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Hush money

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We provide a simple incomplete-information model wherein an initially uninformed plaintiff makes a menu of settlement demands (one of which involves confidentiality) of the informed defendant. The defendant is informed about both his culpability in the harm suffered by the current plaintiff and the existence of other plaintiffs. The possibility that there are other plaintiffs the defendant might face improves the current plaintiff's bargaining position, as the likelihood of follow-on suits depends upon the visibility of the outcome of the current case. For this reason, the defendant may be willing to pay "hush money."

1. Introduction

■ Models of bargaining under incomplete information usually focus on the revelation of information between the participants in the existing negotiation.[1] What this article adds is a consideration of the incentives that one or both participants may have to limit the transmission of that information to agents who are not party to the current negotiations: What if one of the participants wants the details (or the existence) of the negotiations to be kept secret? In such circumstances, bargaining involves multiple issues:[2] the original object of the bargain and the agreement to keep a secret.

A good example of this is pretrial settlement bargaining, where the parties to a suit bargain in anticipation of saving the costs of a trial. A settlement is a contract between the parties in which the defendant pays money to the plaintiff in exchange for a voluntary dismissal of the suit. As will be discussed shortly, courts may seal the records or parties may simply enter into enforceable agreements to maintain silence.

How does the option to incorporate secrecy in the bargain affect the terms of the bargain? The fortunes of the bargainers? The fortunes of other parties (e.g., potential

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[1] The exceptions of which we are aware are all in the area of law and economics, and they feature a sequence of two plaintiffs suing a single defendant; see the discussion below on related literature.

[2] Recent work on multi-issue bargaining includes Ponsati-Obiols (1992) and Ponsati and Watson (1997); the former is strategic (à la Rubinstein) under incomplete information, wherein each issue can take on one of two exogenously specified values, while the latter is axiomatic and involves complete information.

future litigants)? Does having this option increase or decrease the likelihood of bargaining success (where failure involves going to trial)? Is sealing socially valuable? We address these and other questions in a simple incomplete-information model wherein an initially uninformed plaintiff makes a menu of settlement demands (one of which involves sealing the settlement) of the informed defendant. Information here is multidimensional in that the defendant is informed about both his culpability in the harm suffered by the current plaintiff and the existence of other plaintiffs. The possibility that there are other plaintiffs the defendant might face improves the current plaintiff's bargaining position, as the likelihood of follow-on suits depends upon the visibility of the outcome of the current case (a ''publicity effect''). It is for this reason that the defendant may be willing to pay ''hush money.''

The following summary of a recent case (Bechamps (1990), p. 117) provides an illustrative example of a sealed settlement.

> When officials at the Xerox plant near Webster, New York discovered that a hazardous chemical had leaked into the groundwater and contaminated a private well, they disclosed the leak to the community and assured local residents that there were no long-term health risks. However, two families later sued Xerox on allegations that air and water discharges from the plant had caused members of both families to suffer health problems, including a rare form of cancer in one teenage girl. The parties reached a settlement in 1988. Pursuant to the agreement, Xerox paid the families approximately $4.75 million and relocated them, but admitted no liability. Under the terms of the settlement, the trial judge sealed all the court records and prohibited the parties and their attorneys, on penalty of contempt, from discussing the matter with the media or the general public.

Settlements of lawsuits may be sealed through two routes. A court may seal the settlement agreement, along with associated discovery materials, and issue a gag order to the parties; this was the route taken in the example given above. Alternatively, the parties may file a voluntary stipulation of dismissal with the court and formulate a private ''contract of silence'' (see, e.g., Garfield, 1998) whereby both parties agree not to discuss the terms of the settlement or to disseminate information obtained through discovery. We are less concerned with the way in which secrecy is achieved than with whether it is achieved and how this influences the final distribution of wealth. Thus, we will simply refer to a settlement as ''sealed'' or ''confidential,'' regardless of whether this is achieved by court order or by contract. If the parties do not seek sealing via either court or contract, then any settlement arrived at under these terms will be referred to as ''unsealed'' or ''open.''

Currently, judges have broad discretion to issue orders sealing settlement agreements and related papers, especially information generated through discovery proceedings (see Federal Rule of Civil Procedure 26 in Yeazell (1996)). In making these decisions, they are expected to balance the private interests of the parties and any relevant compelling public interests. Needless to say, two strongly divergent opinions are held on the desirability of sealing settlement agreements and related documents. In the past decade, many states have considered (and several have passed) ''sunshine'' laws mandating a strong presumption of public access to pretrial records (see Miller, 1991). On the other hand, two committees of the Judicial Conference recently proposed amending the Federal Rules of Civil Procedure to allow judges to impose confidentiality whenever the parties agreed on its desirability (not adopted at the 1995 annual meeting; see Nader and Wesley, 1996).[3] There remains considerable disagreement and jockeying for position on this issue. Proponents of openness stress the benefits to third parties: other injured people will realize that they have a case, further risks to health and safety

[3] See also Shavell (1997) for a brief discussion of confidential settlements in a broader examination of private and social incentives to use the legal system.

will be averted,[4] and discovery sharing (which allows other plaintiffs to reduce their costs of suit) will be facilitated. Supporters of secrecy argue that discovery sharing is likely to inspire nuisance suits, important privacy interests of the parties (such as protecting trade secrets or highly personal information) will be violated, and many settlements are made contingent upon sealing (promoting settlement is an important goal of the civil justice system).

Our model incorporates some, but not all, of these concerns. In particular, we incorporate the ''publicity'' aspect of trial, settlement, and sealing by assuming that some potential plaintiffs do not know they have a case, and that the disposition of a previous case can affect whether or not later plaintiffs file suit. We are thus able to assess the impact of having the sealing option on the expected payoffs of early plaintiffs, later plaintiffs and the average plaintiff, as well as the defendant. We are also able to examine how having the sealing option affects the equilibrium likelihood of settlement versus trial. Our model does not incorporate continuing risks of harm, discovery sharing, or the idiosyncratic value of privacy to the parties. Moreover, we assume a particular order of play, which accords significant bargaining power to the plaintiff. As a consequence of these limitations, we do not draw strong policy conclusions from our findings, which we regard as suggestive rather than definitive.

In Section 2 we describe the basic model that allows the parties to seal a settlement as part of the resolution of the suit. We find that for some parameter values, all three outcomes are involved in an equilibrium. In particular, an early plaintiff (1) concludes a sealed settlement with defendants who anticipate a later potential plaintiff, (2) concludes an unsealed settlement with a defendant whose culpability in the current case is high but who anticipates no further suits, and (3) goes to trial against a defendant whose culpability in the current case is low and who anticipates no further suits. In Section 3 we reconsider the analysis under the assumption that sealed settlements are prohibited. Although there are some exceptions, for most parameter values the equilibrium extent of settlement is higher when confidentiality is allowed (largely confirming the belief that allowing the details of an agreement to be kept secret promotes settlement). We show that early plaintiffs unambiguously prefer to have the option of confidential settlements; that is, they are able to extract ''hush money'' in exchange for their silence. Predictably, later plaintiffs prefer that confidentiality not be an option, as confidentiality of the first settlement increases the likelihood that the later plaintiff is never compensated. Thus, there is a clear conflict between *ex post* equity and facilitating settlement.

