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# Informational externalities in settlement bargaining: confidentiality and correlated culpability

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*We explore informational externalities that arise when multiple plaintiffs are harmed by the behavior or product of a single defendant. An early plaintiff is likely to raise the awareness of a later plaintiff, and the later plaintiff will be able to learn something about the defendant's culpability by observing the disposition of the early suit: the presence of an early plaintiff provides a benefit to a later plaintiff. The presence of the later plaintiff also confers a potential benefit on the early plaintiff: the early plaintiff has the opportunity to charge the defendant for controlling the flow of information (e.g., through confidential settlement).*

## 1. Introduction

■ When a defendant's behavior or product results in harm, it is not unusual for several people to be injured. For example, a firm may dispose of hazardous waste at several sites, injuring nearby residents; a product may fail and injure its users. It is also not unusual for injured parties to be uncertain about who bears the ultimate responsibility for their injuries. For instance, a person who develops cancer may attribute it to a genetic predisposition, or to poor choices in terms of diet and exercise, being unaware of the nearby disposal of hazardous waste. A person involved in a car accident may attribute it to adverse weather conditions or driving too fast, being unaware that a car part failed. Finally, once a person has become aware that the defendant's behavior or product is the source of her injury, she may still be uncertain about the extent of the defendant's liability. If the defendant did not negligently dispose of the hazardous waste, or the car part was not defective, then the defendant will not be held liable for the harm.

In this article we provide a model that incorporates these two sources of uncertainty on the part of injured parties, and we explore two kinds of informational externalities that can arise as a consequence of multiple people (for simplicity, two) being harmed by the product or behavior of the same defendant. The first kind of informational externality, which we call the "publicity

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effect," reflects the fact that there is some level of publicity attending the filing and, especially, the disposition of a lawsuit. Thus, a person who becomes aware of the defendant's involvement in causing her injuries and files suit will tend to raise the level of awareness of the other potential plaintiff through the publicity attending the disposition of her suit. We will consider three possible dispositions: a trial, an open settlement, and a confidential settlement. Settling confidentially results in the least publicity, since the parties may not discuss the suit or the settlement, and (in extreme cases) even the identities of the parties and the nature of the allegations can be kept confidential. An open settlement results in somewhat more publicity, since the parties are free to discuss the suit and the settlement, and the news media are likely to be able to obtain more information from public sources. Finally, if the case goes to trial, then the suit is a matter of public record and the news media are able to obtain all of the information therein, resulting in the greatest amount of publicity. Publicity is important because it can encourage a later suit, as the second potential plaintiff is more likely to realize that she also has a case against this particular defendant.

The second kind of informational externality, which we call the "learning effect," arises when the defendant's culpability is correlated across cases, as seems plausible if the behavior or the product associated with the two plaintiffs' harms is similar. We assume that the level of the defendant's culpability is the same in both cases (referred to as "strongly correlated culpability"), so the disposition of the first case (whether resolved by trial or settlement, and any observable particulars of either outcome) is potentially informative for the second plaintiff.

Formally, we consider a sequence of incomplete-information bargaining games wherein uninformed plaintiffs make demands of the informed defendant, with the defendant and the early plaintiff recognizing that their actions in the first case may convey these two types of information (i.e., about the defendant's potential culpability, and its extent) to the later plaintiff. The existence of the later plaintiff also confers a potential benefit on the early plaintiff: the early plaintiff has the opportunity to charge the defendant for controlling the flow of information (reducing publicity).

We find that confidentiality increases the likelihood of settlement in the early case but increases the likelihood of trial (given suit) in the later case; on net, however, total expected trial costs are lower. While the early plaintiff's equilibrium payoff is increased by confidentiality and the later plaintiff's is decreased, the average plaintiff's equilibrium payoff is decreased.[1] This occurs despite the fact that our timing convention "stacks the deck" in favor of the plaintiffs, who make take-it-or-leave-it settlement demands, thereby allowing the first plaintiff to extract a premium for confidentiality. Since the early plaintiff is allowed to choose whether to offer an open or a confidential settlement, we find that the confidentiality option will be exercised if it is permitted.

From the defendant's perspective, settling results in an adverse inference about culpability and a savings of trial costs; confidential settlements have these same attributes. For confidentiality to be valuable to the defendant, it must provide some benefit beyond that provided by settlement alone, and this benefit must not be fully extracted by the first plaintiff. We argue that one such benefit is the reduction in later suits due to reduced publicity surrounding the confidential settlement of an early suit. We find that expected settlement transfers (from the defendant to the early plaintiff) are increased by confidentiality, but not sufficiently to discourage defendants from engaging in such agreements: the average defendant's payoff improves with confidentiality because it increases the information rent accruing to those types who settle with one or both plaintiffs.

The extent of learning depends on the demand made by the early plaintiff. One might expect that confidential settlements would be used by a (relatively) small set of types, concentrated at the very "top" (i.e., most culpable) of the type space. If this were the case, then confidential settlement would signal an extremely culpable defendant. In contrast, we find that the early plaintiff's equilibrium demand under confidentiality actually acts to obfuscate the defendant's

[1] This effect can have substantial consequences for goods markets. For example, in a market setting, the average consumer anticipates lower compensation when confidential settlements are possible, which may reduce the demand for products with unobservable safety attributes.

culpability; that is, the equilibrium demand pools a larger set of defendant types (as compared with open settlement). This may explain the claim (see below) that confidential settlement is becoming widely used, and thus one should not infer extreme culpability from observing a confidential settlement.

A good example of strongly correlated culpability and the use of a confidential settlement is a recent "toxic tort" case brought by 178 residents of two trailer parks in Wrightsboro, North Carolina against Conoco, Inc.[2] The suit claimed that Conoco was liable for "negligence, fraud and willful misconduct for leaking gasoline into the community's drinking water from a nearby gas station." Partway through the trial Conoco settled and the court sealed the settlement, issuing a protective order to enforce the confidentiality of the agreement. Not long after the sealing order was issued, a court clerk accidently provided a copy of the sealed settlement to a newspaper reporter, which, along with separately developed (unofficial) information, resulted in the publication of the settlement's main details on the front page of the Wilmington *Morning Star*. The reporter was held in criminal contempt, the reporter and the newspaper were held in civil contempt, and a second reporter was later ordered to reveal the sources of the unofficial information.[3] The civil penalty was set to reflect the likely increased costs to Conoco of dealing with future suits; at the time, Conoco was defending itself against over fifty similar toxic tort claims around the country.

Repeated driving under the influence of alcohol, the persistent use of shoddy manufacturing materials, and insufficient monitoring of a firm's employees with respect to sexual harassment are also examples of correlated culpability. We are not considering an event such as a single airplane crash (where the liability outcome must be the same for all plaintiffs); even though this involves multiple plaintiffs, it is essentially a single case (e.g., a class action). Rather, a series of events (e.g., a series of crashes by the same airline, or the same type of airplane) traceable to the same failure (e.g., an airline's faulty maintenance procedures, or an airframe manufacturer's poor quality control), would be an instance of strongly correlated culpability (but not a class action; we discuss this in more detail below). In such cases, while culpability is correlated, the actual outcome of each case may vary due to case-specific attributes.

In Section 2 we provide a brief literature review and some background information on confidential settlements. In Section 3 we describe the basic structure and assumptions of the model, which we then analyze in Section 4. Section 5 uses the results of the analysis to generate primarily positive (and, to a limited degree, normative) implications of the model. Section 6 summarizes our findings and suggests some extensions. The Appendix contains the derivation of the equilibrium, while a web Appendix (available at www.rje.org) contains additional claims and proofs.

## 2. Literature review and background on confidential settlement

■ We are aware of six previous articles addressing the issue of sequential suits involving asymmetric information.[4,5] Briggs, Huryn, and McBride (1996) consider a government antitrust suit, wherein the defendant has private information as to whether he is liable or not liable, that may be followed by a private suit for treble damages.[6] Che and Yi (1993) provide two models in which two plaintiffs sue a single defendant, in sequence. In the first model ("correlated decisions"), the later plaintiff's likelihood of winning depends on the outcome of the early plaintiff's case

[2] The following is drawn from Singer (1998) and from *Ashcraft* v. *Conoco*, (January 21, 1998).

[3] These findings were later reversed (because of procedural errors on the part of the District Court) by the U.S. Court of Appeals for the Fourth Circuit.

[4] Spier (2002) provides a complete-information model in which two plaintiffs bargain with a single defendant. Externalities arise between the plaintiffs because the defendant's wealth is not sufficient to cover his liabilities should both cases go to trial.

[5] Early incomplete-information models of settlement bargaining are P'ng (1983), Bebchuk (1984), and Reinganum and Wilde (1986). For reviews of the settlement bargaining literature, see Hay and Spier (1998) and Daughety (2000).

[6] In their model the defendant sequentially signals to both plaintiffs (the first signal is observed by both plaintiffs), while in ours the plaintiffs sequentially screen the defendant (the early case's disposition acts as a signal to the later plaintiff).

in a specific (exogenous) way. In the second model ("correlated damages"), the two plaintiffs' damages are positively correlated.[7] Yang (1996) considers a similar model (with only two damage levels), which incorporates the filing decision, so that settlement in the early suit may deter the later suit. Peterson (1991) shares some basic similarities with our model. In particular, a defendant with private information about his type is screened sequentially by two uninformed plaintiffs. In Peterson, however, the trial outcome in the early case determines the outcome in the later case (as in liability determination in a single airplane crash), and there is no publicity effect. Thus, settling the early suit results in an adverse inference about the defendant's culpability, with no potential offsetting benefits of settlement. Peterson finds that the first suit is less likely to settle (and the early plaintiff receives a lower payoff) if there is a later plaintiff to follow. These results are reversed in our model, wherein an early suit is more likely to settle, and the early plaintiff is strictly better off, when a later suit is anticipated. Finally, in all of these articles, the later plaintiff observes the amount of any settlement with the early plaintiff; thus none of them allows for settlements to be confidential.

