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Strategic behavior in suit, settlement, and trial

I. P. L. P'ng*

Previous studies of litigation have sidestepped the strategic element in the decisions to file suit, and to settle or go to trial. This article develops a model of strategic behavior in litigation, which reveals how information is exploited and how the litigants' strategies are interdependent. The model is analyzed to derive conditions on the parameters under which suit is filed, the action is settled, and the action is tried. Further, it is applied to begin to study the question of whether there is excessive litigation in the U.S. legal system. It is found that in certain cases, the outcome of the litigation process does not satisfy private efficiency; that is, in some cases, even ignoring effects on the rest of society, the outcome is not efficient for the litigants.

"Ours is a law-drenched age . . . litigation is gaining public favor as the legitimate and most effective means of seeking and winning one's just deserts. So widespread is the impulse to sue that . . . [these] days one hears a crescendo of concern that America has become a litigious society, posing dangers to individuals and to the commonweal."—Lieberman (1981, p.xi)

1. Introduction

■ There is a growing concern in the judiciary, the bar, and society in general about the seemingly uncontrollable growth of legal action. This has been accompanied by a number of studies of the process of litigation. The motivation has been that a thorough understanding of the problem is necessary to appreciate whether the volume of litigation is excessive, and, if reduction is desirable, to study alternative methods to reduce the volume.[1]

The first descriptive studies of the process of litigation from the standpoint of economic incentives were those of Posner (1972) and Gould (1973). Subsequently, Bodily (1981) showed how the analysis of Posner and Gould could be applied to advise parties to litigation on litigation strategy. The most recent and comprehensive development of this line of thinking is to be found in Shavell (1982a). The common thread beginning in Posner (1972) and extending through to Shavell (1982a) is the use of the theory of single-person decisionmaking as a model of litigation.

We shall take Shavell's model as representative of the class of single-person decision-theory approaches to litigation and focus attention on it. Shavell models litigation as a two-stage process: first the plaintiff files an action, then the suit either is settled or goes to trial. The other important structural elements of his theory are that both litigants are risk neutral, each has a subjective estimate of the likelihood that the plaintiff will win the

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[1] It is worth emphasizing that the term *litigation* includes legal proceedings which do not involve court action, but merely the possibility of it. *Black's Law Dictionary* has the following entry for "litigation": "A lawsuit. Legal action, including all proceedings therein . . ." (*Black's Law Dictionary*, 5th ed. (1979), p. 841).

action, each has an estimate of the award to the plaintiff if the plaintiff wins the action (this award is uncertain so that the estimate takes the form of a probability distribution), the amount of the settlement (if there is one) is exogenous, and no legal costs are incurred if the action is filed but then settled while both parties incur some legal cost if the action goes to trial.

The central contribution of Shavell was to recognize the two-stage nature of litigation: first the plaintiff decides to file an action, then the case is either settled out of court, tried, or dropped. Shavell's model did not allow the third possibility, namely that the plaintiff might drop the action after bringing suit. This restriction has the effect of quite drastically reducing the strategic possibilities for the plaintiff. In reality, we could conceive of a plaintiff bringing an action to extort a settlement from the defendant, but dropping the action if the defendant refuses to settle.

Shavell's first major assumption is that the plaintiff will file an action if and only if the expected return of a trial is positive. From this, he immediately derives his Proposition 1(a): "the plaintiff will file suit if and only if the expected value of the trial judgment is greater than the expected legal costs."

This assumption is a severe limitation on the model. For instance, it rules out the strategic behavior which gives rise to frivolous suits under United States fee rules. (In the United States, unlike in England, it is typical for each litigant to bear his own legal fees, regardless of the outcome of trial; there are only limited areas of law where one party is permitted to recover its costs from the other.) A plaintiff might file suit to extort a settlement from the defendant, even though he (the plaintiff) knows that the expected return to him of a trial is negative. In such cases, the defendant may prefer to settle and thus avoid the high legal costs of a trial which he must incur even if the judgment is in his favor. As indicated earlier, the plaintiff has an escape route—he will drop the action if the defendant refuses to settle: going to trial is merely a threat.