The source of this hush money is threefold. First, as noted above, secrecy can increase the likelihood of settlement, saving trial costs and increasing the expected pie to be divided between the early plaintiff and the defendant. Second, the option to offer a menu[5] of settlement demands allows the plaintiff to sort defendant types better and thereby extract more from the defendant. Finally, by engaging in a confidential settlement (as compared to, e.g., either trial or an open settlement), the early plaintiff and the defendant are able to reduce the likelihood that the later plaintiff files suit; that is, the later plaintiff implicitly provides some (or all) of the hush money! This again

[4] Luban (1995, p. 2560) argues that sealed settlements have hidden defects in ''Dow Corning's silicone gel breast implants; pickup trucks made by Ford and General Motors; Upjohn's sleeping pill Halcion; Pfizer's Bjork-Shiley heart valves; and McNeil Pharmaceutical's painkiller, Zomax.'' Miller (1991) argues that, in many of these cases, sealed settlements were not responsible for further harm.

[5] Wang (1998) provides a model in which workers bargain over wage and product quality with a firm. Our model differs in a number of ways, including that our informed party has two dimensions of private information rather than one and we consider bargaining among three agents, only two of which are actively engaged in negotiation at any given time.

increases the pie to be divided between the early plaintiff and the defendant. While it is not surprising that the early and later plaintiffs have opposite preferences on sealing, it turns out that the average plaintiff may gain from sealed settlement agreements. Moreover, the average defendant can lose from the possibility of such settlements.

In general, we show that there should not be a uniform policy with respect to allowing or prohibiting confidential settlements, which means that judicial discretion becomes important in deciding when confidentiality can be employed. We discuss this in Section 4, which also provides a brief summary and conclusions. The crucial elements supporting the analysis are contained in a brief Appendix; more detail is provided in a second appendix (the ''Web Appendix'') available through http://www.rje.org/main/sup-mat.html.

Before proceeding to the formal analysis, we provide a brief overview of the related literature. Briggs, Huryn and McBride (1996) examine the issue of a private antitrust suit which follows a government suit determining guilt. Che and Yi (1993) and Yang (1996) provide somewhat different models in which an uninformed defendant makes a sequence of settlement offers to two plaintiffs, whose private information is correlated. Peterson (1991) assumes a sequence of uninformed plaintiffs makes settlement demands of an informed defendant whose culpability in the two cases is correlated. In all cases, settlements with the first plaintiff are observable to the second plaintiff. Yang (1994) reconsiders the model of Yang (1996) under the assumption of sealed settlements. However, the decision to seal a settlement is not endogenous; settlements are (by assumption) either all sealed or all open.

2. Bargaining over money and secrecy

■ We first describe how the Xerox case above will be interpreted in the context of the model we present below. In the Xerox case, there are several residents of the community who may have suffered harm. Most attribute any illnesses they suffer to other causes (and indeed they may be due to other causes), but two families attribute at least some culpability to Xerox. We will refer to these families as ''early plaintiffs'' to distinguish them from the other potential plaintiffs, whom we refer to as ''later plaintiffs.'' The early plaintiffs form a prior distribution over the extent of Xerox's level of culpability in contributing to their own illnesses and also over the likelihood that other potential plaintiffs might exist. These families sue, then settle, with the settlement agreement and all related records being sealed. Settling alone may reduce the likelihood that later plaintiffs file suit, and sealing the records reduces it even further. Later plaintiffs may subsequently sue, but since their illnesses may be different, Xerox's chemical spill may contribute more or less to these illnesses, so later plaintiffs have a potentially different prior over Xerox's level of culpability. Thus, when the first case is being negotiated, neither the early plaintiffs nor the firms know what Xerox's level of culpability will be in later cases that may arise. However, Xerox has better information than the early plaintiffs about the likelihood of another plaintiff and about Xerox's level of culpability in the early plaintiffs' illnesses (in the current case). If a later plaintiff files suit, we assume that the firm is able to determine its own level of culpability in that case at that time (it becomes informed), while the later plaintiff continues to operate under its prior (remains uninformed).

More formally, we consider a setting wherein the actions of a defendant (D) may have resulted in at least one person being harmed; denote the associated level of harm by d. For simplicity we will have one early plaintiff, P_1, and the possibility of one later plaintiff, P_2 (that is, someone else who has been harmed and whose suit may be triggered by the outcome of the early plaintiff's suit). Upon recognizing the defendant's involvement, the early plaintiff forms priors over the culpability of the defendant and the likelihood of a later plaintiff. Assume that, for the case involving P_1, D is either highly culpable (H) or not highly culpable (L); this type space, as well as P_1's prior that D is of type H (denoted $p \in [0, 1]$) is common knowledge to P_1 and D. Let P_1's prior over the likelihood of there being a later plaintiff, P_2, be denoted $q \in [0, 1]$, which is also common knowledge. Finally, D knows whether he is H or L and whether P_2 exists or not.

The previously described information structure is motivated as follows. The specific attributes of a case (e.g., plaintiff characteristics, the nature of the harm) determine each plaintiff's prior over D's culpability, which is why the priors may be different between early and later plaintiffs (e.g., it may be relatively easy to link contaminated water to P_1's bladder cancer but relatively difficult to link it to P_2's brain tumor). Moreover, these case attributes determine the early plaintiff's prior over the existence of a later plaintiff. D learns these case attributes when the case is filed, which is why he can reconstruct the plaintiffs' priors. In addition, from these attributes D can determine his own culpability (which is why his culpability may differ from case to case) and whether there will be a later plaintiff to contend with.

The timing of the game is as follows. First, an individual who has suffered harm may attribute it to his or her interaction with D or to ''natural causes'' (by this, we mean anything but D, including the individual's own actions, destiny, or cosmic rays). We assume that, initially, all individuals assign a sufficiently high probability to natural causes so that they do not contemplate suing D. Then assume that one individual observes a signal that the harm was *not* due to natural causes, but to interaction with D (e.g., consumption of a product, medical treatment, environmental exposure). The assessments of the likelihood of being found liable (conditional on true culpability), π_H and π_L, are also taken as common knowledge, as are the court costs each litigant would face (k_P and k_D) should settlement bargaining fail and the case be taken to court. If the firm's culpability is high, the expected damages $\pi_H d$ would be awarded at trial, and if the firm's culpability is low, the expected damages $\pi_L d$ would be awarded at trial. P_1 will pursue the case to trial if $\pi_L d - k_P$, P_1's net return from trial against a low-culpability defendant, is positive. To assure that the threat of trial is always credible, we make the following standard assumption:

Assumption 1. $\pi_L d - k_P > 0$.

Under this assumption it is credible for P_1 to go to trial[6] even if D's culpability is known to be L (i.e., $p = 0$). Thus, it is a dominant strategy for P_1 to file suit once D's involvement is realized.[7]

The later plaintiff, P_2, is assumed not to have observed the early plaintiff's signal but may become aware of D's involvement in P_2's own harm through publicity associated with the outcome of P_1's suit. In particular, we consider three possible outcomes for the suit between P_1 and D, namely trial (denoted T), an unsealed (or open) settlement (denoted O), and a sealed (or confidential) settlement (denoted C). Let (for $m \in \{T, O, C\}$):

[6] This may not be true in actual settings, complicating empirical research. Plaintiffs would bring suit if $(p\pi_H + (1 - p)\pi_L)d - k_P > 0$. However, information released in bargaining may cause the plaintiff to drop the suit, because the posterior expected net return of trial is negative (see Nalebuff, 1987).