Yang (1994) reconsiders his analysis, incorporating sealed settlements; however, all settlements are open or all are sealed as a matter of policy, rather than choice; some of these results are reported in Yang (1996). Finally, Daughety and Reinganum (1999) consider a model in which a defendant has two elements of private information: the defendant knows whether his own culpability in causing one plaintiff's harm is high or low, and he knows whether or not a second potential plaintiff exists. The same defendant is involved in both cases, but the defendant's level of culpability in the later case is independent of that in the early case. Equilibrium often involves the early plaintiff's making a menu of settlement offers, one open and the other confidential. Daughety and Reinganum show that confidentiality is more valuable to a defendant who (privately) knows there is a second potential plaintiff, and thus it facilitates the screening of defendant types. They find that: (1) the early plaintiff prefers confidentiality; (2) the later plaintiff never prefers confidentiality; and (3) the average plaintiff's preferences are parameter-specific, as is true of the defendant (in particular, the defendant is sometimes worse off when confidentiality is possible).

In the current article the second plaintiff's existence is common knowledge, so there is only one dimension of private information. In contrast with Daughety and Reinganum (1999), we take the defendant's culpability in the two cases to be strongly correlated, leading to an inference problem for the later plaintiff. A preliminary analysis, wherein the early plaintiff can make a menu of settlement offers, suggests that such complex strategies do not facilitate improved screening of defendant types over the simple offer analyzed in Section 4 (see Section 6 and the web Appendix). In addition, the impact of confidentiality on the parties' respective payoffs is quite clear in this model when culpability is strongly correlated: results (1) and (2) above continue to hold, but the average plaintiff now never prefers confidentiality while the defendant prefers it; these issues are discussed in detail in Section 5.

□ **Background on confidential settlements.** There are two methods of maintaining confidentiality of settlements. A court may issue a protective order, sealing the settlement agreement (and often all associated discovery materials), and issue a "gag" order to the parties;[8] this was what the District Court did in the Conoco case and why it employed contempt sanctions (in this case, against an individual and a firm who were not even parties to the confidential agreement). Alternatively, the parties may agree to dismiss the suit and form a private "contract of silence" (Garfield, 1998) in which they agree not to discuss the terms of the settlement or to disseminate information obtained through discovery. We refer to a settlement as "sealed" or "confidential" whether this is achieved by court order or by contract. Any settlement that is not made confidential by agreement or by court order is referred to as "unsealed" or "open."

[7] Settlement offers are made to each of the plaintiffs, in sequence, by the uninformed defendant, who uses his negotiation with the early plaintiff to learn (or to avoid learning) something about the later plaintiff's likely level of damages.

[8] Indeed, cases can be filed under seal, so that even the parties' identities are confidential. As one Texas Supreme Court Justice notes (Doggett and Mucchetti, 1991, p. 645), "Even the sealing orders are frequently sealed."

Systematic data on the extent of confidential settlement are nonexistent. In particular, voluntary dismissals accompanied by contracts of silence are simply recorded as voluntary dismissals; no indication of a settlement or its confidential nature will appear. In a series of articles in *The Washington Post*, Weiser and Walsh (1988a,1988b,1988c,1988d) describe numerous individual examples of the existence of confidential settlements (including malpractice, falsification of pharmaceutical test results, safety hazards in public facilities, race and sex discrimination), as well as their (essentially fruitless) search for official data on court-issued sealing orders. However, there seems to be a consensus that the use of confidentiality is increasing, largely as a consequence of mass tort and product liability suits (good examples of correlated culpability). Nissen (1994, pp. 932–933) remarks that "In modern products liability cases, many defense attorneys routinely seek protective orders to create a 'wall of silence.'. . . This has led to an explosion of sealed court records cases."

Judges have broad discretion to issue orders sealing settlement agreements and related papers, especially when obtained through discovery (Federal Rule of Civil Procedure 26, in Yeazell (1996)). They are expected to consider both the private interests of the parties and any relevant compelling public interests. There is widespread disagreement on the desirability of sealing settlement agreements and related documents.[9] Advocates of openness argue that other injured people will realize that they have a case; further risks to health and safety will be averted;[10] and discovery sharing (which allows other plaintiffs to reduce their costs of suit) will be facilitated. Advocates of allowing confidentiality argue that discovery sharing is likely to inspire nuisance suits; important privacy interests of the parties (protecting trade secrets or highly personal information) are protected by, and many settlements are made contingent upon, maintaining confidentiality (promoting settlement is an important goal of the civil justice system).[11] Our model will incorporate some (but not all) of these issues. In particular, we will explicitly model the informational externality between plaintiffs and assess the impact of confidentiality on the extent of settlement. The interesting issues of discovery sharing and of nuisance suits (separately and in combination) would both require a model involving incomplete information about damages as well as culpability. This is beyond the scope of the current article, though a topic of future research.

## 3. Model setup

■ We assume that there are three relevant parties: the early plaintiff, denoted $P_1$; the defendant, denoted $D$; and the later plaintiff, denoted $P_2$. Initially, the plaintiffs, who realize they have suffered an injury, do not attribute this injury to the defendant. Rather, as described earlier, they may attribute the injury to their own error, to other causes, or to chance; if they even entertain the possibility that the defendant is responsible, we assume it is at too low a level to trigger a lawsuit. Suppose there is an exogenous "background" probability, denoted $\underline{\gamma}$, that such an individual realizes (receives a private signal, or comes upon some sufficiently suggestive evidence like $D$'s hazardous waste truck hightailing it away from the nearby creek) that $D$ was indeed (potentially) responsible. Let $P_1$ denote the first individual to get this signal; our analysis begins at this point in time, at which the extent of $D$'s culpability is still unknown to $P_1$. Upon investigation, $P_1$ learns that $\pi$, the probability that $D$ will be found liable in the event that $P_1$ files suit, is distributed according to the cumulative distribution function $F(\cdot)$, with continuously differentiable density

[9] In the past decade, many states have considered (and several have passed) "sunshine" laws mandating a strong presumption of public access to pretrial records (Miller, 1991); on the other hand, two committees of the Judicial Conference recently proposed that the Federal Rules of Civil Procedure be amended to allow judges to impose confidentiality whenever the parties agreed (these proposals were not adopted at the 1995 annual meeting; see Nader and Smith (1996)).

[10] Luban (1995, p. 2560) argues that "Products whose defects are alleged to have been hidden by protective orders or sealed settlements are 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 cases, sealed settlements were not responsible for the occurrence of further harm.

[11] "It is probable that judges' lenient attitudes towards sealing settlement agreements are a reflection of strong public policy favoring settlements. . . . Even the Federal Rules of Civil Procedure provide for and encourage an activist role for judges in facilitating settlement." (FitzGerald, 1990, p. 406).

function $f(\cdot) > 0$ on $[\underline{\pi}, \overline{\pi}]$, $0 < \underline{\pi} < \overline{\pi} \leq 1$. $D$ is assumed to possess private information regarding the extent of his culpability in causing $P_1$'s injury; that is, $D$ knows the true value of $\pi$. This formulation implies that, in addition to the defendant's activity, there are also case-specific attributes that result in imperfect information on the part of both parties regarding the outcome of the suit. We assume that $\underline{\pi}$ reflects the minimum evidentiary standard necessary to obtain standing to sue; thus, defendant types who are "truly innocent" are weeded out by this pretrial requirement. Let $k_P$ and $k_D$ represent the trial costs for $P_i$, $i = 1, 2$, and $D$, respectively (with $k \equiv k_P + k_D$), and let $\delta$ denote the damage award should $D$ be found liable; all of these are assumed to be common knowledge. Furthermore, we assume that $\underline{\pi}\delta - k_P > 0$, so that when $P_1$ learns of $D$'s involvement, it is a dominant strategy for $P_1$ to file suit.

*Assumption 1.* $\underline{\pi}\delta - k_P > 0$.

The disposition of $P_1$'s suit is likely to affect the probability that $P_2$ makes the connection between her injury and $D$'s activity. Possible dispositions of $P_1$'s suit are $T$ (a trial), $O$ (an unsealed, or open, settlement), or $C$ (a sealed or confidential settlement). Let $\gamma_m = \Pr\{P_2$ becomes aware that $D$ could be at fault, given the disposition of $P_1$'s suit is $m\}$, $m = T, O, C$. The exogenously specified parameter $\gamma_m$ captures the "publicity effect" discussed earlier. We assume that $1 = \gamma_T > \gamma_O > \gamma_C \geq \underline{\gamma}$. That is, any disposition of $P_1$'s suit (at least weakly) increases $P_2$'s probability of realizing $D$'s involvement, with a trial being associated with more widespread publicity than an open settlement, and with a confidential settlement providing the least publicity (we consider the reverse ordering, and a plaintiff's incentives to adjust the $\gamma$ values, in Section 5). Thus, while $P_2$ may not have observed $D$'s hazardous waste truck fleeing her own nearby creek, she saw a news story about the verdict (or settlement) in $P_1$'s suit against $D$, alleging that $D$'s improper disposal of hazardous waste near a creek caused $P_1$'s illness, which is similar to $P_2$'s illness. This causes $P_2$ to update her beliefs about the source of her illness and to investigate and thereby learn the support and distribution of $\pi$; finally, $P_2$ can use any information generated by the disposition of $P_1$'s suit. Under the assumption that $\underline{\pi}\delta - k_P > 0$, it is a dominant strategy for $P_2$ to file suit once alerted to $D$'s involvement.

