Against Compromise: A Mechanism Design Approach

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A risk-neutral plaintiff sues a risk-neutral defendant for damages that are normalized to one. The defendant knows whether she is liable or not, but the plaintiff does not. We ask what are the settlement procedures and fee-shifting rules (which, together, we call a mechanism) that minimize the rate of litigation subject to maintaining deterrence. Two main results are presented. The first is a characterization of an upper bound on the rate of settlement that is consistent with maintaining deterrence. This upper bound is shown to be independent of the litigants' litigation cost. It is shown that any mechanism that attains this bound must employ the English fee-shifting rule (according to which all litigation costs are shifted to the loser in the trial). The second result describes a simple practicable mechanism that attains this upper bound. We discuss our results in the context of recent legal reforms in the United States and United Kingdom.

1. Introduction

There is a widespread perception that the administration of civil justice in many places around the world is severely compromised by high litigation costs and long delays. This perception is supported by comparative analysis that demonstrates that problems of cost and delay persist across national and cultural boundaries. According to some commentators, the situation in some countries is grave enough to be considered a crisis (Zuckerman, 1999).[1]

The recognition that an increased incidence of out-of-court settlements may help save time, cut costs, and reduce existing backlogs has led to the implementation of law reforms that were backed by legislators, courts, and academics, and whose purpose was to facilitate settlements. Two notable examples are

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1. Even those who avoid the term crisis agree that there is an increasing problem of cost and delay. See Woolf (1995), the Federal Courts Study Committee (1990), and Brookings Institution (1989). See also Galanter (1983) and Posner (1996).

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the Civil Justice Reform Act (1990) (CJRA) in the United States, and the Civil Procedure Rules (1998) (CPR) in Britain. Both American and British rules of procedure seek to reduce the rate of litigation by encouraging early judicial involvement in pretrial stages, promoting the use of alternative dispute resolution (ADR) mechanisms such as arbitration, mediation, and early neutral evaluation, and by using offer-of-judgment fee-shifting rules that condition the allocation of litigation costs on early settlement offers as well as on the outcome of the trial. The purpose of these rules is to encourage litigants to resolve their disputes consensually by providing persistent support for settlement throughout the litigation process, from filing to trial.[2]

These procedural measures have been scrutinized both with respect to their effectiveness in reducing costs and delays, and with respect to their possible adverse effects on justice and deterrence. Empirical studies that have examined the effects of procedural changes on the rate of filing lawsuits, on the expected time from filing to termination, and on litigants' and administrative costs have shown that active judicial involvement in settlement negotiations and referral to ADR mechanisms had no significant effect on either one of these measures (Kakalik et al. 1996a, b). Theoretical research of other mechanisms, notably fee-shifting rules and strict pleading standards, has come up with no definitive conclusions with respect to the effects of such mechanisms on the rate of litigation and litigation costs.[3] In addition, concerns have been raised about the possible implications of such reforms on the substantive content of the law, namely, justice and deterrence. Settlement has been claimed to be normatively inferior to litigation (Fiss, 1984); managerial judging has been alleged to undermine inherent values of the judicial system (Resnik, 1982); and promotion of ADR has been questioned over its possible adverse effects on deterrence (Shavell, 1996; Hay 1997).

Although the debate over civil justice reform is fraught with ambiguity about what is exactly an optimal procedural system,[4] both American and British rules of civil procedure seem to agree that the main objective should be the attainment of procedural efficiency (namely, reducing cost and delay) together with substantive justice and deterrence.[5] Yet existing theoretical literature, for the most part, has focused on only one of these considerations. This article presents a first attempt to address both procedural and substantive considerations in the search for an optimal procedural mechanism.

We restrict our attention to cases in which the amount of damages is not contested and the only disagreement between the parties is over the defendant's

2. See Woolf (1996) and the references from note 1.

3. This literature is briefly surveyed below.

4. See, for example, Leubsdorf (1999: 57).

5. Rule 1 of the American Federal Rules of Civil Procedure (FRCP) states that the rules "shall be construed and administered to secure the just, speedy and inexpensive determination of every action." Rule 1.2 of the British Civil Procedure Rules provides that "These rules are a new procedural code with the overriding objective of enabling the court to deal with cases justly," where dealing with a case justly is interpreted as saving expense and ensuring that cases are dealt with expeditiously and fairly.

liability. We ask what is the settlement procedure and fee-shifting rule (which together we call a mechanism) that minimizes the rate of litigation subject to maintaining a given fixed differential between the expected liability of a liable and a nonliable defendant, as prescribed by the law. For reasons that will be more fully elaborated below, we call this constraint the deterrence constraint.

We present two main results. The first result (Theorem 1) identifies an upper bound on the rate of settlement (which is equivalent to a lower bound on the rate of litigation) that is consistent with maintaining the deterrence constraint. Interestingly, this upper bound is independent of the parties' litigation costs. This normative result stands in stark contrast to the literature on litigation and settlement, which has consistently maintained that the probability of settlement would increase as litigation costs increase (e.g., Posner, 1973; Bebchuk, 1984). Thus a reduction in per case litigation costs would have an ambiguous welfare effect because it would imply more trials, but lower costs per trial. In contrast, our result shows that reducing per case litigation costs would unequivocally reduce total litigation costs, provided of course that deterrence is not compromised.

Furthermore, we show that, conditional on the plaintiff having suffered damage, the upper bound on the rate of settlement is increasing in the ex ante probability that the defendant is liable. That is, as more defendants abide by substantive law, fewer disputes arise, yet a higher proportion of such disputes are litigated to judgment. Finally, it is also shown that any mechanism that achieves the upper bound on the rate of settlement must employ the English fee-shifting rule, according to which all litigation costs are shifted to the loser in trial.

The second result (Theorem 2) describes a simple practicable mechanism that attains the upper bound identified in Theorem 1. This mechanism (which we call a pleading mechanism) assumes the following form: let the defendant plead liable or not. Instruct a defendant who admitted liability to pay the plaintiff the entire sum of damages. If the defendant denies her liability, let the plaintiff decide whether he wants to proceed to trial or not. If he does, shift all litigation costs to the loser in the trial (following the English fee-shifting rule).

Notably, the pleading mechanism described above does not allow the parties to compromise. Either the defendant pays the plaintiff's damages in full or the plaintiff drops the suit — no middle ground is sought or permitted. If neither party gives up, the case is litigated to judgment. This surprising feature of the optimal mechanism is a consequence of its objective of minimizing litigation subject to preserving deterrence. Compromise dilutes deterrence because it narrows the difference between the expected payment of liable and nonliable defendants. Such dilution may of course be offset by a higher rate of litigation, but at the cost of frustrating the initial goal of maximizing the rate of settlement.

In addition, under the pleading mechanism, all negotiations between the parties take place before pretrial activity begins and before any litigation costs are incurred. It therefore follows that this mechanism minimizes not only the probability of litigation but also total litigation costs, and it is thus the most "speedy and inexpensive" mechanism among all possible mechanisms that induce the same level of deterrence.

One implication of the optimality of the pleading mechanism concerns the efficacy of information revelation procedures, most importantly those practiced during pretrial discovery. We show (Corollary 1) that such procedures cannot increase the probability of settlement without compromising deterrence. Thus in the simple setting of our model, discovery procedures are at best unnecessary. This finding is to be compared to previous economic analysis of discovery rules, which has shown that by inducing full exchange of information before trial, discovery can increase the probability, accuracy, and efficiency of settlements if it is not misused (e.g., Cooter and Rubinfeld, 1994).

Another implication of the optimality of the pleading mechanism is that when the disagreement between the parties is mainly about the defendant's liability, there may be no need to resort to sophisticated fee allocation rules that are based not only on findings of liability on trial, but also on early settlement offers (offer of judgment rules), such as Rule 68 of the FRCP and Part 36 of the CPR.[6] Indeed, the literature on offer of judgment rules [most notably Spier (1994a)], as well as case law, have concluded that Rule 68 would not facilitate settlements when liability is the main issue to be decided at trial. Yet the possibility that there are other types of fee allocation rules that would encourage settlement has not been ruled out. Our analysis shows that when the social goals of justice and deterrence are imposed as a constraint on the settlement procedure, no fee allocation rule may outperform the simple English fee-shifting rule that is accompanied by an effective ban on late settlements.

The literature on litigation and settlement under incomplete information has often suggested that the American fee allocation rule, according to which each party bears its own litigation cost irrespective of the outcome at trial, induces a higher rate of settlement than the English fee-shifting rule [see Bebchuk (1984) and Talley (1995), but also Reinganum and Wilde (1986), who argued the ranking is indeterminate]. Some economic and legal scholars have investigated the welfare properties of different fee allocation rules,[7] and there is also

6. According to Rule 68 of the FRCP, a defendant may serve upon the plaintiff an offer of judgment that the plaintiff may accept within 10 days. An offer that is not accepted within this time is deemed withdrawn, and if the final judgment obtained by the plaintiff is less favorable than the offer, the plaintiff must pay the defendant all costs, except attorney fees, incurred after the making of the offer. Part 36 of the CPR in Britain is similar.

