

A Theory of Legal Presumptions

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This article analyzes how legal presumptions can mediate between costly litigation and ex ante incentives. We augment a moral hazard model with a redistributive litigation game in which a presumption parameterizes how a court “weighs” evidence offered by the opposing sides. Strong prodefendant presumptions foreclose lawsuits altogether, but also engender shirking. Strong proplaintiff presumptions have the opposite effects. Moderate presumptions give rise to equilibria in which both shirking and suit occur probabilistically. The socially optimal presumption trades off agency costs against litigation costs, and could be either strong or moderate, depending on the social importance of effort, the costs of filing suit, and the comparative advantage that diligent agents have over their shirking counterparts in mounting a defense. We posit three applications of our model: the litigation rate effects of the 1995 Private Securities Litigation Reform Act, the business judgment rule in corporations law, and fiduciary duties in financially distressed firms.

1. Introduction

Few features of American jurisprudence are as fundamental as legal presumptions.¹ Indeed, presumptions—and the concomitant burdens of

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1. *Black's Law Dictionary* defines a presumption as, “A legal device which operates in the absence of other proof to require that certain inferences be drawn from the available evidence A presumption is either conclusive or rebuttable.” The *Dictionary of Modern Legal Usage* (2nd ed) defines it as, “A judicially applied prediction of factual or legal probability.”

proof necessary to overcome them—appear virtually everywhere in law. Though some are widely recognized (such as a criminal defendant’s presumption of innocence), other less renowned presumptions are analogously important in their own right. In company law, for example, officers and directors of corporations enjoy the protection of the “business judgment rule” (BJR)—a strong presumption of care favoring defendants who are alleged to have acted negligently.²

The ubiquity of presumptions has led a number of prominent commentators and judges to posit that most rules of law are little more than presumptions, subject to rebuttal by the adversely affected party [e.g., Wilkinson (1992: 907)]. Accordingly, the topic has spawned a vast literature within legal scholarship [see Allen (1994) for a brief survey]. Somewhat surprisingly, however, presumptions have garnered relatively little attention within game theory and law and economics, and the few recent attempts to explore them tend—in large part—to offer only a limited positive account of their economic incentive effects.

This article attempts to offer such an account, focusing principally on the role of presumptions within corporate and commercial contexts.³ Our principal argument is that presumptions can play a critical role in mediating a trade-off between *redistributional* and *productive* sources of social cost. On the one hand, litigation is an expensive redistributional mechanism, imposing both fixed and variable costs on its participants. Viewed alone, these costs represent a pure deadweight loss.⁴ On the other hand, the specter of costly litigation is often a credible deterrent for defendants contemplating self-interested or analogously wasteful behavior *ex ante*. We argue below that the evidentiary rules adopted by courts—that is, initial presumptions and burdens of proof⁵—are an

2. Of importance, the BJR does not protect corporate fiduciaries who are accused of self-dealing. [Klein and Ramseyer (1997)].

3. Our focus on commercial and corporate presumptions should not be read to preclude possible future extensions to other doctrines. In fact, a number of prominent noncommercial legal rules amount (in large part) to some form of presumption. In accident law, for instance, the doctrine of *res ipsa loquitur* shifts the presumption against the defendant if a plaintiff’s injury is of a type that ordinarily happens because of negligence [Prosser (1984)]. In employment discrimination litigation under Title VII of the 1964 Civil Rights Act, the burden of evidentiary production (and thus the applicable presumption) can shift to the defendant if the plaintiff was a qualified (but rejected) applicant and a member of an historically oppressed group [*McDonnell-Douglas v. Green*, 411 U.S. 792 (1973)]. Even in constitutional law, the equal protection doctrine implicitly operates as a presumption, requiring a court to determine a “level of scrutiny” to apply to a challenged statutory or regulatory classification [Gunther and Sullivan (1998)]. Each of these doctrines might fruitfully be analyzed with appropriate modifications of our framework.