We assume that the defendant's type is the same in the two cases.[12] Notice that although the outcomes (i.e., liable or not liable) in the two suits are correlated because $\pi$ is the same in both suits, the outcome in the early suit does not *determine* the outcome in the later suit, which again reflects case-specific attributes resulting in imperfect information. Thus, we assume that the early and later plaintiffs' suits cannot be consolidated into a single (class action) suit. This can occur for a variety of reasons. First, the early and later plaintiffs' injuries may not occur in the same time period. Second, the identity of the later plaintiff may not be known or easily discovered by the early plaintiff (we consider the incentives for the early plaintiff to find and contact a later plaintiff in Section 5). Third, the case-specific attributes or differences in liability laws in different states may be sufficient to distinguish the cases so that they cannot be certified as a class. For example, in *In re Rhone-Poulenc Rorer Inc.*, the Seventh Circuit Court of Appeals decertified a nationwide class action (on behalf of hemophiliacs who contracted AIDS from blood solids) partly because the court objected to "a single trial before a single jury instructed in accordance with no actual law of any jurisdiction—a jury that will receive a kind of Esperanto instruction, merging the negligence standards of the 50 states and the District of Columbia" (p. 1300 of the majority opinion by Chief Judge Richard A. Posner). In the approximately 50 separate class-action suits against Conoco (one of which is the North Carolina suit), each suit is likely to have to show that Conoco was negligent and responsible in the particular case. This might be influenced by local gas station policies, physical details about the site and its relationship to water supplies, other potential sources of the pollution, and differences in state law.

Since the defendant's type is the same in the two cases, the later plaintiff will draw an

[12] One could allow case-dependent types, say, $\pi^1$ and $\pi^2$, related by a commonly known joint distribution satisfying the monotone likelihood ratio principle. This needlessly complicates the exposition and has fairly predictable qualitative effects; we return to this in Section 6.

inference about $\pi$ from observing the disposition of $P_1$'s suit (that is, $T$, $O$, or $C$). For simplicity, we assume that upon observing $T$, $P_2$ learns $D$'s type perfectly. This occurs because the record of the trial is available for scrutiny, allowing $P_2$ and her attorney to accurately assess $\pi$ (this holds independent of whether $D$ won or lost at trial).

Generally, sealed cases do not progress as the Conoco case did. Typically, the most that is observable (if one is aware of the case at all) is that a confidential settlement occurred. Upon observing $C$, $P_2$ must make an inference about $D$'s type based only on the knowledge that a confidential settlement was concluded, and not on the amount of that settlement (since it is sealed). Finally, we assume that observing $O$ implies observing also the amount of the settlement (since it is not sealed); thus $P_2$ makes an inference about $D$'s type based on the knowledge that an unsealed settlement was concluded, and on the amount of that settlement.

We assume the following game form: $P_1$ makes a single settlement demand, specifying the amount and whether the settlement is to be open or confidential (in Section 6 we briefly discuss the issues associated with extending this model to allow a menu of settlement demands, one open and one involving confidentiality). Any settlement demand will sort defendant types into (at most) two groups, those who settle and those who go to trial. We refer to such a grouping of defendant types as a *configuration*. In the web Appendix (see Claim 1), we show that a configuration of the form $\{OT\}$ or $\{CT\}$, wherein defendant types with relatively low values of $\pi$ choose settlement, while those with relatively high values of $\pi$ choose trial, cannot be an equilibrium configuration. Thus, the only possible equilibrium configurations are as follows:

(i) All defendant types make the same choice; these configurations are $\{T\}$, $\{O\}$, and $\{C\}$.

(ii) Defendant types with relatively low values of $\pi$ choose $T$, while those with relatively high values of $\pi$ choose $z$, $z = O, C$; these configurations are denoted $\{Tz\}$, $z = O, C$.

Since the configurations $\{T\}$, $\{O\}$, and $\{C\}$ are (degenerate) special cases of the configurations $\{TO\}$ and $\{TC\}$, it suffices to analyze the case $\{Tz\}$ in detail, where $z = O, C$. We characterize equilibrium behavior and payoffs separately in each of these two configurations. We then allow $P_1$ (as the first mover) to choose between them if confidential settlement is permitted.

Given the structure of the configuration $\{Tz\}$, $P_2$'s beliefs upon observing $z$ can be described as follows: $P_2$ believes that $\pi \in [t_z, \overline{\pi}]$ for some $t_z$, and the posterior density function for $\pi$ on this interval is given by $f(\pi)/[1 - F(t_z)]$. That is, upon observing a settlement rather than a trial, $P_2$ infers that the defendant has a comparatively high level of culpability. Note that $t_C$ is simply a number (since the settlement amount is unobservable to $P_2$), while $t_O$ is a function of $P_1$'s settlement offer. We will make this distinction clear when it is relevant, but otherwise we will simply refer to $t_z$; this abuse of notation provides an economy by allowing us to treat the two cases $\{TO\}$ and $\{TC\}$ simultaneously. The hazard rate $h(\pi) \equiv f(\pi)/[1 - F(\pi)]$ will play an important role in the analysis to follow. We maintain the following assumption regarding $h(\pi)$.

*Assumption 2.* $h(\pi)$ is an increasing function of $\pi$ with $h(\underline{\pi}) = f(\underline{\pi}) < \delta/k$.

Under this assumption, $h(\pi)$ is an increasing function that begins below $\delta/k$ and approaches infinity as $\pi$ approaches $\overline{\pi}$. Thus, there exists a unique value $\pi_2^* \in (\underline{\pi}, \overline{\pi})$ such that $h(\pi_2^*) = \delta/k$. For future reference we note here that $\pi_2^*$ would be the equilibrium marginal type (that is, the type just willing to accept the equilibrium demand) if there were only one suit.

## 4. Analysis

■ We analyze the problem in reverse order to ensure the selection of a perfect Bayesian equilibrium. Thus we first consider $P_2$'s choice of settlement demand after observing the disposition of $P_1$'s case. Since $P_2$ is the last plaintiff, a defendant of type $\pi$ will accept a demand of $s$ from $P_2$ if and only if $s \leq \pi\delta + k_D$. Recall that, upon observing $T$, $P_2$ learns the defendant's true type. In this case, the optimal demand for $P_2$, denoted $s^*(T)$, is given by $s^*(T) = \pi\delta + k_D$. Upon observing a settlement, $P_2$ still faces a potential screening problem in which the highest demand that will be acceptable to a defendant of type $\pi$ is given by $\tilde{s}(\pi) = \pi\delta + k_D$. Let $\pi_2$ denote the marginal defendant type in the second stage, who is just indifferent between settlement and trial. Then $\tilde{s}(\pi_2)$ is the associated settlement demand. $P_2$ can be viewed as choosing a settlement demand or, alternatively, as choosing a marginal type with whom to settle. We take the latter approach.

Let $w_2(\pi_2; z)$ denote $P_2$'s expected payoff from settling with defendant types whose culpability is at least $\pi_2$, given that $P_1$'s suit was settled under regime $z$ ($z = O, C$). Then

$$w_2(\pi_2; z) = \int_A (\pi\delta - k_P) f(\pi) d\pi / [1 - F(t_z)] + \tilde{s}(\pi_2)[1 - F(\pi_2)]/[1 - F(t_z)],$$

where $A \equiv [t_z, \pi_2]$. The first term reflects $P_2$'s expected payoff against those $D$-types who reject $P_2$'s demand (having settled with $P_1$), while the second term reflects $P_2$'s expected payoff against those $D$-types who accept $P_2$'s demand (having settled with $P_1$). $P_2$'s optimal choice of $\pi_2$ maximizes $w_2(\pi_2; z)$ subject to the constraint that $\pi_2 \geq t_z$; the other constraint, that $\pi_2 < \overline{\pi}$, will never bind (that is, going to trial against all defendant types is never an equilibrium). The following first-order condition characterizes an interior optimum (the properties of the hazard function guarantee that if the optimum is at an interior point, then the first-order condition uniquely characterizes it):

$$[\pi_2\delta - k_P - \tilde{s}(\pi_2)] f(\pi_2) + [1 - F(\pi_2)]\tilde{s}'(\pi_2) = 0.$$

Noting that $\tilde{s}(\pi_2) = \pi_2\delta + k_D$ and $\tilde{s}'(\pi_2) = \delta$, this reduces to $-kf(\pi_2) + [1 - F(\pi_2)]\delta = 0$. Thus, at an interior solution, $P_2$'s optimal marginal type is given by $\pi_2^*$ as defined previously (immediately below Assumption 2). It follows that $\pi_2^* < \overline{\pi}$; if $\pi_2^* > t_z$, then $P_2$'s optimal demand is $s^*(z) = \pi_2^*\delta + k_D$. In this case, $P_2$ makes a demand that sorts defendant types (who previously settled) into those who go to trial and those who accept $P_2$'s demand, a screening equilibrium. On the other hand, if $\pi_2^* \leq t_z$, then the solution is on the boundary, implying that $s^*(z) = t_z\delta + k_D$. In this case, $P_2$ makes a demand that is accepted by all defendant types who previously settled, a pooling equilibrium. The equilibrium behavior and payoffs for $P_2$ and $D$ are summarized in Proposition 1.

*Proposition 1.* (i) If $D$ chose $T$ in $P_1$'s suit, then $P_2$ demands $s^*(T) = \pi\delta + k_D$ and $D$ accepts. $P_2$'s payoff is $\pi\delta + k_D$ and $D$'s cost (in the later suit) is given by $V_2^*(\pi; T) = \pi\delta + k_D$.

(ii) If $D$ chose $z$ in $P_1$'s suit, then $P_2$ demands $s^*(z) = \max\{\pi_2^*, t_z\}\delta + k_D$ and $D$ accepts if $\pi \geq \max\{\pi_2^*, t_z\}$ and otherwise rejects. $P_2$'s payoff is given by $w_2(\max\{\pi_2^*, t_z\}; z)$ and $D$'s cost (in the later suit) is given by $V_2^*(\pi; z) = \min\{s^*(z), \pi\delta + k_D\}$.