7. Gravelle (1993) analyzes the effect of fee-shifting rules on both primary behavior and litigation and settlement incentives. Yet his model is based on a specific take-it-or-leave-it bargaining mechanism in a setting of mutual optimism that does not allow for information asymmetry (see also Landes, 1971; Posner, 1973; Gould, 1973; and Shavell, 1982). Hylton (1993) discusses the welfare effects of fee-shifting rules under a negligence regime, but does not construct a comprehensive model that accounts for both primary behavior and litigation and settlement incentives; Beckner and Katz (1995) discuss the welfare effects of fee-shifting rules when settlement is not available. In all these articles, the results about which fee-shifting rule is optimal are mostly inconclusive.

Further theoretical and empirical analysis of offer of judgment fee-shifting rules may be found in Miller (1986), Rowe and Vidmar (1988), Schwarzer (1992), Anderson (1994), Anderson and Rowe (1995), Rowe and Anderson (1996), Chung (1996), Hylton (1996), and Farmer and Pecorino (2000).

some related literature on optimal damage awards when settlement is possible [see, e.g., Spier (1994b) and Polinsky and Rubinfeld (1988)]. However, none of the studies mentioned above has tried to identify the optimal settlement procedure and fee-shifting rule when the goal is to minimize the cost of litigation subject to the constraints imposed by substantive law, such as maintaining deterrence. As we show, deterrence introduces a binding constraint on the set of feasible settlement mechanisms, with the consequence that the likelihood of litigation is minimized by the English, and not the American, fee-shifting rule.

In a related article, Spier (1997) analyzed the welfare implications of settlement and deterrence in a simple bargaining model where the probability that the defendant is liable is determined endogenously. She obtained mixed results about the English rule and showed that reliance on damage multipliers would improve overall efficiency. Hylton (2002), who considers a similar model, showed through simulation methods that reliance on the English fee-shifting rule generates higher welfare than reliance on the American rule. This article takes a different perspective: rather than asking what would be the "optimal" level of deterrence, we optimize given a specific level of deterrence. Furthermore, unlike Spier (1994a, 1997), this article assumes the plaintiff's threat to litigate must be credible in view of the information that is revealed in the pretrial bargaining process (in fact, we impose a stronger constraint, which we call renegotiation proofness; the relationship between these two constraints is discussed in Section 4.3). As we show, in the optimal mechanism, both the deterrence and the renegotiation proofness constraints must be binding.

The rest of the article proceeds as follows. Section 2 presents the model. Section 3 is devoted to deriving an upper bound on the rate of settlement. In Section 4 we discuss three possible extensions of the basic model, including optimal deterrence, court errors, and alternative notions of renegotiation proofness. In Section 5 we analyze the properties of the pleading mechanism described above and prove its optimality. In Section 6 we extend the basic model to include a discovery phase. It is shown that our main conclusions are unaffected by this change. Finally, Section 7 concludes. All proofs are relegated to the appendix.

2. The Model

We consider the following situation. A risk-neutral plaintiff sues a risk-neutral defendant for the loss he incurred in an accident. The value of the loss is normalized to one. If the case proceeds to trial and the defendant is found liable, then she is required by the court to pay the plaintiff a sum $J > 0$. The judgment against a liable defendant, J, may, but need not necessarily, be equal to the plaintiff's loss. If, on the other hand, the defendant prevails in court, then she does not have to pay the plaintiff anything. Both the plaintiff and the defendant incur litigation costs, denoted $c^P, c^D \geq 0$, respectively. Total litigation costs are denoted by $c \equiv c^P + c^D$. These costs can be incurred before or during the trial. Settling the case before it goes to trial allows the parties to save part or all of their litigation costs.

The defendant knows whether she is liable or not, and it is assumed that the defendant's liability can be precisely determined at trial (the consequences of relaxing this assumption are discussed in Section 4.2). Yet before the end of trial, no one except the defendant herself knows for sure whether she is liable or not. We denote the (ex ante) probability that the plaintiff assigns to the defendant being liable as $0 \leq p \leq 1$. The plaintiff's belief, p, is assumed to be commonly known. The defendant is thus assumed to be of one of two types, denoted L and N for liable and not, respectively; the plaintiff, who holds no private information, is assumed to have only one type.

Our approach is motivated by the idea that the goal of the legal system should be the minimization of legal costs subject to the constraints imposed by practicability and substantive justice. We are therefore interested in the question of what combination of pretrial bargaining procedure and fee-shifting rule, which together is called a mechanism, maximizes the (ex ante) probability of settlement among all the possible mechanisms that satisfy the constraints of renegotiation proofness (accounting for the practicability of the mechanism) and deterrence (which is motivated by considerations of substantive justice). We restrict attention to fee-shifting rules. That is, we assume that the court may only divide the total costs of litigation between the defendant and the plaintiff. It cannot "punish" or "reward" the parties through any other means, and it cannot decouple its judgment so that the award to the plaintiff would be different from the defendant's payment.[8]

We say that a mechanism is renegotiation proof if upon being informed that the case proceeds to trial, there does not exist any settlement offer that both liable and nonliable defendants as well as the plaintiff, given his updated beliefs, all strictly prefer to proceeding to trial.[9]

Deterrence is taken into account through the requirement that the mechanism be such that the induced difference between the expected payments of liable and nonliable defendants may not be lower than some amount $D > 0$. Notably the very same mathematical constraint can also be justified by appeal to other considerations of substantive justice, such as corrective justice, or just allocation. Throughout our analysis, we treat both D and J as fixed, exogenous parameters. In Section 4.1, we explain how D and J should be set to achieve "optimal deterrence" taking the cost of precaution into account. Still, it is usually the case under a negligence regime that a defendant who is found liable at trial pays the plaintiff his actual loss, which we have assumed to be equal to one. Furthermore, it seems reasonable to suppose that a judgment of one reflects what is "just" or "fair" to impose on a liable, versus from a nonliable, defendant. Thus the case in which $D = J = 1$ merits special consideration when considering the practical

8. Clearly, allowing the court to punish or reward the parties beyond fee shifting would greatly enhance its power to enforce settlement. Decoupling may also enhance the court's ability to promote deterrence and reduce administrative and litigation costs [see, e.g., Polinsky and Che (1991), but also Choi and Sanchirico (2004)]. Yet courts, as well as legislators, seem reluctant to implement such measures. We therefore take the more restrictive (and, in our view, more realistic) approach of maximizing social welfare within an existing legal culture and framework.

9. See Section 4.3 for a discussion of other notions of renegotiation proofness.

implications of the following analysis. Another case that merits special consideration is the one where the judgment J is set to be very large, that is, where $1, D \ll J$. This case may be interpreted as requiring liable defendants to pay punitive damages. Not surprisingly, setting J to be very large can be done in such a way that it increases social welfare. See Section 4.1 for details.

Renegotiation proofness and deterrence are the only constraints we impose on the mechanism. The class of mechanisms over which we optimize is thus very general and includes mechanisms in which settlement is obtained, if at all, only after some time has passed and the parties have incurred part of their litigation costs.[10] However, an additional important, although implicit constraint is that before the conclusion of the trial, neither the plaintiff nor the court receive any signal about the defendant's liability that is independent of the defendant's actions. This constraint is relaxed in Section 6, where we discuss the issue of discovery.

3. An Upper Bound on the Likelihood of Settlement

The formal description and analysis of the optimization problem described above rely on the well-known revelation principle (see, e.g., Myerson, 1985), which is applied here as follows. Any (Bayesian) equilibrium under any mechanism induces (i) probabilities with which the two types of defendant settle, denoted q_N and q_L, respectively; (ii) expected settlements for each of the two types of defendant, denoted s_N and s_L, respectively; and (iii) expected legal costs that are borne by the defendant depending on the defendant's report of her type and the outcome of the trial, denoted $c^D_{N,N}$, $c^D_{N,L}$, $c^D_{L,N}$, and $c^D_{L,L}$, respectively. Restricting our attention to fee-shifting rules implies that the expected legal costs borne by the plaintiff as a function of the defendant's report of her type and the outcome of the trial are given by $c^P_{N,N} \equiv c - c^D_{N,N}$, $c^P_{N,L} \equiv c - c^D_{N,L}$, $c^P_{L,N} \equiv c - c^D_{L,N}$, and $c^P_{L,L} \equiv c - c^D_{L,L}$, respectively. It is thus possible to characterize every Bayesian equilibrium under any mechanism in terms of the vector $(q_N, q_L, s_N, s_L, c^D_{N,N}, c^D_{N,L}, c^D_{L,N}, c^D_{L,L})$.

The revelation principle implies that attention may be restricted, without any loss of generality, to "truth-telling" equilibria in "direct revelation" games in which the defendant is asked to report her type, and she reports it truthfully. If she reports type $i \in \{L, N\}$, then the case settles with probability q_i for the sum s_i, and with probability $1 - q_i$ the case proceeds to trial where the defendant bears litigation costs $c^D_{i,N}$ or $c^D_{i,L}$ depending on the outcome of the trial.[11]

10. We do not model the passing of time explicitly; rather, a settlement that is reached after some litigation costs have already been incurred may be interpreted as implying that some time has passed. See Section 6 for details.

