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SETTLEMENT OF LITIGATION MAY INCREASE OR DECREASE DETERRENCE AND SOCIAL WELFARE

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ABSTRACT

Although the obvious effect of settlement is to save litigants the costs of trial, settlement also influences deterrence—and for two reasons. First, because settlement is agreed upon by plaintiffs, it raises their expected return from litigation and thus the probability of suit. This augments deterrence. Second, because settlement is agreed upon by defendants, it lowers their expected costs of litigation and therefore dilutes deterrence. The primary objective of the article is to identify the net effect of settlement on deterrence and on social welfare in a model of accidents, liability, and litigation. The conditions for the bringing of suit in the model are not only that plaintiffs be willing to go to trial, but also that their anticipated settlements would exceed their pretrial costs.

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Settlement of Litigation May Increase or Decrease Deterrence and Social Welfare

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1. Introduction

Settlement of litigation is a phenomenon of importance to those interested in the functioning of the legal system because it is commonly the manner in which legal disputes are resolved.[1] The most obvious effect of settlement is that it enables litigants to avoid the costs and risks of trial. However, and as will be a focus of this article, settlement may also influence deterrence of undesirable conduct. It can do so for two distinct reasons.

First, a plaintiff will expect to fare better in a settlement than he would have had he gone to trial—otherwise the plaintiff would not have agreed to the settlement. This improvement in the plaintiff's predicted outcome from litigation can lead to a greater probability of suit and thus augment deterrence of misconduct.

Second, a defendant will anticipate paying less in a settlement than he would have had he engaged in a trial—otherwise the defendant would not have approved the settlement. Such

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[1] About 90 percent of cases brought in state courts end without trial; see Gibson et. al. (2024). And over 99 percent of cases brought in federal courts conclude without trial; see United States Courts, Judicial Business 2024, Table C-4. However, the high percentage of cases that terminate without trial overstates the settlement rate because cases often finish for reasons apart from settlement—they are frequently dropped, dismissed, or transferred to other courts. At the same time, estimates of the settlement rate may understate the true rate because cases are regularly settled without having been filed and thus are excluded from studies of filed cases. On the importance of such factors that complicate assessment of the settlement rate, see Chang and Klerman (2022), Eisenberg and Lanvers (2009), and Hadfield (2004).

a decrease in the defendant's effective liability from litigation can reduce the deterrence of wrongful conduct.

The resultant of these opposing forces on deterrence may point in either direction as a general matter. The task of the present article will be to elucidate the determinants of the effects of settlement on deterrence, litigation costs, and a measure of social welfare.

In particular, I will analyze in Section 2 below a simple model of accidents and liability in which the occurrence of harm depends on the care exercised by injurers. In regard to litigation, victims will be presumed to have to take various pretrial steps (to locate counsel, gather facts, evaluate law) before they are able to proceed to settlement or trial. This assumption will imply that victims will decide to take the pretrial steps—and will then decide to settle—if and only if two conditions are met: that after taking the pretrial steps, they would have a credible threat to go to trial; and that the settlement amount that they would obtain would exceed their pretrial costs. The effect of settlement will be found by comparing the outcomes just described with the outcomes that would have occurred if, hypothetically, settlement had not been permitted. The social welfare objective that will be considered is the minimization of total costs, namely, the expected sum of harms that eventuate, the costs of care, and litigation expenses.

To illustrate litigation in the model, suppose that a victim's pretrial costs would be $45,000, that his trial costs would be $60,000, that an injurer's trial costs would be $65,000, and that the damage award for harm were there a trial would be $100,000. Then if a victim takes the pretrial steps, he would have a credible threat to go to trial, for his net return from doing so would be positive, $40,000. Having taken the pretrial steps, the range of mutually desirable settlements would be between $40,000 and $165,000 (the injurer's damage payment plus trial

costs). Suppose as well that the settlement amount would be $90,000. Accordingly, a victim would decide to take the $45,000 pretrial steps—because the $90,000 settlement he would receive would be greater. Further, that victims would bring suit means that injurers would have an incentive to exercise care, in the form of the $90,000 they would know that they would pay in settlement if they caused harm.

In contrast, suppose that settlement was not allowed. Then a victim would not take the pretrial steps, for that would entail $45,000 in expenses, whereas his net gain from trial would be lower, $40,000. Consequently, victims would not bring suit and injurers would have no motive to exercise care.

In other words, in the foregoing example it is the opportunity to settle that instigates litigation and deterrence of harm. At the same time, that the settlement of $90,000 is less than the $165,000 payment an injurer would have had to make in the event of trial illustrates the point that settlement lowers deterrence relative to what it would have been had there been a trial. More generally, by employing logic along the lines that have been sketched in this example, the various possible effects of settlement on litigation, the exercise of care, and social costs can be identified in the analysis.

The article concludes in Section 3 with comments on the ability of the state to intervene helpfully in settlements, the assumption that private parties do not value deterrence of misconduct, the importance of pretrial expenditures, and factors favoring trial that were omitted from the definition of the social objective in the model.

The analysis here builds on an extensive theoretical literature on litigation[2] and exemplifies the theme that private decisions in litigation may deviate from the socially desirable.[3] The article most closely related to this one is Polinsky and Rubinfeld (1988), who first investigate the point that settlement can reduce deterrence and social welfare because settlement lowers the amount that defendants would have paid if they had gone to trial.[4] Spier (1997) and Wickelgren (2004) provide additional reasons that settlement can lead to socially inadequate deterrence in specific models involving asymmetric information in settlement bargaining.[5] Also related to this article is Anderlini et al. (2019) because it studies pretrial costs in litigation.[6] The contribution of the present article lies mainly in developing the observation that settlement may not only weaken deterrence but may also enhance it by raising the probability of litigation.[7]

[2] See the surveys by Cooter and Rubinfeld (1989), Spier (2007), Daughety and Reinganum (2012), and Wickelgren (2013).