Next we consider $P_1$'s choice of a marginal defendant type in the first stage, who is just indifferent between settling and going to trial, given that the settlement regime is $z$ ($z = O$ or $C$). For any given type $\pi$, there is a highest settlement demand on the part of $P_1$, denoted $\tilde{S}_z(\pi)$, that would still be acceptable to $\pi$;[13] moreover, this highest acceptable demand will depend upon $P_2$'s anticipated demand upon observing (with probability $\gamma_z$) that the defendant settled with $P_1$, which is summarized in the continuation value $V_2^*(\pi; z)$. Thus, for each $\pi$, the highest demand on the part of $P_1$ that is acceptable will satisfy $\tilde{S}_z(\pi) + \gamma_z V_2^*(\pi; z) = 2[\pi\delta + k_D]$, where the right-hand side is what the defendant of type $\pi$ expects to pay if he goes to trial against $P_1$, and is subsequently fully extracted by $P_2$. $P_1$ can then be modelled as choosing a marginal type, denoted $\pi_z$, and employing the highest acceptable demand for that type. All defendants who are less culpable go to trial, while those who are more culpable settle with $P_1$. It is possible that $P_1$ might choose to settle with all types of $D$, which is a boundary outcome. In this case, configuration $\{Tz\}$ reduces to configuration $\{z\}$. We provide a sufficient condition for an interior solution and proceed under this further assumption (in the Appendix this is referred to as Assumption 2a, since it implies Assumption 2 above).

[13] We employ an uppercase $S$ for demands made by $P_1$ to distinguish them from the demands made by $P_2$, which were denoted by using a lowercase $s$.

Finally, since the amount of the settlement is unobservable to $P_2$ when settlements are confidential, the analysis of this regime is somewhat more complex; in particular, we cannot eliminate the possibility that there may be no pure-strategy equilibrium for some parameters. To ensure that a pure-strategy equilibrium exists, we impose one further parametric restriction.

*Assumption 3.* $\gamma_C \leq [\pi_2^*\delta - k_P]/[\pi_2^*\delta + k_D]$.

Assumption 3 implies that confidentiality is sufficiently effective at reducing publicity. Note that the right-hand side can be reexpressed as $1 - k/[\pi_2^*\delta + k_D]$. Thus, if total court costs, $k$, are small compared with $P_2$'s screening demand, then this is not a particularly restrictive assumption on the possible values that $\gamma_C$ can assume.

In the Appendix we show that the equilibrium marginal type ($\pi_z^*$) is defined by the equation

$$h(\pi_z^*) = (2 - \gamma_z)\delta/\{k + (1 - \gamma_z)[\pi_z^*\delta + k_D]\}; \tag{1}$$

it is straightforward to show that $\pi_z^* < \pi_2^*$. Proposition 2 summarizes the behavior of the parties along the equilibrium path.

*Proposition 2.* (i) In the first stage, $P_1$ demands $S_z^* = (2 - \gamma_z)[\pi_z^*\delta + k_D]$; defendant types with $\pi < \pi_z^*$ reject this offer and go to trial, while defendant types with $\pi \geq \pi_z^*$ accept this offer.

(ii) In the second stage, $P_2$ demands $s^*(T) = \pi\delta + k_D$ from a defendant whose type has been revealed at trial, and this demand is accepted. $P_2$ demands $s^*(z) = \pi_2^*\delta + k_D$ from a defendant who settled with $P_1$; defendant types with $\pi < \pi_2^*$ reject this offer and go to trial, while defendant types with $\pi \geq \pi_2^*$ accept this offer.

Thus, equilibrium involves two rounds of screening. In particular: (1) types in the interval $[\underline{\pi}, \pi_z^*)$ go to trial against $P_1$, but if there is a second suit they settle with $P_2$; (2) types in the interval $[\pi_z^*, \pi_2^*)$ settle with $P_1$, but if there is a second suit they go to trial against $P_2$; and (3) types in the interval $[\pi_2^*, \overline{\pi}]$ settle with $P_1$ and (if there is a second suit) settle with $P_2$, too. Alternatively put, later plaintiffs sometimes go to trial, and they go to trial against defendant types who are neither the most *nor* the least culpable, but rather those that are "moderately" culpable. Finally, observe that $P_2$'s demand (and $D$'s cost) in the later suit is the same following a settlement (of either kind) as it would be in the absence of an early plaintiff. Thus, in equilibrium, learning affects $P_2$'s beliefs and her payoff, but not her equilibrium demand or $D$'s costs in the second suit.

It is important to note that this last result is an outcome of equilibrium play, rather than being wired into the model. It is possible for the early plaintiff to provide useful information to the later plaintiff by, for example, making a high open settlement demand such as $\hat{S}_O = (2-\gamma_O)[\hat{\pi}\delta + k_D]$, where $\hat{\pi} > \pi_2^*$. This demand is accepted by all defendant types with $\pi \geq \hat{\pi}$; thus, the later plaintiff will demand $s^*(O) = \hat{\pi}\delta + k_D$ and settle with all defendant types who concluded open settlements with the early plaintiff. In this case, the later plaintiff learns something about the defendant that alters her subsequent demand. However, it is not in the early plaintiff's interest to provide this information to the later plaintiff, since it involves going to trial more often and forgoing the payment that many defendant types are willing to make in exchange for reduced publicity.

The observation that $\pi_C^*$ is less than $\pi_2^*$ may seem to be at odds with a fairly common intuition that only extremely culpable $D$'s would be willing to pay for confidentiality. This does not occur in equilibrium; $P_1$ settles with more (moderately culpable) types, which is a benefit to them (via the publicity effect) *and* to the extremely culpable $D$'s, who are now lumped together with the more moderately culpable $D$'s, lowering $P_2$'s demand to $\pi_2^*\delta + k_D$. Thus, what $P_1$ provides to extremely culpable $D$'s (besides suppressing publicity) is *obfuscation* of their degree of culpability. In fact, as we will show in the next section, $\pi_C^* < \pi_O^* < \pi_2^*$, so that an even larger set of types settle confidentially than settle openly. Thus, observing that $P_1$ and $D$ have concluded a confidential settlement provides less information than observing the details of an open settlement: confidentiality is not a useful signal that $D$ is extremely culpable.

## 5. Positive and normative implications

■ **Positive implications.** We first compare the equilibria under configurations $\{TC\}$ and $\{TO\}$ in terms of (1) the likelihood of settlement given suit (both in the early case and in the later case); (2) total expected trial costs; (3) $P_1$'s equilibrium settlement demand, and $P_1$'s expected equilibrium settlement; and (4) the equilibrium payoffs of the parties. We can then determine whether $P_1$ will choose to employ confidential settlements.

For any probability of a second suit, $\gamma$, let the marginal type accepting a settlement in the first suit, $\pi^*(\gamma)$, be defined implicitly by

$$h(\pi^*(\gamma)) = (2-\gamma)\delta/\{k + (1-\gamma)[\pi^*(\gamma)\delta + k_D]\}, \tag{2}$$

and let $P_1$'s demand be $S^*(\gamma) \equiv (2-\gamma)[\pi^*(\gamma)\delta + k_D]$. Finally, let $P_1$'s expected payoff be $U_1^*(\gamma)$. Then, in the notation of Section 3, $\pi_z^* = \pi^*(\gamma_z)$ and $S_z^* = S^*(\gamma_z)$, for $z = O, C$. It is straightforward to show that $\partial\pi_z^*/\partial\delta > 0$, $\partial\pi_z^*/\partial k_P < 0$, and $\partial\pi_z^*/\partial k_D < 0$. Thus, increasing the stakes ($\delta$), or decreasing either litigant's court costs, increases the likelihood of a trial in the first suit.

Moreover, equation (2) implies that $\mathrm{d}\pi^*(\gamma)/\mathrm{d}\gamma > 0$; thus, $\pi_C^* < \pi_O^* < \pi_2^*$. Intuitively, the marginal defendant type who is just willing to accept a given settlement demand (from $P_1$) is ordered by these three cases. Due to the incremental reduction in the likelihood of a future suit provided by settlement and by confidentiality, the benefit to the defendant from settling at a given demand is higher for a confidential settlement than an open one, which is higher than the benefit from settling if there were no $P_2$ (since, in that event, there would be no benefit from reducing publicity). Alternatively put, to induce the *same* marginal defendant type to settle, $P_1$ could demand more if the settlement is confidential rather than open, and more if the settlement is open than if there were no $P_2$. Thus, $P_1$ would lose more by triggering this marginal type to choose trial instead of settlement when settlement is confidential rather than open, and would lose more when settlement is open than if there were no $P_2$. Hence, it is optimal for $P_1$ to induce more settlement when settlement is confidential rather than open, and more settlement when settlement is open than if there were no $P_2$.

Recall that $P_1$ goes to trial with $D$-types in $[\underline{\pi}, \pi^*(\gamma))$ and settles with $D$-types in $[\pi^*(\gamma), \overline{\pi}]$, while $P_2$ goes to trial with $D$-types in $[\pi^*(\gamma), \pi_2^*)$ and settles with $D$-types in $[\underline{\pi}, \pi^*(\gamma))$ and $[\pi^*(\gamma), \overline{\pi}]$. This observation and the fact that $\pi_C^* < \pi_O^*$ imply that $P_2$ has less information after a confidential settlement than after an open settlement and that the set of $D$-types against which $P_2$ will go to trial is strictly greater because of confidentiality. This yields Proposition 3.

*Proposition 3*. Confidentiality increases the likelihood of settlement in the early case, and decreases the likelihood of settlement (given suit) in the later case.

Total expected trial costs depend not only on the likelihood of settlement, but also on the fact that some later suits are suppressed by settlement and, *a fortiori*, by confidentiality. Total expected trial costs (as measured from our reference point, after $P_1$ has realized $D$'s involvement) are given by $k\{F(\pi^*(\gamma)) + \gamma[F(\pi_2^*) - F(\pi^*(\gamma))]\}$, where $F(\pi^*(\gamma))$ is the likelihood of trial (given suit) in the early case, $\gamma$ is the probability of a later suit, and $[F(\pi_2^*) - F(\pi^*(\gamma))]$ is the likelihood of trial (given suit) in the later case. Note that total expected trial costs can also be written as $k\{(1-\gamma)F(\pi^*(\gamma)) + \gamma F(\pi_2^*)\}$. Intuitively, since there are two possible lawsuits, this cost should be less than $2k$, the court costs associated with the two suits. In fact, it appears to be considerably less: since the term in brackets is simply a convex combination of two fractions, total expected trial costs are a fraction of the cost of a single trial (that is, less than *one* $k$). Since this expression is an increasing function of $\gamma$, it follows that total expected trial costs are lower in configuration $\{TC\}$ than in configuration $\{TO\}$. Equivalently, the expected number of trials is lower (overall) in configuration $\{TC\}$ as compared with configuration $\{TO\}$.

