

Optimal use of information in litigation: should regulatory information be withheld to deter frivolous suits?

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We examine the value of incorporating regulatory information into the court liability decision and making it publicly available, when the causality of harm is uncertain. Public access to regulatory information, coupled with its use in a liability decision, not only improves the accuracy of court adjudication but also guides victims to more informed decisions about their lawsuits, when victims' private information on causality of harm is verifiable to the court. When victims' information is unverifiable, however, withholding regulatory information until after victims bring lawsuits induces them to utilize their private information better in their litigation decisions, and thus may be socially desirable.

1. Introduction

■ Uncovering truth is an essential part of court proceedings. In tort cases, for example, courts expend many resources processing information to determine the magnitude of harm, negligence, injurers' liability, etc. While litigants are the main providers of information under the current adversarial system, the government is also an important source of information when performing its role as regulator. Various regulatory agencies monitor potential tortfeasors (e.g., polluting chemical firms) and collect relevant information (e.g., monthly pollution discharges). This regulatory information can be used later in a court proceeding should a lawsuit be brought against the party to whom the information is relevant. More important, several U.S. laws allow public

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access to much of this regulatory information and other government-held information,¹ which can influence victims' decisions to litigate.

Until very recently, the law and economics literature has not addressed such basic questions as why information is gathered and how it should be used. An exception is the recent literature that explores the value of accurate adjudication in damage and liability assessment (Kaplow and Shavell, 1994, 1996; Kaplow, 1994). Although these articles illuminate the merit of gathering accurate information with regard to the provision of deterrence, their attention is limited to situations where the government is the sole enforcement party. In practice, however, much enforcement is initiated by private citizens through civil litigation, especially in areas such as product liability, antitrust, medical malpractice, and to some extent, environmental protection. In antitrust enforcement, for instance, private suits have consistently outnumbered government suits by a wide margin in the postwar period.²

In this article we study how the government should manage regulatory information to induce efficient private enforcement. In so doing, we focus on two areas of policy intervention: (1) the liability rule and (2) public access to regulatory information. Clearly, incorporating regulatory information into the liability rule can make adjudication more accurate. Access to regulatory information, on the other hand, can influence the victims' litigation decision. Suppose, for example, that a cancer victim suspects that pollution from a chemical plant caused her disease but, lacking information about the carcinogenic qualities of the pollutant, cannot be certain.³ In this situation, regulatory information linking the plant's emissions to similar cases of cancer will encourage her to sue, while information casting doubt on such a link will discourage her from suing. Thus, regulatory information, if revealed prior to litigation, can encourage a lawsuit against a guilty defendant and discourage one against an innocent defendant.

Several questions arise: Should liability depend on regulatory information? Should regulatory information be made available to victims so that they can make more informed decisions about lawsuits? Or should regulatory information be revealed only during court proceedings? To answer these questions, we develop a model in which a victim has verifiable harm but is uncertain about its cause: the harm could have been caused by the defendant or by nature. The victim gathers imperfect information about the cause of the harm. The government gathers additional independent information about causality, which we call "regulatory information." According to the manner in which regulatory information is revealed and used, we distinguish three regimes: (1) simple rule, (2) *ex ante* rule, and (3) *ex post* rule.

The "simple rule" is the benchmark rule in which the court simply bases its liability decision on the victim's information and does not consult regulatory information. In both the "*ex ante*" and "*ex post*" rules, the defendant's liability is based on both regulatory and the victim's information. These rules differ in terms of when regulatory information is revealed. In the *ex ante* rule, regulatory information is revealed before the victim's litigation decision, whereas in the *ex post* rule it is revealed after a lawsuit is brought (i.e., during the court proceedings). In practice, the *ex ante* rule corresponds roughly to the current U.S. policy that makes government-held information publicly available. The *ex post* rule corresponds to discovery activities such as

¹ Major legislative acts include the Freedom of Information Act, the Security Act of 1933, the Security Exchange Act of 1934, the Community Right to Know Act, and the Clean Water Act.

² Prior to 1965, the ratio of private to government cases tended to be 6 to 1 or less. Between the mid-1960s and late 1970s, the ratio of private to public cases exceeded 20 to 1. The ratio was in the 10 to 1 range in the 1980s. See Salop and White (1988) for more details.

³ Throughout this article, the victim is referred to by female terms and the injurer by male terms.

expert witnessing. It is also relevant when regulatory agencies restrict access to information until after litigation,⁴ which outside the United States is the rule rather than the exception.⁵ Even in the United States, access to regulatory information is often limited until after a victim acquires legal standing as a litigant.⁶

Comparison of the alternative rules depends critically on the verifiability of the victim's private information. When the victim's information is verifiable, the *ex ante* rule dominates the other rules. By basing a defendant's liability on both victim's and regulatory information, the former rule punishes the defendant when he is most likely to have caused the harm. Furthermore, the *ex ante* rule allows the victim to make a more informed litigation decision, minimizing the chances of her bringing a lawsuit when the harm is naturally caused. The latter effect is absent in the two other rules, since the victim bases her suit decision only on her private information.

In many litigation situations, however, a victim's information takes the form of "soft evidence," such as first-hand observations by victims and other interested parties. Despite being informative, the court cannot verify such information, given that the victim has a vested interest in packaging the evidence in her favor. In this situation, disinterested third-party evidence, such as regulatory information, will play a critical role in determining liability.

When the victim's information is unverifiable, the *ex post* rule may dominate the *ex ante* rule. Under the *ex ante* rule, the victim bases her lawsuit decision on regulatory information but is unresponsive to her own information (knowing that it would not affect the defendant's liability). The opposite is true under the *ex post* rule. Although the victim cannot incorporate the regulatory information into her lawsuit decision, the anticipated use of the regulatory information can make her responsive to her private information, since it signals what regulatory information will reveal in trial. Thus, comparison of the alternative rules depends on the relative precision of the regulatory information vis-à-vis the victim's private information. When regulatory information is sufficiently more precise than the victim's private information, the *ex ante* rule dominates, whereas the opposite is true when private information is more precise than regulatory information and the latter is itself sufficiently precise.