4. For the moment, our analysis assumes that litigation costs are a simple deadweight loss. If, however, courts and legislators value the production of social policy within a legal system, then they might favor policies that encourage the expenditure of resources on litigation. We comment briefly on this possibility *infra* at Section 4.

important mechanism for striking an optimal balance between these competing inefficiencies.⁶

To illustrate our thesis we develop a two-stage model that explicitly links agency and influence costs. The first stage of the model is a conventional principal-agent production problem, in which an agent makes an unobservable and unverifiable decision about how much effort to expend in furtherance of the principal's commercial venture. Once this choice is made (and the venture's payoffs realized), a second stage commences in which a principal may decide to sue the agent over whether the latter is guilty of shirking. This litigation stage introduces an influence-cost model in which the courtroom serves as the venue for redistributive activity.⁷ The mechanics of liability at this stage depend (in part) on the evidentiary rules which we represent through a legal presumption.

The equilibria that emerge from this framework starkly illustrate the agency-cost/influence-cost trade-off identified above. Strong prodefendant presumptions obviate influence costs altogether by precluding lawsuits, but in so doing ensure problems of *ex ante* shirking. Strong proplaintiff presumptions maximize the frequency of suit, but simultaneously deter shirking. Finally, moderate presumptions tend to have moderate effects and support mixed-strategy equilibria in which shirking and suit both occur probabilistically.

But of greater interest, this richer framework can yield a number of seemingly counterintuitive predictions. For example, we demonstrate how a marginal change of the underlying presumption in the defendant's favor can, ironically, lead to a *higher litigation rate* and even a *higher win rate* for plaintiffs in equilibrium. While this prediction is initially surprising, the intuition behind it is actually straightforward: although prodefendant presumptions make it more difficult for plaintiffs to win in any

5. Formally, of course, presumptions are distinct from evidentiary burdens of proof. As noted above, presumptions refer to an initial probabilistic estimation by the court—in the *absence of evidence*—of some fact. Burdens of proof, in contrast, refer to whether or how the parties can dislodge the court's estimation through the presentation of evidence. In fact, the burden of proof is often further subdivided into two subparts: (1) the "burden of production," focusing on which litigant has a duty to come forward with evidence in court (or risk losing); and (2) the "burden of persuasion," referring to the applicable criterion a court uses to update its initial presumption on the production of evidence (e.g., preponderance, clear-and-convincing, beyond a reasonable doubt, etc.). As will become apparent below, our analysis collapses all of these concepts into a single parameter. We offer some justifications for this modeling decision when we present the framework in Section 2.

6. It is worth noting as well that other legal and nonlegal mechanisms (such as substantive law and express contractual mechanisms) can provide important incentives. Our analysis, however, holds many of those other possibilities constant in order to focus on the role played by presumptions.

7. More traditional influence-cost accounts focus on out-of-court venues, such as the boardroom or factory floor. See, for example, Milgrom and Roberts (1990), Becker (1983), Hirshleifer (1995), Welch (1997).

given case, the more protective rule also skews defendants' ex ante behavior toward shirking. Consequently, when the plaintiff suffers harm, she is much more likely to believe that it was caused by the defendant's misfeasance rather than simple bad luck. Moreover, such a prediction is consistent with empirical observations from prominent legal reform experiments. For instance, the principal legislative intent of the Private Securities Litigation Reform Act of 1995 was to reduce litigation rates by (*inter alia*) enhancing prodefendant presumptions [15 U.S.C. § 77a (*et seq.*) (1999)]. Nevertheless, after an initial decline of approximately 38% during the act's first year, the number of issuers sued for fraud under federal securities laws soon surpassed its *pre-act* level—a full 32% higher by the end of 1998.⁸

On a more general level, however, the intuitions that emerge from our approach can lend interpretational insights to existing legal presumptions. For example, the fundamental tension between productive and redistributive concerns we highlight may help explain some existing legal presumptions in corporate fiduciary duty law. As noted above, the business judgment rule (BJR) represents a strong presumption that protects corporate officers and directors against shareholder allegations of “negligence.” Ordinarily, by favoring an agent who is already in an informationally advantaged position, the BJR tends to reduce litigation at the cost of exacerbating agency problems. But the BJR affords no protection against allegations of “self-dealing.” The dichotomy between negligence and self-dealing cases is nowhere more stark than in cases of managerial entrenchment against hostile acquirors, where both forms of agency cost can exist, and where courts have had the most difficult time determining whether to apply the BJR. Our analysis suggests that the BJR makes the most sense from a social efficiency perspective when there is only limited divergence between the interests of the manager (agent) and the socially best outcome, that is, when the fiduciary's personal cost of effort is high relative to either the underlying stakes or the causal relation between effort and outcome (and thus the net social benefits of productive effort are small). In takeover situations, especially when there are multiple bidders, the divergence of interest increases, suggesting that the BJR may no longer be optimal. Even beyond such positive examples, however, our analysis may also have normative implications, because it exposes the factors that inform the setting of optimal presumptions.

