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Abstract: Litigation is costly because information is not free. Given that information is costly and perfect information prohibitively costly, courts will occasionally err. Finally, the fact that information is costly implies an unavoidable degree of informational asymmetry between disputants. This paper presents a model of the civil justice system that incorporates these features of the real world and probes its implications for compliance with the law, efficiency of law, accuracy in adjudication, trial outcome statistics, and the evolution of legal standards. The model's claims are applied to and tested against the relevant empirical and legal literature.

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I. Introduction

Because the gathering and provision of information is costly, disputants must incur legal expenses to present information to courts. Litigation is costly because information is not free. Moreover, given that information is costly and perfect information prohibitively costly, courts will occasionally err in determining innocence or guilt. Finally, the fact that information is costly implies an unavoidable degree of informational asymmetry between disputants.

This paper presents a model of the civil justice system that incorporates these features of the real world and probes its implications for compliance with the law, trial outcome statistics (e.g., plaintiff trial win rates), efficiency of law, accuracy in adjudication, and the evolution of legal standards. These implications address some long-standing issues in the law and economics literature.

One such issue is the difference between efficiency as understood in the law-and-economics literature analyzing legal doctrine and efficiency as understood more generally. *Doctrinally efficient* rules would be efficient if followed in the course of ordinary social interaction by potential plaintiffs and defendants. Much of the economic analysis of law literature explains why common law rules appear to be doctrinally efficient (Posner, 2011). However, doctrinally efficient rules are not necessarily operationally efficient.[1] *Operationally efficient* legal rules seek to generate efficient compliance levels given the costs of operating the legal system, which are primarily due to imperfect information. In some circumstances, information costs prevent courts from implementing doctrinally efficient standards, and compel them to alter standards in light of such costs. These altered standards lead to predictable distortions away from efficiency, though they may be preferable to feasible alternatives.

[1] The operational efficiency test was introduced in the law and economics literature by Guido Calabresi (1970).

Another long-standing issue addressed here is the social value of judicial accuracy. In this framework, some degree of error may be socially desirable, and more error may be preferable to less. In the absence of error, a regime of perfect legal compliance would be unlikely, because no complainant would incur costs to sue when the compliance rate is perfect.[2] However, the risk of error makes the threat to sue credible even when the compliance rate is perfect.[3]

Another issue is the effect of informational asymmetry in litigation on trial outcome statistics. This matter was addressed in Hylton (1993), which proposed the asymmetric information hypothesis as an explanation of the patterns reflected in the data on trial win rates for plaintiffs. The most common theory of trial outcome statistics is due to Priest and Klein (1984), who hypothesized that win rates will tend toward 50 percent in the absence of a substantial disparity in stakes – because only the most uncertain cases proceed to judgment. However, in a setting of asymmetric information, trial win rates are unlikely to meet the 50 percent conjecture of Priest and Klein. On the other hand, trial win rates, I show here, are not as unpredictable, as suggested by Shavell (1996). Trial win rates are associated with legal compliance rates in a predictable manner.[4] I show that several puzzles and anomalies in the statistics on trial outcomes – such as the low plaintiff win rates in medical malpractice litigation – can be explained by the model presented here.[5]

Lastly, I address the question of legal evolution. How does information get embedded in legal rules? I show that this model provides an explanation for how legal rules evolve over time. Informationally advantaged litigants tend to prevail, especially on appeal, and this tends to drive the menu of issues in appellate courts and the rules generated by those courts. Legal standards are enhanced, toward efficiency, as courts incorporate the private

[2] Ordover (1978). Extending this concept to settlement negotiations, see Spier (1997).
[3] Hylton (1990).
[4] Hylton (2002), Klerman and Lee (2014), Wickelgren (2013).
[5] Many of the empirical puzzles I address here were uncovered in articles by the late Professor Theodore Eisenberg and coauthors (Eisenberg, 1990; Clermont and Eisenberg, 1992, 1998, 2001; Eisenberg and Heise, 2009).

information of litigants.[6] On the other hand, it is possible to have evolution away from efficiency – and against "the rule of law" – if the informational advantage consists of superior access to information on judicial biases or errors. Evolution of this sort, toward class-biased rules, is consistent with Bentham's account of the common law (Postema, 1986).

The model here builds mostly on three papers - Hylton (1990, 1993, and 2006). Most important for my purposes, this model provides a unified, tidier, and simpler framework while extending and updating claims from these earlier papers. My goal is to address seemingly disparate questions in the law and economics literature within a single cradle-to-grave model of the civil justice system. The emphasis here in not on theory but on the derivation of empirically testable propositions. I have incorporated discussions of the relevant empirical and legal literature as tests or as applications of the model's claims.

Part II presents the basic model and its results. Although this is a model of civil liability, I will use the terms "guilt" and "liability" interchangeably for ease of expression. Part II.F concludes Part II by presenting implications of the model for compliance with the law and for the social value of error. Part III addresses conflicting concepts of efficiency of law (doctrinal versus operational). Part IV examines the litigation and settlement process, and uses the model to explain some of the data on trial outcomes. Part V addresses evolution of common law rules.

II. Model

The model consists of injurers and victims, all risk neutral. I will use the terms injurer, actor, and defendant interchangeably. Similarly, I will treat the terms victim and plaintiff as the same. Although I use the term injurer, this is not a model limited to accidental and intentional physical injuries. The injurer could be a violator of the antitrust laws, or a party who breaches a contract or fails to meet a regulatory standard of conduct.

[6] Cooter, Kornhauser, and Lane (1979), Hylton (2006). For critiques of the efficiency thesis, see Hadfield (1992), Klerman (2017).

A. Injurers

Taking Care: The injurer has a choice to take care or not to take care. To "take care" means taking an action that reduces the foreseeable harm to the victim. This notion applies to many areas of law. In the negligence setting, taking care means taking an action that reduces the likelihood of harm to the victim or refraining from an action that increases the likelihood of harm. In the intentional torts or crime setting, taking care means forgoing the profit from an intentional harmful act. For example, in the antitrust setting a firm can take care by refraining from monopolizing its market. In the contracts setting, an actor might take care by refraining from breaching the contract or by taking the effort to clarifying the contract's terms.

If the injurer takes care, he suffers a burden of compliance $x > 0$, a random variable distributed according to G, with corresponding density g. The injurer knows his compliance burden, though it is unobservable to victims.

If the injurer chooses not to take care, the victim will suffer a loss with probability p. If the injurer chooses to take care, the victim will suffer a loss with probability q, where $p > q > 0$.

Compliance: Given the foregoing, I will say that the injurer *complied* with the law if he took care when taking care was required by the legal standard, and that he failed to comply if he did not take care even though taking care was required by the standard. It follows that *perfect compliance* exists when those injurers and only those injurers who are required by the law to take care do so. *Undercompliance* exists when there are injurers who fail to take care even though the law requires them to do so, and *overcompliance* exists when there are injurers who take care even though the law does not require them to do so.

B. Victims

In the event of an injury, the victim's loss is v, observed by all parties. Further, v has the distribution function H with corresponding density h, where

$$E(v) = \int_0^\infty vh(v)dv \,.$$

C. Courts

Courts decide cases on the basis of information (evidence) brought before them by the parties in litigation pertaining to the injury suffered by the victim. Since it is costly to bring evidence to a court, litigation is costly for both parties. The plaintiff's (victim's) cost of litigating is $c_p > 0$; the defendant's (injurer's, actor's) cost of litigating is $c_d > 0$.

Since perfect information requires infinite resources, courts occasionally make mistakes in determining liability. A court may erroneously fail to hold a guilty defendant (that is, a defendant who has failed to comply with the law) liable with probability θ_1, which I will refer to as the *probability of type-1 error*,[7] or the *probability of a false acquittal*. Similarly, the court may erroneously hold an innocent defendant (that is, a defendant who has complied with the law) liable with probability θ_2, which I will refer to as the *probability of type-2 error* or the *probability of a false conviction*. Victims and injurers know θ_1 and θ_2, and the courts are *reasonably accurate*, such that $1- \theta_1 - \theta_2 > 0$.[8]

D. The Legal Standard

[7] Type-1 error is erroneously rejecting the null hypothesis. If we treat the null hypothesis as guilt, then type-1 error here means erroneously finding innocence. Arguably, this is an undesirable premise because of the presumption of innocence in criminal law. But since this is a model of civil liability, the importance attached to the initial presumption is less clear. For convenience, I follow much of the literature in the implicit assumption of guilt as the null hypothesis, see Polinsky and Shavell (1990). On estimates of error rates (based on a sample of criminal case verdicts), see Spencer (2007) (finding false conviction rate of .25, and false acquittal rate of .14).

[8] In words, this implies that the probability of an accurate finding of liability (nonliability) is greater than the probability of an inaccurate finding of liability (nonliability). A court that decided cases by a coin toss would violate the requirement.

If a dispute comes to court, the court will attempt to determine, subject to error, whether the injurer violated the legal standard. In the absence of error, a court would find that the defendant violated the legal standard if (1) the defendant's *care or forbearance* was required by the legal standard under the circumstances and (2) the defendant did not take care or forebear as required by the standard. Virtually every legal standard fits this description.[9] For example, in the torts setting, a defendant should be found negligent if $x < (p\text{-}q)E(v)$ and he failed to take care. A similar legal standard effectively holds in contract law.[10] Similarly, in antitrust, courts use the rule of reason test, which compares efficiencies with anticompetitive effects.[11] The test in antitrust is equivalent to a comparison of the profits of the defendant to the loss borne by consumers.[12] Even in intellectual property law a legal standard similar to the general one described appears to apply.[13]

Summing up, the legal standard is an inquiry into compliance (did the injurer take care when care was required?) coupled with an inquiry into whether the burden of taking care is less than some measure of the incremental social loss, where social loss is a function of the expected victim loss:

$$x < (p\text{-}q)\Psi(E(v))$$

[9] Craswell (1999), at 2217-2219.