At a more general level, the single-person decision-theory approaches suffer from two common shortcomings. First, they do not recognize the adversarial character of litigation in the English and United States legal systems. It is this opposition which gives rise to the strategic interdependence of the litigative process. To extend the previous example, the plaintiff might sue if he knew that the defendant would offer to settle, while the plaintiff might not sue if he knew that the defendant would refuse to settle. Second, they do not give an adequate treatment of the differences in the information available to the respective litigants. For instance, in Shavell (1982a) these are reduced to differences in the parties' estimates of the likelihood of judgment in favor of the plaintiff and the size of the award. Such asymmetry of information is a vital force in strategic behavior, both before and during trial. These two features are central to the English and United States systems of litigation.

The aim of this article is to apply the theory of two-person games of incomplete information to model litigation when United States fee rules are in effect. It is hoped, thereby, to capture the strategic interdependence and use of information that are absent from earlier studies. The method of analysis of such games applied here is that of Harsanyi (1967, 1968a, 1968b). For concreteness, we consider a civil action alleging a violation of tort law.

Section 2 sets out the basic model of analysis used in this article. Then in Section 3 the strategic form of the model is analyzed. The private efficiency of the litigation process is discussed in Section 4. That is followed by an analysis of frivolous suits. The final section contains concluding remarks.

2. Basic model: incomplete information on one side

■ The basic model of this article is characterized by incomplete information on one side; in particular, the defendant has information that is not available to the plaintiff, but

the plaintiff has no information to which the defendant does not have access. The defendant knows whether he indeed violated the law as alleged, but the plaintiff does not know that. There are two types of defendants: those who committed the violation and those who did not. The proportion of defendants who are in violation is q. The plaintiff has rational expectations in the sense that his subjective probability that the defendant violated the law is q.

The structure of the game in extensive form is shown in Figure 1. In extensive form, the game is as follows. Either the defendant is in violation or he is not in violation. The plaintiff must decide whether to file suit. Since the plaintiff does not know the true type of the defendant, he cannot make this choice dependent on the true type of the defendant. (In the figure, the broken line which joins the two branches of the game tree at the plaintiff's first decision point signifies that the plaintiff cannot distinguish the two branches when making his decision.) Since his decision cannot depend on the true type of the defendant, the plaintiff must make a common choice for the two branches, that is, if he decides to file suit on one, he must file suit on the other, too.

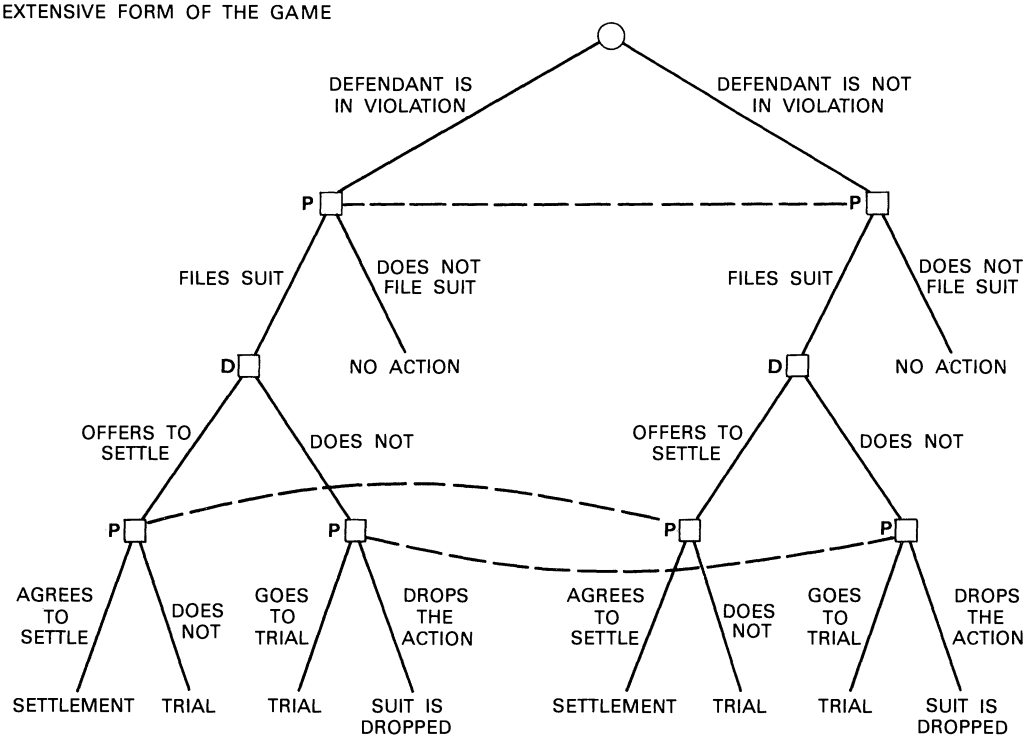
If the plaintiff decides not to file an action, the matter ends there with both parties receiving nothing and losing nothing. If the plaintiff decides to file suit, it is then the defendant's turn to move.