[7] Note that, to economize on notation, we have not formally defined the probability that P_1 receives a private signal about D's involvement or a filing strategy for P_1 conditional on receipt of this signal (or for P_2). The former does not affect the continuation game, and the probability associated with the latter would be one by Assumption 1.

$\gamma_m \equiv \Pr\{P_2$ becomes aware that D could be at fault $| P_2$ exists and the outcome of P_1's suit is $m\}$.

We assume that $1 = \gamma_T > \gamma_O > \gamma_C > 0$. Thus (if P_2 exists), a trial in the early case results in significant publicity, with the result that P_2 learns of D's involvement with certainty. It is the fact that a trial took place that is important here: even if D were found not liable in a trial in the early case, the publicity about D is still present and alerts P_2. Open settlement in the early case results in some (but considerably less) publicity, which results in a lower chance that P_2 learns of D's involvement. Finally, a confidential settlement entails yet less publicity, resulting in a yet lower chance that P_2 attributes his harm to interaction with D.

If a later plaintiff exists and learns the outcome of P_1's suit, this plaintiff also receives a (possibly different) prior over D's level of culpability (H or L). For simplicity, we assume that the later plaintiff's damages are also d (this is of no consequence in what follows; it merely saves notation). Since $\pi_L d - k_P > 0$, it is a dominant strategy for the later plaintiff to file suit once alerted to D's involvement. Note that not everyone in the economy, even though alerted, could file suit; they must have been harmed and there must be reason (e.g., they used the well water) to believe it was D's actions that caused the harm. This is the notion of having standing to sue.

While D is involved in both P_1's and P_2's mishaps, this is separate from the issue of the extent to which D's culpability is correlated over the plaintiffs. For example, in a plane crash, D's culpability in one plaintiff's case is of great interest to the litigants in another plaintiff's case; in fact, there may be little that the second plaintiff need prove. Thus, the outcome in one case influences the beliefs of the second plaintiff about D's culpability in *his* case. This is one end of a spectrum. At the other end are cases closer to that of Xerox: the extent of D's culpability in an early plaintiff's case may have little to do with the extent of its culpability in a later plaintiff's case because the characteristics of the harm may be so case specific. Thus, while there is a weak form of correlation (P_2 becomes informed that D may be a source of his problems), the actual outcome of (say) P_1's trial is not particularly informative for P_2 in and of itself. Thus, for example, even if D were found to be liable in P_1's case of bladder cancer, he might be found not liable in P_2's case of a brain tumor. It is this weak form of correlation that we examine here; we consider the stronger form—wherein the first case's outcome signals information about the likely type of D for the second case—elsewhere (see Daughety and Reinganum, 1999).

Therefore, the likelihood that P_2 files suit is purely dependent upon the publicity effect; it relies upon the fact of the event T, O, or C and not any observable (or inferred) details of the event. Thus, if P_2 exists, γ_m is the probability that P_2 files suit if the outcome of P_1's suit is m, $m \in \{T, O, C\}$. Under the assumption that the actual degree of culpability of D in the early suit does not determine the degree of culpability of D in the later case, the expected cost to D of a later suit, denoted V, is independent of the outcome of P_1's suit. Thus, for example, if D concludes a sealed settlement, amounting to x, with P_1, then (if P_2 exists) the expected cost to D of the two cases together is $x + \gamma_C V$. Clearly, while we have couched the discussion in terms of a later potential plaintiff, V could as well represent a stream of potential future plaintiffs.

Two further notational observations are in order. First, where there is no risk of confusion, we will refer to P_1 simply as P. Second, D has four possible types reflecting his private information about culpability and the existence of a potential later plaintiff. However, the four types are not well ordered by D's payoff, so it is useful to keep track of D's type by a "type pair" ij, where $i = H$ or L (culpability) and $j = 1$ or 0

(existence of P_2); this reflects the multidimensional character of *D*'s type (thus, the type pairs are *H*1, *H*0, *L*1, and *L*0). Thus, if *D*'s private information is that he is of low culpability and P_2 exists, his type is denoted *L*1.

□ **Analysis of the multidimensional-type screening game.** We model settlement bargaining as an ''ultimatum game'' under incomplete information,[8] with *P* making the first move. The ultimatum game wherein the uninformed player goes first (here, *P*) is usually referred to as a ''screening'' or ''sorting'' game. When the type space is unidimensional, the uninformed player either makes a demand that is accepted by all the types of the informed player (the demand pools all the types), or makes a demand that separates some of the types from the rest by causing some to accept the offer and some to reject it, resulting in trial (that is, the offer screens or sorts the types; see Bebchuk (1984)). In our multidimensional-type case, *P*'s demand will be a vector (or menu), denoted $\mathbf{S} = (S_O, S_C)$, where S_O is the amount *P* demands to conclude an open settlement with *D* and S_C is the amount *P* demands to conclude a confidential settlement with *D*.[9] This induces a choice by *D* among the options of rejection (which leads to trial by Assumption 1), acceptance of the open settlement demand S_O or acceptance of the confidential settlement demand S_C. Note that *D* might be indifferent between two or more of the foregoing, which therefore requires a tie-breaking rule:

Assumption 2. If *D* is indifferent between any two outcomes, *D* chooses *P*'s most preferred outcome.

The behavior described in Assumption 2 is an implication of equilibrium following any equilibrium demand (if an indifferent *D* wouldn't make *P*'s preferred choice following an equilibrium demand, then *P* would adjust his demand marginally to induce *D* to make *P*'s preferred choice, thus contradicting the assumption that the initial demand was an equilibrium one). Following an out-of-equilibrium demand, *D*'s behavior when indifferent is unconstrained; thus the assumption. Note that relaxing this assumption following out-of-equilibrium demands makes them even less attractive to *P*; thus this assumption does not eliminate any equilibria. An immediate implication of Assumption 2 (Claim 0, which is proved in the Appendix) is that ties between *O* and *C* are broken in favor of *C*, ties between *T* and *O* are broken in favor of *O*, and ties between *T* and *C* are broken in favor of *C*.

The result of *P* making a demand **S** is that the various types of *D* may elect to take various responses. We organize the outcome possibilities in 2×2 matrices, with the rows representing the culpability of the defendant and the columns representing the existence of a potential later plaintiff. More precisely, the demand **S** induces the outcome configuration $[{}^{uv}_{wx}]$, where *u* is *H*0's choice, *v* is *H*1's choice, *w* is *L*0's choice, and *x* is *L*1's choice. Since there are three possible outcomes (*T*, *O*, and *C*) and four type-pairs, there are 81 such configurations. For example, the configuration $[{}^{OC}_{TC}]$ represents the response by *D* to a demand by *P* of $\mathbf{S} = (S_O, S_C)$ wherein a highly culpable *D* who is aware that a potential later plaintiff exists accepts the demand S_C (*C*) while a low-culpability *D* who knows that no potential later plaintiff exists chooses trial (*T*);

[8] Early incomplete-information models of settlement bargaining are P'ng (1983), Bebchuk (1984), and Reinganum and Wilde (1986). An extensive literature on settlement bargaining involving screening and/or signalling (where the informed player moves first) during single or multiple periods has developed; for a recent review, see Daughety (1999).