The remainder of the article formalizes these ideas. A formal model is presented in Section 2. Section 3 considers the case where the victim's information is verifiable, while Section 4 considers the case where it is unverifiable. Finally, Section 5 concludes by commenting on the robustness of the findings.

2. The model

■ We consider a tort situation that has three parties: a victim (or plaintiff), a defendant (or injurer), and the social planner (or government consisting of a regulator and a court).⁷ The defendant engages in a risky activity that may cause harm to the victim. By taking a preventive effort, $e \geq 0$, however, the defendant can reduce the probability of causing harm to the victim, $p(e)$. We assume that $p'(\cdot) < 0$ and $p''(\cdot) > 0$: the

⁴ These two interpretations of the *ex post* rule may not be the same if there are positive costs associated with collecting information.

⁵ For example, the United Kingdom has yet to adopt a system of public access to government-held information (Marsh, 1987). In many other West European countries, the right of public access to government-held information is ineffective because of institutional barriers such as long waiting periods, lack of publication description, etc. (Errera, 1987).

⁶ The Freedom of Information Act exempts from public access some government-held information. Also, in some cases, parties were denied access to government information based on the act but were granted access through civil discovery. See *Pleasant Hill Bank v. US* [58 F.R.D. 97, 99, 101 (W.D. Ma. 1973)] and *Baldrige v. Shapiro* [455 U.S. 345, 71 L.E.D. 2d 199, 102 S. Ct. 1103].

⁷ The social planner is referred to as a regulator or a court, whichever is appropriate for the context.

probability of the defendant's causing harm decreases with preventive effort at a diminishing rate. To ensure an interior solution, we further assume that $p'(0) = -\infty$ and $p'(\infty) = 0$. The defendant's effort is unobservable to the other parties.

The victim can alternatively be harmed by a natural accident with probability $n(> 0)$. The two events of harm are mutually exclusive, with $n + p(e) \leq 1$ for all $e \geq 0$. Note that the defendant has no control over the likelihood of naturally caused harm. The harm results in a loss, l , that is randomly drawn from $[0, L]$ by the same distribution function F and density f , regardless of the source.⁸ In other words, the same risky activity causes different levels of harm, depending on the random circumstances.⁹

The victim, if injured, acquires only imperfect knowledge about the source of harm. She draws a private signal $s \in \{s_n, s_d\}$, where s_n and s_d respectively indicate that harm was naturally and defendant-caused. The signal could represent, for example, the plaintiff's knowledge of her health condition, episodes of rivals' predatory trade practices, or experience of product malfunctions. The precision of the signal is represented by $\delta \in [\frac{1}{2}, 1]$, the probability of receiving a correct signal conditional on the actual cause of harm. When $\delta = \frac{1}{2}$, the signal is uninformative; when $\delta = 1$, the signal is perfectly informative. The victim draws her signal prior to her litigation decision. Although we do not explicitly model how the signal is revealed during litigation, we assume that the presence of such information is public knowledge, so even a signal that is unfavorable to the plaintiff is revealed during trial, for example, at the defendant's request.

A lawsuit by the victim (or plaintiff) always results in litigation.¹⁰ The plaintiff and the defendant bear their litigation costs, c_p and c_d , respectively (i.e., the American fee system). The social planner designs the liability system as well as the information system. When trial occurs, the social planner verifies the realized harm, l , and determines the defendant's liability. Unobservability of the defendant's effort precludes a liability rule depending on it (e.g., negligence rule), so the court uses a strict liability rule that depends on verifiable causality information.¹¹

In addition to the victim's causality signal, the social planner can acquire, through *ex ante* regulatory monitoring or *ex post* discovery, causality information, $r \in \{r_n, r_d\}$, where r_n and r_d respectively indicate that the harm was naturally and defendant-caused.¹² This signal could represent, for example, regulatory information about the carcinogenic quality of air pollution, "smoking gun" evidence of a predatory practice, or information on safety problems in a car design. The precision of the signal is represented by $\theta \in [\frac{1}{2}, 1]$, the probability of receiving a correct signal conditional on the actual cause of harm.

The three rules that the planner chooses are more precisely described as follows:

(i) Simple rule: The social planner does not draw r . In litigation, the defendant is liable if and only if $s = s_d$, when the signal is verifiable. When the plaintiff's signal is unverifiable, the defendant is liable for all verified harm.¹³

⁸ The assumption that the distribution of harm is independent of the source of harm is not essential. Our results remain valid, provided that the plaintiff does not infer causality perfectly from the realized level of harm.

⁹ Alternatively, there is a continuum of victims with different levels of harm. The subsequent results of the article hold with this interpretation, unless victims' signals are independent and the court can aggregate the victims' information efficiently. In the latter case, the court can establish perfect causality, by the law of large numbers.

¹⁰ That is, we abstract from the possibility of pretrial settlement. This assumption is obviously unrealistic, since most lawsuits result in settlement. See Section 5 for further discussion of this issue.

¹¹ Our model departs from the existing models of strict liability that assume the court's ability to establish causality of harm without errors. Shavell (1985) also considers imperfect causality information in a different context.

¹² In practice, the government may control the precision of signal at some costs.

¹³ This assumption is in keeping with the standard description of strict liability, according to which

(ii) *Ex ante* rule: The social planner draws r when the harm occurs and makes the information available to the plaintiff prior to the latter's lawsuit decision. When trial occurs, the defendant is liable if and only if $r = r_d$ and $s = s_d$ (i.e., when both signals implicate the defendant), if s is verifiable.¹⁴ If s is unverifiable, the defendant is liable if and only if $r = r_d$.

(iii) *Ex post* rule: The social planner draws r only after a lawsuit is brought (e.g., during discovery). Equivalently, the social planner collects r but withholds it until after a lawsuit is brought. Liability is determined in the same way as in (ii).