The defendant must choose between offering to settle (at the judicially determined amount) or not. As he can distinguish the two branches of the tree, his decision can depend on his true type, that is, whether he has violated the law.

Finally, it is the plaintiff's turn to move. If the defendant has offered a settlement, the plaintiff must choose between agreeing to settle and going to trial. (In this case, where the defendant offers to settle, we ignore the possibility of the plaintiff dropping the action, as he is better off by agreeing to settle.) If the defendant has not offered to settle, the plaintiff has a choice between going to trial and dropping the case. Again, the broken lines in the figure signify that the plaintiff cannot distinguish the decision points joined by the lines: his choice must be the same for both points.

FIGURE 1

EXTENSIVE FORM OF THE GAME



An important difference between the structure of Shavell's model and the present model is the distinction between an offer to settle and the act of settlement. The defendant's offer to settle need not be sincere—it may be a strategic ploy. A settlement is realized only if the defendant offers to settle and the plaintiff accepts the offer at the stated terms. Following Shavell, we assume that the amount, S, of the settlement is exogenous. We recognize that this is a very restrictive assumption. Our justification is that a realistic model of the process of settlement must rely on a theory of bargaining. Such a theory is still in gestation. The contribution of the present model to our understanding of the process of settlement is to provide bounds on the acceptable amount of the settlement.

We make the further simplifying assumption that if the plaintiff drops the case before it goes to trial or if the action is settled, neither party incurs legal costs. We also assume that the courts are perfect in the sense that at the end of a trial, they are able to determine the true type of the defendant, without possibility of error. (These two assumptions will be relaxed where they affect the results.) Thus, both parties are certain that if the case goes to trial, the court will find in favor of the plaintiff if the defendant was in violation, and in favor of the defendant if there was no violation. We assume that if judgment is in favor of the plaintiff, he will be awarded the sum W, the size of which is known to both litigants. Further, we assume that United States fee rules are in effect; that is, whatever the outcome of the trial, each party bears its own legal costs. The cost to the plaintiff is π, while the cost to the defendant is δ.

The final assumption is that the litigants are indifferent to risk. It follows that their behavior is guided by the maximization of expected return.

In summary, the plaintiff chooses one of five strategies:

(1) "do not sue" = do not bring suit;
(2) "sue; settle, try" = file suit, then settle if the defendant offers to settle, otherwise go to trial;
(3) "sue; try, try" = file suit, then go to trial regardless of the defendant's move;
(4) "sue; try, drop" = file suit, then go to trial if the defendant offers to settle, otherwise drop the action;
(5) "sue; settle, drop" = file suit, then settle if the defendant offers to settle, otherwise drop the action.

The defendant has available four strategies:

(1) "settle, settle" = offer to settle whether or not violator;
(2) "try, try" = do not offer to settle whether or not violator;
(3) "settle, try" = offer to settle if violator, otherwise do not;
(4) "try, settle" = do not offer to settle if violator, otherwise offer to settle.

A strategy such as (sue; try, drop) may not at first seem to make much sense. Why does the plaintiff not grab the settlement when it is offered? Further reflection reveals that such a strategy may be quite appropriate where the defendant has information not available to the plaintiff. For instance, it might be that the defendant has chosen (settle, try). For the plaintiff then, the defendant's offer to settle is an indication that the defendant did in fact violate the law, so that the plaintiff may prefer to increase his winnings by going to trial. On the other hand, the defendant's refusal to offer to settle may be an indication that he did not violate the law, in which case the plaintiff would want to cut his losses.