[10] On "fault" in contract law, see Posner (2009), Hillman (2014). The general similarity between the objective standards of tort law and the standards of contract law was explained in Lectures VIII and IX of Holmes (1881). Consider something as simple as determining whether a defendant breached a contract whose terms were not clear. Under the objective reasonableness approach, a court would determine whether the burden of complying with the strict interpretation is reasonable in light of the potential harm to the promisee. This is equivalent to a negligence inquiry.

[11] See United States v. Microsoft Corporation, 253 F.3d 34 (D.C. Cir. 2001).

[12] In a simple model of monopolization, with constant average and marginal cost, the gain to the monopolist (from monopolizing) is the sum of the profit and the efficiency gain. The loss to consumers is the sum of the consumer wealth transfer and the deadweight loss. If the profit is equal to the transfer, then the comparison of the efficiency gain to the deadweight loss is equivalent to comparing the profit to the total consumer loss.

[13] The question whether compliance (non-infringement) was required depends on an analysis of the patent's validity. This analysis is at bottom a balancing test comparing static and dynamic costs of protecting the particular innovation from competing with a close substitute. Merges and Nelson (1990), Cass and Hylton (2013). The static cost of intellectual property is the social burden of forgoing infringement. The social loss from infringement (reduction in incentives) typically correlates with the loss suffered by the patentee.

If this condition holds for a particular actor, then that injurer is *legally culpable* for failing to comply. If, on the other hand, for a particular actor $x > (p - q)\Psi(E(v))$, then the actor is not legally culpable. Such an actor is *legally immune* from liability. Of course, given the possibility of judicial error, legal immunity does not imply actual immunity from liability.

Again, torts and antitrust provide illustrations. In torts, x is the burden of taking care and $\Psi(E(v)) = E(v)$. In antitrust, x is the forgone profit from refraining from a monopolizing act, and $\Psi(E(v))$ is the expected total harm suffered by consumers (monopoly transfer plus deadweight loss).[14]

E. The Legal Process and the Incentive to Comply with the Law

If the court decides in favor of the plaintiff, it will award the plaintiff the value of his loss v.[15] A victim will file a lawsuit when $wv > c_p$, where w is the probability that the court will find that the injurer violated the legal standard, given that an injury has occurred. The probability that a suit will be filed after an injury is therefore $1- H(c_p/w)$.

Consider the incentive to comply for a legally culpable injurer. In the case where the injurer has complied with the legal standard, and the resulting probability of harm is q, the probability of liability, conditional on harm, is only θ_2. Similarly, in the case where the injurer has not complied, and the resulting probability of harm is p, the probability of liability, conditional on harm, is $1- \theta_1$. Thus, given the threat of liability, a legally culpable injurer will comply (take care) when

$$x < [1 - H\left(\frac{c_p}{w}\right)]\{[p(1-\theta_1) - q\theta_2]E(v \mid v > \frac{c_p}{w}) + (p-q)c_d\}$$

[14] To illustrate, if p_c and q_c represent competitive price and output respectively, p_m and q_m the monopoly outcomes, then in the case of linear demand and constant marginal cost the total harm to consumers is $(p_m - p_c)(3/2)q_m = (3/2)$(victim harm).

[15] To simplify, I assume the award is not enhanced by a multiplier, though it would be straightforward to modify the model to include a multiplier. For a special case of this model that incorporates a multiplier, see Hylton and Miceli (2005).

where

$$E(v \mid v > \frac{c_p}{w}) = \frac{\int_{\frac{c_p}{w}}^{\infty} v h(v) dv}{[1 - H(\frac{c_p}{w})]} \quad .$$

The right hand side of the above inequality is the increase in liability that results from failing to comply with the law.[16]

Now consider the incentive to take care for an actor who is not legally culpable. Such an actor will be held liable only if type-2 error occurs with probability θ_2. The risk of such error occurring could lead an actor who is not legally culpable to take care if:[17]

$$x < [1 - H\left(\frac{c_p}{w}\right)]\{(p - q)[\theta_2 E(v \mid v > \frac{c_p}{w}) + c_d]\}$$

Given the possibility of judicial error, the probability of finding a legal violation conditional on an injury, w, is a function of the error probabilities. Specifically, if r is the probability that the injurer violated the legal standard given an injury, then

$w = r(1 - \theta_1) + (1 - r)\theta_2$.

where

[16] Although this model does not explicitly incorporate settlement of disputes (I consider settlement explicitly later), it can easily be interpreted to include settlements. To do so, simply interpret the litigation costs as averaging over the settled and non-settled cases, and the expected harm as averaging over both types of dispute as well. The error rates would also average over the settled and non-settled cases. For example, the "false-acquittal probability", under this approach, would incorporate the case of a settlement payment or of a court judgment when the defendant is innocent. This is the approach to calculating the error rate in compensation reported in Studdert et al. (2006).

[17] This condition is arguably too simple because it assumes that the probability of false conviction, for the legally immune actor, is the same whether he complies or does not comply. It is plausible that the probability of false conviction is lower if the actor complies. If the probability is zero when the immune actor complies, then the risk of overcompliance increases greatly. Grady (1983) shows that causation doctrine in negligence law dampens the overcompliance effect in this scenario.

$$r = \frac{p\int_{[1-H\left(\frac{c_p}{w}\right)]\{[p(1-\theta_1)-q\theta_2]E(v|v>\frac{c_p}{w})+(p-q)c_d\}}^{(p-q)\Psi(E(v))} g(x)dx}{(1-g_n)q+g_n p}$$

and where g_n is the probability that an actor does not take care and is given by

$$g_n = 1 - G\left([1-H\left(\frac{c_p}{w}\right)]\{[p(1-\theta_1)-q\theta_2]E(v\,|\,v>\frac{c_p}{w})+(p-q)c_d\}\right).$$

I will refer to r as the *noncompliance rate*. Undercompliance exists when there are actors for whom $x < (p\text{-}q)\Psi(E(v))$ and the expectation of liability is insufficient to lead them to comply with the legal standard. Overcompliance exists when the expectation of liability causes some actors for whom $x > (p\text{-}q)\Psi(E(v))$ to take care. Perfect compliance is observed when only those actors for whom $x < (p\text{-}q)\Psi(E(v))$ are led by the expectation of liability to comply.

F. Implications

Here are the key implications of this model.

1. Deterrence: As long as courts are reasonably accurate (i.e., the sum of false acquittal and false conviction probabilities is less than one), the expectation of liability will have a deterrent effect on legally culpable actors (sufficiency). Reasonable accuracy is both necessary and sufficient to ensure that the increase in liability that results from failing to take care is greater for a legally culpable actor than for one who is legally immune. It follows that reasonable accuracy is necessary and sufficient to rule out an equilibrium of simultaneous undercompliance and overcompliance.

For the first claim, note that liability has a deterrent effect as long as the marginal increase in expected liability from failing to comply is positive. The reasonable accuracy requirement is sufficient for this to hold. For the second claim, note that for any given actor, either $x < (p\text{-}q)\Psi(E(v))$ or $x > (p\text{-}q)\Psi(E(v))$. Suppose there exist actors who are legally culpable but do not find it privately optimal to comply (undercompliance). For such actors

$$(p-q)\Psi(E(v)) > x > [1-H\left(\frac{c_p}{w}\right)]\{[p(1-\theta_1)-q\theta_2]E(v\,|\,v>\frac{c_p}{w})+(p-q)c_d\}$$

For overcompliance to also exist, then there must be actors for whom

$$(p-q)\Psi(E(v)) < x < [1-H\left(\frac{c_p}{w}\right)](p-q)\theta_2[E(v\,|\,v>\frac{c_p}{w})+c_d]$$

For this to be true, $p(1 - \theta_1) - q\theta_2 < (p - q)\theta_2$ must hold, which requires $1 - \theta_1 - \theta_2 < 0$, contradicting the reasonably accuracy requirement.[18]

This first implication identifies the fundamental reason liability serves as a deterrent even when courts make mistakes in determining compliance. Legally culpable actors pay a price if they fail to comply and that price is higher for them than for the legally immune as long as courts are reasonably accurate. In a study of medical malpractice liability and deterrence, White (1994) (at 82, exhibit 3), relying on an empirical analysis in Farber and White (1991), estimates that the marginal increase in liability to a physician for failing to take care is on average roughly equal to $5,000. White also finds that false acquittal and false conviction error rates for medical malpractice are roughly 15 percent.[19] A recent

[18] The remaining claims are easily proven, see Hylton (1990).