[9] One might consider an expanded set of settlement contracts which provides for an intermediate probability of sealing. Such a contract would specify a payment and a probability; an appropriately weighted coin flip would determine if the settlement is confidential or open. It can be shown (see the Appendix) that such contracts cannot improve *P*'s payoff.

the diagonal terms have similar interpretations. Finally, note that an outcome configuration is more than a best response by D to the associated demand by P, since it also incorporates the tie-breaking rule.

Of these 81 configurations, 74 can be eliminated via dominance arguments, thereby reducing the relevant set of best responses by D that P must consider. The following proposition summarizes the undominated configurations (see the Appendix):

Proposition 1. There are seven undominated configurations:

$$(1)\ \begin{bmatrix} OC \\ TC \end{bmatrix} \quad (2)\ \begin{bmatrix} TC \\ TT \end{bmatrix} \quad (3)\ \begin{bmatrix} OC \\ TT \end{bmatrix} \quad (4)\ \begin{bmatrix} OC \\ OC \end{bmatrix} \quad (5)\ \begin{bmatrix} CC \\ TC \end{bmatrix}$$

$$(6)\ \begin{bmatrix} TC \\ TC \end{bmatrix} \text{ and } (7)\ \begin{bmatrix} CC \\ TT \end{bmatrix}.$$

Note that the presence of the alternative kinds of settlement (O and C) means that the three possible extreme configurations in which (1) all types go to trial ($[{TT \atop TT}]$), (2) all types settle with a sealed proposal ($[{CC \atop CC}]$), or (3) all types settle with an open proposal ($[{OO \atop OO}]$) are never equilibria. The observation that $[{TT \atop TT}]$ is not an equilibrium directly generalizes the result in standard screening ultimatum games that some level of settlement is always involved in an equilibrium. The second observation, that $[{CC \atop CC}]$ and $[{OO \atop OO}]$ are dominated (by, e.g., $[{OC \atop OC}]$), is different from the unidimensional models. In a unidimensional model it is sometimes an equilibrium to settle with all types; thus, full pooling, with no trials but no information revelation, is sometimes an equilibrium. Here, while configuration (4) ($[{OC \atop OC}]$) involves no trials, some information about type will be revealed. This is because avoiding trial with the ''strongest'' type ($L0$) does not require a confidential agreement, but the weakest type ($H1$) is willing to pay substantially more to restrict the flow of information. Thus, even though D's culpability is not revealed in this equilibrium, the truth about the existence of a potential later plaintiff is (of course, there is nothing that P_1 can do with this information since his lips are sealed by a confidential settlement in this event).

Deriving P's optimal demands for the remaining seven configurations depends upon the incentive conditions for each player as well as the relative values of some of the parameters of the model. More precisely, in the rest of this subsection we will characterize the conditions under which each configuration in Proposition 1, and the associated optimal settlement demand **S**, forms an equilibrium for the overall game. For a particular configuration to be part of an equilibrium, each type of D must not wish to defect from its part of the equilibrium. This means that the elements of **S** must satisfy a set of payoff inequalities (self-selection constraints) for each type-pair. For example, for $[{OC \atop TC}]$ to be an equilibrium, the demand $\mathbf{S} = (S_O, S_C)$ must satisfy the following self-selection constraints for each D type:

$$\text{(a)} \quad S_O < S_C \qquad \text{(b)} \quad S_O \leq \pi_H d + k_D \qquad (H0)$$

$$\text{(a)} \quad S_C + \gamma_C V \leq S_O + \gamma_O V \qquad \text{(b)} \quad S_C + \gamma_C V \leq \pi_H d + k_D + V \qquad (H1)$$

$$\text{(a)} \quad S_C + \gamma_C V \leq S_O + \gamma_O V \qquad \text{(b)} \quad S_C + \gamma_C V \leq \pi_L d + k_D + V \qquad (L1)$$

$$\text{(a)} \quad \pi_L d + k_D < S_O \qquad \text{(b)} \quad \pi_L d + k_D < S_C. \qquad (L0)$$

For $H0$ to choose O over C and T, it must be that D's payoff from accepting S_O is strictly better than that from accepting S_C (since ties between O and C are broken in favor of C) and it must weakly prefer S_O to trial (since ties between T and O are broken in favor of O). These requirements are given in line ($H0$) above in inequalities (a) and (b). The requirements for each of the other type-pairs are also given.

Finding a solution to the above inequalities requires an assumption on the relationship between the difference in the expected award at trial under high versus low culpability, $\Delta \equiv (\pi_H - \pi_L)d$, and the reduction in the cost to D of future litigation that current settlement produces (that is, $V_O \equiv V(1 - \gamma_O)$ and $V_C \equiv V(1 - \gamma_C)$). We have chosen a particular assumed relationship to exposit our results; the Web Appendix indicates how the results are modified by changing the assumed relationship.

Assumption 3. $V_O < \Delta < V_C$.

Under Assumption 3, Table 1 provides the (configuration-specific) demand vector **S** which induces the configuration-specified choices by D (i.e., satisfies the self-selection inequalities) and maximizes P's expected payoff. Analysis of the first configuration is in the Appendix; full details are in the Web Appendix. In the second, fifth, and sixth configurations, open settlements are not part of the equilibrium, and this is supported by making S_O sufficiently large (or, equivalently, not offering O as an option). The seventh configuration, $[\substack{CC\\TT}]$, is not feasible when Assumption 3 is maintained (that is, the self-selection constraints cannot all be satisfied simultaneously).

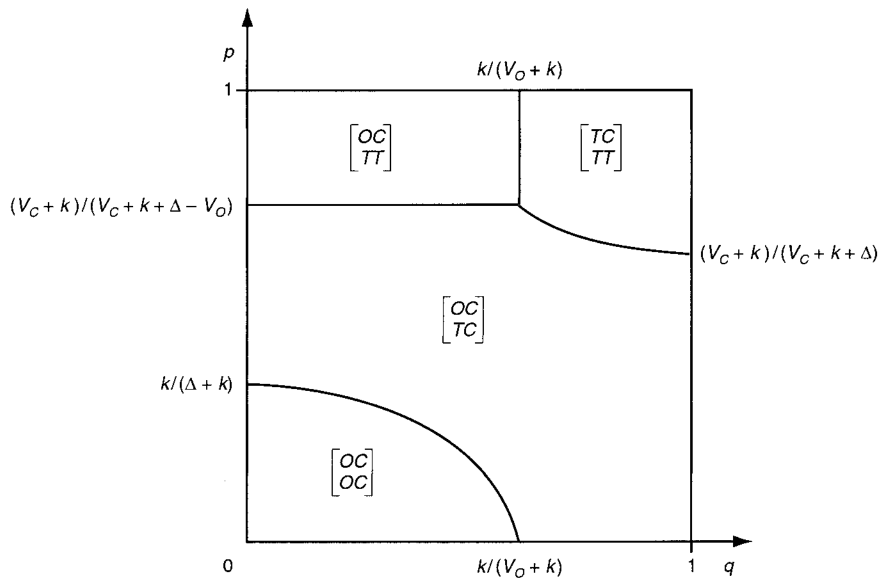
In the overall game, for any given p (P_1's prior probability that D is highly culpable) and q (P_1's prior probability that P_2 exists), P chooses **S** (and thus, the configuration) so as to maximize his expected payoff (see the Appendix for a formal statement of P's expected payoff function). This allows us to characterize the equilibria of the game by partitioning (q, p) space into regions under which a particular configuration is the equilibrium. Figure 1 depicts the regions of equilibria in (q, p) space. Notice that the overall (q, p) region is partitioned by the configurations $[\substack{OC\\TC}]$, $[\substack{TC\\TT}]$, $[\substack{OC\\TT}]$ and $[\substack{OC\\OC}]$. Under Assumption 3, configuration $[\substack{CC\\TT}]$ is infeasible and $[\substack{OC\\TC}]$ dominates both $[\substack{CC\\TC}]$ and