From the structure of the game, we deduce the payoffs which accrue to the two litigants, and these depend on the strategies chosen by the litigants. The payoffs are shown in Table 1, which presents the game in strategic form.

For each pair of strategies, consisting of one for the plaintiff and one for the defendant, there is a set of three entries in the table. The first is the plaintiff's expected return if the

TABLE 1 **Strategic Form of the Game**

Plaintiff's Strategy	Defendant's Strategy			
	settle, settle	try, try	settle, try	try, settle
no action	0, (0, 0)	0, (0, 0)	0, (0, 0)	0, (0, 0)
sue; settle, try	S, $(-S, -S)$	$qW - \pi$, $(-W - \delta, -\delta)$	$qS - (1 - q)\pi$, $(-S, -\delta)$	$q(W - \pi) + (1 - q)S$, $(-W - \delta, -S)$
sue; try, try	$qW - \pi$, $(-W - \delta, -\delta)$	$qW - \pi$, $(-W - \delta, -\delta)$	$qW - \pi$, $(-W - \delta, -\delta)$	$qW - \pi$, $(-W - \delta, -\delta)$
sue; try, drop	$qW - \pi$, $(-W - \delta, -\delta)$	0, (0, 0)	$q(W - \pi)$, $(-W - \delta, 0)$	$-(1 - q)\pi$, $(0, -\delta)$
sue; settle, drop	S, $(-S, -S)$	0, (0, 0)	qS, $(-S, 0)$	$(1 - q)S$, $(0, -S)$

litigants adopt the respective strategies. The second and third are grouped in parentheses: the second is the defendant's return if he is in violation and if the two litigants adopt their respective strategies; the third is the defendant's return if he is not in violation. For instance, if the plaintiff chooses (sue; try, drop) and the defendant selects (settle, try), the expected return to the plaintiff will be $q(W - \pi)$, while the defendant's return will be $-W - \delta$ or nothing, depending on whether he is in violation.[2]

3. Analysis of the strategic form of the basic model

■ In this section we analyze the strategic form of the basic model.

First, observe that the plaintiff will never adopt his first strategy. Regardless of the defendant's choice of strategy, the plaintiff will receive a higher expected return from his fifth strategy. Put differently, the plaintiff's first strategy, (do not sue), is dominated by his fifth strategy, (sue; settle, drop). We conclude that the plaintiff will always bring an action.

This surprising result is implied by the assumption that the plaintiff incurs no legal costs by filing an action and then dropping it. Given the assumption, the conclusion is quite intuitive: the plaintiff loses nothing from filing suit. Shavell (1982a) makes the same assumption, but in his model the plaintiff gains nothing by filing unless he is willing to go to trial. If it is assumed instead that the cost π includes some cost of filing an action, π_0, then the result does not hold.

Secondly, the defendant will offer to settle only if $S < W + \delta$; that is, the defendant will offer to settle only if the amount of the settlement is less than the amount that the defendant would lose if he lost the action at trial. If the amount of the settlement is larger, he will refuse to offer to settle, in which event the case will go to trial, provided that the plaintiff does not drop it.

We shall employ the concept of Nash equilibrium to study the strategic form of the basic model. A pair of strategies, one for the plaintiff and one for the defendant, is a Nash equilibrium if, given the strategy of the other litigant, each party would maximize his payoff by choosing the strategy stated for him. In our model, for example, if the parameters are such that $qW - \pi < 0$, then the pair of strategies (sue; try, drop) for the plaintiff and (try, try) for the defendant constitutes a Nash equilibrium. This results because, given that the defendant chooses (try, try), the plaintiff maximizes his expected return by selecting the strategy (sue; try, drop). Likewise, given that the plaintiff chooses (sue; try, drop), both types of defendant maximize their winnings with the strategy (try, try).

The parameters of the model are W, π, δ, S, and q. Whether a particular pair of strategies forms a Nash equilibrium depends on the relative values of the parameters. There are six potential Nash equilibria:

NE1: (sue; settle, try) and (settle, settle);
NE2: (sue; settle, try) and (try, try);
NE3: (sue; try, try) and (settle, settle);
NE4: (sue; try, try) and (try, try);
NE5: (sue; try, drop) and (try, try);
NE6: (sue; settle, drop) and (try, try).