*Proposition 4*. Confidentiality reduces total expected trial costs.

Another comparison can be made with respect to settlement demands and expected settlements. Notice that the equilibrium settlement demand made by $P_1$ is not necessarily higher in configuration $\{TC\}$ than in configuration $\{TO\}$. Since $S^*(\gamma) \equiv (2-\gamma)[\pi^*(\gamma)\delta + k_D]$, then

$$S_C^* - S_O^* = (2-\gamma_O)[\pi_C^* - \pi_O^*]\delta + (\gamma_O^* - \gamma_C^*)[\pi_C^*\delta + k_D].$$

The first term on the right-hand side is negative, while the second term is positive, and although $\mathrm{d}\pi^*(\gamma)/\mathrm{d}\gamma > 0$, it is not possible to provide a precise relationship between $\pi_C^* - \pi_O^*$ and $\gamma_O^* - \gamma_C^*$. If $F(\cdot)$ is the uniform distribution, one can compute $S_C^*$ and $S_O^*$ and show that $S_C^* > S_O^*$; however, we cannot prove that this holds for all admissible $F$. On the other hand, $P_1$'s expected settlement, $S^*(\gamma)[1 - F(\pi^*(\gamma))]$, is a decreasing function of $\gamma$, yielding the following result.

*Proposition 5*. Confidentiality results in a higher expected settlement for $P_1$.

We now compare the equilibrium payoffs of the parties in configurations $\{TC\}$ and $\{TO\}$. If confidential settlements are allowed, then $P_1$ will choose between the two configurations. $P_1$ will choose configuration $\{TC\}$ when both $\{TC\}$ and $\{TO\}$ are available if and only if $U_1^*(\gamma_C) \geq U_1^*(\gamma_O)$. $P_1$'s payoff as parametrized by $\gamma$ is given by

$$U_1^*(\gamma) = \int_A (\pi\delta - k_P) f(\pi)\mathrm{d}\pi + (2-\gamma)[\pi^*(\gamma)\delta + k_D][1 - F(\pi^*(\gamma))],$$

where $A \equiv [\underline{\pi}, \pi^*(\gamma)]$. Differentiating (and using the envelope theorem) yields $\mathrm{d}U_1^*(\gamma)/\mathrm{d}\gamma < 0$. That is, $P_1$ strictly prefers the configuration with the lower value of $\gamma$, which is the one involving confidential settlements. Thus, when confidential settlement is permitted, the equilibrium for the overall game will involve the configuration $\{TC\}$.

It is not surprising that $P_2$'s preferences are just the reverse of $P_1$'s. Let $P_2$'s equilibrium payoff for the overall game be denoted

$$U_2^*(\gamma) \equiv \int_A (\pi\delta + k_D) f(\pi)\mathrm{d}\pi + \gamma \int_{\mathrm{B}} (\pi\delta - \mathrm{k_P})\mathrm{f}(\pi)\mathrm{d}\pi + \gamma[1 - \mathrm{F}(\pi_2^*)][\pi_2^*\delta + \mathrm{k_D}],$$

where $A \equiv [\underline{\pi}, \pi^*(\gamma)]$ and $B \equiv [\pi^*(\gamma), \pi_2^*]$. Differentiating and collecting terms implies that $\mathrm{d}U_2^*(\gamma)/\mathrm{d}\gamma > 0$. It follows that $P_2$ strictly prefers the configuration $\{TO\}$.

The *average* plaintiff strictly prefers $\{TO\}$ to $\{TC\}$. To see this, let $U_P^*(\gamma) \equiv U_1^*(\gamma) + U_2^*(\gamma)$ denote the sum of plaintiff payoffs (dividing by 2 yields the average payoff). It can be shown (see Claim 3 in the web Appendix) that $\mathrm{d}U_P^*(\gamma)/\mathrm{d}\gamma > 0$. While the early plaintiff gains from confidential settlement, she gains less than the later plaintiff loses.

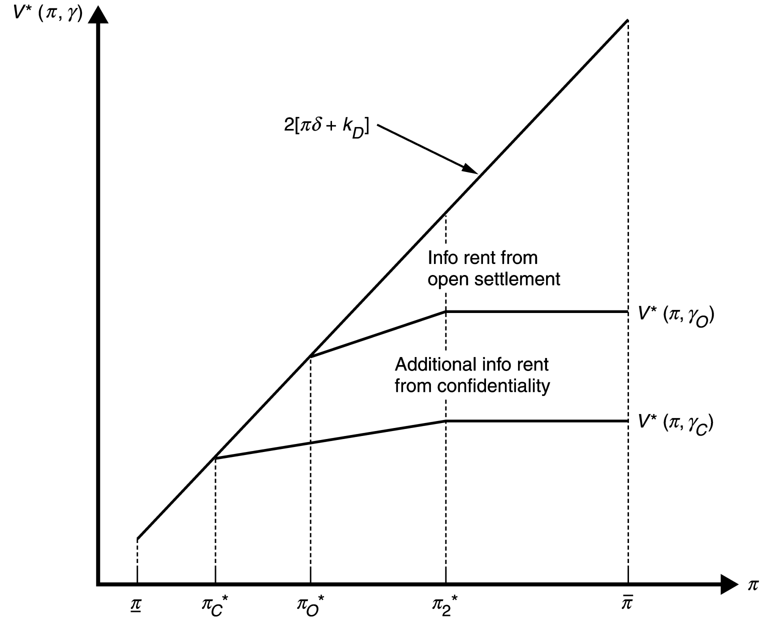
The average defendant prefers confidential settlement. To see why, let $V^*(\pi;\gamma)$ denote the equilibrium payoff to the defendant of type $\pi$. For $\pi \in [\underline{\pi}, \pi^*(\gamma))$, the defendant of type $\pi$ goes to trial against $P_1$ (and then settles with $P_2$), so $V^*(\pi;\gamma) = 2[\pi\delta + k_D]$. For $\pi \in [\pi^*(\gamma), \pi_2^*)$, the defendant of type $\pi$ settles with $P_1$ and goes to trial with $P_2$, so $V^*(\pi;\gamma) = (2-\gamma)[\pi^*(\gamma)\delta + k_D] + \gamma[\pi\delta + k_D]$. Finally, for $\pi \in [\pi_2^*, \overline{\pi}]$, the defendant of type $\pi$ settles with both plaintiffs, so $V^*(\pi;\gamma) = (2-\gamma)[\pi^*(\gamma)\delta + k_D] + \gamma[\pi_2^*\delta + k_D]$. $V^*(\pi;\gamma)$ is constant in $\gamma$ over $[\underline{\pi}, \pi^*(\gamma))$ and is strictly increasing in $\gamma$ over $[\pi^*(\gamma), \overline{\pi}]$. These latter defendant types, who settle with one or both plaintiffs, retain an information rent equal to $2[\pi\delta + k_D] - V^*(\pi;\gamma)$, which is decreasing in $\gamma$. The information rents from open and confidential settlements are illustrated in Figure 1, and we summarize the results on litigants' preferences in Proposition 6.

*Proposition 6*. $P_1$ strictly prefers $\{TC\}$ to $\{TO\}$; $P_2$ strictly prefers $\{TO\}$ to $\{TC\}$; the average plaintiff strictly prefers $\{TO\}$ to $\{TC\}$; the average defendant strictly prefers $\{TC\}$ to $\{TO\}$. Since the choice is $P_1$'s, the equilibrium configuration is $\{TC\}$.

Despite their disagreement on the issue of confidentiality, each plaintiff benefits from the other's presence. The existence of $P_2$ allows $P_1$ to extract extra compensation for settlement (and yet more for a promise of confidentiality), while the existence of $P_1$ raises $P_2$'s likelihood of

FIGURE 1

DEFENDANT'S EQUILIBRIUM PAYOFF AND INFORMATION RENT




discovery from $\underline{\gamma}$ to (at least) $\gamma_C$ and allows $P_2$ to observe perfectly the defendant types $\pi < \pi^*(\gamma_C)$ (against whom $P_1$ goes to trial) and to subsequently settle with them at a demand that fully extracts the defendant's maximum willingness to pay.

□ **Robustness of the positive implications.** While we believe it is most plausible to assume that open settlements generate more publicity than confidential settlements, the model is easily solved under the assumption that $\gamma_O < \gamma_C$. In this case, the results of Propositions 3–6 are all reversed; since confidentiality is now disadvantageous to $P_1$ (and to $D$), it will not be used in equilibrium, even if it is permitted. If $\gamma_O = \gamma_C$, there is literally no difference in the *equilibrium* outcomes (though the *analysis* of confidential settlement remains more complex than that of open settlement; see the Appendix), and all parties are indifferent between open and confidential settlements. In the sequel, we revert to the assumption that $\gamma_O > \gamma_C$.

We have assumed that $\gamma_m$ ($m = T, O, C$) was exogenously determined, with $1 = \gamma_T > \gamma_O > \gamma_C \geq \underline{\gamma}$. Suppose that $P_1$ could influence these parameter values, subject to maintaining the ordering specified above. Then it is clear from the fact that $U_1(\gamma)$ is decreasing in $\gamma$ that $P_1$ would want to (1) threaten as much publicity as possible if there were no settlement and (2) use a confidential settlement, promising as much confidentiality (i.e., as little publicity) as possible. Therefore, if $P_1$ could influence these parameter values, she would want to make $\gamma_T = 1$ (as assumed) and $\gamma_C$ as small as possible (i.e., as low as $\underline{\gamma}$, if possible).