8. The intuition behind this prediction is, in an abstract sense, analogous to the idea within optimal deterrence theory that reducing the fines levied against tortfeasors will cause them to commit harm with greater frequency. Our approach diverges from the standard approach, however, by focusing on evidentiary rules rather than substantive fines, on contractual allocations rather than torts, and on game-theoretic rather than decision-theoretic environments.

Finally, our approach isolates an important role for presumptions even when courts have only a limited ability to verify information directly.⁹ On first blush, it might seem that courts should not encourage litigation if they cannot directly assess the defendant's culpability. However, so long as hard-working and shirking agents face differential costs of producing evidence, litigation can be an effective screening device for separating high-effort and low-effort agents. As such, it may be optimal even for courts with imperfect verification skills to exploit this screening phenomenon by employing moderate presumptions *designed specifically* to encourage litigation.

Although the influence-cost approach to litigation is well known in the literature, the explicit strategic interaction between legal conflict and *ex ante* incentives is somewhat more novel. To examine this interaction obviously requires an asymmetric-information model of conflict, in which the agent's "type" (i.e., privately known true culpability) at the litigation stage is endogenously determined by his earlier decisions. The handful of existing efforts that study the effects of evidentiary rules on litigation behavior largely avoid such hybrid approaches.¹⁰ Katz (1988), for example, utilizes conflict theory to examine how the underlying legal doctrine affects litigation expenses, but he employs a complete-information model that does not allow for endogenous defendant behavior and signaling. Daughety and Reinganum (1998) show how a number of factors, such as differential stakes and selective "sampling" of evidence may engender systematic biases in judicial outcomes. Their approach, however, also assumes complete information between the litigants, and does not analyze legal presumptions *per se*. Similarly, Hay and Spier (1997) analyze evidentiary burdens within a complete-information model, assuming that the litigants commonly observe a unitary piece of informative evidence, which either party can choose to present in court. Because the party benefiting from the information always presents it (and because no false testimony is allowed), the evidentiary burden has no effect on primary behavior. Rubinfeld and Sappington (1987) explicitly analyze litigation behavior within an asymmetric-information environment. They demonstrate that under certain conditions, litigation effort can constitute a signal of private information about guilt or innocence. Nevertheless, their model treats both the agent's type

9. Some legal scholars have made the opposite claim [see, e.g., Gaskins (1993)]. Others [e.g., E. Posner (1999)] have posited that litigation before extremely error-prone courts may provide a beneficial punishment device for parties that interact repeatedly over time, so long as they care about reputations, and opportunism is observable to both sides. Our principal argument, in contrast, assumes neither repeat interaction nor the observability of shirking.

10. A notable exception is Sanchirico (1998a, b), discussed below.

(i.e., the productive effort) and the costs associated with “bad” judicial opinions (i.e., false positives and false) as exogenous.¹¹ Their approach does not yield insights as to how evidentiary rules endogenously affect the defendant’s level of culpability.

In contrast, Sanchirico’s (1998b) notable recent work posits an analytical framework that explicitly links evidence production to primary behavior. Using this framework, he provides insights about when it is optimal to “decouple” damages in civil litigation, and gives a possible explanation of the historical transition in England toward a more passive, fact-finding jury.¹² Our conceptual framework is similar in spirit to Sanchirico’s, but differs in two respects. First, our approach utilizes an equilibrium analysis to animate this relationship, while his employs mechanism design. Although both approaches have their own respective merits, an equilibrium analysis enables one to characterize how particular instruments of judicial process (e.g., presumptions) affect individual behavior. Such interpretations are not possible (or are at least less forthcoming) within a mechanism-design context. Second, the ability to isolate the equilibrium role of presumptions in turn facilitates a more precise positive application of our theoretical analysis to a number of existing doctrines and reform experiments within American law.