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[2] We illustrate the computation of the entries for this combination. First, the plaintiff files an action. Then if the defendant is in violation, he will offer to settle. According to the plaintiff's strategy, he (the plaintiff) will refuse the offer of settlement. Hence, the case goes to trial. The plaintiff receives the award less his legal fees, $W - \pi$, while the defendant loses the award plus his legal fees, a total of $W + \delta$. This occurs with probability q. If the defendant is not in violation, he will not offer to settle, in which event the plaintiff will drop the case. In this case both parties lose and gain nothing. This occurs with probability $(1 - q)$. Thus, the expected return of the plaintiff is $q(W - \pi)$, and the return of the defendant is $-W - \delta$ if he is in violation and nothing if he is not.

Figure 2 is a partition of the parameter space into the regions in which these potetntial Nash equilibria exist.

In general, the outcome of the players' chosen strategies will depend on the true type of the defendant. In all the potential Nash equilibria of this game, however, the defendant chooses strategies in which his action does not depend on his true type. Thus, the Nash equilibrium outcomes here do not depend on the true type of the defendant.

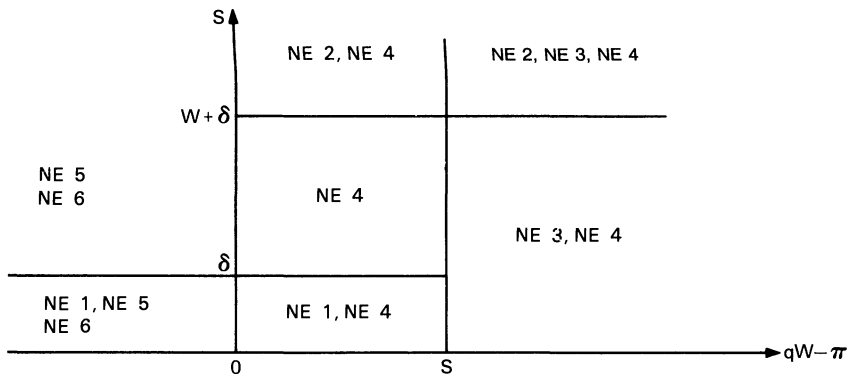
The outcomes of the potential Nash equilibria are, respectively:

NE1: settlement;
NE2: trial;
NE3: trial;
NE4: trial;
NE5: plaintiff drops the action;
NE6: plaintiff drops the action.

It seems intriguing that, in Nash equilibrium, the defendant does not gain any advantage from his private information. In some sense, this is socially wasteful: one of the parties has crucial information, but the incentives of the legal system are for him quite deliberately to disregard his information in his behavior. The reason for this is simple. If the litigants are in Nash equilibrium, each party has correct beliefs about the strategy of the other. Hence, if the defendant's action were to depend on his true type, the plaintiff could deduce precisely the true type of the defendant from the defendant's move. Moreover, the judiciary is perfect: if the defendant is a violator, the result of the trial would be judgment in favor of the plaintiff; if the defendant is not a violator, the result of the trial would be judgment in favor of the defendant. Hence, for example, if the plaintiff deduces that the defendant did not violate the law, he would have no incentive to go to trial—he would be certain of losing the amount of his legal costs, π, with no prospect of winning anything.[3]

FIGURE 2

NASH EQUILIBRIA UNDER ALTERNATIVE PARAMETER VALUES



[3] I have studied an extension of the basic model in which there is incomplete information on one side but there is some probability of judicial error; that is, in which a judgment for the plaintiff is possible even if the defendant is not a violator, and similarly, a judgment for the defendant is possible; even if he is in fact a violator. For this more elaborate game, the list of potential Nash equilibria include pairs of strategies in which the defendant chose (settle, try) and one in which the defendant chose (try, settle). In this case, the plaintiff might still profit from trial, even if he had access to the defendant's information. Whether he would do so would depend on the probability of judicial error. Hence under certain circumstances, the defendant would not care about revealing his private information.