11. Intuitively, consider any Bayesian equilibrium in any game. Rename the equilibrium strategies chosen by liable and nonliable defendants by L and N, respectively, and redefine the outcome function such that when the defendant employs strategy $\sigma \in \{L, N\}$, the outcome is given by $(q_\sigma, s_\sigma, \hat{c}^D_{\sigma,L}, \hat{c}^D_{\sigma,N})$. Because truthful reporting in the direct revelation game induces the equilibrium outcome in the original game, and nontruthful reporting generates a different possible outcome in the original game, the fact that we started with an equilibrium implies that truthful reporting must be an equilibrium as well.

The ex ante probability of settlement in a truthful equilibrium in a direct revelation game is given by

$$pq_L + (1-p)q_N,$$

because with probability p the defendant is liable and the case settles with probability q_L, and with probability $1 - p$ the defendant is not liable and the case settles with probability q_N. The expected payment of a nonliable defendant in such an equilibrium is given by

$$q_N(-s_N) + (1-q_N)(-c^D_{N,N}),$$

because with probability q_N the case settles for s_N, and with probability $1 - q_N$ the case proceeds to court where the defendant is found not liable and so has to pay only the litigation costs $c^D_{N,N}$. Similarly the expected payment of a liable defendant in such an equilibrium is given by

$$q_L(-s_L) + (1-q_L)(-J - c^D_{L,L}).$$

The equilibrium where the ex ante probability of settlement is maximized among all equilibria under all mechanisms that satisfy renegotiation proofness and deterrence may thus be characterized as the solution to the following constrained optimization problem. Find a feasible vector $(q_N, q_L, s_N, s_L, c^D_{N,N}, c^D_{N,L}, c^D_{L,N}, c^D_{L,L})$ that maximizes the objective function

$$pq_L + (1-p)q_N. \tag{1}$$

The feasible set is defined by 12 constraints—2 incentive compatibility constraints, the renegotiation proofness and deterrence constraints, and 8 constraints that are due to fee shifting. The two incentive compatibility constraints, one for liable [Equation (3)] and the other for nonliable [Equation (2)] defendants, require that the expected payment for the defendant when she reports her type truthfully is larger than or equal to her expected payment when she reports she is of the other type:

$$q_N(-s_N) + (1-q_N)(-c^D_{N,N}) \geq q_L(-s_L) + (1-q_L)(-c^D_{L,N}), \tag{2}$$

$$q_L(-s_L) + (1-q_L)(-J - c^D_{L,L}) \geq q_N(-s_N) + (1-q_N)(-J - c^D_{N,L}). \tag{3}$$

Together, Equations (2) and (3) ensure that truthful reporting of types is indeed optimal for both types of defendant.

Renegotiation proofness requires that, conditional on proceeding to trial, there does not exist a settlement offer $\hat{s}$ such that the expected payment to the plaintiff given his updated beliefs is smaller than $\hat{s}$, and the expected payments of both types of defendant are greater than or equal to $\hat{s}$. Thus it is required that for any settlement offer $\hat{s}$, either

$$\frac{(1-p)(1-q_N)(-c^P_{N,N})+p(1-q_L)(J-c^P_{L,L})}{(1-p)(1-q_N)+p(1-q_L)} \geq \hat{s},$$

or

$$\min\{c^D_{N,N}, J+c^D_{L,L}\} < \hat{s}.$$

The two preceding inequalities are combined into the following renegotiation proofness constraint as follows:

$$\frac{(1-p)(1-q_N)(-c^P_{N,N})+p(1-q_L)(J-c^P_{L,L})}{(1-p)(1-q_N)+p(1-q_L)} \geq \min\{c^D_{N,N}, J+c^D_{L,L}\} \quad (4)$$

The deterrence constraint requires that the difference between the expected payments of liable and nonliable defendants be greater than or equal to D, or

$$q_N(-s_N)+(1-q_N)(-c^D_{N,N}) \geq q_L(-s_L)+(1-q_L)(-J-c^D_{L,L})+D. \quad (5)$$

Finally, fee shifting imposes eight more constraints,

$$0 \leq c^D_{N,N}, c^D_{N,L}, c^D_{L,N}, c^D_{L,L} \leq c. \quad (6)$$

Theorem 1. If $c \leq \frac{pJ}{1-p}$ and $D \leq J + c$, then

(i) The ex ante probability of settlement induced by any mechanism that satisfies renegotiation proofness and deterrence is less than or equal to $1-(1-p)\frac{D}{J}$ (it therefore follows that the rate of litigation induced by any mechanism that satisfies renegotiation proofness and deterrence is greater than or equal to $(1-p)\ \frac{D}{J}$); and

(ii) If a mechanism that satisfies renegotiation proofness and deterrence induces an ex ante probability of settlement that is equal to $1-(1-p)\ \frac{D}{J}$, then it must employ the English fee-shifting rule (that is, $c^D_{N,N}=0$ and $c^D_{L,L}=c$). Namely, if the defendant is found liable in court, then she bears the entire legal costs of both parties; if she is found not liable, then it is the plaintiff who bears the entire legal costs of both parties.

Notice that the maximum probability of settlement is increasing in J and decreasing in D. If deterrence is set equal to the judgment, $D = J$, then the upper bound on the probability of settlement equals the probability that the defendant is liable, p. We return to these observations when we discuss optimal deterrence in Section 4.1.

The proof of Theorem 1, which is based on using the constraints to bound the objective function from above is relegated to the appendix. It shows that Equations (2), (4), and (5), as well as four of the eight fee-shifting constraints ($c^D_{N,N}=0$, $c^D_{N,L}=c^D_{L,N}=c^D_{L,L}=c$), must all be binding in the optimal solution. This implies that the optimal solution, which consists of eight variables, has to satisfy seven equations, which reduces the dimensionality of the feasible set to one and makes the problem relatively easy to solve. Notably the proof is constructive and can be used to explicitly solve for an optimal direct revelation mechanism.

The intuition for why a mechanism that attains the upper bound specified in the theorem must employ the English fee-shifting rule is the following. If it had been commonly known whether the defendant was truly liable or not, then under the optimal mechanism the plaintiff and defendant would have settled with probability one, and because of the deterrence constraint, the difference between the expected settlements of liable and nonliable defendants would have been equal to D. Obviously such a mechanism is not incentive compatible. In a world in which the defendant's true liability is not known to anyone but herself, a liable defendant has an incentive to pretend she is not liable so she can settle for less. It follows that an optimal mechanism must provide an incentive for liable defendants to admit their liability. Because the defendant's true liability can only be verified in court, the only way to do this involves going to court with a positive probability. And because going to court is costly, the probability of going to court has to be minimized under the optimal mechanism. Now, conditional on the case going to trial, it is easy to see that the English fee-shifting rule is the one that maximizes the difference between the expected payments of liable and nonliable defendants. Therefore, because the optimal mechanism should provide the "cheapest" possible incentives for being truthful, deterrence implies that it must rely on the English rule, because in this way it is possible to satisfy the deterrence constraint with the lowest possible probability of going to trial. The reason is similar to the well-known argument that efficiency requires setting very large fines for those caught violating the law, but very small probabilities of detecting offenders (Becker, 1968).

Interestingly, the upper bound on the probability of settlement that is identified in Theorem 1 does not depend on the parties' litigation costs (however, the expected payments of and to the parties obviously do). Intuitively, this is due to the fact that under the English fee-shifting rule, as litigation costs increase, the plaintiff becomes less willing to proceed to trial. The defendant thus has a stronger incentive to deny her liability and refuse to settle in the hope that the plaintiff would drop the suit. Hence, as litigation costs rise, the plaintiff has a stronger incentive but the defendant has a weaker incentive to settle. Under the optimal mechanism, these two effects exactly cancel each other and so the likelihood of settlement remains constant.

If the first condition specified in Theorem 1 is not satisfied, that is, if $c > \frac{pJ}{1-p}$, then, under the English fee-shifting rule, the plaintiff's threat to sue is not credible.[12] Consequently, in this case, the defendant would refuse to admit her liability, rationally expecting the plaintiff to drop the suit. Deterrence

12. This is because the expected payment to the plaintiff if the case proceeds to trial is

$$p \cdot J + (1-p) \cdot (-c),$$

which is negative if and only if

$$c > \frac{pJ}{1-p}.$$

would obviously not be satisfied in this case, but the ex ante probability of settlement (which includes the case where the plaintiff drops the suit) would be one.

Finally, because the maximal payment that the court may impose on a liable defendant at trial is $J + c$, and the minimal payment (including litigation costs) of a nonliable defendant is zero, the maximal level of deterrence that can be supported by any mechanism is bounded from above by $J + c$. Intuitively, high deterrence depends on a high judgment to sustain it.

4. Extensions

In the next three subsections, we discuss three possible extensions of the basic model that address the issues of optimal deterrence, court errors, and alternative notions of renegotiation proofness.