The remainder of this article consists of six parts. Section 2 develops a multistage principal-agent model, incorporating a litigation endgame as the redistributive conflict mechanism through which principals can attempt to punish misfeasance by agents. In Section 3 we derive the equilibria of this model and simple comparative statics, some of which—as noted above—are surprising. Section 4 explores welfare concerns, and characterizes the optimal legal presumption as a function of some of the fundamental parameters in the model. Section 5 discusses a number of possible applications of the model, including the 1995 Reform Act mentioned above, corporate fiduciary law, and debtor-creditor law. Section 6 considers alternative objectives that courts and legislatures might employ, and how such alternative objectives may change our analysis. Section 7 offers concluding remarks and possible extensions.

2. The Framework

In this section we develop a conflict-theory approach to characterize the role of legal presumptions in a standard agency model. Our model begins with a simple moral-hazard framework. After the agent has

11. Similarly, Hirshleifer and Osborne (1996) conceive of litigation as a conflict game in which the degree of a party’s “fault” is an exogenous parameter in the model.

12. In a companion piece, Sanchirico (1998a) uses the same framework to demonstrate how litigation stage concerns may induce an optimal second-best legal rule to overdeter a potential defendant relative to first-best.

chosen an action and the project outcome has materialized, we introduce an explicit litigation stage. The primary parameter of interest occurs in this latter stage, in the form of a legal presumption specifying the manner in which courts weigh and process each party's proffered evidence so as to reach a decision. As we demonstrate in subsequent sections, the strength of the presumption provides an important link between productive and redistributive incentives.

Consider a two-person game involving a principal ("she") who hires an agent ("he") to provide labor for some productive enterprise (the "project"). In performing his duties, the agent is assumed to make a private, nonmonitorable decision about whether to expend high effort (e^H) or low effort (e^L). Although it costs the agent nothing to expend low effort, high effort imposes on him a nonmonetary cost of ϕ dollars. Nevertheless, a high level of effort can benefit the principal, as it affects the probability that the project realizes a high payoff (V_H) instead of a low payoff (V_L , where $V_L < V_H$). In particular, the relationship between the agent's effort choice and the likelihood of project success is summarized in the following table:

	High Payoff (V_H)	Low Payoff (V_L)	
High Effort (e^H)	p	$1 - p$	(1)
Low Effort (e^L)	$1 - p$	p	

The parameter $p \in [\frac{1}{2}, 1]$ captures the degree to which the agent's effort can affect prospective outcomes, with larger values representing a greater importance of effort on the project's success rate.¹³ In general, because $p \geq 1/2$, the principal—who is the residual claimant on the project's revenues—would always like the agent to choose a high effort level. [From a societal standpoint, of course, effort is desirable only if $(2p - 1)(V_H - V_L) > \phi$.] The principal observes only the project's outcome—she is unable to observe the agent's actual effort choice directly.¹⁴

In most standard agency-cost models, the optimal contractual solution is to offer incentive pay: that is, the principal promises to pay the agent a bonus should the project yield a high payoff. In contrast to this standard approach, we limit our attention below to "fixed-wage" contracts, in which the agent receives a wage of w regardless of the

13. The only critical aspect of the probability structure in Equation (1) is that effort must increase the likelihood of the high-payoff state.

14. We also assume that the agent's effort is not verifiable (at least directly) in court. Nonetheless, as we demonstrate below, the underlying evidentiary rule may act as an *indirect* means of verifying the agent's effort.

realized state, but may be subject to suit should a low project payoff obtain. We motivate this assumption on three grounds. First, and most obviously, our main focus concerns downstream litigation (rather than express contract terms) as a means for providing optimal incentives for the agent. Although such rules utilize “sticks” rather than “carrots” as the primary tool for achieving incentive compatibility, an efficient legal rule can substitute for contingent terms, which themselves may be difficult to anticipate or costly to draft.¹⁵ Second (and relatedly), to the extent that incentive contracts entail enforcement costs (e.g., they require that courts stand ready to interpret the incentivizing contingency, or verify which state has obtained), one can specify a presumption within our framework that is an *exact* substitute for an incentive contract. Finally, there are (for reasons outside our model) a number of substantive contract doctrines that are immutable in nature, and thus preclude reallocation by contract.¹⁶ Thus, while express incentive devices are almost certainly an apt alternative to litigation in some instances, litigation remains—for whatever reason—a distinct likelihood in many (if not most) contractual environments.