Under each rule, we assume that the social planner can adjust the level of damages in an *ex ante* credible way with a multiplier, $m > 0$. In other words, a prevailing plaintiff with harm l receives ml , and a losing defendant pays ml . This type of damage adjustment can be achieved through the imposition of punitive damages when $m > 1$. While our purpose here is primarily normative—to examine the potential of each rule under the best policy arrangement currently available¹⁵—the damage adjustment that we envision is consistent with the current use of punitive damages. Under the current system, judges instruct the juries to set punitive damages, not by a fixed multiplier, but often to fit the deterrence needs of a specific setting.¹⁶ In this sense, our analysis imposes no additional requirement: judges can inform the juries of the deterrence needs under each rule.

3. When the plaintiff's information is verifiable

■ In this section we assume that the plaintiff's causality signal is verifiable and thus admissible in court as evidence. We analyze each regime by backward induction, starting from the plaintiff's lawsuit decision, moving next to the defendant's effort choice, and finally examining the social planner's damage award adjustment. At the end of this section we compare the performance of alternative rules.

□ **Simple rule.** Given a damage multiplier, m , the plaintiff brings a lawsuit when she can establish the defendant's liability and her expected damage award is no less than her litigation costs. Since under the simple rule the court relies on the plaintiff's signal to determine the defendant's liability, the plaintiff will bring a lawsuit if and only if (a) $s = s_d$ and (b) $ml \geq c_p$. Given the defendant's effort e , the plaintiff receives a signal s_d if either defendant-caused harm *correctly* triggers the plaintiff's signal or naturally caused harm *incorrectly* triggers the plaintiff's signal. The combined probability of these events is $[p(e)\delta + n(1 - \delta)]$. The probability of (b) is $(1 - F(c_p/m))$. Thus the probability of a lawsuit is

proving harm is sufficient for establishing a defendant's liability. Our results remain qualitatively unaffected if the defendant is liable with probability less than one.

¹⁴ This rule represents just one possible evidence standard that can be employed by the court. Alternatively, the court may use an evidence standard that is more unfavorable to the defendant (e.g., only one unfavorable signal may be required to convict the defendant). This alternative standard is socially inferior to the one considered in this article. The proof is available upon request.

¹⁵ The government may conceivably use other instruments, such as fee shifting and the decoupling of damages. The former instrument is inferior to damage adjustment (Kaplow, 1993), whereas the latter instrument, though theoretically superior to damage adjustment (Polinsky and Che, 1991), is seldom used in practice. Relatively speaking, punitive damages are much more common (Daniels and Martin, 1995). Moreover, our main results are robust to the decoupling arrangement.

¹⁶ Supreme Court decisions clearly state that (a) a jury is "instructed to consider . . . the need to deter similar conduct" when awarding punitive damages, and (b) no "mathematical bright line" should be drawn with regard to a fixed damage multiplier "that would fit every case." See *Pacific Mutual Life Insurance Co. v. Haslip* [499 U.S. 1 (1991)] and *TXO Production Corporation v. Alliance Resources Corporation* [125 L. Ed. 2d 366 (1993)].

$$\phi_s(e, m) \equiv [p(e)\delta + n(1 - \delta)](1 - F(c_p/m)). \quad (1)$$

Next we consider the defendant's problem of choosing an effort level. Let $\bar{l}(m) \equiv E\{l | l \geq c_p/m\}$ denote the plaintiff's expected loss conditional on $ml \geq c_p$. Then the defendant's expected payment conditional on being sued (and found liable) equals the expected damage award $m\bar{l}(m)$ and his litigation costs c_d . The defendant chooses e to

$$\min e + \phi_s(e, m)\{m\bar{l}(m) + c_d\}.$$

The assumptions about $p(\cdot)$ ensure the existence of a unique, interior solution for any $m \geq 0$. The associated first-order condition is

$$1 + p'(e)\delta(1 - F(c_p/m))\{m\bar{l}(m) + c_d\} = 0. \quad (2)$$

Notice that the naturally triggered lawsuit has no effect on the defendant's effort choice. Note also that raising the multiplier increases the level of effort chosen by the defendant (since $p'(\cdot) < 0$ and the coefficient on $p'(e)$ is increasing in m).

The social planner's problem is to choose the damage multiplier, m , and the induced level of effort, e , in order to minimize expected social loss. Formally,

$$\begin{aligned} \min_{e, m} p(e)\bar{l} + e + \phi_s(e, m)\{c_p + c_d\} \\ \text{such that } e \text{ satisfies (2),} \end{aligned} \quad (3)$$

where $\bar{l} \equiv E[l]$, the (unconditional) expected loss from harm. Note that the naturally caused harm is excluded since it is beyond the social planner's control. A solution to (3) exists, and we denote it as (m_s, e_s) .¹⁷ We assume that $m_s > 0$ (i.e., it is never optimal to block litigation altogether), which can be guaranteed by assuming that c_p and c_d are small relative to \bar{l} .

Recall that if the plaintiff's signal is not perfectly informative ($\delta < 1$), naturally caused harm can result in a lawsuit. As can be seen from (3), this lawsuit imposes social costs but has no value in providing deterrence. On this count, the next two rules can improve upon the simple rule.

□ **Ex ante rule.** Under the *ex ante* rule, the social planner gathers signal r and releases it to the plaintiff prior to her decision to sue. If a lawsuit is brought, the defendant is found liable in trial if evidence from both the plaintiff and the social planner implicates the defendant. Given this liability rule, the plaintiff brings a lawsuit if and only if $r = r_d$, $s = s_d$, and $m \geq c_p$, or with probability

$$\phi_a(e, m) \equiv [p(e)\delta\theta + n(1 - \delta)(1 - \theta)](1 - F(c_p/m)). \quad (4)$$

The defendant's problem is analogous to the simple rule. He chooses e to

$$\min e + \phi_a(e, m)\{m\bar{l}(m) + c_d\}.$$

The first-order condition for this problem is

¹⁷ By the assumptions on $p(\cdot)$, there is no loss of generality in restricting the support of m to an interval $[0, M]$ for some $M < \infty$. Since e satisfying (2) is continuous in m and the objective function is continuous in e and m , existence follows. The same argument holds for all subsequent social planner's problems.

$$1 + p'(e)\delta\theta(1 - F(c_p/m))\{m\bar{l}(m) + c_d\} = 0. \quad (5)$$

The social planner's problem is the following:

$$\min_{e,m} p(e)\bar{l} + e + \phi_d(e, m)\{c_p + c_d\} \quad (6)$$

such that e satisfies (5),

and its solution is denoted by (m_a, e_a) .