TABLE 1 Configuration-Specific Optimal Demands Under Assumption 3

Configuration	S_O	S_C
$\begin{bmatrix}OC\\TC\end{bmatrix}$	$\pi_H d + k_D$	$\pi_L d + k_D + V_C$
$\begin{bmatrix}TC\\TT\end{bmatrix}$	Large	$\pi_H d + k_D + V_C$
$\begin{bmatrix}OC\\TT\end{bmatrix}$	$\pi_H d + k_D$	$\pi_H d + k_D + V_C - V_O$
$\begin{bmatrix}OC\\OC\end{bmatrix}$	$\pi_L d + k_D$	$\pi_L d + k_D + V_C - V_O$
$\begin{bmatrix}CC\\TC\end{bmatrix}$	Large	$\pi_H d + k_D$
$\begin{bmatrix}TC\\TC\end{bmatrix}$	Large	$\pi_L d + k_D + V_C$
$\begin{bmatrix}CC\\TT\end{bmatrix}$	Infeasible	Infeasible

FIGURE 1

REGIONS OF EQUILIBRIA UNDER ASSUMPTION 3



$[{TC \atop TC}]$. An important implication of the diagram is that a configuration incorporating all three outcomes can be an equilibrium (this is independent of the employment of Assumption 3; see the Web Appendix).

The upper right area of (q, p) space is associated with beliefs by P that D is weak both because p is high, suggesting a high likelihood that D is highly culpable, and because q is high, suggesting a high likelihood that there is a potential later plaintiff and therefore substantial reason for D to be willing to pay to obtain a sealed settlement with the current plaintiff, P. Consulting Table 1 for the configuration $[{TC \atop TT}]$, we can see that P is extracting the most possible from the D-type that chooses C (that is, $H1$), as S_C for this case makes $H1$ indifferent between settling sealed and trial. On the other hand, the lower left area of the diagram reflects beliefs by P that D is strong, both in the sense that p is low (i.e., the likelihood is low that D is highly culpable) and in the sense that q is low (i.e., the likelihood of a later plaintiff is low). Here the equilibrium involves always settling, but note (see Table 1, configuration $[{OC \atop OC}]$) that S_O is exactly what a D of type $L0$ (the "toughest" type) would expect to pay at trial.

One further observation concerns the effects of parameter changes on the frequency of trial. First, consider the effect of a marginal increase (that is, maintaining Assumption 3) in γ_C. Such an increase lowers V_C, causing the upper two regions in Figure 1 to expand at the expense of the region $[{OC \atop TC}]$. This means that such a change will result in, on average, more trials. Similarly, a marginal increase in Δ expands the upper two regions and shrinks the lower left region, thereby increasing the likelihood of a trial. On the other hand, a marginal increase in k shrinks the two upper regions and expands the region in the lower left corner, resulting in (on average) fewer trials. Finally, a marginal increase in γ_O lowers V_O and therefore results in both the upper left and lower left regions expanding at the expense of the region $[{OC \atop TC}]$. In this case the effect on trial frequency is ambiguous.

3. Restricting secrecy: implications of requiring settlements to be open

■ In this section (for analysis, see the Web Appendix) we consider a policy change suggested by some lawyers and interest groups: prohibiting sealed settlements. We assume that if sealed settlements were not allowed, the parties would now choose only between enforceable open settlements and trial, and we examine how this would affect the settlements that would obtain. We refer to this case as the *restricted case* and the previous analysis as the *unrestricted case.*

All the previous notation is as before except that (1) there are only two possible outcomes, t and o (lower case will be used to indicate that the restricted case is being discussed), and thus there are 16 possible configurations, and (2) the settlement offer made by P will be denoted s (which is now a scalar). Using dominance arguments similar to those employed in proving Proposition 1, 11 of the configurations can be eliminated from further consideration.

Proposition 2. There are five undominated configurations for the restricted case:

$$(1)\ \begin{bmatrix} to \\ tt \end{bmatrix} \quad (2)\ \begin{bmatrix} to \\ to \end{bmatrix} \quad (3)\ \begin{bmatrix} oo \\ tt \end{bmatrix} \quad (4)\ \begin{bmatrix} oo \\ to \end{bmatrix} \ \text{and}\ (5)\ \begin{bmatrix} oo \\ oo \end{bmatrix}.$$

Now, while the extreme configuration $[^{tt}_{tt}]$ (wherein all types go to trial) is still dominated and never occurs in equilibrium, full pooling (configuration 5 above, $[^{oo}_{oo}]$) is a possible equilibrium outcome. This occurs because there is no option for a confidential settlement. Thus, the restriction reduces the previous outcomes to ones similar to the standard unidimensional model.

P's optimal (configuration-specific) demands are derived in a manner similar to that used earlier. Since C is not feasible, Assumption 3 reduces to the following:

Assumption 4. $V_O < \Delta$.

Under this assumption we can solve the self-selection inequalities that characterize the optimal demands for P to induce any specified configuration. Table 2 provides results analogous to Table 1.

TABLE 2 Configuration-Specific Optimal Demands Under Assumption 4

Configuration	s
$\begin{bmatrix} to \\ tt \end{bmatrix}$	$\pi_H d + k_D + V_O$
$\begin{bmatrix} to \\ to \end{bmatrix}$	Infeasible
$\begin{bmatrix} oo \\ tt \end{bmatrix}$	$\pi_H d + k_D$
$\begin{bmatrix} oo \\ to \end{bmatrix}$	$\pi_L d + k_D + V_O$
$\begin{bmatrix} oo \\ oo \end{bmatrix}$	$\pi_L d + k_D$