[19] A related study reports considerably higher error rates close to 25 percent, see Studdert et al. (2006). However, the estimates in Studdert et al. use data both on settlement payments and court judgments. As noted earlier, this model could be modified to include both settlements and court judgments, and applied to Studdert et al. study's estimates. This would require distinguishing the average payments in the two events (where settlement payouts are on average less than court judgments). In a suitably modified version of this model, the implied error rates would be less than the levels reported in Studdert et al.

empirical study of medical malpractice litigation confirms the deterrence findings of Farber and White.[20]

The deterrence result here should be compared with Craswell and Calfree (1986), who show that undercompliance and overcompliance may exist simultaneously. Their result could also hold in this model if it were modified to permit the reasonable accuracy condition to fail over some specific range of *x*. Specifically, if the false conviction rate increases near the threshold of legal culpability, then the reasonable accuracy condition could fail to hold near the threshold, generating both incentives to undercomply and to overcomply.[21]

2. Expectation of Liability: Equilibrium requires that the probability of finding noncompliance (guilt) be positive in a civil justice system. Thus, there must always exist some actors who expect to be found guilty of failing to comply with the legal standard. More specifically, there must always exist (1) some legally culpable actors who fail to comply with the law ***or*** *(2) actors who are legally immune and who nonetheless expect to be erroneously found guilty*.

The essential reason for this was first articulated in Ordover (1978), though the proposition here is broader and the model broader in scope. The basic intuition is that if there are no actors at risk of being found liable – that is, if everyone is completely free of any chance of being found in violation of the law – then no victims would have an incentive to bring a legal action in response to an injury. But then no actor would have an incentive to comply with the law. Thus an outcome in which the probability of finding noncompliance is zero cannot be an equilibrium. Because of information costs, a Nirvana where everyone complies with the law and no one sues cannot exist.

[20] See Iizuka (2013).
[21] To return to Grady (1983) (see note 17), if the risk of false conviction for the legally immune depends on whether the actor complies, then this sort of distortion is quite plausible. Under this assumption, the marginal increase in liability from false conviction is especially high for the legally immune, generating the discontinuity that Grady describes in his article.

This point applies generally to civil litigation – torts, contracts, antitrust, etc. As long as the cost of providing information to courts is positive, and consequently it is prohibitively expensive to provide complete information to a court, there must be some degree of noncompliance or risk of erroneous conviction for failing to comply.

3. Compliance: Three types of compliance equilibrium are possible in a civil justice system: (i) one in which the probability of a guilty (liability) verdict exceeds the probability of false conviction and there is undercompliance; (ii) a second in which the probability of a guilty verdict is equal to the probability of false conviction and there is perfect compliance; and (iii) a third in which the probability of a guilty verdict is equal to the probability of false conviction and there is overcompliance.

Thus, although the probability of a guilty verdict must be positive in equilibrium, this does not mean that a perfect (or over) compliance equilibrium cannot exist. If everyone who is legally culpable complies, plaintiffs will still have an incentive to sue if false convictions are possible.

It may seem to be a paradox that a perfect or an overcompliance equilibrium could exist, given public knowledge of variables such as the judicial error probabilities and the equilibrium compliance rate. For example, one might think that if courts know that the equilibrium is one of perfect compliance, they would exonerate any defendant of guilt (liability) on the basis of general information that the equilibrium is one of perfect compliance. However, courts do not determine guilt or innocence based on knowledge of statistical generalities. Courts determine guilt based on information brought before them by the parties involved in the transaction that injured the plaintiff. Thus, even if the equilibrium is one of perfect or overcompliance, courts will still examine the evidence brought before them and may erroneously conclude that the defendant violated the law.

4. Social Value of Error: A perfect (or over-) compliance equilibrium requires a positive probability of false conviction.

It follows that judicial error is not necessarily detrimental to deterrence. Indeed, error in the form of a positive false conviction risk appears to be necessary to have a perfect compliance equilibrium.

This result requires some reconciliation with standard "accuracy in adjudication" arguments.[22] Returning to the first point above, deterrence generally improves with accuracy. If, for example, accuracy could be enhanced by investing in some technology, then an increase in such investment would cause the marginal increase in liability due to noncompliance to increase.[23] Thus, in the standard analysis of accuracy, improving accuracy enhances deterrence, and social welfare, as long as the marginal gain from enhanced deterrence exceeds the cost of improving accuracy. However, the analysis here shows that the relationship between accuracy and deterrence is more complicated when one explicitly incorporates the costs of providing information to courts. A biased approach to enhancing accuracy that aims at reducing false acquittals more than reducing false convictions may enhance welfare more than either a neutral approach to enhancing accuracy or an approach that focuses on reducing false convictions.[24]

III. Legal Standards and Efficiency

In much of the literature, the legal standard $x < (p\text{-}q)\Psi(E(v))$ is argued to be efficient (e.g., Posner, 2011). For example, in the torts context, the Hand Formula, $x < (p\text{-}q)\mathrm{E}(v)$, encourages the potential tortfeasor to take care when and only when care is efficient. However, when litigation costs and judicial error probabilities are taken into consideration, compliance with the legal standard may no longer be efficient.

The inconsistencies between these two approaches illustrate the conflict between doctrinal efficiency and operational efficiency. Analysis of common law efficiency tends

[22] Kaplow (1994), Posner (2001, at 336-379).

[23] The change in $p(1- \theta_1) - q\theta_2$ is $-(pd\theta_1/dz + qd\theta_2/dz)$, which is positive under the assumed effect of the technology.

[24] This contradicts the theory commonly accepted in criminal procedure that reducing false convictions is socially preferable to reducing false acquittals (In Re Winship, 397 U.S. 358, 1970). Of course, criminal procedure is different from the civil justice system considered here. The basis for the bias endorsed in *Winship* is a concern for the social costs of imprisonment and the incentives of public enforcement agents.

to focus solely on the question of doctrinal efficiency. Operational efficiency would consider whether a given legal standard is efficient in light of the actual operation of the law.

The case for operational efficiency as the objective, rather than doctrinal efficiency, would appear to be obvious. Society should concern itself with efficiency in operation, not efficiency in theory. However, even recognizing this, an argument for examining doctrinal efficiency still can be advanced. If legal doctrine serves mostly as a set of instructions to guide conduct, and if it is in this role that it has its most important effect on behavior, then society should concern itself with doctrinal efficiency as much or perhaps more than operational efficiency. For example, if once a legal norm is established it operates independently of the threat of liability, then the efficiency of that norm in isolation should be of central if not primary interest (Shavell, 2002).

It should be clear that this analysis points to a link between operational efficiency, norms,[25] and doctrinal efficiency. Doctrinal efficiency deserves to be a central social welfare concern only if society adopts rules established by courts, or rules that would be discovered or established by courts,[26] as guidelines governing social interaction. If society adopts such rules as norms, then the doctrinally efficiency of such rules becomes an important consideration because the rules either reflect norms that already operate, or establish norms that will operate broadly, and once established the courts effectively disappear. Such norms could be propagated within society through legal advice,[27] or though informal sanctions.[28] However, if such norms do not exist, then the case for

[25] Cooter (1994), McAdams (1997), Posner (2000).
[26] Blackstone (1979, 63-92).
[27] If the advice consists solely of information on expected liability, taking litigation costs and judicial error rates into account, then the level of compliance generated through norm propagation, mediated by legal advice, is no different from the level of compliance that would be generated through direct information on the expected liability. However, since litigation would be avoided through such propagation, the operational efficiency standard would be inappropriate, and compliance levels distorted away from efficiency. If the advice ignores litigation costs (and judicial error rates) and instead focuses on the costs of compliance and benefits in terms of injury avoidance, then it would result in efficient compliance. For a model that allows for (doctrinally) efficient compliance resulting from legal advice, see Shavell (1988).
[28] Ostracism by cooperators in a community could internalize doctrinally efficient norms, Cooter (1994).

analyzing or justifying legal rules on the basis of doctrinal efficiency would appear to be weak.

Another implication of this model is that in light of information constraints binding on courts, there are some legal standards that are unlikely to meet even the doctrinal efficiency standard. This is observed especially in areas where factors other than the defendant's compliance failure might account for the plaintiff's injury – the so-called factual causation cases. Courts often hold that the defendant is immune from liability because the injury suffered by the plaintiff would have happened even if the defendant had complied with the law. Such a finding often relies on information revealed only *after* the injury has occurred. By using such ex post information to determine whether the defendant should be held liable, courts may distort the ex ante effect of the legal standard (Hylton and Lin, 2013). However, in such settings, the information necessary to frame an efficient test is often lacking.

IV. The Litigation Process

How does litigation arise in this framework? I have assumed plaintiffs do not know whether the defendant is innocent or guilty of violating the legal standard. The plaintiff sues knowing the general likelihood of a finding of guilt (w), based on judicial error probabilities and the rate of compliance. The defendant has the same information, and in addition knows his specific innocence or guilt. If defendants did not act strategically in settlement, innocent defendants would reject settlement offers and guilty defendants would accept them, revealing their status. No suits would proceed to trial.

A. Incorporating Settlement

The problem of explaining litigation under informational asymmetry has been addressed in models by Png (1983, 1987), Reinganum and Wilde (1986), and Bebchuk (1984). Png's (and Reinganum-Wilde) is a signaling model and Bebchuk's is a screening model. While signaling would appear to be the natural choice for modeling litigation, the screening model is easier to analyze. The Bebchuk model assumes plaintiffs know the distribution of the defendant's guilt probability while defendants know the true probability.

In this paper's model, plaintiffs know more than the distribution of the guilt probability. They know the probability of guilt based on the noncompliance rate *r* (conditional on information specific to the type of injurious event) and public information on the likelihood of judicial error. Defendants, on the other hand, know with certainty whether they are guilty or innocent.