□ **Ex post rule.** Under the *ex post* rule, although liability depends on both signals, r and s , the plaintiff has no access to the social planner's information prior to her suit decision. Thus, the plaintiff can base her suit decision only on her own signal. The plaintiff sues if $s = s_d$ and her expected recovery justifies her court costs. Without knowing r , however, the plaintiff does not know if she will prevail (i.e., if the defendant will be found liable). Instead, she can only form a belief about the probability of prevailing (i.e., $r = r_d$), given $s = s_d$. According to Bayes' rule, this probability is

$$a(\tilde{e}) \equiv \frac{\theta\delta p(\tilde{e}) + (1 - \theta)(1 - \delta)n}{\delta p(\tilde{e}) + (1 - \delta)n},$$

if the plaintiff believes that the defendant has chosen \tilde{e} . Notice that $a(\tilde{e})$ is a weighted average of θ and $1 - \theta$ and equal to θ when $\delta = 1$ (i.e., the plaintiff has no doubt about causality). Also, $a(\cdot)$ is (weakly) decreasing; i.e., the plaintiff is more certain of prevailing when she believes that a lower level of effort has been taken.

The plaintiff's expected recovery is $a(\tilde{e})ml$. Hence, the plaintiff brings a lawsuit if and only if $s = s_d$ and $a(\tilde{e})ml \geq c_p$, or with probability

$$\phi_p(e, \tilde{e}, m) \equiv [p(e)\delta + n(1 - \delta)][1 - F(c_p/a(\tilde{e})m)]. \quad (7)$$

Note that (7) differs from (1) only because of the plaintiff's uncertain prospect of prevailing.

Knowing the liability rule and the plaintiff's suit decision, the defendant chooses e to

$$\min e + \phi_p(e, \tilde{e}, m)\{c_d + a(e)m\bar{l}(a(\tilde{e})m)\},$$

for any m and the plaintiff's belief \tilde{e} . Note that the defendant assesses the probability of his being liable based on the actual level of his effort. This problem has a unique minimizer, $e(\tilde{e})$, for any belief \tilde{e} . In equilibrium, the plaintiff's belief must be consistent: $e(\tilde{e}) = \tilde{e}$. This condition is satisfied by a unique, positive value of \tilde{e} , since $e(0) > 0$ and $e(\cdot)$ is nonincreasing.¹⁸ The unique equilibrium effort level e is characterized by the following first-order condition:

$$1 + p'(e)\delta[1 - F(c_p/a(e)m)]\{\theta m\bar{l}(a(e)m) + c_d\} = 0. \quad (8)$$

The social planner's problem is

¹⁸ The result follows from Theorem 4 of Milgrom and Shannon (1994), since the objective function satisfies the single-crossing property in (e, \tilde{e}) and has a unique minimizer for each $\tilde{e} \geq 0$.

$$\min_{e,m} p(e)\bar{l} + e + \phi_p(e, e, m)\{c_p + c_d\} \quad (9)$$

such that e satisfies (8).

The solution to (9) is denoted as (m_p, e_p) .

□ **Comparison of regimes.** The social objective in each rule is to provide the right amount of deterrence at the minimum litigation cost. Comparison of alternative rules, therefore, boils down to the tradeoff between the deterrence and litigation costs that each rule entails. The deterrence of alternative rules is characterized by the defendant's first-order conditions shown in (2), (5), and (8), while litigation costs are summarized by the probability of a lawsuit shown in (1), (4), and (7).

We first compare the simple rule and the *ex ante* rule. Comparing (1) and (4) reveals that the *ex ante* rule has two qualitatively different effects.

The first is what we call the "Becker effect": given the same m , the *ex ante* rule excludes the defendant-triggered lawsuit with probability $1 - \theta$. In the public enforcement context, this procedure, coupled with an appropriately increased penalty, is known to reduce enforcement costs without weakening deterrence (Becker, 1968). Its outcome is less clear in the context of private litigation, however. As m is raised to restore deterrence once a suit is randomly excluded, the victim's incentive for suit increases, which at least partially offsets the initial exclusion effect.

The net effect depends on whether the conditional adjusted award $m\bar{l}(m)$ increases or decreases when m is raised. If $m\bar{l}(m)$ increases with m , the increase in m needed to restore the same level of deterrence is small enough that the probability of a defendant-triggered lawsuit is lower under the *ex ante* rule than under the simple rule (see (4) and (5)). Therefore, the Becker effect exists and favors the *ex ante* rule over the simple rule. However, if $m\bar{l}(m)$ decreases with m , the increase in m needed to restore deterrence is so large that the probability of a defendant-triggered lawsuit actually increases. In this case, the Becker effect is reversed. Whether $m\bar{l}(m)$ is increasing or decreasing in m is generally ambiguous (since $\bar{l}(m)$ decreases in m), but $m\bar{l}(m)$ is likely to be increasing for a broad class of distribution functions.¹⁹ Throughout the analysis, we assume that $m\bar{l}(m)$ is nondecreasing in m . This assumption permits the Becker effect to be operative but weak.²⁰