Till now we have assumed that, for a variety of possible reasons including separation in time and jurisdiction, joinder of the two cases was impossible.[14] A full analysis of the potential for joinder is beyond the scope of this article, but some partial results can be stated (for more detail, please see the web Appendix). Suppose that joinder is modelled simply as handling the two cases simultaneously. Then each of the two plaintiffs makes a settlement demand (these will be the same because the plaintiffs' situations are symmetric), and if the demand is rejected, each will

[14] Joinder allows the simultaneous consideration of multiple claims or cases (and thus plaintiffs) that have some attributes in common (e.g., against the same defendant). The claims themselves may be resolved through different outcomes (liability for one claim need not imply liability for another). See James and Hazard (1985) and Yeazell (1996).

go to trial. Each case is decided separately (though $\pi$ is the same), and there may be small or no economies in trial costs, since each case involves case-specific attributes as well as some common ones.

Absent economies in trial costs, each plaintiff's expected payoff under joinder is the same as if she were the sole plaintiff. In the web Appendix we show that $P_1$ would prefer to bargain alone rather than contact $P_2$ (if this were possible) and join the cases. We also show that if $P_2$ is sufficiently likely to discover $D$'s involvement following a confidential settlement between $D$ and $P_1$, then $P_2$ would also prefer that $P_1$ bargain alone rather than identifying and contacting $P_2$ so as to join the cases (again, assuming that economies in trial costs are sufficiently small). By waiting, $P_2$ can take advantage of the fact that $\pi$ may be revealed by trial, should $P_1$ and $D$ fail to settle. Thus, we find the sequential model is actually robust to endogenous joinder, at least for some parameter values.

As a final robustness check, we reconsider the result that the average plaintiff prefers open to confidential settlements. This result depends upon the extent of correlation in culpability. Suppose that $D$'s type in $P_2$'s case is an independent draw from a possibly different distribution, but the cases still involve the same defendant; we call this "weakly correlated culpability." A suitably modified version of the model analyzed earlier shows that (1) as with the strongly correlated case, $P_1$ and $D$ strictly prefer a confidential settlement while $P_2$ strictly prefers that $P_1$ and $D$ engage in an open settlement; and (2) in contrast with the strongly correlated case, the average plaintiff in the weakly correlated case may strictly prefer that $P_1$ and $D$ conclude a confidential settlement.

To see this, assume that $v$ is the expected cost to $D$ of the second suit (conditional on $P_2$ filing suit) and $u$ is $P_2$'s expected payoff, should she file; since the cases are weakly correlated, $v$ and $u$ are common knowledge to $D$ and $P_1$ when they are negotiating over $P_1$'s suit. Then $P_1$'s equilibrium demand in the first suit becomes $\tilde{S}(\pi) = \pi\delta + k_D + (1-\gamma)v$. The equilibrium marginal type $\pi^*(\gamma)$ is given by $h(\pi^*(\gamma)) = \delta/\{k + (1-\gamma)v\}$, where $d\pi^*(\gamma)/d\gamma > 0$, and the defendant's expected payoff is $V^*(\pi;\gamma) = \pi\delta + k_D + v$ when $\pi \in [\underline{\pi}, \pi^*(\gamma))$, and $V^*(\pi;\gamma) = \pi^*(\gamma)\delta + k_D + v$ when $\pi \in [\pi^*(\gamma), \overline{\pi}]$. Again, the average defendant prefers confidentiality because it increases the information rent retained by those defendant types who settle with $P_1$.

The equilibrium payoffs to $P_1$ and $P_2$ become, respectively (where $A \equiv [\underline{\pi}, \pi^*(\gamma))$),

$$U_1^*(\gamma) = \int_A (\pi\delta - k_P) f(\pi) d\pi + [1 - F(\pi^*(\gamma))][\pi^*(\gamma)\delta + k_D + (1-\gamma)v]$$

and

$$U_2^*(\gamma) = F(\pi^*(\gamma))u + \gamma[1 - F(\pi^*(\gamma))]u.$$

It can be shown that $U_1^*(\gamma)$ is decreasing in $\gamma$ while $U_2^*(\gamma)$ is increasing in $\gamma$. A sufficient condition for the average plaintiff's payoff to be decreasing in $\gamma$ is that $v$ be sufficiently greater than $u$; that is, the cost to $D$ of the second suit sufficiently exceeds its value to $P_2$. In this case, $P_1$ can extract more from $D$ than $P_2$ loses (due to confidentiality), and thus the average plaintiff prefers that confidential settlements be permitted.

□ **Normative implications.** It is possible to draw some partial conclusions involving welfare, most of them negative. Our first result follows directly from Proposition 6: there is no policy upon which $P_1$, $P_2$, and $D$ could agree *ex post* of the plaintiffs learning their identities (e.g., early versus later). Moreover, when the parties do not know their identities but they do know their roles as plaintiff and defendant (we refer to choices made in these circumstances as *role-interim* choices), there is no role-interim policy on which they can agree, because the average plaintiff and the average defendant disagree about the desirability of confidentiality when culpability is strongly correlated.

If there were no significant role-interim decisions that affected welfare (beyond those involved in the negotiation process itself), then minimizing expected trial costs would maximize welfare in an *ex ante* sense, before agents know their roles as plaintiff and defendant. To see this, note that total welfare (as counted forward from the negotiation stage) is the expected gain to plaintiffs minus the expected loss to defendants. Since settlements and awards are simply transfers among the parties, total welfare reduces to (minus) total expected expenditures on trials. According to Proposition 4, total expected trial costs are lower when settlements are confidential.

However, a more comprehensive analysis of welfare would incorporate decisions made before harm occurs but at the role-interim stage, where anticipated liability costs feed back into care decisions made by the potential defendant, while the anticipated level of compensation in the event of harm feeds back into defensive investment decisions made by potential plaintiffs. For example, if we consider a products liability context, then consumers will be plaintiffs and producers will be defendants, not vice versa. In this context, confidentiality lowers the producer's anticipated liability costs and, therefore, his incentives to invest in improving product safety. Moreover, the availability of confidentiality as a bargaining option will reduce consumer willingness to pay for products, both because they anticipate that producers will take less care and because they expect less compensation in the event of harm when confidentiality is an option. Reduced demand means lower profits and therefore, potentially, yet even lower R&D for safety improvements and product innovation.

In the Conoco case discussed earlier, confidentiality reduces the firm's incentive to invest in activities that improve containment, while residents who might otherwise live nearby will instead live further from the potential contamination source (at a higher cost or lower utility, an example of defensive expenditures). Both of these effects are likely to be welfare reducing if there is reason to expect that firms are currently providing too little care.[15] Thus, once these role-interim decisions are incorporated into the model, an *ex ante* welfare analysis of confidential settlements may result in a reversal of the tentative welfare result implied by Proposition 6.

This rationalizes why current policy is to employ judicial discretion[16] as a means for permitting or prohibiting sealing. Moreover, the analysis suggests that confidentiality is most likely to have adverse consequences for social welfare in the case of strongly correlated culpability. Thus, one reasonable safeguard is for the court to maintain a rebuttable presumption against allowing confidentiality in cases where it anticipates that there is strongly correlated culpability. Since the court cannot observe directly whether there is strongly correlated culpability, in the case of parties requesting that their settlement be sealed, the court could require evidence or testimony (on penalty of perjury) to the effect that there are no other similarly affected plaintiffs. In the case of a contract of silence, the court could refuse to enforce such contracts, and perhaps impose penalties, if subsequent plaintiffs arise who were similarly affected at the time the contract of silence was made.

## 6. Summary and potential extensions

■ In this article, we provided a model of settlement negotiations between a defendant and two potential plaintiffs. We found that an early plaintiff chooses to make settlements confidential. Although confidentiality decreases the likelihood of trial (given suit) in the early case and increases this likelihood in the later case, it reduces total expected trial costs. Confidentiality also increases the expected settlement obtained by the early plaintiff, yet it leaves the average defendant better off. We further found that even though early and later plaintiffs disagree about confidentiality, the average plaintiff opposes it. We also showed that the average defendant prefers confidentiality. When role-interim decisions have no (or small) adverse welfare consequences, society would *ex ante* favor permitting confidential settlements. In general, however, we argued that there can be important role-interim effects that may make allowing confidential settlements inadvisable.

We have emphasized two kinds of informational externalities that can arise when the plaintiffs negotiate in sequence. The disposition of the early plaintiff's suit can increase the likelihood that

[15] Of course, if the potential defendant would otherwise take too much care or the potential plaintiff would otherwise invest too little in defensive expenditures, then confidentiality could improve welfare by reducing care and/or increasing defensive expenditures.

[16] Although a few states have passed laws prohibiting sealed settlements, most (and the federal government) provide for judicial discretion in these matters.

the later plaintiff also files suit. At the same time, a later plaintiff can free ride on information provided by the disposition of the early plaintiff's suit. Of course, it is the presence of the potential second plaintiff that allows the early plaintiff to extract more from the defendant: she can't charge the later plaintiff for the positive externality, so she charges the defendant for controlling (by settling confidentially) the magnitude of the negative externality he will face.

A variety of generalizations are possible and desirable. We have allowed for learning that might affect $P_2$'s behavior following a settlement; in equilibrium, however, learning affects $P_2$'s beliefs and payoffs but not her subsequent demand. This is a consequence of (1) our assumption that culpability is the *same* in both cases, so that Bayesian updating consists simply of renormalizing the original distribution to the interval $[t_z^*, \overline{\pi}]$, in which case the hazard rate is independent of the belief $t_z^*$; and (2) the equilibrium marginal type for the early suit ($\pi_z^*$) is less than $\pi_2^*$, and therefore the equilibrium marginal type for the later suit is not on the boundary of the set of types of interest ($[t_z^*, \overline{\pi}]$) and thus remains $\pi_2^*$. If our assumption of strongly correlated culpability were relaxed (providing a conditional distribution, $g(\pi^2 \mid \pi^1)$, which is common knowledge to all players and satisfies the monotone likelihood ratio principle), then the hazard function for $P_2$ would now depend upon $t_z^*$. Thus, the disposition of the first case would influence $P_2$'s equilibrium demand through these beliefs. Since it is the more culpable types who settle in the first case, it is reasonable to speculate that settlement would lead to beliefs that support a higher demand in the second case. If the same equilibrium pattern prevails in the first case (more types settle confidentially than open), then a confidential settlement would also reduce $P_2$'s equilibrium demand (and $D$'s expected costs in the second suit), as compared with an open settlement. We view a careful and complete analysis with a parameterized level of correlation as a substantial extension of the current model.