Since the screening model is easier to analyze, I will present a version of the screening model that is consistent with the information structure assumed in the previous parts of this paper. The model I offer is one of *systemic* and *idiosyncratic* informational asymmetry.

Because of systemic informational asymmetry, only the defendant knows whether he is guilty or innocent. However, in addition to this systemic difference, there is an idiosyncratic type of informational asymmetry. The idiosyncratic asymmetry arises from information that the defendant has peculiar to his case that leads him to predict, rationally, that his likelihood of conviction is either higher or lower than the average for innocent or for guilty defendants. The idiosyncratic factor could arise from facts peculiar to the defendant's case, or something as simple as knowledge that the judge is likely to hold a personal grudge against the defendant. [29] Such idiosyncratic asymmetry seems to be realistic as an assumption, and enables the model to both remain simple and explain some puzzling features of trial outcome statistics.

The defendant's predictions of the probability of liability are as follows

[29] The idiosyncratic shocks could be transformed, with only minor alterations in the treatment of the model, to purely psychological impressions that have nothing to do with accurate information on the real outcome from a trial. Relatively optimistic defendants would tend to litigate and relatively pessimistic defendants would tend to settle (Shavell, 1982). On the psychological basis for optimism in litigation, see Rachlinski (1996).

$\theta_2 + \varepsilon_d$ if innocent

$1 - \theta_1 + \eta_d$ if guilty

where ε_d has density f_ε and distribution function F_ε, η_d has density f_η and distribution F_η, and $E(\varepsilon_d) = E(\eta_d) = 0$. For the innocent defendant ε_d is centered around θ_2 on the interval $[\theta_2\text{-}a, \theta_2+b]$ and for the guilty defendant η_d is centered around $1\text{-}\theta_1$ on the interval $[1\text{-}\theta_1\text{-}b, 1\text{-}\theta_1+a]$. The idiosyncratic shock distributions are assumed to be mirror image reflections.[30] The systemic information asymmetry is captured by the first terms in the probability estimates above.

Although only the defendant knows whether he is guilty or innocent, both the plaintiff and the defendant know w, r, and $1\text{-}\theta_1$ and θ_2. Plaintiffs and defendants both know the distributions of the idiosyncratic terms ε_d and η_d, but only defendants observe their respective idiosyncratic terms.

Assume that the plaintiff always has an incentive to sue because $- C_p + (\theta_2\text{-}a)J > 0$, where J is the damages award.[31] The plaintiff makes a take-it-or-leave-it offer S to the defendant. The defendant, if innocent, will accept the plaintiff's offer if $S \leq (\theta_2 + \varepsilon_d)J + C_d$, or equivalently,

$$\varepsilon_d \geq \frac{S - C_d}{J} - \theta_2$$

Thus, the greater the innocent defendant's idiosyncratic upward adjustment on the risk of conviction, the more likely is settlement. For an innocent defendant, the probability of settlement is therefore

[30] If the densities are graphed over x, $f_\varepsilon(x) = f_\eta(-x)$. This assumption allows for nonsymmetrical densities. The case where the two densities are entirely symmetrical is just a special case of this assumption.

[31] Assuming the court accurately determines damages, J is a specific realization of v (from the previous part). I prefer to use J here because the loss is fixed and observable at the time of settlement negotiations, whereas the model in the previous part treats v as a random variable. (Alternatively, I could use the notation v_0 rather than J to denote a realization of v.)

$$P(settle \mid innocent) = 1 - F_{\varepsilon}\left(\frac{S - C_d}{J} - \theta_2\right)$$

By the same reasoning, the probability of settlement with a guilty defendant is

$$P(settle \mid guilty) = 1 - F_{\eta}\left(\frac{S - C_d}{J} - (1 - \theta_1)\right)$$

The plaintiff chooses an optimal settlement demand by maximizing his expected payoff:

$$\begin{aligned} Payoff\,(S) = (1-r) & \left\{ \begin{aligned} & [1 - F_{\varepsilon}(\frac{S - C_d}{J} - \theta_2)]S \\ & + F_{\varepsilon}(\frac{S - C_d}{J} - \theta_2) E[(\theta_2 + \varepsilon_d) J - C_p \mid \varepsilon_d < \frac{S - C_d}{J} - \theta_2] \end{aligned} \right\} \\ + (r) & \left\{ \begin{aligned} & [1 - F_{\eta}(\frac{S - C_d}{J} - (1 - \theta_1))]S \\ & + F_{\eta}(\frac{S - C_d}{J} - (1 - \theta_1)) E[(1 - \theta_1 + \eta_d) J - C_p \mid \eta_d < \frac{S - C_d}{J} - (1 - \theta_1)] \end{aligned} \right\} \end{aligned}$$

The first bracketed term is the expected payoff to the plaintiff if the defendant is innocent and the second is the expected payoff if the defendant is guilty. Consider the case of innocence first. If the defendant accepts the settlement, the plaintiff receives *S*. If the defendant rejects the settlement offer, the plaintiff receives his expected payoff from litigation, which incorporates the plaintiff's knowledge that idiosyncratic private information (such as the defendant's knowledge that the judge dislikes him) influences the defendant's decision to reject or accept. This pattern repeats for the guilty defendant in the second bracketed term.

Differentiating the plaintiff's payoff function with respect to *S* yields the first-order condition:

$$(1-r)[1-F_{\varepsilon}(\frac{S^{*}-C_{d}}{J}-\theta_{2})]+(r)[1-F_{\eta}(\frac{S^{*}-C_{d}}{J}-(1-\theta_{1}))]$$
$$=\left[(1-r)\left(f_{\varepsilon}(\frac{S^{*}-C_{d}}{J}-\theta_{2})\right)+(r)\left(f_{\eta}(\frac{S^{*}-C_{d}}{J}-(1-\theta_{1}))\right)\right]\left(\frac{C_{p}+C_{d}}{J}\right)$$

The plaintiff trades off an extra dollar of income from a higher settlement (left hand side) against the loss he incurs if litigation results (right hand side). Obviously if the conditional probability of compliance is either 1 or 0, this simplifies greatly, with the plaintiff choosing an optimal settlement amount on the assumption that the population of defendants consists of either innocent actors entirely or guilty actors entirely. If the conditional probability of noncompliance is not in either corner, then it is still possible that the settlement amount will be geared to elicit an optimal payoff with respect to an innocent defendant only (or with respect to a guilty defendant only). The reason is that the uncertainty range surrounding the idiosyncratic shocks may not overlap.

This model is similar to an example discussed in Shavell (1996). Shavell examines a special case in which one type of defendant has a high probability of guilt and the other a comparatively low probability of guilt. He notes that the plaintiff will offer either a high settlement that will be accepted only by the guilty, while the innocent litigate, or a low settlement that will be accepted by both innocent and guilty, resulting in no litigation. In this model, the plaintiff will offer: (a) a low settlement that will be accepted by all of the guilty and resulting in litigation with some of the innocent, (b) a high settlement that will be accepted by some of the guilty while all of the innocent litigate, or (c) a blended settlement that will be accepted by most of the guilty and some of the innocent. In all cases the innocent are disproportionately represented in litigation.

I will focus on this blended solution, though the “single-type” solutions are easy to examine as special cases. The trial win rate for plaintiffs will depend on the average over the types of defendants. Thus, the trial win rate is

$$\frac{(1-r)F_\varepsilon\left(\frac{S-C_d}{J}-\theta_2\right)\left\{\theta_2+E[\varepsilon_d\,|\,\varepsilon_d<\frac{S-C_d}{J}-\theta_2]\right\}+(r)F_\eta\left(\frac{S-C_d}{J}-(1-\theta_1)\right)\left\{(1-\theta_1)+E[\eta_d\,|\,\eta_d<\frac{S-C_d}{J}-(1-\theta_1)]\right\}}{(1-r)F_\varepsilon\left(\frac{S-C_d}{J}-\theta_2\right)+(r)F_\eta\left(\frac{S-C_d}{J}-(1-\theta_1)\right)}$$

or equivalently

$$\frac{(1-r)F_\varepsilon\theta_2+(r)F_\eta(1-\theta_1)}{(1-r)F_\varepsilon+(r)F_\eta}+\frac{(1-r)F_\varepsilon\left\{E[\varepsilon_d\,|\,\varepsilon_d<\frac{S-C_d}{J}-\theta_2]\right\}+(r)F_\eta\left\{E[\eta_d\,|\,\eta_d<\frac{S-C_d}{J}-(1-\theta_1)]\right\}}{(1-r)F_\varepsilon+(r)F_\eta}$$

The first term represents the effect of systemic asymmetry of information on the trial win rate, and the second reflects the effect of idiosyncratic asymmetry. This expression can be rewritten as

$$\begin{aligned}&w+(1-\beta)[(1-\theta_1)-w]\\&\quad+(1-r)\beta\left\{E[\varepsilon_d\,|\,\varepsilon_d<\frac{S-C_d}{J}-\theta_2]\right\}+(1-(1-r)\beta)\left\{E[\eta_d\,|\,\eta_d<\frac{S-C_d}{J}-(1-\theta_1)]\right\}\end{aligned}$$

where $\beta = F_\varepsilon/[(1\text{-}r)F_\varepsilon+rF_\eta] > 1$ given S^*. β measures the propensity of the innocent to litigate relative to the average propensity to litigate. Also, $(1–r)\beta$ is equal to the conditional probability of litigation given that the defendant is innocent.