The second effect is the "information effect": the relative likelihood of a naturally triggered lawsuit to a defendant-triggered lawsuit is smaller under the *ex ante* rule than under the simple rule. To understand this effect, set the multiplier under the *ex ante* rule, m' , so that the probability of a defendant-triggered lawsuit is the same as it is under the simple rule. That is, $\theta(1 - F(c_p/m')) = (1 - F(c_p/m_s))$. With m' , the probability of a naturally triggered lawsuit under the *ex ante* rule is less than that under the simple rule for $\theta > 1/2$, since

$$\begin{aligned} & n(1 - \delta)(1 - \theta)(1 - F(c_p/m')) \\ &= \frac{1 - \theta}{\theta} [n(1 - \delta)(1 - F(c_p/m_s))] < n(1 - \delta)(1 - F(c_p/m_s)). \end{aligned}$$

The information effect arises because the additional information provided by the social planner allows the plaintiff to avoid suing when the harm is likely to be naturally

¹⁹ For example, $m\bar{l}(m)$ is increasing if F follows the uniform distribution, and, regardless of the distribution function, $m\bar{l}(m)$ tends to ∞ as m approaches ∞ .

²⁰ In fact, all our results hold even when $m\bar{l}(m)$ decreases, as long as it does not do so too fast.

caused. Given that a naturally triggered lawsuit has no value in providing deterrence (see (2) and (5)), the information effect always favors the *ex ante* rule.

Combining these two effects, we conclude that if the Becker effect is not reversed or if the reversion is not too strong, the *ex ante* rule induces, under the appropriately chosen multiplier, the same level of the defendant's effort at a lower likelihood of a lawsuit (especially the naturally triggered one) than the simple rule. Thus, the *ex ante* rule dominates the simple rule.

We next compare the *ex ante* and *ex post* rules. Under the *ex post* rule, the plaintiff has no access to regulatory information before bringing a suit, just like under the simple rule. Therefore, the information effect again favors the *ex ante* rule over the *ex post* rule. The Becker effect, however, is ambiguous between the two rules. Just like the *ex ante* rule, the *ex post* rule excludes a defendant-triggered lawsuit with some probability. Nevertheless, the *ex ante* rule can be shown to dominate the *ex post* rule. The results are presented in the following proposition.

Proposition 1. For any $\theta > \frac{1}{2}$ and $\delta < 1$, the *ex ante* rule is socially more desirable than the *ex post* rule, which is in turn more desirable than the simple rule.

Proof. See the Appendix.

The second result deserves a remark. Under both the simple rule and the *ex post* rule, the plaintiff cannot base her suit decision on the social planner's realized signal. Yet the *ex post* rule performs better than the simple rule. This result can be attributed to the plaintiff's uncertain prospect of receiving the favorable regulatory signal in court under the *ex post* rule. Because of this uncertainty, the effective *ex ante* award multiplier facing the plaintiff in her suit decision is $\delta a(e)m$, while the effective *ex ante* penalty multiplier facing the defendant is $\delta \theta m$. Since $a(e) < \theta$ when $\delta < 1$ and $\theta > \frac{1}{2}$, the *ex post* rule creates the effect of decoupling: from an *ex ante* perspective, the defendant pays more than the plaintiff receives. This kind of decoupling makes an enforcement system more efficient (Polinsky and Che, 1991).

The above proposition suggests that more information is better. The same can be said when the precision of a given signal increases. The use of a more accurate signal reduces the chance of a naturally triggered lawsuit relative to a defendant-triggered lawsuit, which allows the social planner to generate a given level of deterrence at lower litigation costs than otherwise.

Proposition 2. (i) The expected social loss decreases in δ under the simple rule and in δ and θ under the *ex ante* and *ex post* rules. (ii) If $\delta = 1$, expected social loss under the simple and *ex post* rules is identical, and naturally caused harm does not result in a lawsuit; if in addition $\theta = 1$, all three rules are equivalent.

The proof of Proposition 2 closely resembles that of Proposition 1 and is thus omitted. The second statement deserves a remark. If the victim has a perfectly informative signal, she is capable of making a fully informed decision about her lawsuit. In this case, conditioning the defendant's liability on the additional signal (provided by the government) has no effect other than excluding the defendant-triggered suit with some probability. When $\theta = 1$, the latter effect disappears, so all three rules become identical.

4. When the plaintiff's signal is unverifiable

■ When the victim's causality signal is unverifiable, the court's liability decision can only be based on the regulatory signal. Then, under the simple rule, the defendant is always liable, while under the two other rules he is liable only if the government presents evidence implicating him. The comparison between the simple rule and the

ex ante and *ex post* rules is the same as before—the latter two rules dominate the simple rule—and is omitted. Therefore, we focus on the comparison between the *ex ante* and *ex post* rules.

□ **Ex ante rule.** The *ex ante* rule works the same as in the previous section, except that the court's liability decision does not reflect the victim's signal due to its unverifiable nature. The latter fact implies that the victim does not base her suit decision on her signal, knowing that it would not affect the court's liability decision.

The victim now sues if $r = r_d$ and $ml \geq c_p$. When the defendant chooses e , the plaintiff will bring a suit with probability

$$\psi_d(e, m) \equiv [p(e)\theta + n(1 - \theta)]\{1 - F(c_p/m)\}. \quad (10)$$

Facing this probability, the defendant chooses e to

$$\min e + \psi_d(e, m)\{m\bar{l}(m) + c_d\}.$$

The first-order condition for this problem is

$$1 + p'(e)\theta[1 - F(c_p/m)]\{m\bar{l}(m) + c_d\} = 0. \quad (11)$$

Unlike in the previous section, neither (10) nor (11) contains δ . In other words, the victim's signal has no effect on the likelihood of a suit and the defendant's effort decision. Hence, the victim may sue even when she is certain of the defendant's innocence, and may not sue when she is certain of the defendant's guilt. As before, the social planner picks m and e to:

$$\begin{aligned} \min p(e)\bar{l} + e + \psi_d(e, m)\{c_p + c_d\} \\ \text{such that } e \text{ satisfies (11).} \end{aligned} \quad (12)$$

We denote the solution to (12) by (m_a, e_a) .