4.1 The Incentive to Exercise Care and Optimal Deterrence

The starting point for our modeling is that an accident, which caused the plaintiff a damage of one, has occurred and the probability the defendant is liable is commonly known to be p. In this subsection we incorporate the ex ante incentives that prospective defendants have to exercise care into the model and address the issue of optimal deterrence.

Suppose that it is commonly known that the cost of exercising care is independently and identically distributed in the population of prospective defendants according to some cumulative distribution function, F. If the defendant exercises care, then the probability of an accident is π_L; if she does not, then it is π_H. We assume that $0 < \pi_L < \pi_H \leq 1$. Prospective defendants each know their own costs of exercising care, but these costs cannot be verified in court.

Under a negligence rule, the defendant is liable for the plaintiff's loss if and only if she failed to exercise care. If found liable at trial, the defendant would have to pay the plaintiff an amount J. As mentioned above, it seems natural to suppose that the judgment against a liable defendant be set equal to the loss caused to the plaintiff, but J could either be set higher, to account for the fact that an accident also imposes legal costs, or lower, to account for the fact that failing to exercise care only increases the probability of an accident by $\pi_H - \pi_L < 1$. Whether or not the defendant exercised care can only be verified at trial.

Recall that D denotes the difference between the expected payments, conditional on an accident having occurred, of liable and nonliable defendants, as specified by the deterrence constraint. If an accident does not occur, then the prospective defendant would not face a plaintiff and would not pay anything. Denote the expected payment (including litigation costs) that is made by a nonliable defendant conditional on an accident by x. Note that $x = q_N s_N + (1 - q_N)c^D_{N,N}$, which is equal, up to a sign, to the left-hand side of the deterrence constraint. The deterrence constraint implies that the expected payment of a liable defendant conditional on an accident is $x + D$.

From the point of view of a prospective defendant, the difference in expected payments between exercising care and not is

$$\Delta(x, D) \equiv \pi_H(x + D) - \pi_L x.$$

She would therefore exercise care if and only if her cost of doing so is less than or equal to $\Delta(x, D)$, and the plaintiff, who anticipates the prospective defendants' behavior, would assess a commonly known probability

$$p = \frac{\pi_H(1 - F(\Delta(x, D)))}{\pi_L F(\Delta(x, D)) + \pi_H(1 - F(\Delta(x, D)))}$$

to the event that the defendant is liable, given that an accident occurred.

We now address the issue of how to set the values of x, D, and J to maximize social welfare. Suppose first that the social planner is constrained to set the values of D and J to be equal to each other. Recall that in the case where $D = J$, by Theorem 1, the lower bound on the likelihood of litigation is given by $1 - p$ and is independent of the value of $D = J$.

Fix the underlying behavior of prospective defendants by fixing some level $\Delta \geq 0$. Note that every pair of x and D that is such that $\Delta(x, D) = \Delta$ induces the same behavior among prospective defendants, and so fixes (i) the plaintiff's belief about the likelihood that the defendant is liable conditional on an accident, p; (ii) the probability that an accident would occur $\Delta\pi_L + (1 - \Delta)\pi_H$; and (iii) the level of deterrence, in the sense that prospective defendants whose costs of exercising care are less than or equal to Δ exercise care, and those whose costs are higher do not. Hence once Δ is fixed, the maximization of welfare requires that among all the pairs in the set $\{(x, D) : \Delta(x, D) = \Delta\}$, the social planner would choose the x and D pair that minimizes expected litigation costs or maximizes the probability of settlement. Inspection of the proof of Theorem 1 in the appendix reveals that for any fixed D, minimization of the likelihood of litigation requires that x, the expected payment of a nonliable defendant conditional on accident, be set equal to zero. Because, as mentioned above, in the case where $D = J$, the likelihood of litigation under the optimal mechanism is independent of the value of D, it follows that among all the pairs in the set $\{(x, D) : \Delta(x, D) = \Delta\}$, the optimal pair is the one in which $x = 0$ and $D = \Delta/\pi_H$.

It is now left to determine the optimal level of Δ. The (minimal) expected costs that a prospective defendant imposes on society by exercising and failing to exercise care are $\pi_L + \pi_L(1 - p)c$ and $\pi_H + \pi_H(1 - p)c$, respectively. Therefore the expected benefit that is generated by exercising care is given by

$$(\pi_H - \pi_L)(1 + (1 - p)c),$$

and the maximization of social welfare requires that prospective defendants exercise care if and only if they have a lower cost of doing so. It follows that maximization of social welfare requires that Δ be set equal to $(\pi_H - \pi_L)(1 + (1 - p)c)$, and that x and D be set equal to zero and $\frac{\Delta}{\pi_H} = \frac{(\pi_H - \pi_L)(1 + (1 - p)c)}{\pi_H}$, respectively, where p is such that[13]

13. It can be verified that this equation has a unique solution for any values of c, π_H, π_L, and cumulative distribution function F.

$$p = \frac{\pi_H(1 - F((\pi_H - \pi_L)(1 + c - pc)))}{\pi_L F((\pi_H - \pi_L)(1 + c - pc)) + \pi_H(1 - F((\pi_H - \pi_L)(1 + c - pc)))}.$$

Suppose now that D and J are not constrained to equal each other. Theorem 1 implies that for any fixed D, the minimal probability of litigation decreases in J. Thus for any fixed Δ, and in particular for the optimal Δ, maximization of social welfare requires that J be set as large as possible. However, if J is bounded from above, then because we do not know the probability of litigation when $x \neq 0$, we cannot solve for the optimal values of x, D, and Δ. Specifically, for any fixed Δ, and in particular for the optimal Δ, we cannot rule out the possibility that setting $x > 0$ and $D < \frac{\Delta}{\pi_H}$ would improve social welfare relative to $x = 0$ and $D = \frac{\Delta}{\pi_H}$ (which we still conjecture to be optimal) by decreasing the likelihood of litigation.

4.2 Noise

The result reported in Theorem 1 is robust to the introduction of "noise" in the following sense. Suppose that the court may err in deciding the defendant's liability: it may rule in favor of a liable defendant with probability $e_1 \geq 0$ and against a nonliable defendant with probability $e_2 < 1 - e_1$. The methods used in the proof of Theorem 1 can be used to derive the optimal mechanism in this case as well.[14] It can be shown that in this case, if $D = J = 1$, then the ex ante probability of settlement is bounded from above by

$$\frac{\begin{array}{c}(p(1+c) - e_2(1 + p + 2c + pc - c^2 e_2 + c^2 - 2ce_2 - e_2) \\ - e_1(1 + p + 2c - e_1 - e_1 c) + e_1 e_2(2 + 3c + c^2))\end{array}}{\begin{array}{c}1 + c - e_1(2 + 2c - e_1 - e_1 c) - e_2(2 + 3c + c^2 - e_2 - 2ce_2 - c^2 e_2) \\ + e_1 e_2(2 + 3c + c^2)\end{array}},$$

which converges to p as e_1 and e_2 tend to zero. As before, a mechanism that attains this upper bound must employ the English fee-shifting rule.

4.3 Renegotiation Proofness

A practicable mechanism must be renegotiation proof. In this subsection, we present three different notions of renegotiation proofness. The first two (credibility and durability) are weaker than the renegotiation proofness constraint presented in Section 3, and the third (strong renegotiation proofness) is stronger. Throughout this subsection we assume, for simplicity, that $D = J = 1$.

4.3.1 Credibility.

It is natural to suppose that the plaintiff cannot be forced to litigate. He should always have the option to drop the case rather than proceed to trial. The importance of this constraint stems from the fact that because threatening a defendant who denies her liability with a high probability of trial would exert pressure on truly liable defendants to admit their liability, it may

14. The precise argument may be obtained from the authors upon request.

be possible to increase the ex ante likelihood of settlement by forcing the plaintiff to proceed to trial in some circumstances.

Formally the credibility constraint [Equation (7)] requires that, conditional on being informed that the case proceeds to trial, the plaintiff, given his updated beliefs about the likelihood of prevailing at trial, prefers to continue litigating than to drop the case and get an expected payment of zero, or

$$\frac{(1-p)(1-q_N)(-c^P_{N,N})+p(1-q_L)(J-c^P_{L,L})}{(1-p)(1-q_N)+p(1-q_L)} \geq 0. \tag{7}$$

Notice that the left-hand side of the credibility constraint is identical to the left-hand side of the renegotiation proofness constraint, but the right-hand side is smaller. It therefore follows that credibility is weaker than our notion of renegotiation proofness. Any mechanism that satisfies the latter constraint also satisfies the former.

4.3.2 Durability. Say that a mechanism is ex ante renegotiation proof if, prior to the application of the mechanism, the parties would not want to settle the case rather than to proceed according to the mechanism. Because any positive offer to settle would be correctly interpreted by the plaintiff as an admission of liability, the plaintiff would rationally refuse to settle for anything less than the judgment against a liable defendant, J, which he could win by litigating the case to trial. Because the expected payment of a liable defendant under the optimal mechanism is equal to $D = J$, no settlement is possible at this stage.

