing in this demand interval. Hence, Player P should optimally demand $d^* = x_L + c + e^*$ where $e^* \geq 0$. To determine e^*, Player P's expected utility function is

$$EU_P = \int_{x_L}^{x_{L+e}} u_P(\text{court}) \mu(t) \, dt + \int_{x_{L+e}}^{x_H} u_P(\text{settle}) \mu(t) \, dt =$$

$$\int_{x_L}^{x_{L+e}} (t - wc) \left[\frac{1}{x_H - x_L}\right] dt + \int_{x_{L+e}}^{x_H} (x_L + c + e) \left[\frac{1}{x_H - x_L}\right] dt = x_L + c + e - \frac{e\left[c(1+w) + \frac{e}{2}\right]}{x_H - x_L}$$

which is maximized at $e^* = x_H - x_L - c(1 + w)$, where $e^* \geq 0$ for $c \leq (x_H - x_L) / (1 + w)$. Hence, substituting e^* into $d^* = x_L + c + e^*$ and simplifying, yields $d^* = x_H - wc$ for $c \leq (x_H - x_L) / (1 + w)$ and $d^* = x_L + c$ for $c > (x_H - x_L) / (1 + w)$. These are the best responses for the plaintiff when he or she has complete information ($x_H = x_L = t$) as well as incomplete information ($x_L < x_H$) about the defendant's type. There is one more best response to specify: when the plaintiff has complete information and litigation costs are zero, any settlement demand greater than the defendant's type is optimal. The defendant will reject such a demand and go to court, and the plaintiff's payoff will be equal to t; i.e., what the plaintiff would obtain if he or she were to demand exactly what the defendant owes. Thus, grouping players' best responses with relevant parameter values yields the equilibria listed in the proposition.

PROOF of Proposition 2

For $c = 0$, Player P will demand $d^* = x_H$ and all defendant types, except $t = x_H$, will go to court and pay what they truly owe. Hence, all players obtain desirable outcomes with probability one, a fair situation. For court costs $c > 0$, the equilibrium probability of a desirable outcome for Player P is $D_P = c / (x_H - x_L)$. The equilibrium probability of a desirable outcome for Player D is $D_D = (x_H - d^*) / (x_H - x_L)$. For $d^* = x_H - wc$, we find c such that $D_P = D_D$: $c / (x_H - x_L) = wc / (x_H - x_L) \Leftrightarrow c = wc \Rightarrow c \in [0, (x_H - x_L) / (1 + w)]$ for $w = 1$, and $c = 0$ for $w \neq 1$. Similarly, for $d^* = x_L + c$, $D_P = D_D \Leftrightarrow c / (x_H - x_L) = (x_H - x_L - c) / (x_H - x_L) \Leftrightarrow c = (x_H - x_L) / 2$, which is in the required range of costs, $(x_H - x_L) / (1 + w) \leq (x_H - x_L) / 2 \leq 1$, for $w \geq 1$. Grouping these derived costs levels with values of w yields the correspondence given in the proposition.

PROOF of Proposition 3

To find the values of c that maximize,

$$E = 1 - [c + wc] \left[\frac{x_H - c(1 + w) - x_L}{x_H - x_L} \right],$$

we divide litigation costs into the following intervals, $C_L = [0, (x_H - x_L) / (1 + w)]$ and $C_H = ((x_H - x_L) / (1 + w), 1]$. Regarding the first interval, E is minimized at $c = (x_H - x_L) / (2w + 2)$. Hence, plugging the endpoints of the interval into the expression for E yields $E [c = 0] = E [(x_H - x_L) / (1 + w)] = 1$, which are the maxima for this cost interval. Regarding the second interval of costs, the bracketed expression for equilibrium probability of trial is negative, which we set to zero. Hence, E is maximized for all costs in this interval.