□ **Ex post rule.** Under the *ex post* rule, the victim cares about the realized regulatory signal, r , for it solely determines the defendant's liability, as under the *ex ante* rule. Because the signal is not revealed until after a suit is brought, however, the plaintiff cannot base her suit decision on that signal. Instead, the plaintiff can only anticipate the realization of r based on her own signal. Suppose the victim believes that the defendant has expended effort \tilde{e} . If her signal implicates the defendant ($s = s_d$), she sues if and only if $a(\tilde{e})ml \geq c_p$, where $a(\tilde{e})$ is defined in Section 3. If, on the contrary, her signal indicates that the harm was naturally caused ($s = s_n$), then she sues if and only if $b(\tilde{e})ml \geq c_p$, where

$$b(\tilde{e}) \equiv \frac{\theta(1 - \delta)p(\tilde{e}) + (1 - \theta)\delta n}{(1 - \delta)p(\tilde{e}) + \delta n}$$

is the posterior probability of her prevailing (i.e., $r = r_d$), given $s = s_n$ and belief \tilde{e} . This probability is a weighted average of $1 - \theta$ and θ and is equal to $1 - \theta$ when δ is one (i.e., the plaintiff has no doubt about causality). Observe that $b(\tilde{e}) \leq a(\tilde{e})$ for all \tilde{e} , which implies that the plaintiff is more likely to sue when $s = s_d$ than when $s = s_n$. (The equality holds when the victim's signal is uninformative.) In other words, unlike under the *ex ante* rule, the victim's signal affects her suit decision under the *ex post*

rule. In particular, the victim's signal has the most significant effect on her suit decision when both signals are informative. When both δ and θ approach one, $b(\tilde{e})$ goes to zero and $a(\tilde{e})$ goes to one. In this case, the victim will sue if and only if $s = s_d$, since for any positive m , $b(\tilde{e})m \approx 0 < c_p$ (i.e., a suit is not profitable if $s = s_n$).

It may be surprising that the predictive power of the victim's signal depends also on θ . To see why, suppose $\delta = 1$ but $\theta = 1/2$ (i.e., the regulatory signal is uninformative). Then, $b(\tilde{e}) = a(\tilde{e})$. In this case, the victim's signal does not affect her suit decision. The reason is simple: while the victim's signal is perfectly informative about true causality, it has no predictive value as to the causality that the court will find in trial, which depends on the (uninformative) regulatory signal.

The probability that the plaintiff brings a lawsuit is

$$\psi_p(e, \tilde{e}, m) \equiv \psi_p^d(e, \tilde{e}, m) + \psi_p^n(e, \tilde{e}, m), \quad (13)$$

where

$$\psi_p^d(e, \tilde{e}, m) \equiv [p(e)\delta + n(1 - \delta)][1 - F(c_p/a(\tilde{e})m)]$$

and

$$\psi_p^n(e, \tilde{e}, m) \equiv [p(e)(1 - \delta) + n\delta][1 - F(c_p/b(\tilde{e})m)]$$

are the probabilities of a lawsuit associated with the plaintiff receiving s_d and s_n , respectively.

Knowing the liability rule and the plaintiff's suit decision, the defendant chooses his effort e to minimize the expected losses:

$$\min_e e + \psi_p^d(e, \tilde{e}, m)\{c_d + a(e)m\bar{l}(a(\tilde{e})m)\} + \psi_p^n(e, \tilde{e}, m)\{c_d + b(e)m\bar{l}(b(\tilde{e})m)\}.$$

As before, we study a unique equilibrium level of effort that satisfies the first-order condition

$$\begin{aligned} 1 + p'(e)\delta[1 - F(c_p/a(e)m)]\{\theta m\bar{l}(a(e)m) + c_d\} \\ + p'(e)(1 - \delta)[1 - F(c_p/b(e)m)]\{\theta m\bar{l}(b(e)m) + c_d\} = 0. \end{aligned} \quad (14)$$

(Existence and uniqueness of the equilibrium can be established as in Section 3.) The two coefficients on $p'(e)$ capture the amounts of deterrence generated by the suit following $s = s_d$ and the suit following $s = s_n$, respectively. One can verify that the suit following $s = s_d$ creates more deterrence per unit probability of a suit than does the suit following $s = s_n$. Intuitively, the former type of suit more likely punishes the defendant when he is actually responsible for the harm. Therefore, the former type of suit is socially more desirable. In the special case where δ and θ are both close to one, the *ex post* rule induces a socially efficient suit decision from the victim, as she sues only if $s = s_d$.

Again, the social planner chooses m and e to

$$\begin{aligned} \min p(e)\bar{l} + e + \psi_p(e, m)\{c_p + c_d\} \\ \text{such that } e \text{ satisfies (14).} \end{aligned} \quad (15)$$

The solution to this problem is denoted as (m_p, e_p) .

□ **Comparison of regimes.** The tradeoff between the two rules is clear from the discussion of the preceding subsections. Although the *ex ante* rule induces the victim to condition her suit decision on the regulatory signal, it fails to induce her to be responsive to her own signal. The converse is true with the *ex post* rule, under which the victim is unresponsive to the regulatory signal but does incorporate her own signal into the suit decision (in trying to anticipate the regulatory signal).

Thus the issue boils down to the following question: To which signal should the victim be made responsive? Intuition suggests that if the victim's signal is relatively less informative than the social planner's signal, then the *ex ante* rule must be preferred to the *ex post* rule. The previous subsection, meanwhile, suggests that if both signals are sufficiently informative, the *ex post* rule performs relatively well. These conjectures are verified in the following proposition.

Proposition 3. (i) The *ex ante* rule (at least weakly) dominates the *ex post* rule if either δ or θ is sufficiently close to $\frac{1}{2}$. (The dominance is strict if, in addition, $\theta > \frac{1}{2}$.) (ii) The *ex post* rule dominates the *ex ante* rule if $\delta > \theta$, θ is sufficiently high, and $n > p(e_a) - \epsilon$ for some $\epsilon > 0$.