[3] On this theme, see Shavell (1982) and Shavell (1997) and its section on settlement.

[4] As a result, they find that it could be socially desirable for the state to bar settlement with a positive probability in order to raise deterrence.

[5] Spier (2007) studies a model of the negligence rule in which injurers possess private information about their level of care. In the mixed-strategy equilibrium that results, settlement bargaining leads to socially inadequate deterrence. Wickelgren examines a model of strict liability in which injurers have private information about the level of harm that their actions would cause. In the equilibrium of his model, settlements paid by injurers who would cause relatively high harm pay too little in damages, resulting in under deterrence of these injurers. Furthermore, Friedman and Wickelgren (2008) develop a model in which settlement can result in a chilling of socially desirable activity, whereas the accuracy of a trial proceeding can reduce that effect and render trial superior to settlement. Additionally, Shavell (1999) examines a model in which the social value of settlement is studied but in which the settlement amount is taken to be the net return the victim would have obtained from trial (see p. 108), ruling out the considerations studied in the model here where settlement can be any amount in the interval of mutually desirable settlements.

[6] They study a symmetric information model of litigation and assume that settlement bargaining is itself costly but that trial does not involve pretrial costs. These assumptions lead to the possibility that trial as well as settlement might occur. They explore the effect of fee-shifting and several parameters of their model on the incentive to bring suit and the choice between settlement and trial. They do not investigate the effect of settlement on deterrence or the social versus the private incentive to settle.

[7] The only prior reference of which I am aware to the possibility that settlement could raise deterrence is in a remark made by Spier (2007, p. 281) in her survey of the theory of litigation.

2. A Model of Accidents and Litigation

Risk-neutral injurers may harm risk-neutral victims in accidents with a probability that depends on the level of care exercised by the injurers. Let

x = level of an injurer's care; $x \geq 0$;

$p(x)$ = probability of an accident; $p(0) > 0$; $p'(x) < 0$; $p''(x) > 0$; $p(x) \to 0$ as $x \to \infty$;

h = harm to a victim from an accident; $h > 0$.[8]

Injurers are identical to one another as are victims. Moreover, injurers and victims have common knowledge of these and other variables and functions in the model.

If an accident occurs, the victim will be able to engage in litigation, to be described below. As a result, the injurer may have to pay an amount to the injurer and bear litigation costs. Let

z = total amount that an injurer must pay if an accident occurs; $z \geq 0$;

z will be zero if the victim does not litigate.

An injurer will choose his level of care x to minimize his expected costs $c(x)$, where

(1) $c(x) = x + p(x)z$.

Because $c(x)$ is convex, the x that minimizes $c(x)$ is unique and will be denoted $x(z)$. It is readily shown that $x(z) = 0$ for z up to a threshold $z_o > 0$, determined by

(2) $z_o = -1/p'(0)$,

and such that above z_o, $x(z) > 0$.[9] When $x(z)$ is positive, it satisfies

[8] Harm is assumed to have a single positive value.

[9] Because $c'(0) = 1 + p'(0)z$, we know that $c'(0) = 0$ at $z = z_o$. And since $c'(0)$ is decreasing in z, $c'(0)$ must be positive for $z < z_o$ and negative for $z > z_o$. Moreover, observe that if $c'(0) \geq 0$, then $c'(x) > 0$ for all $x > 0$, since $c''(x) > 0$. This implies that $c(x)$ is monotonically increasing for $x \geq 0$ and thus that $x = 0$ minimizes $c(x)$. Hence, $x(z) = 0$ for all $z \leq z_o$ as claimed. If $c'(0) < 0$, then the x minimizing $c(x)$ must obviously be positive.

(3) $c'(x) = 1 + p'(x)z = 0$ or $p'(x) = -1/z$,

implying that $x'(z) > 0$.[10]

The social objective is minimization of expected social costs, comprised of care x, expected harm $p(x)h$, and expected litigation costs.

2.1 The Trial or Settlement Regime

The ways in which litigation may unfold after a victim is harmed by an injurer are shown in Figure 1. As can be seen, the victim first decides whether or not to invest in pretrial effort; and provided that he does this, he may proceed to trial or settlement or end litigation. To elaborate, let us define the following variables.

k = pretrial costs of a victim; $k > 0$;[11]

t_V = victim's trial cost; $t_V > 0$;

t_I = injurer's trial cost; $t_I > 0$;

s = settlement amount; $s > 0$.

The victim's pretrial activities are assumed to be necessary for trial or settlement bargaining;[12] hence, if the investment k in pretrial effort is not made, the litigation ends.