The remaining results are observations about the Nash equilibria of the basic model and are derived from the partition of the parameter space shown in Figure 2. In only two areas of the space are there multiple Nash-equilibrium outcomes. In all other areas, there may be multiple Nash equilibria, but all the equilibria give rise to an identical outcome—that is, either settlement, trial, or the plaintiff's dropping the case. Hence, the concept of Nash equilibrium yields fairly strong predictions about the outcome of the long-run behavior of the litigants. The theory is ambiguous when $S \leq \delta$ and $qW - \pi \leq S$.

The plaintiff brings the case to trial only if his expected return from trial is nonnegative, that is, $qW - \pi \geq 0$. Otherwise, the case is either settled out of court or the plaintiff drops the case. The plaintiff drops the action only if his expected return from a trial is negative, that is, $qW - \pi < 0$. It is important to emphasize that this is a necessary, not a sufficient, condition: the plaintiff might still be able to extract a settlement under these conditions. This possibility is developed in Section 5, which is a study of frivolous suits.

Settlement occurs only if the amount of the settlement is no less than the plaintiff's expected return from trial and no greater than the defendant's legal costs; that is, $S \in [qW - \pi, \delta]$. Thus, the model verifies Posner's remark that "other things being equal, the higher the stakes in a case, the more likely it is to be litigated" (1977, p. 436).

4. Private efficiency of the litigative process

■ The outcome of a legal action has consequences not only for the litigants involved but also for their lawyers, the size and character of the load on the judicial system, and other individuals who might engage in behavior that would lead to similar legal actions. We shall mention briefly the effects on other litigants, and then explain the approach taken in this article.[4]

The most important effect is that of deterrence, in the most general sense. For instance, if malpractice actions against surgeons for careless surgery tend to be settled out of court for $10,000, aggrieved patients and accused surgeons will adjust their behavior accordingly. Or, if the management of some corporation tends not to offer to settle frivolous antitrust actions against the firm, potential plaintiffs will be deterred from bringing such frivolous actions. There is another externality when the action goes to trial and a previously undecided area of the law is clarified by the courts.[5] Finally, the outcome of the strategies chosen by the litigants affects other litigants in all areas of law. If the outcome is to go to trial, the action will add to the backlog of cases awaiting hearing. One aspect of litigation that is not captured in the basic model studied here is the impact of the waiting time to trial on the litigants' willingness to go to trial.

In the present analysis, I shall confine attention to the two litigants and ignore the effects of their choice of strategies on other individuals. The discussion will be concerned with *private efficiency*—that is, efficiency within the game,—rather than social efficiency.[6] It must be emphasized that the question of whether "there is too much litigation" can only be decided conclusively in an analysis of social efficiency.

In settings of complete information, where all individuals have identical information, it is typical to apply the concept of Pareto efficiency. A direct application of this concept to a situation with incomplete information is not appropriate since the analysis should take account of the differences in the information available to the various individuals.

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[4] The other issues are outlined in Posner (1977, pp. 399–460).

[5] Landes and Posner (1976) apply the theory of capital to the description of the development of the case law. They do not consider the question from the standpoint of efficiency.

[6] Shavell (1982b) presents a study of the private efficiency (in the sense defined here) of litigation in a model of complete information.

For instance, in the basic model, consider the outcome of the pair of strategies (sue; settle, try) for the plaintiff and (settle, try) for the defendant. The plaintiff values this pair at its expected return to him, *viz.*, $qS - (1 - q)\pi$. In contrast, the value of the pair of strategies to the defendant depends on the true type of the defendant. If he is in truth a violator, his strategy calls for him to offer to settle, in which case, given the plaintiff's strategy, the outcome will be a settlement and the defendant's return will be a loss of S. If, in truth, the defendant is not a violator, his strategy calls for him to refuse to offer to settle, in which case the outcome will be that the plaintiff will go to court and the defendant will lose the amount of his legal fees, δ. There is a complication because although the defendant evaluates the pair of strategies with regard to his private information, the central planner does not necessarily have access to such private information.