Proof. See the Appendix.

The last assumption means that the naturally caused harm is relatively significant. Intuitively, the value of deterring the naturally triggered lawsuit is high in such a case.

The above proposition has interesting policy implications for public access to regulatory information: Revealing regulatory information is socially desirable when either the victim's signal or the regulatory signal is poor, while withholding regulatory information is desirable if both signals are good and the victim's signal is better. The latter possibility is the most novel result of this article and lends support to selective limitation of public access to regulatory information in situations where the public has better information than the government. One application may be found in the area of simple accident cases. If the victim has first-hand information about the injurer's guilt or innocence, it may be socially desirable to limit the victim's access to the information held by a third-party witness until after the victim brings a lawsuit, since the withholding of the information can make the victim act more responsibly in making her suit decision.

5. Concluding remarks

■ We conclude by commenting on the robustness of our results and further implications.

□ **Compensatory damages.** We have assumed that the social planner can adjust damages. While this assumption allows us to focus on the normative aspects of managing regulatory information, it is also useful to examine this issue in a compensatory damages setting (where m is restricted to be one). When damages cannot be adjusted, there is underdeterrence, since the defendant does not internalize the litigation costs of the plaintiff. Under the *ex ante* rule, this underdeterrence problem is worsened because of the exclusion effect, so the application of compensatory damages disfavors the *ex ante* rule. Still, the benefit of screening a naturally triggered lawsuit remains an important consideration. In fact, given stronger conditions, our main results continue to hold with compensatory damages.²¹ Of course, compensatory damages introduce other

²¹ If θ and n are close to one, then the exclusion effect associated with the *ex ante* rule is negligible, whereas the benefit of blocking the naturally triggered suit is large, so the *ex ante* rule dominates the simple rule as in Proposition 1. Proposition 3 holds under qualitatively similar conditions.

issues (such as the potential optimality of other evidentiary rules), which warrant further studies.

□ **Pretrial discovery.** We have assumed that a lawsuit always results in trial. This assumption, while simplifying our analysis greatly, is unrealistic because most legal disputes are settled before trial. If pretrial settlement involves costless discovery, it can affect the *ex post* rule adversely, since the victim may sue regardless of her own signal and simply drop her case if discovery reveals little chance of prevailing. In practice, however, pretrial discovery can be costly. First of all, it usually requires the involvement of attorneys. Second, discovery requires the parties seeking information to bring oral deposition against information sources, which can be often costly. If pretrial discovery is costly, the main results of our article still hold.

□ **Costly information gathering.** In the analysis, we assumed that parties gather their signals costlessly. In practice, regulatory monitoring may incur substantial expenditures. Introduction of information-gathering costs favors the *ex post* rule relative to the *ex ante* rule. The *ex ante* rule is not cost effective because it requires information to be gathered even when there is no subsequent litigation. The *ex post* rule may allow information to be gathered only when a suit is brought. In some cases, however, the *ex ante* rule still appears to be a favorable option. In securities cases, for example, the regulatory agency (the Securities and Exchange Commission) can almost costlessly gather information by simply requiring firms to report their financial status. In environmental cases, even though regulatory monitoring is costly, it may be the only way to gather accurate information about pollution. In other words, when victims have very coarse information, the *ex ante* rule may still be a dominant choice (recall Proposition 3 (i)).

□ **Frivolous suits.** The concern of our article can be rephrased as how to deter lawsuits when plaintiffs are relatively certain of defendants' innocence. In our framework, these kinds of suits are meritless because even though they constitute social costs, they do not generate any deterrence. Yet these suits are not exactly "frivolous" by the conventional definition, according to which a lawsuit is frivolous if the plaintiff has a low probability of winning and brings the suit solely to extract a settlement (Rosenberg and Shavell, 1985; Bebchuk, 1988; Katz, 1990; Polinsky and Rubinfeld, 1993). This conventional definition is not appropriate in a world where courts lack the ability to uncover truth. The cases that have a high chance of prevailing according to public information may actually be meritless according to (potentially superior but unverifiable) information that plaintiffs themselves possess. Our "information-based" notion of meritless suits may be useful in this situation.

Appendix

■ Proofs of Propositions 1 and 3 follow.

Proof of Proposition 1. To prove the first statement, fix any $\theta > \frac{1}{2}$, $\delta < 1$. Suppose that, under the *ex ante* rule, the multiplier is set at m' so that the probability of a suit is the same as that under the *ex post* rule (with its optimal multiplier m_p), given that the defendant chooses the same effort e_p under both regimes. That is, m' satisfies $\phi_a(e_p, m') = \phi_p(e_p, e_p, m_p)$, or

$$1 - F(c_p/m') = \frac{1}{a(e_p)}(1 - F(c_p/a(e_p)m_p)). \quad (A1)$$

(Such an m' exists, since $\phi_a(e_p, \cdot)$ is continuous and can take any value between zero and one.) Since $a(e_p) < 1$, (A1) implies that $m' > a(e_p)m_p$. Now substitute (A1) into (5). Then, the coefficient of $p'(e)$ in (5) (under the *ex ante* rule) is

$$\begin{aligned}
& (1 - F(c_p/m'))\delta\theta\{m'\bar{l}(m') + c_d\} \\
&= \frac{1}{a(e_p)}(1 - F(c_p/a(e_p)m_p))\delta\theta\{m'\bar{l}(m') + c_d\} \\
&\geq (1 - F(c_p/a(e_p)m_p))\frac{\theta}{a(e_p)}\{a(e_p)m_p\bar{l}(a(e_p)m_p) + c_d\} \\
&= (1 - F(c_p/a(e_p)m_p))\delta\left\{\theta m_p\bar{l}(a(e_p)m_p) + \frac{\theta}{a(e_p)}c_d\right\} \\
&> (1 - F(c_p/a(e_p)m_p))\delta\{\theta m_p\bar{l}(a(e_p)m_p) + c_d\}.
\end{aligned}$$

The first inequality follows since $m' > a(e_p)m_p$ and since $m\bar{l}(m)$ is nondecreasing in m . The last inequality follows since $a(e_p) < \theta$ for $\theta > 1/2$ and $\delta < 1$. Notice that the last line of the above inequalities is the coefficient of $p'(e)$ in (8) (i.e., under the *ex post* rule). It follows that the *ex ante* rule induces more effort than e_p with m' . Hence, there exists an $m''(< m')$ with which the *ex ante* rule induces e_p . (Recall that e is increasing in m under the *ex ante* rule.) Since $m'' < m'$, the probability of a suit that is needed to induce e_p is smaller under the *ex ante* rule. Since m'' is not necessarily optimal under the *ex ante* rule, the *ex ante* rule dominates the *ex post* rule.