Returning to our model, then, we assume that the agent receives a constant wage w , but if a low state obtains the principal may file a lawsuit against the agent. The lawsuit—if successful—would require the agent to pay money damages to the principal. Accordingly, the extensive form of the game is shown in Figure 1.

The figure presupposes that the agent has been offered and accepted a contract paying him a specified wage, w , which satisfies his participation constraint. The agent is first to move, deciding whether to expend high or low effort in performing his duties. Next, nature determines whether the project yields a high or a low payoff, according to the probabilities associated with the agent’s effort choice. Should the project yield a high payoff, the game immediately ends, with the high-effort agent type receiving a payoff of $w - \phi$, the low-effort agent type receiving a payoff of w , and the principal receiving a payoff of $V_H - w$.¹⁷

15. There is a growing literature on the costs of express contracting, costs that emanate from problems of (among other things) bounded rationality, multitasking concerns, complexity, and intraorganizational political concerns [see, e.g., MacLeod (1999)].

16. A number of statutes make certain types of contracts invalid [see, e.g., Cal. Civ. Code § 1668 (1999) (voiding as unlawful all contracts that exempt anyone from responsibility for fraud, willful injury of another, or violation of law)]. This trend appears to be continuing [see, e.g., California Assembly Bill 858, 1999 CA A.B. 858 (voiding, as against public policy, all contracts in which consumers or employees consent to binding arbitration, waive their right to rescind a contract during a statutory cooling-off period, or waive their rights to a jury trial)]. In this article, however, we do not attempt to provide a reason for immutable rules, other than to recognize that they exist in many circumstances.

17. Our analysis excludes the possibility of suit in the high-payoff state, assuming implicitly that it would be impossible to prove damages in such a suit. We briefly revisit this possibility in Section 4, where we discuss optimal presumptions.

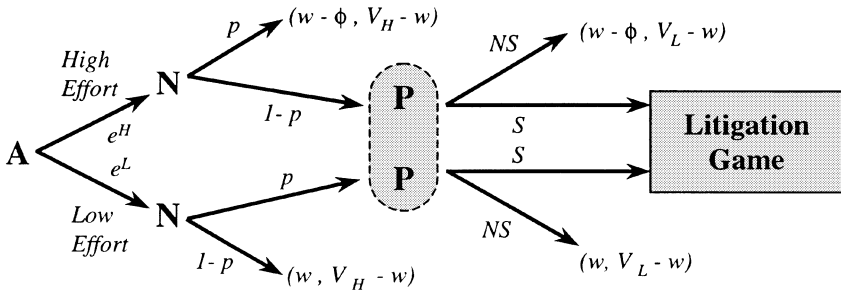


Figure 1. Extensive form of the game.

Should a low payoff obtain, the principal may choose whether to file suit against the agent. If she decides not to sue (*NS*), then the game similarly ends with the high-effort agent, low-effort agent, and the principal, respectively, receiving payoffs of $w - \phi$, w , and $V_L - w$. If, on the other hand, the principal decides to sue (*S*), the players enter an endgame of litigation, in which a court must decide whether to find the agent liable. To concentrate on the particular role of presumptions, we hold constant throughout the substantive rule of law: If the agent is found to have shirked, he must pay to the principal the sum of D dollars.¹⁸ While the prospect of recovering such damages is attractive to the principal, litigation does not come without costs. Indeed, in order simply to bring suit, the principal must incur a nonrecoverable fixed cost $F > 0$ to draft and file a complaint. Thus only if the expected net payoffs from litigation are sufficiently large to cover these fixed costs would a rational principal ever choose to file suit.¹⁹

Once invoked, litigation imposes additional *variable* costs on both parties as they argue the case in court.²⁰ In particular, we conceive of litigation as a redistributive conflict game, wherein parties expend “litigation effort” producing and presenting evidence about whether the agent has shirked. Let $L_P \geq 0$ denote the amount of incriminating evidence the principal chooses to present against the agent in litigation. Similarly, let $L_A^L \geq 0$ and $L_A^H \geq 0$ denote the amount of exculpatory evidence the low-effort and high-effort agent types, respectively, choose

18. We treat D as exogenous in what follows, assuming only that it is “large” enough to have a potential deterrent effect on the agent. See Section 3.4, *infra*. In principle, it is possible to generalize the model to allow for alternative substantive liability rules as well; however, so doing would simply obscure the intuitions we attempt to expose below.