Hölmstrom and Myerson (1983) propose a more general definition of ex ante renegotiation proofness. They say that a mechanism is durable if, before the mechanism is implemented, the relevant agents would not unanimously approve a change to another mechanism that would make at least one of them strictly better off.[15] Intuitively an optimal mechanism that attains the upper bound identified in Theorem 1 is durable for the same reason that it is ex ante renegotiation proof. Namely, the plaintiff would correctly interpret any offer to switch to a mechanism that promises a higher expected payoff to a liable defendant as coming from a liable defendant. He would therefore require that this alternative mechanism give him an expected compensation of at least J (which is what he would get if he takes a liable defendant to trial). But because the expected payment of a liable defendant under an optimal mechanism is $D = J$, she would refuse to pay more than J. Thus it cannot be that at least one of them strictly prefers to switch.

More formally, as shown by Proposition 1 in the appendix, an optimal mechanism that attains the upper bound identified in Theorem 1 is durable in the

15. Crawford (1985) proposes an alternative definition of durability. According to Crawford (1985), a mechanism is durable if it would be the one selected by the agents at the end of a bargaining process over which mechanism to use (see also Watson, 1999). Because we already have a candidate mechanism, namely an optimal mechanism that attains the bound derived in Theorem 1, and because it is natural in our context to suggest or even require that litigants rely on this proposed mechanism, Crawford's notion of durability is less suitable for our purposes.

sense that there is no other mechanism that employs the English fee-shifting rule and satisfies renegotiation proofness (but not necessarily the deterrence constraint) that the plaintiff and either a liable or a nonliable defendant would want to switch to with at least one of them strictly preferring to switch.[16] The reasons we restrict our attention to this particular class of alternative mechanisms are, (i) because the fee-shifting rule is determined by the court at trial, it is not subject to renegotiation by the litigants; (ii) a mechanism that is not renegotiation proof is "unstable," and would be recognized as such by the litigants, who presumably would not want to switch to it; and (iii) there is no reason that the plaintiff and defendant would want the alternative mechanism to satisfy deterrence. Indeed, the fact that such a mechanism might fail to satisfy deterrence may generate a positive rent for the litigants, which they can share between themselves.

4.3.3 Strong Renegotiation Proofness. Recall that according to our definition, a mechanism is renegotiation proof if upon being informed that the case proceeds to trial, there does not exist any settlement offer that both liable and nonliable defendants as well as the plaintiff, given his updated beliefs, all strictly prefer to proceeding to trial. A stricter notion of renegotiation proofness, which we call strong renegotiation proofness, requires that upon being informed that the case proceeds to trial, there does not exist a settlement offer that the plaintiff and either liable or nonliable defendants prefer to proceeding to trial. Formally, strong renegotiation proofness requires that the expected payoff to the plaintiff, conditional on learning that the case proceeds to trial, should be greater than or equal to the expected payments of both a liable and a nonliable defendant, or

$$\frac{(1-p)(1-q_N)(-c^P_{N,N})+p(1-q_L)(1-c^P_{L,L})}{(1-p)(1-q_N)+p(1-q_L)} \geq c^D_{N,N},\, 1+c^D_{L,L}. \tag{8}$$

No mechanism that satisfies deterrence can satisfy strong renegotiation proofness. To see this, note that any mechanism that satisfies deterrence must be such that the plaintiff takes a liable defendant to court with a positive probability ($q_L < 1$).[17] Because the expected payoff to the plaintiff conditional on learning that the case proceeds to trial is less than or equal to the judgment, which is one, the only way in which the strong renegotiation proofness constraint can be satisfied is if the left-hand side of Equation (8) is equal to one, and the cost born by

16. The plaintiff and a liable defendant could of course switch to the trivial mechanism, according to which the defendant pays the plaintiff $J = D = 1$. But such a deviation, to which both are indifferent, should not be interpreted as a failure of durability.

17. This follows from the fact that if $q_L = 1$, then the plaintiff meets only non liable defendants at trial. Unless defendants that are found to be non liable in court bear the entire legal cost of the plaintiff, the plaintiff would be reluctant to proceed to trial, which in turn implies that liable defendants would deny their liability. A contradiction.

Suppose then that defendants that are found to be non liable in court do bear the entire legal cost of both parties, c. The plaintiff can then extort a payment of c from non liable defendants in settlement ($s_N = c$), and deterrence therefore implies that liable defendants who settle with the plaintiff should pay $1 + c$. But then, a liable defendant that denies her liability may be lucky enough to settle for $s_N = c$ while in court she would be required to pay at most $1 + c$. So, again, a liable defendant would have an incentive to deny her liability. A contradiction.

a defendant who was found to be liable in court, $c^D_{L,L}$, is zero. But if $c^D_{L,L}, = 0$, then because $q_L < 1$, there is a positive probability that the plaintiff would meet a liable defendant in court and bear positive expected litigation costs. This implies that the left-hand side of Equation (8) must be strictly smaller than one. A contradiction.

5. An Optimal Practicable Mechanism

Although it is possible to explicitly solve for a direct revelation mechanism that attains the bound specified in Theorem 1, such a mechanism, which calls for the defendant to announce whether she is liable or not and then instructs the plaintiff to proceed to court with certain positive probabilities that depend on the defendant's announcement, does not appear to be practicable.

The sense in which direct revelation mechanisms, and in particular the optimal direct revelation mechanism, fail to be practicable is difficult to define formally. Wilson (1985) and elsewhere, in what became known as the "Wilson critique," argued that truly practicable mechanisms should be independent of whatever is commonly known among the agents, such as, in the context of this article, the plaintiff's belief, p. The motivation for this requirement is that in practice, very little, if anything at all, is commonly known among the agents. The optimal direct revelation mechanism that is described in the proof of Theorem 1 depends on p. In contrast, the pleading mechanism that is described in the next subsection does not.

5.1 The Pleading Mechanism

Consider the following "pleading"mechanism. The defendant is asked to plead whether she is liable or not. If the defendant admits her liability, then the court enters a judgment of D against her. If the defendant denies her liability, then the plaintiff is asked to choose between dropping the case and litigating to trial. If the plaintiff decides to proceed to trial, then the court decides the case on its merits. If the defendant is found liable, then she has to pay the plaintiff an amount J. The court allocates the litigation costs according to the English (loser reimburses the winner) fee-shifting rule.

The process of settlement negotiation under this "pleading" mechanism can be described as a Bayesian game. We show that if $c < \frac{pJ}{1-p}$ and $D \leq J + c$, then this game has a unique Bayesian equilibrium. In this equilibrium, the ex ante probability of settlement is equal to $1 - (1-p)\frac{D}{J}$.[18] As before, if $c > \frac{pJ}{1-p}$, then, under the English fee-shifting rule, the plaintiff's threat to sue is not credible.

Theorem 2. Suppose that $c < \frac{pJ}{1-p}$ and $D \leq J + c$. The pleading mechanism described above minimizes both the likelihood of litigation and total litigation costs among all the mechanisms that satisfy the incentive compatibility, renegotiation proofness, deterrence, and fee-shifting constraints.

18. In the case where $c = \frac{pJ}{1-p}$, there exists a multiplicity of equilibria. In these equilibria, defendants always deny their liability, and the plaintiff proceeds to trial with a probability $\pi \in [0, \frac{D}{J+c}]$. Among these equilibria, only the one where $\pi = \frac{D}{J+c}$ satisfies deterrence. In this equilibrium, the probability of settlement is equal to $1 - (1-p)\frac{D}{J}$.

The proof of Theorem 2 consists of solving for the Bayesian Nash equilibrium under the pleading mechanism described above, which is shown to be unique. It is also shown that in equilibrium the pleading mechanism satisfies renegotiation proofness and deterrence, and the probability of settlement under the mechanism is equal to the upper bound established in Theorem 1, $1-(1-p)\,\frac{D}{J.}$

Importantly, the optimal pleading mechanism described in Theorem 2 does not allow the parties to compromise. This is most transparent in the case where $D = J = 1$. Then either the defendant pays the plaintiff's damages in full, or the plaintiff drops the suit — no middle ground is sought or allowed. Intuitively, the reason that the high and low settlements are one and zero, respectively (we interpret the plaintiff dropping the suit as a settlement of zero), is that an optimal mechanism must provide the plaintiff with sufficient encouragement to proceed to trial after the defendant denies her liability in order to ensure that the sanction against liable defendants is exercised with a sufficiently high probability. To achieve this aim, the settlement offered to the plaintiff after the defendant denies her liability is set equal to zero (it cannot be set lower because of the credibility constraint). This gives the plaintiff a strong incentive to proceed to trial after the defendant has denied her liability, because by dropping the case he would get at most zero, which is equal to what he would get if he did not initiate the suit to begin with. The fact that the deterrence constraint is binding in the optimal solution then implies, in the special case where $D = J = 1$, that the high settlement is set equal to the sum of damages, one.

5.2 Renegotiation Proofness and Practicability of the Pleading Mechanism

As shown in Theorem 2, the optimal pleading mechanism is renegotiation proof, which implies that it satisfies the two first renegotiation proofness notions mentioned in Section 4.3, but not strong renegotiation proofness.