FIGURE 2

COMPARISON OF UNRESTRICTED AND RESTRICTED REGIONS UNDER ASSUMPTIONS 3 AND 4

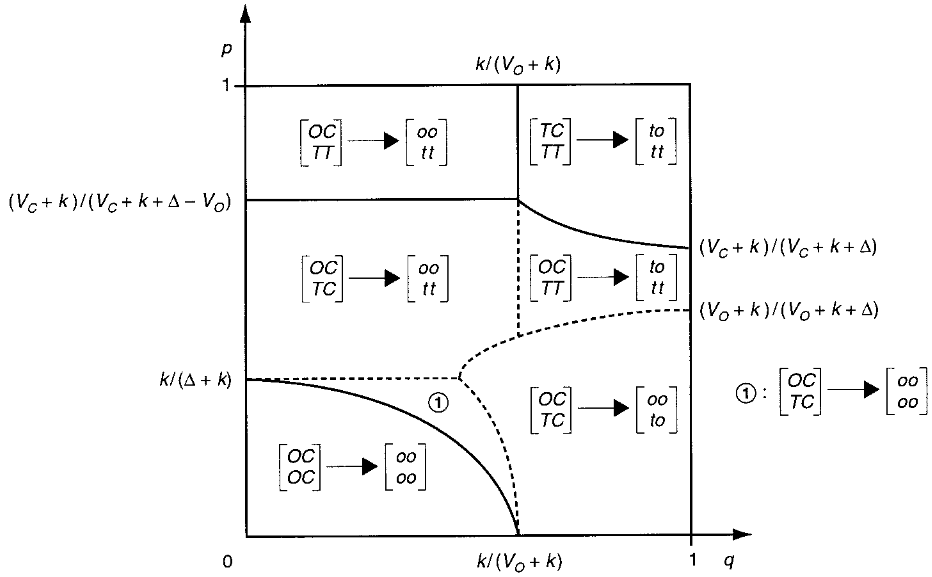


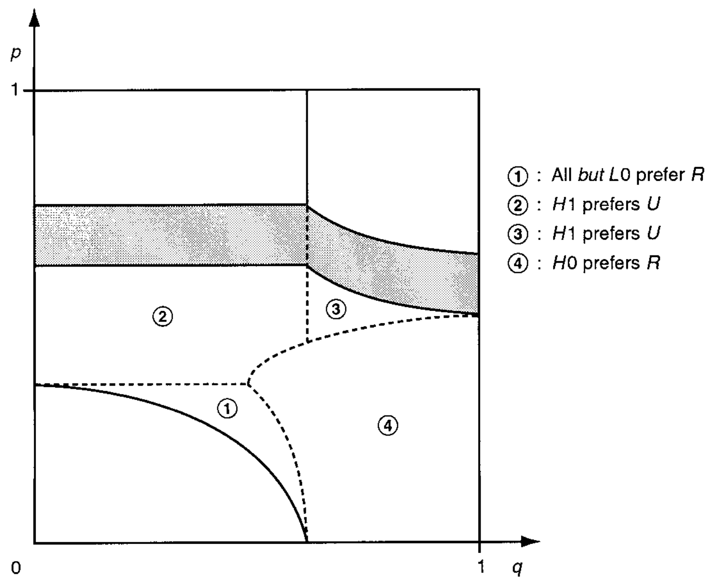
Figure 2 overlays the equilibrium regions under Assumption 4 in the restricted case with those under Assumption 3 in the unrestricted case.[10] Except for the region in Figure 1 labelled $[\begin{smallmatrix}OC\\TC\end{smallmatrix}]$, all the other regions in Figure 1 have become part of regions wherein *o* replaces *C* wherever *C* occurs (for example, $[\begin{smallmatrix}OC\\TT\end{smallmatrix}]$ became part of $[\begin{smallmatrix}oo\\tt\end{smallmatrix}]$). In the case of the region corresponding to $[\begin{smallmatrix}OC\\TC\end{smallmatrix}]$, this region has been subdivided as shown, with the lower right part becoming the region $[\begin{smallmatrix}oo\\to\end{smallmatrix}]$ and the other parts being identified with the subregions on each part's boundary. Thus, the dotted lines represent the boundaries of the regions that now partition the (q, p) space under the restriction. Notice that this center area (the previous $[\begin{smallmatrix}OC\\TC\end{smallmatrix}]$ region) involves some types who previously settled now proceeding to trial. Only in the region labelled 1 does restricting confidentiality result in fewer defendant types choosing trial.

□ **Preferences of *P* and *D* over the availability of sealing.** Should settlement bargaining be unrestricted, or should sealed settlements be prohibited? To consider this question we must consider the preferences of three agents: P_1, P_2, and *D*. Figure 3 depicts the same regions as shown in Figure 2. The following can be (tediously) shown. First, in each subregion from Figure 2, P_1 unambiguously prefers unrestricted settlement bargaining (*U*) to restricted settlement bargaining (*R*). We denote this as $U \succ_1 R$. Similarly, it can be shown that $R \succ_2 U$, that is, P_2 strictly prefers *R* to *U*. It is interesting that for much of the (q, p) space, all types of *D* are indifferent between *U* and *R*. The exceptions, by type, are noted on Figure 3. For example, in region 2 (which includes the shaded horizontal region) *H*1 prefers *U* to *R* ($U \succ_{H1} R$), but the other types are indifferent. In region 3 (including the shaded curved region) $U \succ_{H1} R$, while the rest of the types are again indifferent. In contrast, in region 1, $R \succ_{H1} U$, $R \succ_{H0} U$ and $R \succ_{L1} U$, with only *L*0 indifferent between *U* and *R*. Finally, in region 4, $R \succ_{H0} U$,

[10] For illustration purposes, we assume that *k* is small in the sense that $k < \Delta - V_O$, making the lower boundary of the $[\begin{smallmatrix}to\\tt\end{smallmatrix}]$ region convex (rather than concave) in Figure 2.

FIGURE 3

PREFERENCES FOR CLOSED SETTLEMENT



with the rest of the types indifferent. Thus, for moderately high values of *p*, *D* prefers *U* to *R*, while for moderately low to low values of *p*, *D* prefers *R* to *U*.

If taking more care is viewed as lowering both π_H and π_L, then these preferences imply that whatever the level of care is under *R*, (*q*, *p*) pairs in regions 2 and 3 will be associated with lower care if sealing is allowed. In contrast, whatever the level of care under *R*, (*q*, *p*) pairs in regions 1 and 4 will be associated with higher care if sealing is allowed. Note also that outside of these areas, allowing or prohibiting sealing does not influence the level of care achieved.

Next consider the preferences of the average plaintiff, $\mathcal{P}$, where $\mathcal{P}$'s payoff is that of P_1 plus *q* times that[11] of P_2, all divided by $1 + q$. In all regions except those that are shaded, $\mathcal{P}$ prefers *U* to *R*; in the shaded region, $\mathcal{P}$ prefers *R* to *U*. Outside of the shaded region, $\mathcal{P}$'s preference for *U* over *R* reflects the fact that, in theory, P_1 could compensate P_2 for P_2's expected losses due to the existence of sealing as an option; in the shaded regions he cannot. Alternatively, in all but the shaded region, all potential plaintiffs would like the chance to be the early plaintiff and are willing to risk that they won't be.

Note the conflict between $\mathcal{P}$ and *D*, since in the shaded region *D* prefers *U* to *R* (*H*1 prefers *U* to *R* and the other types are indifferent). There is also a conflict between $\mathcal{P}$ and *D* in regions 1 and 4, where $\mathcal{P}$ prefers *U* to *R* while *D* prefers *R* to *U*. Finally, in the three unnumbered, unshaded regions, $\mathcal{P}$ prefers *U* to *R* and *D* is indifferent. Summarizing, the only areas where $\mathcal{P}$ and *D* disagree are regions 1 and 4 and the shaded area. While the pattern of preferences does not readily admit a simple characterization, we note that the defendant does not always gain, and the average plaintiff does not always lose, from allowing confidentiality.

[11] No further plaintiffs exist so P_2 screens *D*; denote P_2's payoff as *W*. It can be shown that $V - W \in (0, k)$; this is the only fact used in deriving the results to follow, so we do not describe this game in detail.