In the absence of any selection effects in settlement the trial win rate would be the same as the "population win rate" $w = r(1 - \theta_1) + (1 - r)\theta_2$, the rate that would be observed if all disputes went to trial. However, selection distorts the trial win rate from the population win rate in two ways. The first distortion, $(1- \beta)[(1- \theta_1)-w]$, shows the negative effect of systemic information asymmetry, and the second distortion (third and fourth terms above) shows the effect of idiosyncratic informational asymmetry. Since the conditional shock terms are both negative, the second distortion also suppresses the trial win rate below the population win rate.

The trial win rate is not any frequency imaginable, contrary to Shavell (1996). The trial win rate is equal to the population win rate adjusted downward by selection effects, where the population win rate is a function of the equilibrium compliance and judicial error rates. To be sure, the trial win rate could be any number between 0 and 1 in this model, but here *there is a predictable link between the noncompliance rate r and the trial win rate*.[32] The trial win rate is in large part *anchored* by the noncompliance rate.

B. Understanding Trial Outcomes

In a high compliance equilibrium, the noncompliance rate *r* will be relatively low, and the downward bias due to selection by innocent defendants will be the dominant downward distortion from the population win rate. For example, in the extreme case of perfect compliance ($r = 0$), there are no guilty defendants, yet the trial win rate is still biased downward as follows:

$$\theta_2 + E[\varepsilon_d \mid \varepsilon_d < \frac{S - C_d}{J} - \theta_2)]$$

Thus, if we choose an area of litigation where compliance rates are high, we will observe low trial win rates.

Medical malpractice litigation provides an illustration. Under this "anchoring model," low trial win rates can be taken as evidence of high compliance rates, coupled with selection toward innocent defendants (more specifically, the most confident innocent defendants) as litigants. *Since physicians generally comply with medical custom,*[33] *leading to high compliance rates* (*low noncompliance rates*), *this model predicts that one should, as a general matter, observe low trial win rates in medical malpractice litigation*. Moreover, *trial win rates in medical malpractice litigation should vary with the rate of*

[32] See Klerman and Lee (2014), Hylton (2002).
[33] See, e.g., White 1994, at 78. One might argue that since most people comply with the law, this statement suggests that low win rates should be the norm. However, the anchoring model here applies to systemic informational asymmetry cases (first), and (second) says only that win rates should both reflect and vary with compliance rates.

compliance.[34] *Since rates of compliance vary across regions, regional variation in medical malpractice win rates should reflect variation in compliance rates*.

Table 1 presents data, from Daniels and Martin (1986), on regional variation in medical malpractice win rates in New York counties (1980-1985). Among the jurisdictions with at least 35 verdicts in their sample, win rates range from 51.2 percent in Bronx County to 19.9 percent in Westchester County. These rates reflect, in part, the mix of claims brought by plaintiffs. However, they also reflect local variation in the quality of medical malpractice – or, using the terms of this model, the compliance rate. To test this hypothesis I include data in Table 1 on median household income in 1980 in the sample counties.[35] Other things being equal, counties with higher household income should generally have access to higher quality medical care. The win rates in Table 1 correlate negatively with household income levels, supporting the hypothesis that local variation in win rates reflects regional variation in the quality of medical care. Thus, the data suggest that win rates correlate inversely with compliance rates, as this model predicts.

[34] On compliance rate changes and win rates, see Hylton (2002), Klerman and Lee (2014).

[35] The win rate sample runs from 1980-84. The census data are from 1979. I also gathered median household income for 1989, and the ranking of counties remained the same as in 1979. The only noticeable change was that the differential in median income between Queens and New York counties declined over the intervening years, putting them at near parity in 1989.

Table 1

Plaintiff Success Rates in New York Counties for Medical Malpractice

New York Supreme, Civil, and County Courts, 1981-84

	Medical Malpractice		**Median Household Income 1979**
	Success Rates (1)	Number of Verdicts (2)	
Bronx	51.2	43	$10,947
Kings	46.2	130	$11,919
New York	45	169	$13,904
Queens	45.1	71	$17,028
Westchester	19.9	39	$22,725
Nassau	33.3	90	$26,090

Sources: Litigation data from Daniels and Martin (1986). Median Household Income from U.S. Census 1979.

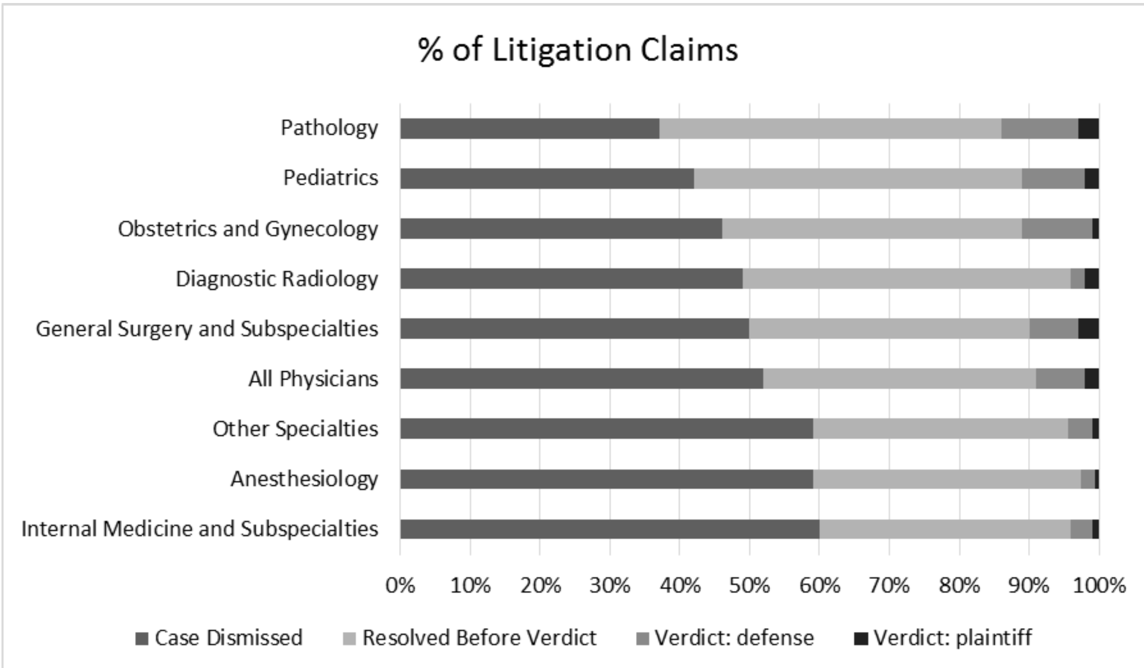
C. Trial Win Rate Variation Across Medical Specialties

Some of the variations shown in the previous chart are attributable to variations in the mix of specialties heavily demanded in different regions. Some regions, for example, may include a higher percentage of claims against pediatricians than do other regions. This suggests that it would be helpful to consider variation in plaintiff win rates across specialties as a way of ensuring that the previous chart is not entirely due to variation in the basket of specialties. I present data on win rates across specialties in Figure 1 below.

The two rightmost shaded areas of Figure 1 provide a visual representation of the win rate. The low plaintiff win rates generally observed in medical malpractice hold across the specialties, again confirming the model's predictions. The exception is in diagnostic radiology, where the plaintiff win rate is close to fifty percent. The win rates in the other specialties shown in Figure 1 range from roughly one tenth to one third. The relatively high win rate for diagnostic radiology probably results from the lack of systemic informational asymmetry: a plaintiff's expert can read an image (say, an x-ray or MRI report) as well as the defendant. Diagnostic radiology differs from other specialty fields in that litigation involves parties with relatively equal information on the likelihood of malpractice. This equality of information probably accounts for the relatively high win rate in radiology malpractice litigation.[36]

[36] Put another way, only idiosyncratic information, which could be two-sided, drives litigation. I should note that an alternative potential explanation for the high trial win rate is that there may be a relatively low compliance rate in diagnostic radiology. On radiology and the problem of quality standards, see http://www.radisphereradiology.com/misdiagnosis-is-pervasive-in-healthcare-and-radiology-is-part-of-the-problem/. This alternative explanation is also consistent with this paper's model.

Figure 1



Source: Jenna et al. (2012)

D. Plaintiff Win Rates and Compliance Rates

In a low compliance equilibrium, the downward bias of the win rate due to settlement by guilty defendants will be the dominant distortion from the population win rate. In the extreme of total noncompliance (r = 1), the trial win rate will be

$$(1-\theta_1)+rE[\eta_d \mid \eta_d < \frac{S-C_d}{J}-(1-\theta_1)]$$

Thus, *the trial win rate will not to be as high as one would expect given the absence of compliance*. In particular, *in settings of extremely low compliance, one should observe trial win rates that are significantly lower than one minus the error rate*.

There is empirical support for this prediction. A survey of several studies of medical malpractice win rates concludes that physicians win 80 percent to 90 percent of the jury trials with weak evidence of medical negligence, approximately 70 percent of the borderline cases, and even 50 percent of the trials in cases with strong evidence of medical negligence (Peters, 2007). Figure 2 provides a summary of the findings. Cases of strong evidence of medical negligence, using the terms of this anchoring model, are cases where the conditional probability of noncompliance is high. The predicted plaintiff win rate for such cases should approximate 100 percent minus the probability of error. With error rates in medical malpractice estimated to be roughly 15 percent (White, 1994), the average plaintiff win rate for strong cases of medical negligence should be nearly 85 percent. The empirical studies, however, generate actual trial win rates for such cases of only 50 percent (see Figure 2). The differential between observed and predicted trial win rates, roughly 20 to 30 percentage points, presumably is due to the selection decisions of medical defendants.[37]

[37] One alternative possible explanation is that the false acquittal rate is especially high for "poor" care cases in Figure 2. However, this seems implausible, because it would imply that physicians who are most negligent are also most likely to be acquitted by juries.