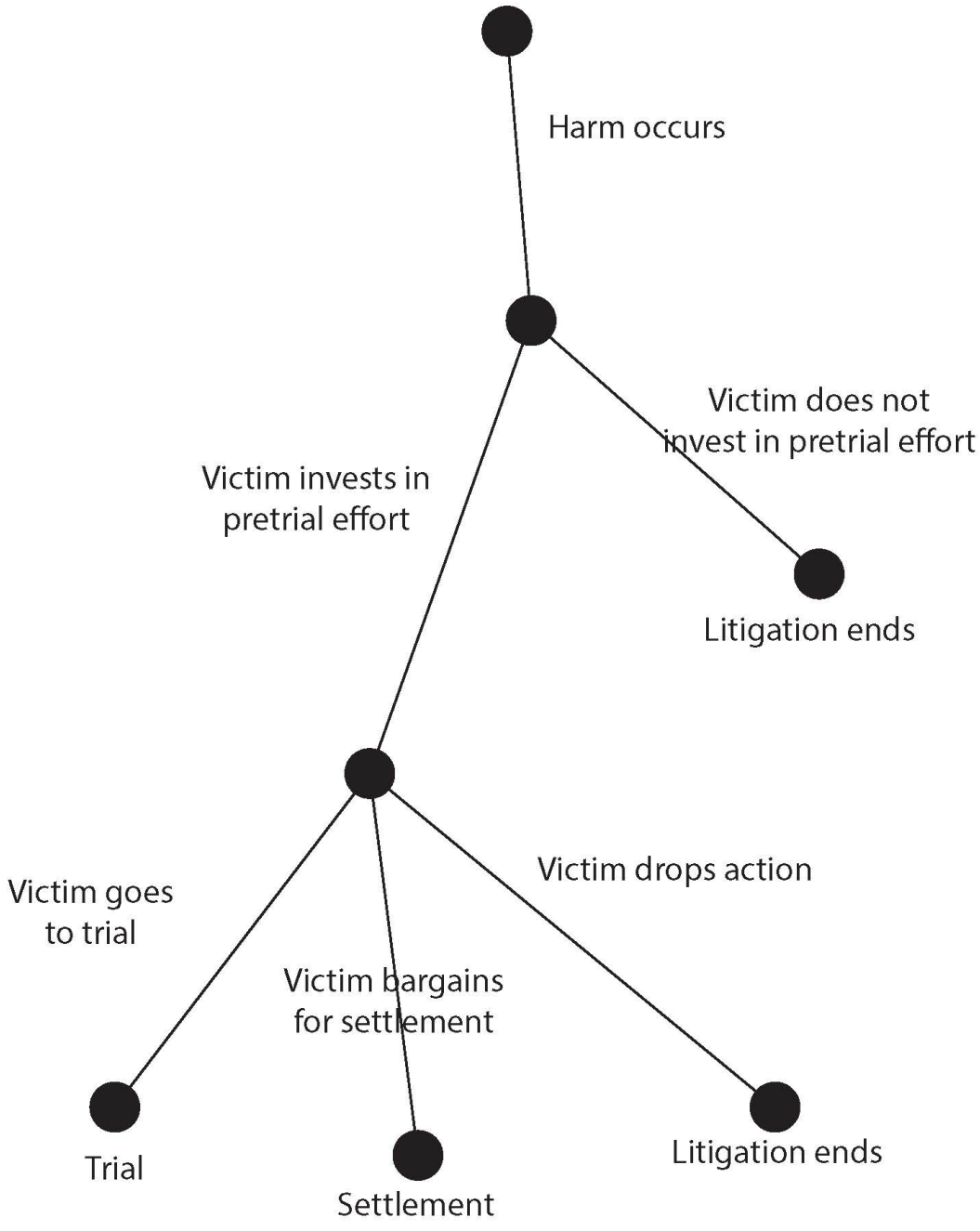
If the victim invests k, one option is for him to proceed directly to trial. In a trial, it is assumed that he would definitely prevail and would be paid h by the injurer; moreover, each party would bear his trial cost. Hence, if there is a trial, the victim's net return would be $h - t_V$

[10] Implicitly differentiating $1 + p'(x(z))z = 0$ with respect to z we obtain $x'(z)p''(x(z))z + p'(x(z)) = 0$. Hence $x'(z) = -p'(x(z))/p''(x(z))z > 0$.

[11] Pretrial costs of an injurer are not considered for simplicity.

[12] We can view the pretrial costs k narrowly as those needed by a victim to retain an attorney and convey information to him sufficient for bargaining and writing an enforceable settlement agreement. But as noted in Section 3, pretrial costs can be interpreted more broadly.

Figure 1. Sequence of Events



and the injurer would spend $h + t_I$. If $h - t_V \leq 0$, the victim would not have a positive incentive to go to trial and we will assume he would not do so. If, however, $h - t_V > 0$, the victim would have a positive incentive to go to trial.

Second, the victim may bargain for a settlement. Here we assume that if $h - t_V > 0$, the victim would obtain a positive settlement s in $[h - t_V, h + t_I]$, which will be called the settlement interval. The justification for this assumption is twofold. On one hand, if the injurer refused to pay a settlement, the injurer would know that the victim would be willing to go to trial and thus that the injurer would have to pay $h + t_I$. On the other hand, the injurer and the victim would each be made at least as well off by agreeing to a settlement s in the settlement interval as he would have been had there been a trial—for under such a settlement s, the injurer would spend at most $h + t_I$ and the victim would receive at least $h - t_V$.[13]

We also assume that if the victim bargains for settlement when $h - t_V \leq 0$, the victim would not be able to obtain a positive settlement and would receive nothing. The motivation for this assumption is that the injurer would refuse to settle for a positive amount: because the victim would not have a positive incentive to go to trial, the injurer would pay nothing upon his refusal.

Third, the victim may drop his action and obtain nothing.

We can summarize the foregoing assumptions about the victim's choices, given that he has spent k on pretrial activity, as follows. If $h - t_V \leq 0$, the victim could not make a profit from going to trial or from settling, and we will therefore assume that the victim would drop his

[13] Because of the assumption that parties have common knowledge, failure to settle due to asymmetric information, as considered in Bebchuk (1984), does not arise.

action. If $h - t_V > 0$, the victim would bargain for a settlement and agree to an s in $[h - t_V, h + t_I]$ rather than going to trial or dropping his action.

Now let us consider the victim's initial decision whether to spend k to place himself in a position so that he can go to trial or settle. We will assume that the victim will spend k if and only if he would obtain a positive profit from doing so. He would make a positive profit if two conditions hold: $h - t_V > 0$ and $s > k$. Specifically, when $h - t_V > 0$, the victim will be able to bargain and obtain a settlement s, as just discussed. Thus, if $s > k$, the victim's return from pretrial effort and settlement, $s - k$, will be positive. Hence, the two conditions are sufficient for the victim to spend k.