Another extension is suggested by the fact that $P_2$'s beliefs would not be updated if she were to learn $S_C^*$ in an unanticipated way (since she can compute $S_C^*$ in equilibrium). To incorporate an element of surprise, one could suppose instead that (prior to settlement, perhaps due to costly discovery) $P_1$ also obtains a private signal $x$ that is affiliated with $\pi$, allowing her to update her beliefs to $F(\pi; x)$. Then the settlement values $S_C^*$ and $S_O^*$ would reflect the value of $x$ as well. Since $S_O^*$ is observable, any information about $x$ contained in it would be available to $P_2$, but information in $S_C^*$ about $x$ would not be available to $P_2$. In this case, learning the actual value of $S_C^*$ (*ex post*, in an unanticipated way, such as occurred in the Conoco case) would also affect $P_2$'s demand (increasing it, if $x$ and $\pi$ are affiliated random variables), to $D$'s detriment.

A further avenue for generalization would be to allow $P_1$ to offer a menu of settlement demands, one associated with an open settlement and the other associated with a confidential settlement. Such a menu is used in Daughety and Reinganum (1999), where it facilitates screening with the result that some defendant types are worse off due to confidentiality. In that model, however, the defendant's culpability is weakly correlated (as described earlier) and thus there is no inference problem for $P_2$. Extending the current article to allow for a menu of offers means that the continuation game upon $P_2$'s observing a particular type of settlement is very complex: for instance, upon observing an open settlement at $S_O$, $P_2$ must form a conjecture about whether a confidential settlement offer was also made but rejected (and beliefs about what defendant types would have accepted a confidential settlement offer versus the open settlement offer versus trial), or whether no confidential settlement offer was made (and beliefs about what defendant types would have accepted the open settlement offer rather than go to trial). We are able to rule out certain configurations that one might think are very plausible, in particular $\{TOC\}$, in which the least culpable go to trial and the most culpable settle confidentially (as well as others that seem less plausible, such as $\{OC\}$, $\{TCO\}$, and $\{CO\}$; see Claim 4 in the web Appendix). This leads us to suspect that a menu of offers would not facilitate screening in the current model. However, we leave the complete characterization of equilibrium in this more general model for future research.

## Appendix

■ Here we complete the derivation of the equilibrium strategies for $P_1$, $D$, and $P_2$, for the configurations $\{TO\}$ and $\{TC\}$. Thus, this Appendix provides the proof of Proposition 2.

□ **Configuration $\{TO\}$.** Upon observing an open settlement with $P_1$ in the amount $S_O$, $P_2$ believes that $\pi \in [t_O(S_O), \overline{\pi}]$. However, independent of $P_2$'s beliefs, $P_2$ will never demand less than $\pi_2^*\delta + k_D$ (recall that $P_2$'s optimal demand is $s^*(O) = \max\{\pi_2^*, t_O\}\delta + k_D$ and $D$ accepts if $\pi \geq \max\{\pi_2^*, t_O\}$ and otherwise rejects). Thus, following an open settlement with $P_1$, a defendant of type $\pi \leq \pi_2^*$ expects to pay $\pi\delta + k_D$ in a second suit. Therefore, the highest demand on the part of $P_1$ that is acceptable to a type $\pi \leq \pi_2^*$, denoted $\tilde{S}_O(\pi)$, satisfies $S_O + \gamma_O[\pi\delta + k_D] = 2[\pi\delta + k_D]$, where the right-hand side is what type $\pi$ would pay if he goes to trial with $P_1$ (and is subsequently fully extracted by $P_2$). Thus, $\tilde{S}_O(\pi) = (2 - \gamma_O)[\pi\delta + k_D]$. Alternatively put, for demands $S_O \leq \tilde{S}_O(\pi_2^*) = (2 - \gamma_O)[\pi_2^*\delta + k_D]$, the lowest type $\pi$ willing to accept $S_O$ is given by $\tilde{\Pi}_O(S_O) \equiv [S_O - (2 - \gamma_O)k_D]/(2 - \gamma_O)\delta$. Since $P_2$'s beliefs must be consistent with $D$'s actual behavior for any $S_O$, this ties down $P_2$'s beliefs for $S_O \leq \tilde{S}_O(\pi_2^*)$: $t_O(S_O) \equiv [S_O - (2 - \gamma_O)k_D]/(2 - \gamma_O)\delta$.

Note that $t_O(\tilde{S}_O(\pi_2^*)) = \pi_2^*$. Moreover, the structure of the problem implies that $t_O(S_O)$ is nondecreasing; that is, higher demands are attributed to more-culpable types. Thus, in determining appropriate beliefs for $S_O > \tilde{S}_O(\pi_2^*)$, we employ the fact that $t_O(S_O) \geq \pi_2^*$. For defendant types with $\pi > \pi_2^*$, the highest demand on the part of $P_1$ that is acceptable satisfies $S_O + \gamma_O[\min\{\pi, t_O(S_O)\}\delta + k_D] = 2[\pi\delta + k_D]$. If $\min\{\pi, t_O(S_O)\} = \pi$, again $\tilde{S}_O(\pi) = (2 - \gamma_O)[\pi\delta + k_D]$. If $\min\{\pi, t_O(S_O)\} = t_O(S_O)$, then $\tilde{S}_O(\pi)$ satisfies $S_O = 2[\pi\delta + k_D] - \gamma_O[t_O(S_O)\delta + k_D]$. Alternatively put, the lowest type $\pi$ willing to accept $S_O$ is given by $\tilde{\Pi}_O(S_O) \equiv [S_O + \gamma_O(t_O(S_O)\delta + k_D) - 2k_D]/2\delta$. Consistency of beliefs then requires that $t_O(S_O) = \tilde{\Pi}_O(S_O)$ for all $S_O$; that is, the lowest type that $P_2$ believes would settle for $S_O$ is the lowest type that would actually settle for $S_O$. Substituting $t_O(S_O)$ for $\tilde{\Pi}_O(S_O)$ and solving for $t_O(S_O)$ again yields $t_O(S_O) = [S_O - (2 - \gamma_O)k_D]/(2 - \gamma_O)\delta$ or, equivalently, $\tilde{S}_O(\pi) = (2 - \gamma_O)[\pi\delta + k_D]$.

Thus, given the foregoing beliefs on the part of $P_2$, $P_1$ can be viewed as choosing a marginal type $\pi_O \in [\underline{\pi}, \overline{\pi}]$ so as to maximize her payoff, denoted $u_1(\pi_O; \tilde{S}_O(\pi_O))$, where

$$u_1(\pi_O; \tilde{S}_O(\pi_O)) \equiv \int_B [\pi\delta - k_P] f(\pi) \mathrm{d}\pi + \tilde{S}_O(\pi_O)[1 - F(\pi_O)],$$

where $B \equiv [\underline{\pi}, \pi_O]$. The fact that the hazard rate is increasing means that $u_1(\pi_O; \tilde{S}_O(\pi_O))$ is a single-peaked function of $\pi_O$. Differentiating yields

$$[\pi_O\delta - k_P - \tilde{S}_O(\pi_O)] f(\pi_O) + \tilde{S}'_O(\pi_O)[1 - F(\pi_O)] = 0.$$

Substituting $\tilde{S}_O(\pi_O) = (2 - \gamma_O)[\pi_O\delta + k_D]$ and $\tilde{S}'_O(\pi_O) = (2 - \gamma_O)\delta$ and rearranging implies that an interior optimum $\pi_O^*$ is defined implicitly by

$$h(\pi_O^*) = f(\pi_O^*)/[1 - F(\pi_O^*)] = (2 - \gamma_O)\delta/\{k + (1 - \gamma_O)[\pi_O^*\delta + k_D]\}.$$

Finally, since (1) $\delta/k > (2-\gamma_O)\delta/\{k+(1-\gamma_O)[\pi_O^*\delta+k_D]\}$ by Assumption 1; (2) $h(\cdot)$ is increasing by Assumption 2; and (3) $\pi_2^*$ is defined by $h(\pi_2^*) = \delta/k$, it follows that $\pi_O^* < \pi_2^*$. However, if $\pi_O^*$ (as defined above) is less than or equal to $\underline{\pi}$, then the solution to the problem is on the boundary. This can occur only if $h(\underline{\pi}) = f(\underline{\pi}) \geq (2-\gamma_O)\delta/\{k+(1-\gamma_O)[\underline{\pi}\delta+k_D]\}$. We proceed under the assumption that the solution is interior (Assumption 2a is given below; note that this implies Assumption 2).

*Assumption 2a.* $f(\underline{\pi}) < (2 - \gamma_z)\delta/\{k + (1 - \gamma_z)[\underline{\pi}\delta + k_D]\}, \qquad z = O, C.$

To summarize: in configuration $\{TO\}$, $P_1$ demands $S_O^* = (2 - \gamma_O)[\pi_O^*\delta + k_D]$, which is accepted by all defendant types with $\pi \geq \pi_O^*$ and rejected by all defendant types with $\pi < \pi_O^*$. Upon observing a trial, $P_2$ observes $\pi$ and demands $\pi\delta + k_D$, which is accepted by the defendant. Upon observing an open settlement at $S_O^*$, $P_2$ believes that this demand would have been accepted by all defendants with $\pi \geq t_O(S_O^*) = [S_O^* - (2 - \gamma_O)k_D]/(2 - \gamma_O)\delta = \pi_O^*$. Since $\pi_O^* < \pi_2^*$, $P_2$ demands $s^*(O) = \pi_2^*\delta + k_D$; defendants with $\pi < \pi_2^*$ go to trial while those with $\pi \geq \pi_2^*$ settle with $P_2$.