Figure 2

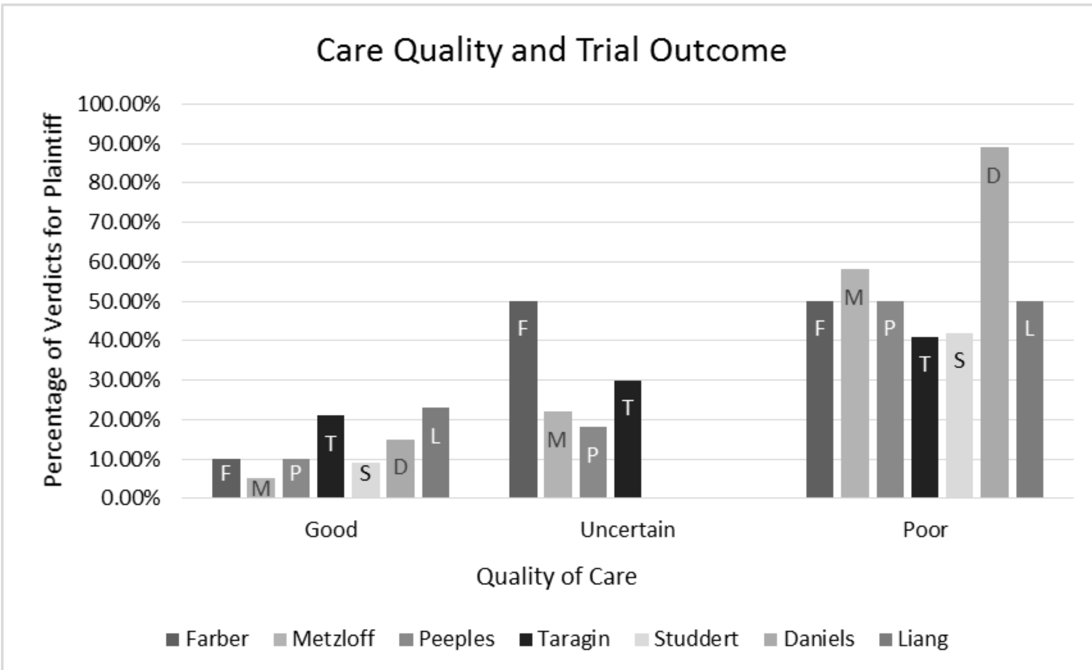


Figure 4: Source, Peters (2007). Studies referenced in the figure: Farber and White (1991), Metzloff (1991), Peeples (2002), Taragin (1992), Studdert (2006), Daniels (1989), Liang (1997).

On the other extreme, consider the extremely low win rates reported for cases of weak evidence of malpractice – with a simple average of roughly 12 percent. In the absence of selection, win rates against innocent doctors should be roughly equal to the 15 percent rate of error. Assuming not all of the doctors were completely innocent in the samples of "weak evidence" cases, the reported win rates seem to be lower than one would expect. This is also consistent with selection even among innocent defendants, with those physicians who for rational though idiosyncratic reasons are pessimistic about their chances settling out of court.

E. Comparing Judicial Forums

What happens if you change the dispute resolution forum from one with a relatively low rate of error to one with a relatively high rate of error? Moving from a bench trial to a jury trial, for example, is an example of moving from a more accurate forum to a less accurate forum. To see what this implies in terms of this model, suppose the two error rates (Type I and Type II) are the same and equal to θ. In the absence of any selection, an increase in the error rate would impact the plaintiff win rate by $dw/d\theta = 1\text{-}2r$, so that if the compliance rate is low, error would reduce the win rate (more false acquittals) and if the compliance is high, error would increase the win rate (more false convictions).

The effect of a change in error is complicated, but some insight can be gained from considering the extreme cases. Suppose compliance is perfect, $r = 0$. The change in the trial win rate is then

$$1+\frac{\partial E[\varepsilon_d \mid \varepsilon_d < \frac{S-C_d}{J}-\theta)]}{\partial \theta} ,$$

where the first term, 1, is the pure "error rate effect" and the second, which is negative, is the selection effect induced by an increase in the error rate. If the selection effect is greater than the error effect, the change in the win rate under perfect compliance, due to an increase in the rate of error, will be negative. Intuitively, since the rate of false convictions is higher under juries relative to judges, only those innocent defendants who know (because of idiosyncratic information) that their chance of victory is very high litigate, which depresses the trial win rate. In short, it is no longer clear that error increases the trial win rate by increasing false convictions. Similarly, in the case of total noncompliance the effect of a change in the error rate on the trial win rate could be positive because of selection.

More generally, an increase in the error rate causes the trial win rate to change as follows:

$$
\begin{aligned}
&1-2r \\
&-({\partial\beta}/{\partial\theta})((1-\theta)-w)-(1-\beta) \\
&+\left[(1-r)(-{\partial\beta}/{\partial\theta})E[\eta_d \mid \eta_d < \frac{S-C_d}{J}-(1-\theta)]+(1-(1-r)\beta)\frac{\partial E[\eta_d \mid \eta_d < \frac{S-C_d}{J}-(1-\theta)]}{\partial\theta}\right] \\
&\quad +(1-r)\left[({\partial\beta}/{\partial\theta})E[\varepsilon_d \mid \varepsilon_d < \frac{S-C_d}{J}-\theta)]+\beta\frac{\partial E[\varepsilon_d \mid \varepsilon_d < \frac{S-C_d}{J}-\theta)]}{\partial\theta}\right]
\end{aligned}
$$

Here the first line shows the "population win rate effect" and it depends on whether the compliance rate is less than or greater than 50 percent. The second line, showing the impact of systemic asymmetry, is unambiguously positive. The reason is that error tends to change the mix toward more guilty defendants, which increases the trial win rate. The mix changes in favor of the guilty because the error rate increase implies more false acquittals. The third and fourth lines show the impact of idiosyncratic asymmetry (combined with systemic asymmetry). The third line is positive and fourth line is negative. Overall, this suggests that counterintuitive results could be observed as a consequence of moving from a more accurate judicial forum to a less accurate forum. If, for example, compliance is high ($r < ½$), then in the absence of selection one would expect the trial win rate to increase as the likelihood of false convictions increases. But the expression above implies that selection by innocent defendants is stronger (because $r < ½$), pushing the win rate down. If the selection effect dominates the population effect, then moving a set of disputes involving high-compliance actors from a more accurate judicial forum to a less accurate forum could lead to a fall in the trial win rate.

This analysis resolves a puzzle identified by Clermont and Eisenberg (1992), who found that plaintiff win rates are *lower in jury trials than in bench trials* for medical malpractice and product liability lawsuits (Table 2). Both medical malpractice and products liability are areas where the legal standard typically points only to the defendant's conduct, and where the defendant is likely to enjoy an informational advantage over plaintiffs. One would ordinarily expect win rates to be higher under jury trials because most doctors comply and an increase in error would imply more false convictions. However, when one takes into account selection due to informational asymmetry, the observation of Clermont and Eisenberg is explainable. Both medical malpractice and products liability are areas where the market strongly encourages potential defendants to comply with the law, and consequently compliance rates are likely to be high.[38] With high compliance rates, the selection effects of innocent defendants impose the dominant distortion. Innocent defendants settle more often under jury trials than under bench trials to avoid the greater risk of a false conviction by a jury, which reduces trial win rates in jury trials below those observed in bench trials.

Clermont and Eisenberg also noted areas of litigation where win rates are higher in jury trials than in bench trials. This is in accord with common intuition that juries favor plaintiffs. However, rather than attributing this finding to the presumption that juries favor plaintiffs, the selection process modeled here provides a potentially superior explanation. The two areas where win rates are higher under jury trials than under bench trials, in the Clermont and Eisenberg data, are FELA and marine torts. In both, the high reported win rates likely reflect low compliance rates.[39] The population effect considered alone ($1-2r$) would imply a reduction in the win rate in moving from judge to jury, contradicting the data. However, on the assumption that the high win rates in these areas

[38] On general compliance in medical malpractice, see White 1994, at 78 (noting that medical malpractice claims are rare).
[39] FELA lawsuits, for example, are against public sector employers, who are can pass on the liability burden to taxpayers. Thus, FELA liability may not be effective in securing compliance.

reflect low compliance rates, the dominant selection effect would be positive, as the mix of litigants changes to include more guilty defendants, which is consistent with the data (Table 2).

Finally, I should note that the other two statistically significant results in Table 2, for negotiable instruments and motor vehicle litigation, probably reflect the pure population effect $1\text{-}2r$ without a significant selection bias. It is unlikely that systemic information asymmetry is substantial in either area.