19. It is easy to demonstrate that the principal will *always* file a complaint if $F = 0$. Thus we limit our attention to the (more realistic) case of $F > 0$.

20. For now, we assume that no presuit bargaining occurs in this model. We conjecture how settlement might affect our results in Section 7.

to offer in their own defense. We assume that the principal's and agent's decisions are made simultaneously.²¹

The litigation strategies, L_P , L_A^L , and L_A^H , are intended to summarize the efforts that litigants routinely expend to gather and present evidence to a court (such as eyewitness testimony, expert opinions, documentary evidence, laboratory tests, and the like). Of importance, we make no specific assumption about the inherent truthfulness of either side's evidence. Indeed, it may be genuine or contrived; unrehearsed or completely orchestrated. All that we require is that the evidence be costly on the margin for both parties to produce. In particular, we assume that the principal faces a (constant) marginal litigation cost of $c_P > 0$ to present L_P , so that his total evidentiary cost is $c_P L_P$. The agent also bears a (constant) marginal cost of presenting evidence, but we allow the agent's cost to depend on his type (i.e., prior effort level). If the agent expended high effort, his marginal litigation cost is $c_A^H > 0$, and thus his total evidentiary cost is $c_A^H L_A^H$. If he expended low effort, his marginal litigation cost is $c_A^L > 0$, and thus his total evidentiary cost is $c_A^L L_A^L$. We assume in what follows that $c_A^L > c_A^H$; that is, shirking agents find it more costly to produce exculpatory evidence than do their high-effort counterparts.²² We justify this assumption by observing that shirkers must (almost by definition) offer evidence that is inconsistent with their actual behavior. As such, producing such evidence may necessitate exhaustive searches for documents and/or expert testimony, more intensive coaching of friendly witnesses, and perhaps even the payment of explicit or implicit bribes in exchange for false testimony.²³ As will become apparent below, this cost differential implies that shirking agents will rationally choose to present less evidence than their nonshirking counterparts in equilibrium. Consequently, the litigation effort expended by the agent may be an efficiency-enhancing signal of

21. As a formal matter, of course, the rules of evidence prescribe sequential rather than simultaneous performances, with the plaintiff moving first. See, for example, Fuller (1967). Nevertheless, we motivate our assumption of simultaneity on three grounds. First, the equilibria of the simultaneous game are simpler to describe yet qualitatively similar to those of the sequential game, which we have solved in a technical companion piece [Bernardo and Talley (1999)]. Second, as a practical matter, litigation is frequently *not* sequential, at least in the sense described above. Discovery, interrogatories, depositions, cross examination, rebuttal witnesses, and the like all tend to blur the discrete divide between the plaintiff's and defendant's evidentiary performances. In the limit, such an iterative process is likely to be captured better by an assumption of simultaneity. Finally, the simultaneous-move equilibrium tends to emerge even from a sequential structure if the first mover's action can only be observed with some noise [Bagwell (1995)].

22. Although we assume constant marginal costs, most of the core arguments presented below carry over to the case in which the marginal cost of evidence production increases in litigation effort (so long as the low-effort agent's cost schedule is uniformly higher than that of the high-effort agent).

23. Similar assumptions to this also appear in Rubinfeld and Sappington (1987), Daughety and Reinganum (1998), and Sanchirico (1998a, b).

her type—a signal that is only possible when litigation occurs along the equilibrium path.

Finally, in order to understand why the parties would even bother to expend litigation effort, it is important to specify how evidence presentation affects judicial findings of liability. To this end, let $q(L_P, L_A^j)$ denote the “legal rule” employed by the court, which maps the players’ litigation efforts into the probability that the agent is found liable, with $j \in \{L, H\}$. (Alternatively, it is possible to interpret $q(\cdot)$ as the fraction of some maximal damages amount D that the principal receives). In order to develop more concrete intuitions (and to remain consistent with the conflict-theory literature [e.g., Hirshleifer (1995)]), we adopt a particular functional form for $q(\cdot)$, in which the principal’s success probability is