□ **Sources of hush money.** Earlier, we mentioned three sources of hush money. These can be illustrated by reference to Figure 3 (see also Figure 2 and Tables 1 and 2 as needed). First, in the unlabelled regions, allowing sealed settlements expands the pie to be divided between the early plaintiff and the defendant *only* by reducing the likelihood of a later plaintiff (since there is no change in the likelihood of trial). Moreover, since all defendant types are indifferent about the sealing option, it follows that the early plaintiff has appropriated all of the incremental pie.

In region 4, the sealing option also has no impact on the likelihood of trial. However, allowing sealed settlements permits the early plaintiff to extract more from three types of defendant: $H0$, $H1$, and $L1$. The additional amount extracted from $H1$ and $L1$ is exactly the difference $V_C - V_O$ that accrues to these defendant types from reducing the likelihood of a later plaintiff. The $H0$-type defendant does not enjoy such a benefit, since he settles open in both cases. The increment that he pays under U comes from his own pocket (leading to his preference for R) and is a consequence of the plaintiff's better sorting ability when sealing is an option.

In region 1, several effects are at work. First, allowing sealing permits the early plaintiff to sort defendant types better, extracting more in settlement from every type but $L0$ (type $L0$ pays the same amount in both cases, but the early plaintiff receives less when sealing is permitted because he goes to trial against $L0$ rather than settling; nevertheless, the early plaintiff makes up for this loss by extracting more from the other types). Moreover, the incremental amount extracted from $L1$ and $H1$ is more than the difference $V_C - V_O$ that accrues to these defendant types from reducing the likelihood of a later plaintiff. The incremental amount extracted from $H0$ is Δ, while $H0$ does not receive any reduction in either the likelihood of a trial in the current case or the likelihood of a later plaintiff (since he settles open in both the restricted and the unrestricted case). Thus, defendant types $L1$, $H1$, and $H0$ all make contributions to P_1 from their own pockets (leading to their preference for R).

In region 2, defendant types $H0$ and $L0$ pay the same amount independent of the sealing option, as does $L1$ (who settles sealed when it is allowed, but at an amount that makes him indifferent to trial). Only type $H1$'s payoff changes, from $\pi_L d + k_D + V$ under sealing to the larger value $\pi_H d + k_D + \gamma_O V$ when sealing is prohibited. In this case both the defendant and the early plaintiff gain from sealing, through a combination of a reduced likelihood of trial in the current case and a reduced likelihood of a later plaintiff. A similar sharing of gains occurs in region 3.

4. Summary and conclusions

■ Some secrets are afforded legal protection. In this article we have focused on an important type of legal secret, the ability to keep the details of a settlement negotiation confidential.[12] We found that when one party wants to limit the diffusion of information to parties outside of the current negotiation, this provides bargaining power to the other party involved in the current negotiation. This effect is capitalized in a higher payment by the first party to the second, a payment that is frequently financed (implicitly) by the unsuspecting third party.

When culpability is not strongly correlated over potential plaintiffs, we have found that allowing confidentiality was always preferred by the early plaintiff, never preferred by the later plaintiff, sometimes preferred by the average plaintiff, and not always

[12] Allowing confidentiality of successful settlement negotiations is but one way that the law operates to limit information. In fact, offers made during (unsuccessful) settlement negotiations are inadmissible at trial; see Daughety and Reinganum (1995).

preferred by the defendant. Though this means that there is no unambiguous welfare result in favor of allowing sealing, it also suggests that uniformly prohibiting sealing is not supported. Moreover, allowing sealed settlements need not necessarily lower care: when the defendant is indifferent about (or prefers prohibiting) sealing as an option, the level of care is unaffected (or actually increased) by allowing sealing.

The lack of a uniform optimal policy (even without considering care) justifies the reliance on judicial discretion, wherein a judge can choose to seal or not (or to enforce contracts of silence or not, if they are breached) on a case-by-case basis. Since we have assumed that D can reconstruct the early plaintiff's priors from the case attributes, so can a court. In principle, the court should care about the preferences of the immediately affected parties (P_1, D, and possibly P_2) as well as providing incentives for proper *ex ante* caretaking by D. If (q, p) is in one of the unshaded, unnumbered regions in Figure 3, then since $\mathcal{P}$ prefers having sealing available and D is indifferent, sealing should be allowed since there is no effect on care. In the unshaded portions of regions 2 and 3 in the figure, $\mathcal{P}$ and D both prefer sealing, but care is reduced. Thus, a judge must weigh these two effects to decide whether sealing should be allowed. In the shaded area and in regions 1 and 4, $\mathcal{P}$ and D disagree as to the desirability of sealing, and incentives for care are influenced as well, requiring yet greater judicial scrutiny.

There are a number of avenues for possible future research. Elsewhere we have considered strong correlation (see Daughety and Reinganum, 1999); however, in both of our analyses all agents know the degree of correlation of culpability. If this is not common knowledge, then the information generated through settlement negotiations and discovery (undertaken by the parties in anticipation of settlement and possible trial) becomes of significance to follow-on suits; for example, releasing such information can affect the likelihood of a follow-on suit and possibly also the outcome of that suit. Thus, a useful extension would involve incomplete information about the degree of correlation of culpability so that the likelihood of future suits would depend upon the amount of information in the instant suit left unsealed.

A second avenue of extension involves the strategic choices made by the defendant. In our model, D is limited to accepting or rejecting the plaintiff's demand. Thus, one possible extension would be to broaden the strategy space for D, such as allowing D to engage in activities that raise the perceived level of k_P. D could also develop a reputation for tough play, such as always appealing any award at trial; this simultaneously raises k_P and lowers the expected award. Finally, one might integrate our model with one of care-taking in the choice of, say, the safety of a product. Early (observable) actions by D that enhance a reputation for producing high-quality products are likely to result in a lower assessment by harmed plaintiffs of D being highly culpable.

The issue of legally enforced secrecy is complex, which is why this first cut at the problem has provided quite limited welfare evaluations. The problem is important, however, and investigating when secrecy enhances social welfare can contribute to an important debate (the references we cited indicate the broad range of perspectives, but only the tip of the iceberg in terms of the volume, both in size and decibel level, of the discussion). The other contribution we make is to view one of the issues in a multi-issue bargain as the dissemination of information about the bargain itself. The incentives for, and limits to, controlling such information figure into many situations; we focused on settlement bargaining as a convenient starting point. An alternative example is a seller who wishes to maintain the confidentiality of his negotiations over price with one buyer because he anticipates bargaining with others in the future. The recognition by parties of the cross-negotiating-pair influence of information inevitably must lead to efforts to control the flow of information and will be reflected in the terms of trade.

Appendix

■ In this Appendix we provide partial proofs of the results when sealing is permitted (the rest of each proof is in the Web Appendix). We also include the summary of P's payoffs when sealing is permitted. The complete analysis of the model when sealing is not permitted and an examination of the sensitivity of the results in Section 2 to changing Assumption 3 are contained in the Web Appendix, available at http://www.rje.org/main/sup-mat.html.

□ **Analysis when sealing is permitted.** Proposition 1 is proved through a series of claims. We state all the claims below and illustrate the proof of Claim 0; the other proofs are to be found in the Web Appendix. Whenever reference is made to a type ij, this represents a defendant of that type, since there is only one type of plaintiff. D's payoffs are given by $U^D(T, S; i, j) = \pi_i d + k_D + jV$, $U^D(O, S; i, j) = S_O + j\gamma_O V$, and $U^D(C, S; i, j) = S_C + j\gamma_C V$, where $i = H, L$ and $j = 0, 1$. Throughout, we maintain Assumption 2 (see Section 2).