On the other hand, if either of the conditions fails, the victim would not be able to profit from spending k. In particular, if $h - t_V \leq 0$, the victim could not earn a positive profit from going to trial and thus could not profit from spending k. Also, as discussed above, if $h - t_V \leq 0$, the victim could not profit from bargaining for settlement and hence could not profit from spending k.

Additionally, if $s \leq k$, the victim could not earn a profit from going to trial: because s is in the settlement interval, $s \geq h - t_V$, we know that $k \geq h - t_V$, meaning that the victim could not earn a profit from spending k and going to trial. Also, $s \leq k$ rules out the possibility that the victim could earn a profit from spending k and then settling.

Regarding social costs, when the two conditions hold, since settlement will occur, social costs will be

(4) $x(s) + p(x(s))(h + k)$.

In particular, because injurers will regard the cost of an accident as s, they will choose level of care $x(s)$. The social cost of an accident involves k as well as h, for when an accident occurs, the victim will invest in pretrial effort in order to reach settlement.

Because pretrial effort will not be made and settlement will not occur when either of the two conditions are not met, injurers will not exercise care, implying that social costs will simply be

(5) $p(0)h$.

Finally, we will assume that there is an equilibrium in which all of the identical victims and the identical injurers make the same decisions about the settlement amount s. Given this assumption, we can summarize what has been said about outcomes in the model as follows.

Proposition 1. Under the assumptions of the model,

(a) victims of harm will incur pretrial expenses k and settle if and only if two conditions hold: that their settlement amount would exceed their pretrial expenses—that $s > k$; and that they would be willing to go to trial—that $h > t_V$. In this case, the settlement s will lie in $[h - t_V, h + t_I]$, injurer care will be $x(s)$, and social costs will be $x(s) + p(x(s))(h + k)$; and

(b) otherwise victims of harm will not engage in litigation, injurers will not exercise care, and social costs will be $p(0)h$.

Example 1. To illustrate Proposition 1 and subsequent results, suppose that

(6) $p(x) = \alpha/(1 + \lambda x)$, where $0 \leq \alpha \leq 1$ and $\lambda > 0$.

Hence, $p(0) = \alpha$ and λ is an index of the productivity of care. Further, $z_o = 1/(\alpha\lambda)$, so that $x(z) = 0$ for $z < 1/(\alpha\lambda)$ and $x(z) = [(\alpha\lambda z)^{.5} - 1]/\lambda$ for greater z.[14] Suppose as well that $\alpha = .5$, $\lambda = .01$, $h = 100{,}000$, $t_V = 30{,}000$, $t_I = 40{,}000$, and $k = 25{,}000$. Accordingly, $p(x) = .5/(1 + .01x)$, $z_o = 200$; for $z < 200$, $x(z) = 0$; and for $z > 200$, $x(z) = 100[(.005z)^{.5} - 1]$. Also, the settlement range $[h - t_V, h + t_I]$ is [70,000, 140,000] and the settlement s is taken to be 90,000.

Under the above assumptions, according to Proposition 1(a), victims will bear the pretrial expense of 25,000 because they will be able to settle for a greater amount, 90,000, and also because they would be willing to go to trial, as that would yield 70,000. Because injurers will pay 90,000 in settlement, their level of care will be 2,021.32 and the probability of an accident will be .024.[15] Furthermore, social costs will be 2,021.31 + .024(125,000) = 5,021.31. Note that social costs in the event of an accident are 125,000 because the harm is 100,000 and the pretrial costs are 25,000.

To illustrate part (b) of the proposition, suppose that the pretrial expense would be 60,000 and the settlement would be for 50,000. Consequently, victims would not invest in pretrial effort, settlements would not be made, and injurers would not exercise care. The probability of an accident would thus be .5 instead of .024 and social costs would be .5(100,000) = 50,000, exceeding the 5,021.31 level when settlements were for 90,000.□

[14] From (3) we have $p'(x) = -1/z$ and from (6) we obtain $p'(x) = -\alpha\lambda/(1 + \lambda x)^2$. Thus, $-\alpha\lambda/(1 + \lambda x)^2 = -1/z$ or $\lambda^2x^2 + 2\lambda x + (1 - \alpha\lambda z) = 0$. Using the quadratic formula, we obtain the expression for $x(z)$ in the text.

[15] From the formula $x(z) = [(\alpha\lambda z)^{.5} - 1]/\lambda$ derived above, we have $x(90{,}000) = 100[((.005)(90{,}000))^{.5} - 1] = 2{,}021.32$ and thus $p(x) = .5/(1 + .01(2021.32)) = .024$.

2.2 The Trial-Alone Regime

Because an objective of this article is to inquire about the effect of settlement, we need to ask what would have happened if settlement had not been permitted. We will call such a regime the trial-alone regime.

From the previous section, and from consideration of Figure 1 but with the lower branch describing settlement omitted, it is apparent that the next proposition describes what would occur in the absence of the opportunity to settle.

Proposition 2. In the trial-alone regime,

(a) victims of harm will incur pretrial expenses k if and only if their return from trial would exceed their pretrial expenses—that is, $h - t_V > k$. In this case, injurer care would be $x(h + t_I)$ and social costs would be $x(h + t_I) + p(x(h + t_I))(h + k + t_V + t_I)$;

(b) otherwise victims of harm would not engage in litigation, injurers would not exercise care, and social costs would be $p(0)h$.

2.3 The Effects of Settlement

Let us now ascertain the consequences of permitting settlement.

Proposition 3. The effects of settlement—the difference between outcomes that occur under the regime of the model, in which settlement is permitted, and outcomes that would have occurred under a trial-alone regime—are as follows.

(a) Victims of harm will engage in litigation more often under the regime with settlement permitted than they would have under the trial-alone regime: victims will incur pretrial expenses and proceed under the trial-alone regime only if $h - t_V > k$; whereas victims will incur

pretrial expenses and settle in the regime with settlement not only when $h - t_V > k$, but also when $s > k \geq h - t_V > 0$.