$$q_j \equiv q(L_P, L_A^j) = \frac{L_P}{bL_A^j + L_P} \quad (2)$$

for $j = L, H$. (To economize on notation, in what follows we will often denote $q(L_P, L_A^j)$ simply as q_j). The parameter $b > 0$ denotes the ex ante “weight” that a court accords the agent’s proffered evidence relative to the principal’s, thereby representing the role of a legal presumption.²⁴ Moreover, by varying the value of b it is possible to consider a range of potential presumptions, from a conclusive (or “irrebuttable”) presumption favoring the principal ($b = 0$) to a conclusive presumption favoring the defendant ($b = \infty$), and all (theoretically rebuttable) presumptions in between ($0 < b < \infty$).²⁵

This functional form exhibits a number of useful and intuitive properties.²⁶ First, note that it is increasing in L_P and decreasing in L_A^j :

24. The reader should note that the judicial heuristic captured in the q_j function collapses presumptions, burdens of production, and burdens of proof into a single parameter. Our reasons for doing so are twofold. First, the concepts are clearly related. For example, knowing that a defendant enjoys the benefit of an initial presumption in his favor also conveys information about the applicable burden of production and persuasion (i.e., the plaintiff must carry both, and in stronger proportions as the initial prodefendant presumption increases). For a similar point, see R. Posner (1999). Second, although it is possible to enrich the posited judicial heuristic so that it accounts separately for presumptions and burdens of production/persuasion, we conjecture that such an adaptation would have little effect on our qualitative results.

25. There are other possible evidentiary interpretations of the b parameter. For example, a judicial bias toward a litigant may manifest itself in the relative frequency with which the court deems one party’s evidentiary offerings inadmissible. A proplaintiff court may tend to admit virtually all of a plaintiff’s offers of proof, while admitting the defendant’s only 70% of the time.

26. In addition to those listed in the text, Skaperdas (1996) shows that this functional form also has some desirable axiomatic properties in other contexts, such as a monotonic improvement in outcome when more resources are expended. The only other known conflict parameterization that satisfies such properties (exponential) leads to corner solutions.

greater litigation effort by either party *ceteris paribus* increases one's likelihood of prevailing (or alternatively, her share of the surplus available for redistribution). Moreover, it is possible for either party—holding the opponent's action constant—to choose a level of litigation that realizes the entire range of success probabilities between 0 and 1. Finally, as the two parties' litigation levels tend uniformly to zero, the limiting probability of plaintiff success is $1/(1 + b)$, which one might interpret as the court's default presumption—that is, its *ex ante* bias in the absence of any production of evidence. [Explicitly, $\lim_{L \rightarrow 0} q(L, L) = 1/(1 + b)$.]

3. Equilibrium Behavior

Given the fundamentals of the game, we may now proceed to analyze the plausible equilibria that emerge from noncooperative play. Our equilibrium concept in what follows is *sequential equilibrium* (Kreps and Wilson 1982), though even weaker equilibrium concepts would do as well.²⁷ Denote the probability that the agent expends high effort by β , and the probability that the principal brings an action in a low state by γ . Accordingly, the strategy profile $(\beta^*, \gamma^*, L_P^*, L_A^{L*}, L_A^{H*})$ is part of a sequential equilibrium for the game if no player type has an affirmative incentive to deviate from her prescribed strategy given her beliefs at each stage, and if the principal's and agent's beliefs at each information set are consistent and sequentially rational. We solve the game in reverse order, starting with the litigation contest, then inducting backwards to the principal's decision about whether to file suit, and finally to the agent's *ex ante* decision about whether to expend effort.

3.1 Litigation Stage

To analyze the final, litigation stage of the game, one must assume that a low state of the world has come about and that the principal has chosen to file suit. Let α denote the principal's belief that the agent has previously expended a high level of effort conditional on being in the low state. The endogenous levels of litigation activity L_A^L , L_A^H , and L_P will generally depend on α , and are characterized below.²⁸

Consider first the principal's choice of litigation effort. Having already sunk the fixed cost of bringing suit, the principal's expected payoff from litigation consists of damages she can expect (i.e., $[\alpha q_H + (1 - \alpha)q_L] \cdot D$) less her variable costs of litigation ($c_P L_P$). Thus, given the

27. In particular, the set of equilibria described below is also the set of perfect Bayesian equilibria (PBE), an equilibrium concept that does not require consistency in beliefs. There is no distinction between PBE and sequential equilibrium in much of what follows because all relevant information sets are reached with positive probability.