Claim 0. If D of type ij is indifferent between
(i) O and C, then D chooses C;
(ii) O and T, then D chooses O;
(iii) C and T, then D chooses C.

Proof. (i) Type ij is different between O and C if and only if $S_O + j\gamma_O V = S_C + j\gamma_C V$. But then

$$S_C = S_O + j(\gamma_O - \gamma_C)V > S_O.$$

Since P receives S_O from settling open and S_C from settling confidentially, P strictly prefers outcome C to outcome O.

(ii) Type ij is indifferent between O and T if and only if $S_O + j\gamma_O V = \pi_i d + k_D + jV$. But then $S_O = \pi_i d + k_D + j(1 - \gamma_O)V > \pi_i d - k_P$. Since P receives S_O from settling open and $\pi_i d - k_P$ from trial, P strictly prefers outcome O to outcome T.

(iii) Type ij is indifferent between C and T if and only if $S_C + j\gamma_C V = \pi_i d + k_D + jV$. But then $S_C = \pi_i d + k_D + j(1 - \gamma_C)V > \pi_i d - k_P$. Since P receives S_C from settling confidentially and $\pi_i d - k_P$ from trial, P strictly prefers outcome C to outcome T. *Q.E.D.*

Claim 1. P will induce type $H1$ to choose C.

Claim 2. P will induce type $L1$ to choose either C or T.

Claim 3. If $L1$ chooses T, then $L0$ also chooses T.

Claim 4. If $H0$ chooses T, then $L0$ also chooses T.

Claim 5. If $H0$ chooses O, then $L0$ chooses O or T.

Claim 6. If $H0$ chooses C, then $L0$ chooses C or T.

Claim 7. P will not induce all types to choose C.

Application of these claims leaves seven undominated configurations, as described in Proposition 1.

□ **Proof of claim in footnote 9.** Let (S_M, α_M) be a contract in which D pays P_1 the amount S_M to settle, and the settlement is sealed with probability $\alpha_M \in (0, 1)$ and otherwise is open. An open settlement corresponds to $(S_O, 0)$, while a confidential settlement corresponds to $(S_C, 1)$. The probability α_M implies a probability $\gamma_M = \alpha_M\gamma_C + (1 - \alpha_M)\gamma_O$ of a second suit (if P_2 exists).

Between any two (or more) contracts involving settlement, the preferences of defendant types $H1$ and $L1$ are identical. Hence they would not be induced to choose different settlement contracts. The proofs of Claim 1 and Claim 2 above can easily be adapted to show that $H1$ will be induced to choose C and $L1$ will be induced to choose either C or T. Thus neither $H1$ nor $L1$ will ever be induced to choose the contract (S_M, α_M).

Now consider defendant types $H0$ and $L0$. Again, between any two (or more) contracts involving settlement, these two types have identical preferences and thus would not be induced to choose different settlement contracts. These types care only about S_m; γ_m is irrelevant, since they do not face a second plaintiff. Thus, they most prefer the settlement contract with the lowest payment S_m, $m \in \{O, M, C\}$. If S_M is not the lowest, then it is irrelevant to all types and may be dispensed with. If S_M were the lowest, P_1 could do no worse by setting $\tilde{S}_O = S_M$ and dispensing with (S_M, α_M). The contract $(\tilde{S}_O, 0)$ is better for P_1 because it is equally attractive to $H0$ and $L0$ (compared to (S_M, α_M)) and is less tempting to $H1$ and $L1$. Thus, the intermediate contract (S_M, α_M) cannot improve P_1's payoff. *Q.E.D.*

□ **Derivation of *P*'s optimal demand for configuration (1).** This analysis is conducted under Assumption 3. Again, we illustrate the method of proof for one configuration; proofs for the other six configurations are in the Web Appendix.

$[^{OC}_{TC}]$ The self-selection constraints associated with this configuration are as follows:

$$\text{(a)}\quad S_O < S_C \qquad \text{(b)}\quad S_O \leq \pi_H d + k_D \qquad (H0)$$

$$\text{(a)}\quad S_C + \gamma_C V \leq S_O + \gamma_O V \qquad \text{(b)}\quad S_C + \gamma_C V \leq \pi_H d + k_D + V \qquad (H1)$$

$$\text{(a)}\quad S_C + \gamma_C V \leq S_O + \gamma_O V \qquad \text{(b)}\quad S_C + \gamma_C V \leq \pi_L d + k_D + V \qquad (L1)$$

$$\text{(a)}\quad \pi_L d + k_D < S_O \qquad \text{(b)}\quad \pi_L d + k_D < S_C. \qquad (L0)$$

Collectively, these imply the following constraints:

(i) $\pi_L d + k_D < S_O \leq \pi_H d + k_D$;
(ii) $\pi_L d + k_D < S_C \leq \pi_L d + k_D + V_C$; and
(iii) $0 < S_C - S_O \leq V_C - V_O$.

Clearly, P wants to set S_C and S_O as high as possible, subject to these constraints. Under Assumption 3, P can set both S_C and S_O at their upper limits and still satisfy (iii). Thus for this configuration, $S_C = \pi_L d + k_D + V_C$ and $S_O = \pi_H d + k_D$.

□ **Summary of *P*'s expected payoff under configurations (1)–(7).** Let $EU^P\,(q, p)$ denote the plaintiff's expected payoff if p is the probability of facing a highly culpable defendant (i.e., the probability that $i = H$) and q is the probability that D faces a second potential plaintiff. Recall that these payoffs are derived under Assumption 3.

$$(1)\quad \begin{bmatrix} OC \\ TC \end{bmatrix} EU^P(q, p) = p(1 - q)[\pi_H d + k_D] + q[\pi_L d + k_D + V_C] + (1 - p)(1 - q)[\pi_L d - k_P]$$

$$(2)\quad \begin{bmatrix} TC \\ TT \end{bmatrix} EU^P(q, p) = p(1 - q)[\pi_H d - k_P] + (1 - p)[\pi_L d - k_P] + pq[\pi_H d + k_D + V_C]$$

$$(3)\quad \begin{bmatrix} OC \\ TT \end{bmatrix} EU^P(q, p) = p(1 - q)[\pi_H d + k_D] + (1 - p)[\pi_L d - k_P] + pq[\pi_H d + k_D + V_C - V_O]$$

$$(4)\quad \begin{bmatrix} OC \\ OC \end{bmatrix} EU^P(q, p) = (1 - q)[\pi_L d + k_D] + q[\pi_L d + k_D + V_C - V_O]$$

$$(5)\quad \begin{bmatrix} CC \\ TC \end{bmatrix} EU^P(q, p) = (p + q - pq)[\pi_H d + k_D] + (1 - p)(1 - q)[\pi_L d - k_P]$$

$$(6)\quad \begin{bmatrix} TC \\ TC \end{bmatrix} EU^P(q, p) = p(1 - q)[\pi_H d - k_P] + q[\pi_L d + k_D + V_C] + (1 - p)(1 - q)[\pi_L d - k_P]$$

$$(7)\quad \begin{bmatrix} CC \\ TT \end{bmatrix} \text{infeasible under Assumption 3.}$$

Notice that P prefers configuration (1) to configurations (5) and (6); thus the remaining comparisons of interest are configurations 1, 2, 3, and 4.

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