(b) Injurer care would be at least as high under the trial-alone regime as it will be under the regime with settlement, provided that victims would engage in litigation—when $h - t_V > k$. However, injurer care will be at least as high under the regime with settlement as it would be under the trial-alone regime when victims would engage in litigation only under the regime with settlement—when $s > k \geq h - t_V > 0$.

(c) Social costs may be either lower or higher under the regime with settlement than they would be under the trial-alone regime; which will be so depends in part on whether victims would engage in litigation under both regimes or only under the regime with settlement.

Notes. The explanation for part (a) is that because the victim's settlement could exceed the net amount that he would obtain from trial, the victim's settlement could more often offset his pretrial cost k than would have been true had he gone to trial.

The intuition regarding part (b) is that when the gain from trial would be sufficient to induce litigation, the only effect of settlement would be to reduce the amount injurers would spend from what it would be had they gone to trial. This would dilute their incentive to exercise care. But when the gain from trial would not induce litigation, then no care would be taken in the trial-alone regime, whereas litigation with settlement would often lead to the exercise of positive care.

Regarding part (c), that there is not an easily stated conclusion about the social desirability of settlement should not be surprising. In particular, parts (a) and (b) imply that deterrence could either be enhanced on account of settlement because it could raise the

probability of litigation, or that deterrence could be dulled due to settlement because it would lower the amount injurers would pay given litigation. These observations suggest that it is not possible to say that the overall effect of settlement is socially desirable, even though settlement saves litigation costs. Moreover, it is not possible to conclude that an increase in deterrence stimulated by settlement is necessarily socially desirable. A primary reason for these ambiguities is that neither a victim's decision whether to litigate nor the parties' joint decision about settlement and its amount reflects the social goal. That point will be clarified in Proposition 4.

Proof. (a) That litigation would occur in the trial-alone regime only if $h - t_V > k$ was stated in Proposition 2.

That litigation would occur in the regime with settlement when $h - t_V > k$ follows from Proposition 1, stating that victims would engage in litigation if and only if $h - t_V > 0$ and $s > k$. In particular, because $h - t_V > k$, we know that $h - t_V > 0$; and because we know that $s \geq h - t_V$ and that $h - t_V > k$, we know that $s > k$.

That litigation would occur in the regime with settlement when $s > k \geq h - t_V > 0$ follows because these conditions contain the two conditions of Proposition 1(a) that will lead victims to litigate.

(b) We know from part (a) that litigation would occur under both regimes when $h - t_V > k$. In this case, injurer care would be $x(h + t_I)$ under the trial-alone regime and $x(s)$ under the regime with settlement. Since $h + t_I \geq s$, and since $x'(z) > 0$ when x is positive, $x(h + t_I) \geq x(s)$ must hold when both $x(h + t_I)$ and $x(s)$ are positive. However, we also know that there is a region up

to $z_o = -1/p'(0)$ in which $x(z) = 0$. Hence, if $h + t_I$ and s are both less than z_o, then $x(h + t_I)$ and $x(s)$ would both be 0 and thus equal.

We also know from part (a) that litigation will occur only under the regime with settlement when $s > k \geq h - t_V > 0$. In this case, since litigation would not occur under the trial-alone regime, care would be 0. And since litigation will occur under the regime with settlement, care will be $x(s)$. Hence, care will be positive if $s > z_o$ and otherwise care will be 0.

(c) In the case when litigation would occur under both regimes, when $h - t_V > k$, injurer care would be $x(h + t_I)$ under the trial-alone regime and social costs would be

(7) $$x(h + t_I) + p(x(h + t_I))(h + k + t_V + t_I),$$

whereas care would be $x(s)$ under the regime with settlement and social costs would be

(8) $$x(s) + p(x(s))(h + k).$$

Either level of social costs could be lower. To explain why, suppose that $x(h + t_I) > x(s)$, so that the probability of harm in (7) is lower than the probability of harm in (8). However social costs in the event of harm are higher in (7) than in (8). Thus, whether (7) or (8) is lower depends on the significance of the lower probability of harm in (7) as opposed to the lower social cost of a harmful event in (8), and illustrations of each possibility are provided in Example 2 following the proof of this proposition.

In the case when litigation will occur only under the settlement regime, when $s > k \geq h - t_V > 0$, injurer care under the trial-alone regime would be 0 and thus social costs would be $p(0)h$. Under the regime with settlement, care will be $x(s)$, so that social costs will be given by (8). Either level of social costs could be lower. Now, however, the reason is that the probability of harm in the trial-alone regime could be higher than that in (8) but the magnitude

of social costs when harm occurs would be lower than that in (8). Again, examples are provided Example 2.□

Example 2. To elucidate part (a), recall that in the first illustration in Example 1, with s = 90,000 and $h - t_V$ = 70,000 > 25,000 = k, litigation would occur in the regime with settlement. Suppose, however, that k is 75,000. Then, although litigation would occur under the regime with settlement, it would not occur under the trial-alone regime—for 70,000 < 75,000. In cases like this, settlement can be said to cause litigation, for if settlement were not permitted, there would be no litigation.

Regarding part (b), in Example 1, with k = 25,000 and litigation occurring in both regimes, the level of care in the regime with settlement was 2,021.32, reflecting injurer payments of 90,000, and the probability of an accident was .024. But in the regime with trial alone, since injurers pay 140,000 (harm of 100,000 plus their litigation cost of 40,000), injurer care is higher and the probability is lower: care is 2,545.75 and the probability is .019.[16]

Yet in the case with litigation resulting in the regime with settlement but not in the trial-alone regime, care is 0 in the latter and thus the probability of an accident is as high as it can be, $p(0)$ = .5. Thus we see that whether the settlement regime lowers or raises care depends on whether litigation would occur under the trial-alone regime.