We adopt a similar method to prove the second result. Suppose that under the *ex post* rule the multiplier m' is set so that the same effort level is induced as under the simple rule (with the optimal multiplier m_s). The multiplier m' then must make the coefficient of $p'(e)$ in (8) equal to that in (2) given $e = e_s$, or

$$(1 - F(c_p/a(e_s)m'))\{\theta m'\bar{l}(a(e_s)m') + c_d\} = (1 - F(c_p/m_s))\{m_s\bar{l}(m_s) + c_d\}. \quad (A2)$$

Since $a(e_s) < \theta$ for $\theta > 1/2$ and $\delta < 1$, $a(e_s)m' < m_s$, or else the left-hand side of (A2) exceeds its right-hand side. Consequently,

$$\phi_p(e_s, e_s, m') = [\delta p'(e_s) + (1 - \delta)n](1 - F(c_p/a(e_s)m')) < [\delta p'(e_s) + (1 - \delta)n](1 - F(c_p/m_s)) = \phi_s(e_s, m_s).$$

In sum, the same effort is induced at a lower likelihood of a suit given m' under the *ex post* rule. Since m' is not necessarily optimal under the *ex post* rule, it dominates the simple rule. *Q.E.D.*

Proof of Proposition 3. To prove (i), it suffices to show that the result holds when either $\delta = 1/2$ or $\theta = 1/2$. Then, by the continuity of the indirect objective functions of (12) and (15) in (δ, θ) , the result holds in neighborhoods of $\delta = 1/2$ and of $\theta = 1/2$. The key point of the proof is that when either $\delta = 1/2$ or $\theta = 1/2$, $b(\cdot) = a(\cdot)$, which implies that the victim ignores her signal in her litigation decision. Given this result, the proof follows the same line of argument as that of Proposition 1 and is omitted.

Next we prove (ii). Let $\mu(\theta, \delta)$ be the set of multipliers that entail the same probability of a lawsuit under the *ex post* rule as does m_a under the *ex ante* rule. If $\mu(\theta, \delta)$ is empty, the *ex post* rule clearly dominates the *ex ante* rule, since e_a can be induced at a lower probability of a lawsuit under the former regime.²² So, assume that $\mu(\theta, \delta)$ is nonempty and let M be the supremum of $\mu(\theta, \delta)$. One can verify that $\mu(\theta, \delta)$ is compact. Thus, $M < \infty$. Since $b(e)$ goes to zero as θ and δ approach one, there exists a sufficiently high $\theta' < 1$ such that, for all $\delta > \theta > \theta'$, $b(e_a)ML < c_p$ (i.e., the probability of a suit is zero). Fix any (θ, δ) such that $\delta > \theta > \theta'$, and let $m' \in \mu(\theta, \delta)$. Since $m' \leq M$, the probability of a suit is zero under the *ex post* rule when the victim observes $s = s_n$. Therefore, m' satisfies $\psi_p^d(e_a, e_a, m') = \psi_a(e_a, m_a)$, or

$$1 - F(c_p/a(e_a)m') = \rho(\theta, \delta)(1 - F(c_p/m_a)), \quad (A3)$$

where $\rho(\theta, \delta) \equiv [p(e_a)\theta + n(1 - \theta)]/[p(e_a)\delta + n(1 - \delta)]$. We initially assume that $p(e_a) \leq n$. Then $\rho(\theta, \delta) \geq 1$, which implies that $a(e_a)m' \geq m_a$ (see (A3)). Then, at $e = e_a$ and $m = m'$, the coefficient of $p'(e)$ in (14) is

$$\begin{aligned}
& \delta(1 - F(c_p/a(e_a)m'))(\theta m'\bar{l}(a(e_a)m') + c_d) \\
&= \delta\theta m' \int_{c_p/[a(e_a)m']}^L lf(l) dl + \delta(1 - F(c_p/a(e_a)m'))c_d \\
&> \theta m_a \int_{c_p/m_a}^L lf(l) dl + \theta(1 - F(c_p/m_a))c_d \\
&= \theta(1 - F(c_p/m_a))(m_a\bar{l}(m_a) + c_d),
\end{aligned}$$

²² That $\mu(\theta, \delta) = \emptyset$ implies that the probability of a lawsuit is smaller under the *ex post* rule, for all levels of multiplier, than under the *ex ante* rule with m_a . Therefore, e_a can be induced under the *ex post* rule at a smaller probability of a lawsuit.

where the inequality follows since $\delta > \theta$, $\theta \geq a(e_a)$, and $a(e_a)m' \geq m_a$. Notice that the last line is the coefficient of $p'(e)$ under the *ex ante* rule (see equation (11)). This shows that the *ex post* rule with m' induces a higher effort than e_a . It then follows that there exists $m'' (< m')$ with which the *ex post* rule induces e_a . But at m'' the probability of a suit is lower under the optimal *ex post* rule. Since m'' is not necessarily optimal under the *ex post* rule, the *ex post* rule dominates the *ex ante* rule. Since the result holds with strict inequality, by continuity, it holds when $n > p(e_a) - \epsilon$ for some $\epsilon > 0$. *Q.E.D.*

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