To understand the difficulty that arises as a consequence of the fact that the optimal mechanism is not strong renegotiation proof, consider the situation immediately after the defendant pleaded not liable. Any positive offer to settle at this stage would still be correctly interpreted by the plaintiff as an admission of liability. However, now, while a liable defendant expects to pay $J + c$ if the case is litigated to trial, the plaintiff only expects to win J, which implies that the two may settle at this stage, undermining the equilibrium, and with it the optimality of the pleading mechanism. Ensuring strong renegotiation proofness is a serious problem. As explained in Section 4.3.3, because litigating to trial involves litigation costs, any mechanism, including the optimal direct revelation mechanism that is described in the proof of Theorem 1, that requires the parties to proceed to trial with a positive probability cannot be strong renegotiation proof. In a model with no noise, the only mechanisms that can be strong renegotiation proof are those that send the parties to trial with probability zero, but such mechanisms cannot possibly satisfy the deterrence constraint because if the defendant can avoid appearing in court, then it is impossible to find out whether she is truly liable or not and sanction her in case she is liable.

In order to ensure the strong renegotiation proofness of the optimal pleading mechanism, the court must therefore be able to block any settlement $s \in [J, J + c]$ between the plaintiff and the defendant that is obtained after the defendant pleaded not liable and the plaintiff announced that he proceeds to trial. The court can prevent such settlements by declaring any such settlement illegal and refusing to enforce it.[19] Thus after any such settlement, the plaintiff would not be precluded from filing the lawsuit again, forcing the defendant to litigate the same claim that was presumably already settled. Similarly the defendant, for her part, may always refuse to perform her obligations according to the settlement agreement, as the plaintiff would not have any means for enforcing them, except for filing the suit again. Although the parties may rely on nonjudicial enforcement mechanisms, such mechanisms would usually be available only when the parties have continuous close relationships, in which case they would probably refrain from bringing their dispute to court in the first place (Ellickson, 1991; Bernstein, 1992). Moreover, the court may supplement its refusal to enforce the settlement with a fine on one of the settling parties. This would expose her to extortion by the other party, further increasing the risk of unauthorized settlement.

Short of banning late settlements, courts can also use other, less extreme means for discouraging such settlements. For one thing, courts may simply refrain from encouraging the parties to settle. Our results indicate that, contrary to the common wisdom that guides recent procedural reforms, courts should not take an active role in facilitating settlements and should not encourage parties to use alternative means for resolving their disputes. Rather, managerial judging should concentrate on efficient use of judicial and lawyer time, and not on the promotion of settlements. This consideration points to other means for substituting early for late settlements, such as the setting of firm timetables, shortening the time between filing and trial, and front-loading litigation costs as closely as possible to the pleadings stage — all measures that could decrease the time available for renegotiation. Interestingly, Kakalik et al. (1996a, b), who examined the implementation of the Civil Justice Reform Act (CJRA) in 20 federal district courts, found that early judicial management, including setting trial schedules and reducing the time to discovery, had a statistically significant negative effect on time to disposition (although having no combined effect on lawyer work hours). Following this study, the judicial conference of the U.S. courts has recommended setting early and firm trial dates and shorter discovery periods in complex civil cases (Judicial Conference Report, 1996).

Although our model does not account for the costs of administering the pleading mechanism, there are reasons to believe that its administration should not prove too costly. On a theoretical level, the mechanism requires courts to refrain from active encouragement of settlement, thus saving their time and resources. It calls upon judicial intervention only if the parties try to negotiate

19. For an economic and legal analysis of the possible undesirability of enforcement of renegotiated agreements in general, see Jolls (1997) and the literature cited therein. For a similar approach in the context of litigation and settlement see Shavell (1997).

around it, and as explained above, it should be possible to deter most such circumventions of the mechanism through appropriate sanctions on renegotiated settlements. On a more practicable level, it is notable that recent reform in Britain has adopted a similar approach to the one we advocate, seeking to impose a formal structure on the procedure of pretrial negotiation through the use of preaction protocols [see Woolf (1996: 107–11)]. Each protocol governs the exchange of information and settlement negotiations in a specific type of lawsuit.[20] Thus the professional negligence preaction protocol, for example, requires an exchange of a letter of claim by the plaintiff and a letter of response or (alternatively) a letter of settlement by the defendant. If the defendant denies her liability, then the protocol mandates a strict time schedule for settlement negotiation and for exchange of information. Although none of the protocols bans late settlements, they all seek to encourage the exchange of early and full information about the prospective legal claim, and to enable parties to avoid litigation by agreeing to a settlement of the claim before the commencement of proceedings (see CPR, Practice Direction—Protocols, §1.4). There is some empirical evidence that the number of filings as well as last-minute settlements has decreased, whereas the rate of settlement has increased since adoption of the preaction protocols.[21]

6. Discovery

Our basic framework allows for pretrial negotiation between the litigants to take place over time. A settlement that is reached after some litigation costs have already been incurred may be interpreted as a delayed settlement.[22] Moreover, under the optimal mechanism, the expected payment to the plaintiff conditional on settlement is equal to the expected conditional payment of the defendant. This equality may be interpreted as implying that optimality requires that the parties settle immediately, before they incur any litigation costs, or not at all.

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20. Currently the CPR includes eight protocols for construction and engineering disputes, defamation, personal injury claims, clinical disputes, professional negligence, judicial review, disease and illness claims, and housing disrepair cases.

21. See Emerging Findings: An Early Evaluation of the Civil Justice Reforms, March 2001, available from http://www.lcd.gov.uk/civil/emerge/emerge.htm#part5d and Further Findings: A Continuing Evaluation of the Civil Justice Reforms, August 2002, available from http://www.lcd.gov.uk/civil/reform/ffreform.htm#part1.

22. The passage of time may be explicitly incorporated into the analysis by distinguishing between the expected payment of the two types of defendants conditional on settlement s_L and s_N, respectively, and the expected payment to the plaintiff from the two types of defendants conditional on settlement, denoted s_L^P and s_N^P, respectively. The fact that part of the litigation costs may be incurred before the trial implies that it must be that $s_L^P \leq s_L$ and $s_N^P \leq s_N$; moreover, if these two inequalities are strict, then it is due to the fact that part of the litigation costs have already been incurred before the trial.

Careful inspection of the constrained optimization problem in the proof of Theorem 1 reveals that s_L^P and s_N^P play no role in the constraints and so may be set equal to s_L and s_N, respectively. This implies that there is no advantage in delaying the application of an optimal mechanism.

Until now the model has abstracted away from the possibility of pretrial discovery. Discovery not only takes time, it also generates additional information about the likelihood that the defendant is indeed liable.[23] In the United States, and to a lesser extent in Britain, the rules of civil procedure allow litigants various means of uncovering information held by their opponents before trial. These include discovery of documents, interrogatories, and (in the United States only) depositions.[24] Discovery procedures have been shown to increase the probability of settlement and improve the accuracy and fairness of trials and settlements, yet these advantages have to be weighed against the possible abuse of discovery by litigants who impose burdensome costs on their opponents only to better their bargaining position (Sobel, 1989; Cooter and Rubinfeld, 1994; Mnookin and Wilson, 1998). We show that when $D = J$, discovery confers no advantages and is therefore undesirable in view of its possible misuse.[25]

Intuitively, by Theorem 1 when $D = J$, the probability of settlement is bounded from above by the probability that the plaintiff assigns to the defendant being liable, conditional on an accident, p. Since the plaintiff's beliefs about the likelihood that the defendant is liable satisfy the martingale property, this implies that discovery cannot increase the probability of settlement. More specifically, suppose that discovery consists of the release of a commonly observed signal about the defendant's liability. Suppose also that this signal may be either "high" with some probability $\alpha \in (0, 1)$, such that the updated probability that the defendant is liable is $\bar{p} > p$, or "low"with probability $1 - \alpha$, such that the updated probability that the defendant is liable is $\underline{p} < p$. The martingale property implies that the expected value of the posterior probability that the defendant is liable is equal to p, or $\alpha\bar{p} + (1 - \alpha)\underline{p} = p$. By Theorem 1, given any sufficiently large probability that the defendant is liable, $p \geq c/1 + c$, the likelihood of settlement is bounded from above by p. This implies that either, if $\underline{p} \geq \frac{c}{1+c}$, then the expected probability of settlement after the signal is released is less than or equal to p, or if $\underline{p} < \frac{c}{1+c}$, then the mechanism fails to satisfy deterrence with a positive probability. This argument implies the following Corollary:

Corollary 1. If $D = J$, then the probability of settlement if discovery is allowed cannot be higher than the probability of settlement under the pleading mechanism, p.

23. Evidence produced during trial may also affect the probability of settlement, as witnesses' testimony, expert evidence, and the court's responses during trial are all sources of relevant information with respect to the probability of finding the defendant liable at trial. However, the trial's main purpose is to educate the court about the merits of the case. This purpose is the one that should govern the rules of evidence production during trial. Discovery (which is done outside the court) serves no such goal, and hence its scope should be decided according to its effect on the parties' litigation and settlement behavior.