Turning to part (c), we will first show that social costs could be lower under either regime in the case where litigation would result under both. Consider again the first illustration in Example 1. We saw there that litigation would occur under the regime with settlement

[16] We have $x(140{,}000) = 100[((.005)(140{,}000))^{.5} - 1] = 2{,}545.75$ and $p(x) = .5/(1 + .01(2{,}545.75)) = .019$.

because the settlement of 90,000 exceeds the pretrial cost of 25,000, and that care was 2,021.32, the probability of harm was .024, and social costs were 5,021.31. In that illustration, litigation would also be undertaken in the trial-alone regime because $h - t_V = 70{,}000$, which exceeds 25,000. Hence, care would be 2,545.75 and the probability of harm would be .019.[17] Since litigation costs including the pretrial cost would add to 95,000, social costs would be 2,545.75 + .019(195,000) = 6,250.75. Thus, even though the probability of harm would be lower in the trial-alone regime, the bearing of litigation costs of 95,000 by the parties would raise social costs from their level in the regime with settlement.

If, however, we alter the foregoing example sufficiently, we can see that social costs could be lower in the trial-alone regime. Modify the first illustration in Example 1 by assuming that $\alpha = 1$, $t_V = 99{,}915$, so that $h - t_V = 85$, and suppose that $s = 90$, $k = 50$, and $t_I = 100$. Then in the regime with settlement, settlement at 90 would occur. Injurer care would be 0 because their payment of 90 does not induce positive care (as $z_o = 100$). Hence, the probability of harm would be 1. Expected social costs would thus be 100,000 + 50 = 100,050. In the trial-alone regime, trial would occur with injurers bearing 100,000 + 100 = 100,100, implying care of 3,063.86 and a probability of harm of .032.[18] Social costs if harm occurs would be harm, pretrial costs, and trial costs, or 100,000 + 50 + 99,915 + 100 = 200,065; and expected social costs would be (.032)200,065 = 6,402.08. This amount is less than expected social costs of 100,050 in the settlement regime.

[17] See two paragraphs above.

[18] We have $x(100,100) = 100[((.01)(100,100))^{.5} - 1] = 3{,}063.86$ and $p(x) = 1/(1 + .01(3{,}063.86)) = .032$.

It remains for us to show that social costs could be lower under either regime in the case where litigation would result only under the regime with settlement. Let us again modify the first illustration in Example 1 by setting *k* equal to 75,000. Then, although there will be litigation in the settlement regime because *s* is 90,000, there will not be litigation under the trial-alone regime, since $h - t_V$ is 70,000. As we have discussed in Example 1, injurers will exercise care of 2,021.32 and the probability of harm will be .024. Social costs will thus be 2,021.32 + .024(175,000) = 6,221.32. However, there will be no litigation in the trial alone regime since pretrial costs of 75,000 exceed 70,000. Thus, care will be 0 and the probability of harm will be .5, so that social costs will be 50,000, exceeding social costs under the regime with settlement. Hence the regime with settlement has lower costs.

Last, let us change the example in the previous paragraph by assuming that $\alpha = .01$ and $\lambda = .001$. Then, because of the small initial probability of harm of .01 and the low productivity of care, the level of care under the settlement regime when *s* is 90,000 will be 0.[19] Consequently, the probability of harm will be .01 and social costs will be .01(175,000) = 1,750. Under the trial-alone regime, however, no litigation would occur. And since there will be no exercise of care, social costs will be only .01(100,000) = 1,000, which is lower than under the settlement regime (because the pretrial costs *k* will be avoided).□

2.4 The Socially Optimal versus the Privately-Determined Litigation Regime

Here we first examine the behavior of a social welfare-maximizing planner if he could make litigation decisions rather than the parties but faces comparable constraints. We have

[19] Since $z_o = 1/(\alpha\lambda) = 1/.00001 = 100{,}000$, injurers would have to bear settlements greater than this amount to be led to exercise positive care.

Proposition 4. Suppose that a social planner whose objective is to minimize social costs makes litigation decisions subject to constraints similar to those of the parties: the planner chooses whether to incur pretrial costs k; if he does so and if $h > t_V$, he is able to decide whether to go to trial or to settle; and if he elects to settle, he can choose any s in $[h - t_V, h + t_I]$. Then

(a) the planner will engage in litigation and spend k initially if and only if

(9) $x(h + \min(k, t_I)) + p(x(h + \min(k, t_I)))(h + k) < p(0)h$,

that is, social cost when k is invested and settlement occurs at the planner's optimal s is lower than if no litigation occurs;

(b) if the planner spends k, he will settle;

(c) if the planner settles, he will choose s equal to $h + \min(k, t_I)$.

Proof. (a) This claim is self-evident given that claims (b) and (c) hold: for then the planner knows that if he spends k, he will settle and choose s equal to $h + \min(k, t_I)$; and the planner also knows that if he does not spend k, there will be no litigation and care will be 0.

(b) Suppose to the contrary, that the planner spends k and then goes to trial. Then, the level of care of an injurer will be $x(h + t_I)$ and social costs will be

(10) $x(h + t_I) + p(x(h + t_I))(h + k + t_V + t_I)$.

However, if the planner chooses to settle at $s = h + t_I$, care will also be $x(h + t_I)$ and social costs will be

(11) $x(h + t_I) + p(x(h + t_I))(h + k)$.

This is less than (10) because $p(x(h + t_I)) > 0$ and $t_V + t_I > 0$. Hence, trial could not have been the cost minimizing choice for the planner.

(c) Because the planner spends k if an accident occurs and then settles, social costs if an accident occurs will be $h + k$. Hence, the planner will want care x to minimize $c(x) = x + p(x)(h + k)$. And because the injurer will choose x to minimize $x + p(x)s$, the planner will want s to equal $h + k$. Therefore, the planner will choose s to be $h + k$ provided that $h + k$ is contained in the settlement interval, $[h - t_V, h + t_I]$. Accordingly, if $k \leq t_I$, the planner will choose $s = h + k$.