Table 2

Outcomes in Sizable Categories Involving Clear Judge/Jury Choice

	Judge Trial		*Jury Trial*		
	N (Completed)	Win Rate	N (Completed)	Win Rate	Win Ratio
General					
Airplane Personal Injury	75	0.53	324	0.62	0.85
Federal Employers' Liability	94	0.62	1168	0.72	0.86*
Assault, Libel, Slander	86	0.43	339	0.49	0.88
Marine Personal Injury	889	0.57	1455	0.64	0.89***
Other Personal Injury	516	0.51	2769	0.49	1.04
General Contract	3979	0.69	2458	0.66	1.05
Torts to Personal Property	732	0.63	458	0.59	1.07
Torts to Land	203	0.66	149	0.6	1.1
Negotiable Instruments	643	0.81	173	0.73	1.11*
Fraud	308	0.67	265	0.59	1.14
Motor Vehicle	590	0.69	3633	0.60	1.15***
Prod-Med					
Product Liability	456	0.48	3648	0.28	1.71***
Medical Malpractice	64	0.50	732	0.29	1.72***

* Judge/jury win rates differ at .05 level; ** at .01 level; *** at .001 level

Source: Clermont and Eisenberg (1992).

F. Appeals and Reversals

Trials in this model are black boxes that generate results with stable rates of error. Knowing the rates of settlement for the innocent (i.e., nonliable) and guilty respectively and the error rates, one could calculate the ex post rate of wrongful convictions within a sample of defendants who lose at trial.

$$P(innocent \mid conviction) = \frac{(1-r)F_{\varepsilon}\theta_2}{(1-r)F_{\varepsilon}\theta_2 + (r)F_{\eta}(1-\theta_1)}$$

This suggests that as the compliance rate increases, the proportion of falsely convicted defendants in the sample of convictions increases. Indeed, as the compliance rate approaches 100 percent (*r* approaches 0), so does the percentage of innocent defendants in the sample of convictions. Among acquitted defendants,

$$P(guilty \mid acquittal) = \frac{rF_{\eta}\theta_1}{rF_{\eta}\theta_1 + (1-r)F_{\varepsilon}(1-\theta_2)}.$$

Thus, as the rate of compliance approaches zero, the percentage of guilty defendants within the pool of acquittals approaches one hundred percent.

Appeals are likely to be associated with these pools of defendants. The innocent who have been found liable know that they have been falsely convicted (because of their systemic informational advantage) and therefore have a strong incentive to appeal. The guilty who have been acquitted have no incentive to appeal, but plaintiffs – who know the respective settlement rates of the guilty and the innocent, and the judicial error rates – are more likely to file appeals as the share of the falsely acquitted increases within the pool of acquitted defendants.[40]

[40] This assumes that trial is insufficient to resolve informational asymmetry between the parties, see Hay (1995).

As a general matter, probability of innocence given a conviction is greater than the probability of guilt given acquittal when

$$\frac{F_\varepsilon}{F_\eta} > \frac{r\sqrt{(1-\theta_1)\theta_1}}{(1-r)\sqrt{(1-\theta_2)\theta_2}}$$

Given that $F_\varepsilon(S^*) > F_\eta(S^*)$, this inequality holds for middling to high rates of compliance (assuming that judicial error rates are small and of similar magnitude), which suggests that the share of falsely convicted defendants is larger than the share of falsely acquitted defendants – except where rates of compliance are low. Moreover, the incentive to appeal is greater among the falsely convicted defendants than among plaintiffs who believe that they lost because of error. This is because a falsely convicted defendant knows that the likelihood of reversal is just one minus the rate of false conviction error at the appellate level. If error rates are the same on appeal as at trial, the reversal probability for such a defendant is

$$P(reversal \mid innocent) = 1-\theta_2$$

The plaintiff who appeals an acquittal, by contrast, can only infer the defendant's guilt from information on settlement and error rates. For such a plaintiff, the perceived reversal likelihood is $P(guilty|acquittal)(1\text{-}\theta_1) + P(innocent|\ acquittal)(\theta_2)$, or

$$P(reversal \mid uninformed) = \frac{rF_\eta\theta_1}{rF_\eta\theta_1 + (1-r)F_\varepsilon(1-\theta_2)}(1-\theta_1) + \frac{(1-r)F_\varepsilon(1-\theta_2)}{rF_\eta\theta_1 + (1-r)F_\varepsilon(1-\theta_2)}(\theta_2)\ .$$

Since this is likely to be less than $P(reversal \mid innocent)$, the wrongly convicted defendant has a higher likelihood of appealing his conviction than would a plaintiff facing a wrongly acquitted defendant. Put more plainly, defendants, who will tend to have an informational advantage as to their guilt or innocence, are very likely to appeal when innocent, while plaintiffs generally appeal on the basis of hazier information.

These implications of the model explain the data on appeals shown in Table 3. Eisenberg and Heise (2009, 2015) and Clermont and Eisenberg (2001) report that reversal rates on appeal generally favor defendants. The first six rows of Table 3 show statistically significant reversal rate differentials from the Eisenberg and Heise (2009) study, which examines a sample of state civil trials (a longitudinal sample from 2001 to 2005). Overall, the reversal rate for state civil trials appealed by plaintiffs is 21.5 percent compared to 41.5 percent for trial outcomes appealed by defendants. Reversal rates for appeals in the broad categories of torts (38 versus 21 percent) and contracts (46 versus 22 percent) show a defendant advantage. A narrower category consisting of "assault, libel, and slander" cases shows a dramatic defendant advantage (73 versus 8 percent). In sum, the reversal rates from state civil trials are consistent with this model's prediction that the share of wrongly convicted defendants would generally exceed the share of wrongly acquitted defendants and that appeal incentives in disputes involving the former would be significantly greater than for the latter.

The bottom three rows of Table 3 show Clermont and Eisenberg's data from a sample of federal civil trials (1988-97). Substantial reversal-rate differentials are observed in the categories of "assault, libel, slander", "other personal injury", and product liability. Product liability and defamation cases are areas where defendants are likely to enjoy a systemic informational advantage.[41] In product liability cases, the defendant is in a better position than the plaintiff to know the feasibility of an alternative design proposed by the plaintiff. In defamation cases, the defendant is likely to have much better information than the plaintiff on potential privileges and justifications.[42] The "other personal injury"

[41] This is even more likely to be true in medical malpractice. However, the data on medical malpractice cases were too thin for Clermont and Eisenberg to report a statistically significant result. Clermont and Eisenberg argue that their results do not support the selection hypothesis, but they appear to rely on a version of the hypothesis in which differential stakes rather than informational asymmetry drives selection.

[42] This is also consistent with low plaintiff win rates observed in defamation cases. See, e.g., Clermont and Eisenberg (1998), at 596. The category of assault and defamation combined distorts the win rates in both subcategories. Win rates for intentional torts tend to be high, while win rates for defamation are low. See http://www.courtstatistics.org/~/media/microsites/files/csp/highlights/16_4_medical_malpractice_on_appeal.ashx.

category, which consists mostly of tort actions against businesses,[43] is a broad category where the Table 3 results probably reflect the generally superior information possessed by such defendants on their own levels of precaution. These results further support the prediction that defendants who have an informational advantage and regard themselves as innocent are very likely to appeal while plaintiffs who appeal do so on the basis of greater uncertainty about the defendant's guilt.[44]

Table 3 also shows that the reversal rate from jury trials exceeds that for bench trials, which is also consistent with this model's predictions. Given that only the defendants who are most likely to prevail are taking their chances with juries in this model, appeals from these defendants are likely to be overturned more often than defendant appeals from bench trials, given reasonably accurate appellate courts. The jury trial is the less accurate forum, but it places plaintiff and defendant in roughly comparable positions as in the bench trial. Reversal rates for both types of litigant are higher, but the reversal rate differential stays roughly the same, as shown in Table 3.

[43] These lawsuits consist of tort cases that have been excluded from the categories of medical malpractice, airplane, motor vehicle, product liability, and the combined category "assault and defamation".

[44] For additional (and direct) evidence on rates of appeal, showing that appeal rates are higher for medical malpractice and products liability defendants, see Court Statistics Project: Caseload Highlights: Examining the Work of State Courts, vol. 14, Number 1, March 2007, http://www.courtstatistics.org/~/media/microsites/files/csp/data%20pdf/vol14num1civiltrialsonappeal1.ashx.

Table 3

State and Federal Reversal Rates, by Case Category and Trial Type

Case Category	Reversal Rates (%)		Significance of D-P Difference
	Defendant	Plaintiff	
State			
All Cases	41.5	21.5	.000
Assault, Libel, Slander	73.3	8.3	.001
Tort	38.2	20.8	.002
Contract	46.3	21.6	.000
Jury Trial	42.3	22.8	.000
Bench Trial	38.7	18.8	.013
Federal			
Assault, Libel, Slander	40	9.09	.030
Other Personal Injury	27.78	10.9	.000
Product Liability	38.19	12.45	.000

Sources: State: Eisenberg and Heise (2009). Federal: Clermont and Eisenberg (2001).