24. See, e.g., Rules 26–37 of American FRCP; Parts 18 and 31 of the British CPR.

25. The argument generalizes to the case where $D \neq J$.

7. Conclusion

Normatively, our claim that under the optimal settlement mechanism that is described in this article compromise and (late) settlement should be discouraged must be distinguished from other claims against settlement. Previous literature has asserted that adjudication should be preferred to settlement whenever the latter dilutes the substantive goals of justice (Fiss, 1984) and deterrence (Shavell, 1997; Polinsky and Rubinfeld, 1988). In our model, the objective is to maximize the rate of settlement subject to maintaining substantive social goals such as deterrence and justice. Our finding that compromise as well as late settlements should be discouraged is therefore a result of a welfare maximization exercise in which both the satisfaction of substantive goals and the minimization of cost and delay are sought. Our analysis suggests that the pursuit of alternative ways to encourage settlement throughout the litigation process may be misguided because it may adversely affect the possibility of achieving the standard set by substantive law, and because it may create a costly imbalance between early and late settlement.

Preference for the English fee-shifting rule in the optimal mechanism is another feature of the consideration of both substantive and procedural goals. Within the ongoing debate over which liability-based fee allocation rule is best, the English or the American, and whether offer of judgment rules indeed promote settlement, this article supports the use of the English fee-shifting rule.

Finally, the model presented in this article relied on the assumptions that the defendant knows whether or not she is liable and that the damage caused to the plaintiff as well as the plaintiff's beliefs about the likelihood that the defendant is liable are commonly known. In addition, the analysis presented here abstracted away from consideration of the effect of the English rule on litigation expenditure (see, e.g., Katz, 1987; Plott, 1987) and on the set of lawsuits that are filed (see, e.g., Rosenberg and Shavell, 1985; Katz, 1990). Both of these considerations may have substantial welfare consequences. Further research is thus called for in order to extend the mechanism design framework presented in this article to more comprehensive settings that would account for these and other considerations involved in the litigation and settlement process.

Appendix

Proof of Theorem 1. The proof is based on solving the problem of maximizing the objective function [Equation (1)] subject to the constraints of Equation (2)–(5), and those induced by fee shifting. The solution of this constrained optimization problem proceeds according to the following steps:

Step 1: Eliminate the constraint in Equation (2) and replace the right-hand side of Equation (4) with $c^D_{N,N}$. If the maximal value of the objective function in the relaxed problem is less than or equal to p, then a fortiori the value of the objective function in the original problem is less than or equal to p.

Step 2: Inspection of the constraints reveals that setting $c^D_{L,N} = c^D_{N,L} = c$, that is, as high as possible, relaxes the constraints. Intuitively, "lying" is penalized. We may therefore simplify the constraints as follows:

$$q_N(J + c - s_N) \le q_L(J + c^D_{L,L} - s_L) + c - c^D_{L,L} \tag{2'}$$

$$\frac{q_N(1-p)c + p(J + c^D_{L,L} - c^D_{N,N}) - c}{p(J - c + c^D_{L,L} - c^D_{N,N})} \ge q_L \tag{4'}$$

$$q_N(s_N - c^D_{N,N}) \le q_L(s_L - J - c^D_{L,L}) + J - D + c^D_{L,L} - c^D_{N,N}. \tag{5'}$$

Step 3: Further inspection of the constraints reveals that under the optimal solution, Equation (2′) must be binding. Suppose it is not binding and the optimal solution is such that $q_N < 1$. Observe that it is then possible to increase q_N and decrease s_N slightly so that $q_N s_N$ remains constant. This change increases the value of the objective function, and as can be readily verified, does not violate any of the other constraints. Suppose now that Equation (2′) is not binding and $q_N = 1$. Observe that it is possible to slightly decrease the value of s_N and slightly increase the value of q_L. This change increases the value of the objective function, and as can be readily verified, does not violate any of the other constraints.

Step 4: We may assume, without loss of generality, that the left-hand side of Equation (4′) is greater than or equal to zero. Otherwise, the problem is infeasible, which, as we establish below, is false. It can be verified that when this left-hand side is less than one, it is increasing in $c^D_{L,L}$, and when it is greater than one, it is decreasing in $c^D_{L,L}$. Since q_L cannot be greater than one anyway, replacing $c^D_{L,L}$ with c in the left-hand side of Equation (4′) relaxes this constraint as much as possible. We may therefore replace Equation (4′) with the following constraint

$$\frac{q_N(1-p)c + p(J + c - c^D_{N,N}) - c}{p(J - c^D_{N,N})} \ge q_L. \tag{4''}$$

If the maximal value of the objective function in the relaxed problem is less than or equal to p, then a fortiori the value of the objective function in the original problem is less than or equal to p.

Step 5: Equation (2′) binding implies that Equation (5′) may be rewritten as

$$q_N \le \frac{c - c^D_{N,N} + J - D}{J + c - c^D_{N,N}}. \tag{5''}$$

Step 6: Replacing q_L and q_N with their upper bounds from Steps 4 and 5, respectively, we may bound the objective function by a function of $c^D_{N,N}$ alone as follows,

$$pq_L + (1-p)q_N \leq \frac{(1-p)c(c - c^D_{N,N} + J - D)}{(J + c - c^D_{N,N})(J - c^D_{N,N})} + \frac{p(J + c - c^D_{N,N}) - c}{J - c^D_{N,N}}$$
$$+ \frac{(1-p)(c - c^D_{N,N} + J - D)}{J + c - c^D_{N,N}}$$
$$= \frac{J - c^D_{N,N} - (1-p)D}{J - c^D_{N,N}}.$$

Because the computed bound is decreasing in $c^D_{N,N}$, it is highest when $c^D_{N,N} = 0$, where it is equal to $1 - (1-p)(\frac{D}{J})$. If $D = J$, then the upper bound is equal to p.

Step 7: Steps 4 and 6 show that in order for the objective function to achieve its upper bound, $c^D_{L,L}$ should be set equal to c and $c^D_{N,N}$ should be set equal to zero, respectively. This implies that any mechanism that satisfies Equations (4) and (5) and that induces an ex ante probability of settlement $1 - (1-p)(\frac{D}{J})$ must employ the English fee-shifting rule. This completes the proof of the theorem as stated. However, because we believe that our method of solving for the optimal mechanism may be of independent interest, we proceed in the next step to describe an optimal direct revelation mechanism.

Step 8: By Step 2, $c^D_{L,N} = c^D_{N,L} = c$. Steps 4 and 6 imply that $c^D_{L,L} = c$ and $c^D_{N,N} = 0$, respectively. Steps 5 and 6 imply that Equation (5″) should be binding in the optimal solution, which implies that $q_N = \frac{c+J-D}{J+c}$. Suppose that Equations (2′), (4′), and (5′) are binding and solve the implied equations for the values of q_L, s_N, and s_L to get

$$q_L = \frac{pJ^2 - cD + pc(J + D)}{pJ(J + c)},$$

$$s_N = 0,$$

$$s_L = \frac{((pJ - c + 2pc)J - (1-p)c^2)D}{pJ^2 - cD + pc(J + D)}.$$

Because the obtained solution satisfies all the constraints and, as can be verified, induces an ex ante probability of settlement that is equal to $1 - (1-p)(\frac{D}{J})$, the direct revelation mechanism, in which the defendant is asked to report her type and in which the case settles for $s_N = 0$ with probability $q_N = \frac{c+J-D}{J+c}$ upon the report "not liable," the case settles for $s_L = \frac{((pJ-c+2pc)J-(1-p)c^2)D}{pJ^2-cD+pc(J+D)}$ with probability $q_L = \frac{pJ^2-cD+pc(J+D)}{pJ(J+c)}$ upon the report "liable," a case that is not settled proceeds to trial where the English fee-shifting rule is used to allocate the costs, and if it is revealed at the trial that the defendant has misrepresented her type then she bears the full costs of trial, is optimal.

Proposition 1. There is no mechanism that employs the English fee-shifting rule and satisfies renegotiation proofness (but not necessarily deterrence) that both the plaintiff and either a liable or a nonliable defendant prefer, and at least one of them strictly prefers, to an optimal mechanism that attains the upper bound identified in Theorem 1.

Proof. Recall that $D = J = 1$. Consider an optimal mechanism that achieves the bound derived in Theorem 1. Step 8 of the proof of Theorem 1 shows that the expected payoffs of the plaintiff, a liable, and a nonliable defendant in such a mechanism are equal to $p - c + pc$, -1, and 0, respectively.

Lemma 1. Suppose that $c \leq \frac{p}{1-p}$. There is no renegotiation proof mechanism that employs the English fee-shifting rule (including mechanisms that do not satisfy deterrence) that gives to the plaintiff, a liable, and a nonliable defendant expected payoffs that are greater than or equal to $p - c + pc$, -1, and 0, respectively, and that gives to either the plaintiff, a liable, or a nonliable defendant strictly higher payoffs.

Proof. We solve the problem of maximizing the expected payoff of a liable defendant subject to Equations (2) and (4) and the constraint that the expected payoffs to the plaintiff and to a nonliable defendant are greater than or equal to $p - c + pc$, and zero, respectively, under the assumption that fee shifting is done according to the English rule (which implies that $c^D_{L,L} = c^D_{L,N} = c^D_{N,L} = c$ and $c^D_{N,N} = 0$).