If, however, $k > t_I$, so that $h + k$ lies outside the settlement interval, it is claimed that the best that the planner can do is to set $s = h + t_I$. To demonstrate this, consider $C(s) = x(s) + p(x(s))(h + k)$, social costs as a function of s. To prove the claim, it clearly suffices to show that $C'(s) < 0$ for $s < h + k$. Now $C'(s) = x'(s) + x'(s)p'(x(s))(h + k) = x'(s)[1 + p'(x(s))(h + k)]$. Because $x'(s) > 0$, if it is shown that $1 + p'(x(s))(h + k) < 0$ for $s < h + k$, then we will know that $C'(s) < 0$ for such s. Since $1 + p'(x(z))z = 0$, if we let $z = h + k$ we have $1 + p'(x(h + k))(h + k) = 0$. But $p'(x(h + k)) > p'(x(s))$ for $s < h + k$.[20] Hence, we have $0 = 1 + p'(x(h + k))(h + k) > 1 + p'(x(s))(h + k)$, which establishes that $C'(s) < 0$ for $s < h + k$. □

Example 3. Let us use the first illustration of Example 1, where h = 100,000, k = 25,000, t_V = 30,000, and t_I = 40,000. Then, since 25,000 < 40,000, the optimal s for the planner will be 125,000, as it lies within the settlement interval [70,000, 140,000]. Therefore, the level of care will be 2,400, the probability of harm will be .020, and social costs will be 4,900.[21] On the other hand, if the planner does not spend the pretrial amount of 25,000 and engage in litigation, the probability of an accident will be .5, so social costs will be .5(100,000) = 50,000, exceeding

[20] This follows because $x'(s) > 0$ and $p''(x) > 0$.

[21] Since $\alpha = .5$ and $\lambda = .01$, we have $x(125{,}000) = 100[((.005)(125{,}000))^{.5} - 1] = 2{,}400$, $p(2{,}400) = .5/(1 + .01(2{,}400)) = .020$, and social costs will be 2,400 + .020(125,000) = 4,900.

4,900. Hence, in this case the planner would spend the 25,000 and would then settle the case for 125,000.

Next let us consider the possibility that the planner is unable to use the settlement *s* he would like because it lies outside of the settlement interval. Suppose that we modify the previous example by assuming that t_l = 20,000 rather than 40,000. Then the settlement interval would be [70,000, 120,000]. Hence, even though the planner would want *s* to equal 125,000, the highest *s* that he could and would employ is 120,000. Therefore, the level of care will be 2,349.49, the probability of harm will be .020, and social costs will be 4,901.03.[22] Because social costs would be higher, 50,000, if the planner did not spend 25,000 to bring suit and settle for 120,000, the planner's initial decision to spend 25,000 would be the same as in the case just above where the planner was able to use a settlement amount of 125,000.

Last, let us demonstrate the possibility that the planner would not spend 25,000 on pretrial costs and litigate because social costs would be lower if he did nothing. Suppose that we alter the initial illustration of Example 1 by assuming that $\alpha = .01$ and $\lambda = .0001$. Then if the planner does not spend 25,000, the probability of harm will be .01(100,000), so social costs will be 1,000. If, however, the planner does spend 25,000 and settles for 125,000, care will be 0 because its effectiveness is low,[23] so that so social costs will be .01(125,000) = 1,250. Hence, the planner would not spend 25,000 and engage in litigation.□

[22] In this case, we have we have $x(120{,}000) = 100[((.005)(120{,}000))^{.5} - 1] = 2{,}349.49$, $p(2{,}349.49) = .5/(1 + .01(2{,}349.49)) = .0204$, and social costs will be 2,349.49 + .0204(125,000) = 4,901.03.

[23] We know from the proposition that if the planner engages in litigation, it will be socially optimal for the settlement to be 125,000. But $x(125{,}000) = 0$ because $z_o = 1/(\alpha\lambda) = 1/.000001 = 1{,}000{,}000$.

We can now compare the litigation decisions that the social planner would make with those of private parties.

Proposition 5. The differences and similarities between the desired litigation decisions of private parties and the socially best decisions of the social planner, who faces the constraints noted in Proposition 4, are as follows.

(a) Victims decide to spend k and engage in litigation when the criterion $s > k$ is satisfied—the settlement amount s would exceed the pretrial expense k; whereas the social planner would spend k and engage in litigation when $x(h + \min(k, t_I)) + p(x(h + \min(k, t_I)))(h + k) < p(0)h$—social costs would be lower if litigation and settlement occur than if not.

(b) It is possible that victims would engage in litigation when the social planner would not as well as that victims would not engage in litigation when the social planner would do so.

(c) Both victims and injurers and the social planner settle all cases in which litigation occurs.

(d) Victims and injurers jointly select a settlement amount in the interval $(h - t_V, h + t_I)$, whereas the social planner sets the settlement equal to $h + \min(k, t_I)$.

Notes.

Parts (a), (c), and (d) are restatements of earlier propositions and part (b) will be shown in an example below.

Part (a) illustrates the significance of the deviation between private and social objectives. In deciding whether to bring suit, the victim considers only whether the settlement amount would exceed his pretrial expense k, that is, whether he would personally make a profit from litigation. The social planner does not ask that question but rather whether social costs

would be lowered by engagement in litigation and the resulting lowering of the probability of harm, despite the associated cost of k.

Part (b) reflects part (a).

Part (c) means that private and social decisions whether to settle are the same even though private and social objectives about settlement are not in alignment. The private objective of injurers and of victims is individually selfish—for each to better himself by avoiding the expenditure of trial costs. The social objective of the planner incorporates all the effects of settlement on deterrence as well as the pretrial expenses that would be incurred by victims if they engage in litigation.