In such settings, it is appropriate to assess *decision rules* rather than decisions *per se*.[7] It is easiest to explain the meaning of a decision rule with an example. Let the central planner proclaim that the defendant shall be asked to reveal his type under the following conditions: if he announces that he is in violation, the plaintiff will be required to play (sue; settle, try) and the defendant required to play (settle, settle), while if the defendant announces that he is not in violation, the litigants will be required to play (sue; settle, try) and (try, settle), respectively.[8] In general, a decision rule is an assignment of actions to parties according to the types that they announce. A *decision* is an assignment where the assigned actions do not depend on the types announced by the players.

Holmström and Myerson argue that the appropriate concept of efficiency to apply is *interim incentive-compatible efficiency.* In the current setting, a decision rule is interim incentive-compatible efficient if:

(1) it is implemented at a time when the defendant has his private information but the plaintiff is not privy to the defendant's information;
(2) it is incentive-compatible; that is, knowing the decision rule, the defendant will find it in his best interest to reveal his type truthfully; and
(3) it is not Pareto-dominated by another interim incentive-compatible decision rule.

The set of potential Nash equilibria for the basic model was compared with the set of interim incentive-compatible efficient decision rules for the basic model. It was found that there were no conditions on the parameters under which any of NE1, NE2, NE3, NE5, and NE6 was Pareto-dominated by interim incentive-compatible decision rules.

The analysis revealed two cases in which NE4 is dominated by interim incentive-compatible decision rules. When $\delta \geq S \geq qW - \pi$, that is, when the settlement amount is less than the defendant's legal costs and greater than the plaintiff's expected return from trial, then NE4 is dominated by any of the interim incentive-compatible decision rules which force a settlement regardless of the defendant's announcement. The condition implies that $\pi + \delta \geq qW$: in this case, the litigants agree that it is not worthwhile to expend $\pi + \delta$ to achieve an expected transfer of qW.

Perhaps more important is the observation that if $W + \delta \geq S \geq \max\{W - \pi, \delta\}$, that is, if the amount of the settlement is less than the net loss from trial for a defendant in violation but greater than both the plaintiff's net return from trial in the event that the defendant is in violation, and the defendant's legal costs, then NE4 is dominated by any of the interim incentive-compatible decision rules which require a settlement if the defendant announces that he is in violation and a trial otherwise.

We see that although the individuals acting alone could not make use of the defen-

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[7] The following argument is motivated by Holmström and Myerson (1981).

[8] Note that the defendant will be bound to play his assigned strategy according to his announced type. For instance, if he announces that he is in violation, he will be required to offer to settle.

dant's information, society could design a mechanism which would elicit and then use this information in such a way that *both* parties' positions would be improved.

5. Frivolous suits

■ The explanatory power of the basic model is revealed most strikingly in an application to the study of frivolous suits. The approach adopted here is to study the Nash equilibria of the basic model as the probability of the defendant's being a violator becomes very small. It seems reasonable to characterize a frivolous suit as an action where both sides know that it is very unlikely that a trial outcome will favor the plaintiff.

Ceteris paribus, as the probability that the defendant is indeed in violation becomes very small, as $q \to 0$, it becomes more likely that the plaintiff will expect to lose money by going to trial, that is, that $qW - \pi < 0$. Thus from Figure 2 it may be seen that the set of potential Nash equilibria is reduced to NE1, NE5, and NE6. Recall that the outcomes of these potential Nash equilibria are, respectively, settlement, plaintiff drops the action, and plaintiff drops the action—and the outcomes do not depend on the true type of the defendant. To some extent, this result accords with the folklore: a plaintiff brings a frivolous action in the hope of extorting a settlement that is less than the value of the defendant's legal costs. The analysis also points to another possibility: the defendant may be able to deter plaintiffs who have filed actions from bringing these to trial by adopting a strategy of refusing to settle, whatever his true type.

The latter observation is quite sensitive to the particular structure of the basic model. Suppose that there is some cost π_0, where π_0 is included in π, which the plaintiff must incur in filing a legal action, regardless of whether it goes to trial. Then the pairs (sue; try, drop) and (try, try), and (sue; settle, drop) and (try, try) cease to be potential Nash equilibria. In this case, (do not sue) and (try, try) is a potential Nash equilibrium. The interpretation of this Nash equilibrium is straightforward—the defendant deters plaintiffs from bringing actions by forging a reputation for being tough.