Formally the problem is to find a vector (q_N, q_L, s_N, s_L) that maximizes the objective function

$$q_L(1 + c - s_L) - 1 - c \tag{A.1}$$

subject to

$$q_N(1 + c - s_N) \leq q_L(1 + c - s_L) \tag{2$''$}$$

$$\frac{q_N(1-p)c + p(1+c) - c}{p} \geq q_L \tag{4$''$}$$

$$(1-p)(q_N s_N - (1-q_N)c) + p(q_L s_L + 1 - q_L) \geq p - c + pc \tag{A.2}$$

and

$$q_N s_N \leq 0. \tag{A.3}$$

Step 1: Suppose that $q_N > 0$.[26] Equation (A.3) implies that $s_N = 0$.

Step 2: Suppose that q_L attains its upper bound at Equation (4″) (which is binding in the optimal solution). Solve Equation (4″) for q_N as a function of q_L as follows:

$$q_N = \frac{pq_L - p(1+c) + c}{(1-p)c}. \tag{A.4}$$

26. If $q_N = 0$, then Equation (A.2) implies that $q_L s_L \geq q_L$. It follows that either $q_L = 0$ or $s_L \geq 1$. Plugging either of these values into the objective function of Equation (A.1) produces values that are less than or equal to -1.

If the maximal value of the objective function in the relaxed problem where q_L attains its upper bound at Equation (4″) is less than or equal to -1, then a fortiori the value of the objective function in the original problem is less than or equal to -1.

Step 3: Plug Equation (A.4) into Equation (3″) to get

$$\frac{(pq_L - p(1+c) + c)(1+c)}{(1-p)c} \leq q_L(1 + c - s_L). \qquad (2''')$$

Because the coefficient of q_L on the left-hand side of Equation (2‴) is larger than the coefficient of q_L on the right-hand side of Equation (2‴) (because $c \leq \frac{p}{1-p}$), we may proceed under the assumption that Equation (2‴) is binding. If the maximal value of the objective function in the relaxed problem where q_L attains its upper bound as specified by the fact that Equation (2‴) is binding is less than or equal to -1, then a fortiori the value of the objective function in the original problem is less than or equal to -1.

Step 4: Inspection of the objective function reveals that s_L should be set as low as possible. It therefore follows that Equation (A.2) should be binding in the optimal solution. Equation (A.2) can thus be used to express the value of s_L as a function of q_L as follows:

$$\frac{p(1+c) - c}{pq_L} = s_L. \qquad (A.5)$$

Step 5: Equation (A.5) and (2‴) can be used to solve for the optimal value of q_L as follows:

$$q_L = \frac{p - 2c + 2pc}{p - c + pc} + \frac{(1-p)c^2}{p(1+c)(p - c + pc)}. \qquad (A.6)$$

Step 6: Plugging the values of q_L from Equation (A.6) and of s_L from Equation (A.5) into the objective function and simplifying, it can be shown that the value of the objective function is -1. ■

Lemma 1 implies that there is no alternative mechanism (including mechanisms that do not satisfy deterrence) that would be preferred by the plaintiff and both types of defendant. This means that the plaintiff would correctly interpret any offer to switch to a mechanism that promises a higher expected payoff to a liable defendant as coming from a liable defendant. He would therefore require that this alternative mechanism gives him an expected compensation of at least one (which is what he would get if he takes a liable defendant to trial). But because the expected payment of a liable defendant under an optimal mechanism is one, she would refuse to pay more than one. Thus it cannot be that at least one of them strictly prefers to switch.

Could the plaintiff possibly agree to switch to a mechanism that gives him and a nonliable defendant higher expected payoffs, but a lower expected payoff to a liable defendant? The next lemma shows that no such mechanism exists.

Lemma 2. Suppose that $c \leq \frac{p}{1-p}$. There is no mechanism (including mechanisms that do not satisfy renegotiation proofness or deterrence) that a nonliable defendant and a plaintiff who faces a nonliable defendant both prefer, and one of them strictly prefers, to an optimal mechanism.

Proof. Any mechanism that is weakly better for a nonliable defendant must be such that $s_N \leq 0$. Because, as shown in Step 8 of the proof of Theorem 1, the probability of settlement with a nonliable defendant under an optimal mechanism is $\frac{c}{1+c}$, any mechanism that would be better for the plaintiff conditional on facing a nonliable defendant must be such that $q_N \geq \frac{c}{1+c}$. Furthermore, for either the plaintiff or a nonliable defendant to strictly prefer the alternative mechanism, it must be that either $s_N < 0$ or $q_N > \frac{c}{1+c}$. For the plaintiff to believe that he is indeed facing a nonliable defendant, it must be that the expected payoff to a liable defendant under the proposed mechanism is less than or equal to -1, or

$$q_L(1 + c - s_L) \leq c. \tag{A.7}$$

We show that any such mechanism cannot be incentive compatible for a liable defendant. Equation (2) requires

$$q_N(1 + c - s_N) \leq q_L(1 + c - s_L) \tag{2''}$$

and Equation (A.7) implies

$$q_N(1 + c - s_N) \leq c.$$

But either $q_N \geq \frac{c}{1+c}$ and $s_N < 0$ or $q_N > \frac{c}{1+c}$ and $s_N \leq 0$ implies that

$$q_N(1 + c - s_N) > c.$$

A contradiction to the revelation principle, which implies that no loss of generality is entailed by restricting attention to incentive compatible mechanisms. ■

This completes the proof of Proposition 1. ■

Proof of Theorem 2. The proof consists of the following five lemmas.

Lemma 3. In a Bayesian equilibrium of the pleading game, a nonliable defendant always truthfully denies her liability. ■

Proof. Admitting liability implies the defendant has to pay $J > 0$. Denying it implies that a nonliable defendant doesn't have to pay anything because she will win at trial and costs are allocated according to the English rule. ■

Lemma 4. In a Bayesian equilibrium of the pleading game, a liable defendant denies her liability with a probability that is strictly between zero and one.

Proof. Suppose that a liable defendant always admits her liability. In equilibrium, it must be that a defendant that denies her liability is indeed not liable, and the plaintiff, realizing this, would decline to proceed to trial following the defendant's denial of liability because he will lose and will have to incur the litigation costs c. But if the plaintiff does not litigate upon a denial of liability, liable defendants will benefit from denying their liability, contradicting the assumption that they are truthful with probability one. Suppose now that a liable defendant never admits her liability. It follows that the plaintiff proceeds to trial with probability one because doing so yields $pJ - (1-p)c$, which for $c < \frac{pJ}{1-p}$ is more than what the plaintiff would get by dropping the case, which is zero.[27] But then a liable defendant is better off pleading liable and paying D than losing $J + c$ at trial. A contradiction.

Lemma 5. In a Bayesian equilibrium of the pleading game, after the defendant denies her liability, the plaintiff proceeds to trial with probability

$$\pi = \frac{D}{J + c}.$$

Proof. The previous lemma implies that the probability that the plaintiff proceeds to trial after the defendant denies her liability must be such that a liable defendant is indifferent between admitting or denying her liability, namely,

$$-D = -(1-\pi) \cdot 0 - \pi(J + c).$$

Solving for π yields the result.

Lemma 6. In a Bayesian equilibrium of the pleading game, a liable defendant denies her liability with probability

$$d = \frac{c(1-p)}{pJ}.$$

Proof. The previous lemma implies that in equilibrium, the plaintiff must be indifferent between proceeding to trial and dropping the case after the defendant has denied her liability. Bayesian updating implies that it must be that

$$\frac{pdJ + (1-p)(-c)}{pd + 1 - p} = 0.$$

Solving for d yields the result.

Lemma 7. The ex ante probability of settlement in the unique Bayesian equilibrium of the pleading mechanism described above is p.

27. The analysis below still follows in case $c = \frac{pJ}{1-p}$ and the plaintiff proceeds to trial with probability strictly less than one.

Proof. Lemma 5 implies that the probability that a nonliable defendant settles (we interpret the plaintiff dropping the suit as a settlement of zero) in the unique equilibrium is given by

$$1 - \pi = 1 - \frac{D}{J + c}.$$

The probability that a liable defendant settles under the unique equilibrium is given by

$$1 - d + d(1 - \pi) = 1 - \frac{cD(1 - p)}{pJ(J + c)}.$$

The ex ante probability of settlement under the mechanism is therefore given by

$$p\left(1 - \frac{cD(1 - p)}{pJ(J + c)}\right) + (1 - p)\left(1 - \frac{D}{J + c}\right) = 1 - (1 - p)\frac{D}{J}. \qquad \blacksquare$$

Finally, we demonstrate that the pleading mechanism described above satisfies renegotiation proofness and deterrence. Renegotiation proofness follows from the fact that the expected payment to the plaintiff conditional on proceeding to trial, which is equal to zero, is equal to the expected payment of a nonliable defendant. Deterrence follows from the fact that, as can be immediately verified, the expected payments of liable and nonliable defendants in the unique Bayesian equilibrium are D and zero, respectively. ■

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