Part (d), that the privately-determined settlement amount could be anywhere within the settlement interval is not surprising, for that amount did not depend on the effect of s on deterrence or on the pretrial expense.

Example 4. Let us illustrate the contrast between the decisions of the parties and those of the social planner.

Consider the initial illustration of Example 1, but with k = 50,000, t_V = 60,000, t_I = 60,000. Thus, the settlement interval would be [40,000, 160,000]. Assume too that s = 45,000. Then victims would not engage in litigation because the settlement amount of 45,000 (and the 40,000 net gain they would obtain from trial) would be less than the pretrial costs of 50,000. Hence, injurers would not exercise care, the probability of harm would be .5, and expected social costs would be 50,000.

However, the social planner would engage in litigation and would settle for 150,000, the harm plus pretrial costs. To verify this, observe that injurers would exercise care of 2,638.61, the

probability of accidents would be .018, and expected social costs would be 5,338.61,[24] less than the 50,000 if the planner did not engage in litigation and care were not taken, the outcome if private parties make litigation decisions.

We will now demonstrate the reverse of what we just illustrated, that the social planner might not engage in litigation whereas private parties would do so. Consider Example 3, which involved the first illustration in Example 1 but with $\alpha = .01$ and $\lambda = .0001$. As we showed there, the planner would not engage in litigation because doing so would not stimulate the exercise of care—due to its low productivity. In that case, social costs would be 1,000. However, victims would decide to engage in litigation since their pretrial costs were 25,000, and the settlement they would obtain was 90,000. That would lead to care of 0 and thus social costs of .01(125,000) = 1,250. Again, we see that the comparison of *s* to *k*, the concern of victims in deciding whether to engage in litigation, provides little information about its actual social desirability.□

3. Concluding Comments

(a) *Policy Implications of the analysis.* In the world of the model, a social planner with the power to intervene in litigation would initially determine whether the type of litigation at issue is socially worthwhile. If that is true, the planner would bring suit, ensure that settlement occurs, and would if feasible set the settlement amount equal to the harm caused plus the plaintiff's pretrial expenses.[25] The explanation for the desirability of this settlement amount is that proper deterrence is achieved when a defendant must make a payment equal to the social

[24] We have $x(150{,}000) = 100[((.005)(150{,}000))^{.5} - 1] = 2{,}638.61$, $p(2{,}638.61) = .5/(1 + .01(2{,}638.61)) = .018$, so expected social costs are $2{,}638.61 + .018(150{,}000) = 5{,}338.61$.

[25] See Proposition 4, from which it is clear that the optimal settlement is $h + k$ unless that amount exceeds the highest permissible amount of $h + t_l$.

costs that he generates in an accident, which in the model is the harm together with the pretrial costs that precede settlement. If, however, the planner finds that the litigation is not socially worthwhile, the planner would not bring suit.

Do these conclusions about a social planner suggest that courts can usefully intervene in settlement? That would depend on the judicial capacity to evaluate the social desirability of litigation. In some situations, a court might have a reasonable basis for viewing a case before it as socially worthwhile litigating or as not worthwhile pursuing. But in other situations a court might well be unsure.[26] With regard to the matter of the settlement amount, it seems that the task of the courts would often be straightforward, for then courts would only need to estimate harm and pre-settlement litigation costs.

(b) *The assumption that parties who settle are not concerned about deterrence*. A premise on which the analysis in this article rested was that parties who are involved in litigation are not concerned about deterrence of misconduct. The main justification for this supposition derives from the very meaning of deterrence of misconduct produced by a case—that it is the effect of the case on misconduct of actors in the future. We would not ordinarily expect this future effect to impinge on the well-being of the parties involved in a case themselves.[27] An additional justification for the assumption is that the influence of any single case on deterrence is unlikely to be more than marginal.

[26] To appraise the desirability of litigation as a deterrent would require a court to evaluate not only the costs of resolving similar cases in the future but also the benefits. That would necessitate consideration of the ability of potential injurers to reduce risk and the degree to which litigation pressure would induce them to lower risk. A court would often be unfit to undertake such a consideration.

[27] A qualification is that if a party is a repeat player, such as a defendant firm continually facing product liability claims, the party could be concerned about the implications of present litigation for the party's future litigation.

(c) *The importance of pretrial expenditures*. In the analysis, victims decided to invest in suit and pretrial expenditures only if the settlements that they would receive would be larger. If pretrial expenditures were typically small, these expenditures would tend to be superseded by expected settlements and thus not constitute a significant determinant of litigation. However, common experience suggests that the expenditures can be substantial, comprising expenses of discovery, motion practice, retention and preparation of experts, and the like.[28] Therefore, it may be appropriate to view the condition that plaintiffs' predicted settlement amounts exceed their pretrial outlays as serious and of comparable importance to plaintiffs' willingness to go to trial after they have made these outlays.

(d) *Factors favoring trial that were omitted from the social objective in the model.* The holding of trials yields social benefits that did not enter into the social objective considered in the model. In particular, the social goal of the amplification and development of the law requires trial court consideration of cases as well as use of the appeals process. Moreover, public confidence in the judicial system depends on the ability of citizens to witness trials and learn the justifications for legal findings.

It is apparent, however, that the foregoing social benefits of trials would not usually constitute benefits to the particular parties involved in litigation—they would not often have more than modest interest in fostering the articulation of the law or public faith in the judiciary. Hence, a holistic consideration of the desirability of settlement versus trial could conclude that

[28] See, for example, Hannaford-Agor (2018, p. 26) for data on amounts spent during different stages of litigation.

some non-negligible fraction of cases should be resolved by trial, and that this might require actions by courts to accomplish.[29]

[29] See Fiss (1984) for a notable expression of the view that settlements do not tend to reflect important social interests. Hence, he warns against a social policy of programmatic settlement.

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