□ **Configuration $\{TC\}$.** In this configuration, $P_2$ observes only the fact, not the amount, of a settlement. Thus, $P_2$'s beliefs are simply a number, $t_C$, rather than a function. Again, recall that $P_2$'s optimal demand is $s^*(C) = \max\{\pi_2^*, t_C\}\delta + k_D$ and $D$ accepts if $\pi \geq \max\{\pi_2^*, t_C\}$ and otherwise rejects. Since $P_2$'s demand and $D$'s acceptance policy are the same for all $t_C \leq \pi_2^*$, it suffices to define $P_1$'s payoff for beliefs $t_C \geq \pi_2^*$ ($P_1$'s payoff for beliefs $t_C \leq \pi_2^*$ is exactly the same as $P_1$'s payoff for beliefs $t_C = \pi_2^*$). Thus, following a confidential settlement with $P_1$, a defendant of type $\pi \leq \pi_2^*$ expects to pay $\pi\delta + k_D$ in a second suit. Therefore, the highest demand on the part of $P_1$ that is acceptable to a type $\pi \leq \pi_2^*$, denoted $\tilde{S}_C(\pi)$, satisfies $S_C + \gamma_C[\pi\delta + k_D] = 2[\pi\delta + k_D]$, where the right-hand side is what type $\pi$ would pay if he goes to trial with $P_1$ (and is subsequently fully extracted by $P_2$). Thus, $\tilde{S}_C(\pi) = (2 - \gamma_C)[\pi\delta + k_D]$.

For defendant types with $\pi \geq \pi_2^*$, the highest demand on the part of $P_1$ that is acceptable satisfies $S_C + \gamma_C[\min\{\pi, t_C\}\delta + k_D] = 2[\pi\delta + k_D]$. If $\min\{\pi, t_C\} = \pi$, again $\tilde{S}_C(\pi) = (2 - \gamma_C)[\pi\delta + k_D]$. However, if $\min\{\pi, t_C\} = t_C$, then the highest acceptable demand satisfies $S_C + \gamma_C[t_C\delta + k_D] = 2[\pi\delta + k_D]$. Let $\hat{S}_C(\pi; t_C)$ denote this demand: $\hat{S}_C(\pi; t_C) = 2[\pi\delta + k_D] - \gamma_C[t_C\delta + k_D]$. Note that the highest acceptable demand is piecewise linear in $\pi$ and increases faster along $\hat{S}_C(\pi; t_C)$ than $\tilde{S}_C(\pi)$.

Define $P_1$'s payoff, denoted $u_1(\pi_C; t_C)$, as follows (for $t_C \geq \pi_2^*$): when $\pi_C \leq t_C$, then $u_1(\pi_C; t_C) = \tilde{u}_1(\pi_C; \tilde{S}_C(\pi_C)) \equiv \int_B (\pi\delta - k_P) f(\pi) \mathrm{d}\pi + \tilde{S}_C(\pi_C)[1 - F(\pi_C)]$, and when $\pi_C \geq t_C$, then $u_1(\pi_C; t_C) = \hat{u}_1(\pi_C; \hat{S}_C(\pi_C; t_C)) \equiv \int_B (\pi\delta -$

$k_P)f(\pi)\mathrm{d}\pi + \hat{S}_C(\pi_C; t_C)[1 - F(\pi_C)]$; in both cases, $B \equiv [\underline{\pi}, \pi_C]$. Again, recall that $u_1(\pi_C; t_C) = u_1(\pi_C; \pi_2^*)$ for all $\pi_C$ and for all $t_C \leq \pi_2^*$. Both $\tilde{u}_1(\pi_C; \tilde{S}_C(\pi_C))$ and $\hat{u}_1(\pi_C; \hat{S}_C(\pi_C; t_C))$ are single-peaked functions of $\pi_C$ on $[\underline{\pi}, \overline{\pi}]$. Since $P_1$'s overall payoff involves a transition from one to the other at $\pi_C = t_C$, this introduces the possibility that $P_1$'s overall payoff is not single-peaked in $\pi_C$, though it is continuous at $\pi_C = t_C$ since $\tilde{S}_C(t_C) = \hat{S}_C(t_C; t_C)$.

This gives rise to two possible candidates for an equilibrium. In one candidate, $P_1$ makes a relatively low demand and settles with a relatively large fraction of defendant types. In the other candidate, $P_1$ makes a relatively high demand and settles with a relatively low fraction of (highly culpable) defendant types. In the remainder of this Appendix, we derive the first candidate and verify that it is an equilibrium, under the parameter restriction given in the text (Assumption 3). In the web Appendix, we verify that the other candidate is never an equilibrium (in particular, if $P_2$ expects the second type of candidate for an equilibrium, $P_1$ would do better by defecting to the first type of candidate).

One possible candidate for an equilibrium involves $P_1$ choosing a marginal type $\pi_C$, such that $\pi_C \leq t_C$. To obtain this candidate, we maximize $\tilde{u}_1(\pi_C; \tilde{S}_C(\pi_C))$, yielding

$$[\pi_C\delta - k_P - \tilde{S}_C(\pi_C)]f(\pi_C) + \tilde{S}'_C(\pi_C)[1 - F(\pi_C)] = 0.$$

Substituting $\tilde{S}_C(\pi_C) = (2 - \gamma_C)[\pi_C\delta + k_D]$ and $\tilde{S}'_C(\pi_C) = (2 - \gamma_C)\delta$ and rearranging implies that an interior optimum $\pi_C^*$ (if one exists) is defined implicitly by

$$h(\pi_C^*) = f(\pi_C^*)/[1 - F(\pi_C^*)] = (2 - \gamma_C)\delta/\{k + (1 - \gamma_C)[\pi_C^*\delta + k_D]\}.$$

It is clear that $\pi_C^*$ so defined is less than $\overline{\pi}$, and Assumption 2a ensures that $\pi_C^* > \underline{\pi}$. Finally, since (1) $\delta/k > (2 - \gamma_C)\delta/\{k + (1 - \gamma_C)[\pi_C^*\delta + k_D]\}$ by Assumption 1; (2) $h(\cdot)$ is increasing by Assumption 2; and (3) $\pi_2^*$ is defined by $h(\pi_2^*) = \delta/k$, it follows that $\pi_C^* < \pi_2^*$.

Thus, there is a unique candidate for an equilibrium with $\pi_C \leq t_C$. In it, $P_1$ demands $S_C^* = (2-\gamma_C)[\pi_C^*\delta + k_D]$, which is accepted by all defendant types with $\pi \geq \pi_C^*$ and rejected by all defendant types with $\pi < \pi_C^*$. Upon observing a trial, $P_2$ observes $\pi$ and demands $\pi\delta + k_D$, which is accepted by the defendant. Upon observing a confidential settlement, $P_2$ believes that this demand would have been accepted by all defendants with $\pi \geq t_C = \pi_C^*$. Since $\pi_C^* < \pi_2^*$, $P_2$ demands $s^*(C) = \pi_2^*\delta + k_D$; defendants with $\pi < \pi_2^*$ go to trial while those with $\pi \geq \pi_2^*$ settle with $P_2$.

To verify that this candidate actually *is* an equilibrium, we must show that *if* $P_2$ believes $t_C = \pi_C^*$, then it will be optimal for $P_1$ to choose $\pi_C^*$; that is, $\pi_C^*$ maximizes $u_1(\pi_C; \pi_C^*)$ on $[\underline{\pi}, \overline{\pi}]$. First, recall that $u_1(\pi_C; \pi_C^*) = u_1(\pi_C; \pi_2^*)$ for all $\pi_C$. Thus, $\pi_C^*$ maximizes $u_1(\pi_C; \pi_C^*)$ if and only if it also maximizes $u_1(\pi_C; \pi_2^*)$. The preceding analysis implies that $\pi_C^*$ maximizes $\tilde{u}_1(\pi_C; \tilde{S}_C(\pi_C))$ for $\pi_C \in [\underline{\pi}, \pi_2^*]$. What remains to be shown is that $P_1$ would not want to defect to any $\pi_C > \pi_2^*$. To see that this is true, we differentiate $\hat{u}_1(\pi_C; \hat{S}_C(\pi_C; \pi_2^*))$ with respect to $\pi_C$ and evaluate it at $\pi_C = \pi_2^*$. Differentiating yields

$$[\pi_C\delta - k_P - \hat{S}_C(\pi_C; \pi_2^*)]f(\pi_C) + \hat{S}'_C(\pi_C; \pi_2^*)[1 - F(\pi_C)].$$

Substituting $\hat{S}_C(\pi_C; \pi_2^*) = 2[\pi_C\delta + k_D] - \gamma_C[\pi_2^*\delta + k_D]$ and $\hat{S}'_C(\pi_C; \pi_2^*) = 2\delta$, simplifying, and evaluating at $\pi_C = \pi_2^*$ yields

$$[-k - (1 - \gamma_C)(\pi_2^*\delta + k_D)]f(\pi_2^*) + 2\delta[1 - F(\pi_2^*)].$$

Since $f(\pi_2^*)/[1 - F(\pi_2^*)] = \delta/k$, the expression above is nonpositive under Assumption 3. Since the function $\hat{u}_1(\pi_C; \hat{S}_C(\pi_C; \pi_2^*))$ is single-peaked and its derivative at $\pi_C = \pi_2^*$ is nonpositive, no $\pi_C > \pi_2^*$ can provide a higher payoff than $\hat{u}_1(\pi_2^*; \hat{S}_C(\pi_2^*; \pi_2^*)) = \tilde{u}_1(\pi_2^*; \tilde{S}_C(\pi_2^*)) < \tilde{u}_1(\pi_C^*; \tilde{S}_C(\pi_C^*)) = u_1(\pi_C^*; \pi_2^*) = u_1(\pi_C^*; \pi_C^*)$. Thus, $\pi_C^*$ maximizes $u_1(\pi_C; \pi_C^*)$ on $[\underline{\pi}, \overline{\pi}]$. *Q.E.D.*

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