V. Selection and Legal Evolution

Suppose instead of systemic informational asymmetry, as assumed previously, the defendant's private information is only of the idiosyncratic sort. Thus, given the equilibrium compliance rate, the defendant's expectation of being found liable is

$$P_d = w + \varepsilon_d$$

For such an uninformed defendant, a settlement will be possible only if the payment $S \leq (w + \varepsilon_d)J + C_d$, and it follows that

$$\mathrm{P}(litigate \mid no\ asymmetry) = F_\varepsilon\left(\frac{S^* - C_d}{J} - w\right).$$

The settlement model presented earlier can be carried through here to find the optimal settlement demand on the part of the plaintiff. Supposing the idiosyncratic shock follows a Uniform distribution, the optimal settlement demand from the plaintiff is $S^* = (a+w)J - C_p$.[45] Substituting S^*, and letting σ_ε represent the standard deviation of the idiosyncratic shock, the probability of litigation against a defendant whose private information is of a purely idiosyncratic type (either because the defendant is uninformed or the plaintiff knows the defendant's type) is

$$P(litigate \mid no\ asymmetry) = 1 - \left(\frac{1}{2\sqrt{3}\sigma_\varepsilon}\right)\left(\frac{C_p + C_d}{J}\right)$$

Now return to the case of systemic asymmetry of information. For the case of litigation against an innocent defendant:

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[45] This assumes lower and upper bounds $-a$ and a, and $2a > (C_p + C_d)/J$. The offer S^* is the solution for the systemic asymmetry case and also the solution for the case, examined here, where the sole defendant has only idiosyncratic information.

$$P(litigate \mid innocent) = 1 - \left(\frac{1}{2\sqrt{3}\sigma_\varepsilon}\right)\left(\frac{C_p + C_d}{J}\right) + \frac{w - \theta_2}{2\sqrt{3}\sigma_\varepsilon}$$

The last term in this expression is positive, suggesting that litigation is more frequent compared to the case where the defendant has no systemic informational advantage. For the case of litigation against guilty defendants

$$P(litigate \mid guilty) = 1 - \left(\frac{1}{2\sqrt{3}\sigma_\varepsilon}\right)\left(\frac{C_p + C_d}{J}\right) + \frac{w - (1 - \theta_1)}{2\sqrt{3}\sigma_\varepsilon}$$

The last term is negative, suggesting less litigation compared to the case where there is no systemic asymmetry.

A. Priest-Klein and Selection Generally

Several observations follow from the foregoing expressions. First, the Priest-Klein hypothesis can be discerned from these equations by examining the probability of litigation for the case of no systemic information asymmetry – that is, only idiosyncratic asymmetry. Litigation declines as the sum of litigation costs increases, and increases with the judgment, as in the traditional Landes-Posner-Gould model.[46] Notice, however, that litigation increases with the standard deviation of the idiosyncratic shock. If the standard deviation of the idiosyncratic shock increases as the population win rate approaches 50 percent, then the Priest-Klein hypothesis follows immediately: litigation will tend to be dominated by cases in which the expected win rate is 50 percent.[47] To replicate the Priest-Klein conjecture within this model, then, one need only assume that σ_ε is a function of the population win rate w and that the function reaches it maximum when w is 50 percent. This is a natural assumption because idiosyncratic informational differences should be greatest when the question of compliance is most uncertain.

[46] The "LPG" model refers to the basic settlement analysis set out in Landes (1971), Posner (1973),and Gould (1973).

[47] For a formal derivation of the Priest-Klein conjecture, see Lee and Klerman (2016). See also Hylton and Lin (2011).

Although the assumption that the shock variance σ_ε reaches its maximum when the probability of plaintiff victory is 50 percent seems natural, there is no reason to think that it must be this way in all cases. There may be some areas of litigation where σ_ε reaches a maximum at another location, such as near one of the endpoints of the probability spectrum. For example, if it is not clear what you have to do to comply with the law, then a defendant who has every reason to believe that he is innocent may still perceive a substantial risk that the court might find facts to justify a guilty verdict. In such a case, σ_ε might be large near the innocence pole.[48] This would make cases of innocence likely to come to court, and drive observed plaintiff win rates low. In other words, the Priest-Klein model, as presented here, can account for high, medium, or low trial win rates, even without the assumption of unequal litigation stakes, depending on the position along the probability spectrum where the idiosyncratic shock variance reaches a maximum. Of course, the most plausible default assumption is that this maximum occurs in the middle of the spectrum.

Now consider systemic asymmetry. If the idiosyncratic shock variance σ_ε declines as we move toward the endpoints of the spectrum of the likelihood of a plaintiff victory (which, again, is the plausible default assumption), then the variance of the idiosyncratic shock will matter less as a driver of litigation in cases of systemic asymmetry. For such cases, the last terms in the last two equations, reflecting systemic information asymmetry effects, take on greater importance as drivers of litigation. Thus, Priest-Klein-type selection emerges here as a special case within a simple model that also generates selection based on information asymmetry.[49] The greater rate of litigation involving innocent defendants drives win rates down from the 50 percent "base-case" level (e.g., Hylton, 2006).

B. Legal Evolution

[48] Given the endpoint constraint, the distribution of the idiosyncratic shock conditional on the low value of *w* would have to be skewed. A "skew Uniform" distribution would allow for these assumptions.

[49] Depending on the parameters of this model, selection based on "differential expectations" or information asymmetry can be observed. For an empirical studies examining which type of selection best matches the data, see Waldfogel (1998), Siegelman and Waldfogel (1999).

As Priest (1980) noted, if litigation is driven by idiosyncratic shocks, resulting in plaintiff win rates of 50 percent, then doctrinal trends would hardly ever be observed. The law would appear to follow a random walk, in which trends in favor of plaintiffs would be just as likely as trends in favor of defendants. Priest's implicit assumption, which I find plausible, is that trends in the law reflect the side with the best success rate in litigation.

In the case of systemic asymmetry, the random walk is unlikely.[50] In particular, if innocent defendants tend to litigate more often, and appeal more often, then trends in favor of defendants are likely to result. However, the law will be altered by the incorporation of private information held by defendants in the shaping of legal standards. A general cost-benefit standard such as the Hand Formula, for example, has ambiguous implications for efficiency if the standard is not informed by factually accurate assessments of cost and benefit.[51] The biased pattern of litigation induced by informational asymmetry ensures that general legal standards incorporate private (and therefore accurate) information (Hylton, 2006).

However, this is not the complete story on evolution of law. I have so far assumed systemic informational asymmetry only with respect to compliance. However, if one party knows the probability of judicial error, while the other party does not, the party with superior information on error will litigate more, biasing win rates in his favor. Suppose the defendant knows that the true judicial error rates are $\tilde{\theta}_1$ and $\tilde{\theta}_2$. Now the probability of litigation against such a defendant is

$$\mathrm{P}(litigate) = 1 - \left(\frac{1}{2\sqrt{3}\sigma_\varepsilon}\right)\left(\frac{C_p + C_d}{J}\right) + \frac{r(\tilde{\theta}_1 - \theta_1) + (1-r)(\theta_2 - \tilde{\theta}_2)}{2\sqrt{3}\sigma_\varepsilon}$$

[50] It should be clear that altering the allocation of legal expenses (e.g., British rule) could change the pattern of evolution in this model.

[51] See Cooter, Kornhauser, and Lane (1979). Although related, the incorporation of accurate private factual information into legal standards, as a process through which the law becomes more efficient, should be distinguished from the minimization of bias due to extreme policy preferences among judges. On the latter process, see Gennaioli and Shleifer (2007).

If the defendant's information is favorable to himself, the likelihood of litigation is higher than otherwise. Plaintiff win rates will be biased in favor of the defendant because of the defendant's informational advantage with respect to the likelihood of judicial error.

In this evolutionary process, legal standards are not enhanced in accuracy or made more efficient by litigation. Indeed, the rule of law is destroyed over time, as Bentham suggested, by biasing due to litigation involvingy parties with superior information on judicial errors. Such information could result from having superior access to or control over the officers of the courts.[52]

If we define microevolution as marginal changes in the law (e.g., recognizing facts that create exceptions to a settled rule) and macroevolution as the complete abrogation of a rule, the foregoing expressions suggest three types of microevolution in the common law. One is a white noise process observed under Priest-Klein assumptions, and described in Priest (1980).[53] A second is microevolution toward efficiency, through the incorporation of private information in updated legal standards.[54] A third is microevolution toward biased rules, of the sort envisioned by Bentham, where the law gradually becomes the property of advantaged classes.

This model's analysis has no bearing on the question of macroevolution of law, addressed by Rubin (1977) and Cooter and Kornhauser (1980). Inefficient legal rules could generate more litigation, until the rules are undone. Alternatively, injunctive settlements of litigation could quietly overturn inefficient rules (Hylton and Cho, 2010), replacing them with efficient norms or conventions (Ellickson, 1991).

VI. Conclusion

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[52] Gennaioli and Shleifer (2007) show that biased judges distort the path of evolution toward inefficiency. However, if parties know of the judges' biases, they will settle. In this paper's model, by contrast, bias in legal evolution results from selective litigation caused by differential knowledge of judicial biases.

[53] As noted before, this argument is traditionally associated with Bentham. However, the specific connection between this theory and litigation is suggested in Holmes (1881), 126-128 (discussing litigation and resolution of uncertainty over the negligence standard).

[54] This type of evolution is associated with the common law efficiency hypothesis. On updating of standard to incorporate information of litigants, see Cooter Kornhauser, and Lane (1979); Hylton (2006).

Since this is a cradle-to-gave model of litigation, there are many subjects to which it could be applied and perhaps generate novel results. For example, the effects of litigation cost allocation rules on incentives to take care, or to litigate disputes, could be examined within this model.[55] However, I will leave such investigations for later work. My aim here has been to show that both intuitive and counterintuitive implications for deterrence can be derived from a model that takes information costs seriously, that the same model can be employed to resolve puzzles in the data on trial and settlement, and to characterize processes of legal evolution.

[55] E.g., Hylton (1990) examines these issues, but within a more cumbersome model than the one used here.

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