We now present an example to illustrate the occurrence of frivolous suits. Let the parameters take values as follow (where all amounts are in millions): $W = 1.0$; $\pi = .1$; $\pi_0 = .005$; $\delta = .2$; $S = .15$; and $q = 1\%$.

The game in strategic form corresponding to the above parameters is given in Table 2.

By inspection, it may be seen that the Nash equilibria of the game are the pairs (do not sue) and (try, try), and (sue; settle, try) and (settle, settle). Incidentally, this example also shows that it may profit a plaintiff to file an action even though his expected return from trial is negative. (In this example, the plaintiff's expected return from trial is $qW - \pi = -.09$.)

Thus, in the somewhat more general model with a positive cost of filing a legal action, there are two Nash equilibria: (i) (do not sue) and (try, try) from which the outcome is that the plaintiff does not bring an action, and (ii) (sue; settle, try) and (settle, settle) from which the outcome is a settlement. Trial is not a Nash equilibrium outcome.

There remains the question of which of the two Nash equilibria will be realized in practice. The following remarks are preliminary in nature.

Consider the second Nash equilibrium, (sue; settle, try) and (settle, settle). It is reasonable to ask whether the plaintiff's threat to go to trial is credible. After all, by doing so, he would only be certain of losing money. Hence, it might be argued, the defendant should recognize this and refuse to offer to settle, in which case the only "reasonable" Nash equilibrium is the first. This line of attack is still more convincing in the context of repeated litigation: it may profit a potential defendant to develop a "reputation for toughness" to deter frivolous suits. As Posner (1977, p. 447) has observed, there is a close parallel between the issues discussed here and the question of predatory pricing by firms established in an

TABLE 2 **Example of Frivolous Suit: Strategic Form of the Game**

Plaintiff's Strategy	Defendant's Strategy							
	settle,	settle	try,	try	settle,	try	try,	settle
do not sue	0,	(0, 0)	0,	(0, 0)	0,	(0, 0)	0,	(0, 0)
sue; settle, try	.145,	(−.15, −.15)	−.09,	(−1.2, −.2)	−.098,	(−.15, −.2)	.153,	(−1.2, −.15)
sue; try, try	−.09,	(−1.2, −.2)	−.09,	(−1.2, −.2)	−.09,	(−1.2, −.2)	−.09,	(−1.2, −.2)
sue; try, drop	−.09,	(−1.2, −.2)	−.005,	(0, 0)	.004,	(−1.2, 0)	−.099,	(0, −.2)
sue; settle, drop	.145,	(−.15, −.15)	−.005,	(0, 0)	−.004,	(−.15, 0)	.144,	(0, −.15)

industry. Several important economic analyses of predatory behavior have been completed recently and they are discussed in Dixit (1982). A promising avenue for further research is to apply their findings to the study of frivolous suits.

It is immediate from the basic model with $q \to 0$ that the implementation of English rules of awarding legal costs according to the trial judgment will be an effective deterrent of frivolous suits. To take the extreme case of $q = 0$, English rules would raise the plaintiff's legal costs in the event of trial to $\pi + \delta$ and lower the defendant's costs in the event of trial to nothing. From Figure 1, it may be observed that a necessary condition for NE1 (from which the outcome is settlement) to be a Nash equilibrium is that the amount of the settlement be no greater than the defendant's legal costs. Hence, if the latter are zero, settlement can only occur with the amount being zero.

6. Concluding remarks

■ The main objective of this article has been to argue that the appropriate technique for modeling litigation is the theory of games with incomplete information. To do so, we developed a model of a simple case. Although the basic model was quite primitive, it yielded several insights not revealed by the single-person decision-theoretic approaches.

There are three directions in which the basic model may be extended. First, it would be more realistic to suppose that litigation is characterized by incomplete information on both sides. Just as the defendant has private information, the plaintiff too has private information. Second, it is imperative that the process of settlement be modeled. Third, it would be interesting to include an intermediate stage between suit and trial, if the parties do not settle immediately and the plaintiff does not drop the action immediately. It cannot be overemphasized that the revelation of information during discovery is a problem of strategic choice for the two parties.

It also remains to expand Holmström and Myerson's concept (1981) of interim incentive-compatible efficiency within the game to permit analysis of the social efficiency of the outcome of litigation.

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