28. Though α is exogenous at this stage, sequential rationality requires its value to be related to the agent's equilibrium effort choice β via Bayes' rule. This constraint is taken up at length *infra* in Section 3.4.

respective agent types' litigation levels, the principal's optimization problem solves the following:

$$\max_{L_P \geq 0} \left[\alpha \left(\frac{L_P}{bL_A^H + L_P} \right) + (1 - \alpha) \left(\frac{L_P}{bL_A^L + L_P} \right) \right] \cdot D - c_P L_P. \quad (3)$$

The principal's best response will generally be interior, and satisfies the first-order condition

$$\left[\alpha \left(\frac{bL_A^H}{(bL_A^H + L_P)^2} \right) + (1 - \alpha) \left(\frac{bL_A^L}{(bL_A^L + L_P)^2} \right) \right] \cdot D = c_P. \quad (4)$$

This condition states that the principal increases her litigation efforts (L_P) until the marginal private benefits are just equal to the marginal private costs.²⁹

Now consider the agent's choice of litigation level. Unlike the principal, the agent knows how much effort he has previously put forth. Therefore the optimal litigation choice of the agent depends on his type. For the agent type who previously put forth high effort (e^H), the problem is to solve

$$\max_{L_A^H \geq 0} \left[\frac{L_P}{bL_A^H + L_P} \right] \cdot (-D) - c_A^H L_A^H. \quad (5)$$

Assuming an interior solution (which generally obtains for the high-type agent), the following first-order condition characterizes the high-effort agent's best response:

$$\left[\frac{bL_P}{(bL_A^H + L_P)^2} \right] \cdot D = c_A^H. \quad (6)$$

Analogously, assuming an interior solution (which may not obtain for the low-type agent), the following first-order condition characterizes the low-effort agent's best response:

$$\left[\frac{bL_P}{(bL_A^L + L_P)^2} \right] \cdot D = c_A^L. \quad (7)$$

If both agents' optimal choices are interior, the unique equilibrium of the continuation game solving the three FOCs and the associated

29. In this case, as in the others, sufficiency is satisfied by the strict concavity of the objective function in L_P .

indirect liability functions are

$$\begin{aligned}
 L_P^* &= D \cdot b \cdot (\mu_\alpha)^2; & q_H^* &= \sqrt{c_A^H} \cdot \mu_\alpha; \\
 L_A^{H*} &= D \cdot \mu_\alpha \cdot \left[(c_A^H)^{-1/2} - \mu_\alpha \right]; & q_L^* &= \sqrt{c_A^L} \cdot \mu_\alpha, \\
 L_A^{L*} &= D \cdot \mu_\alpha \cdot \left[(c_A^L)^{-1/2} - \mu_\alpha \right]; & & (8)
 \end{aligned}$$

where $\mu_\alpha \equiv ((\alpha\sqrt{c_A^H} + (1 - \alpha)\sqrt{c_A^L}) / (bc_P + \alpha c_A^H + (1 - \alpha)c_A^L))$. However, if the court employs a strong proplaintiff presumption, so that $b < \alpha/c_P \cdot (\sqrt{c_A^H c_A^L} - c_A^H)$, the low-effort agent type will be at a corner solution, and will not mount a defense. In such a circumstance, the equilibrium litigation levels and indirect liability functions are as follows:

$$\begin{aligned}
 L_P^* &= D \cdot b \cdot \alpha \cdot \frac{\alpha c_A^H}{(\alpha c_A^H + bc_P)^2} & q_H^* &= \frac{\alpha c_A^H}{\alpha c_A^H + bc_P} \\
 L_A^{H*} &= D \cdot \alpha \cdot \frac{bc_P}{(\alpha c_A^H + bc_P)^2} & q_L^* &= 1 \\
 L_A^{L*} &= 0 & & (9)
 \end{aligned}$$

Inspection and/or piecewise differentiation of the above expressions shows that higher damages always increase litigation effort. Further, for each party, there is an intermediate b at which their litigative efforts are highest, because it is the intermediate presumption that makes a legal rule most contestable by either party. The players are jointly more aggressive when they have roughly comparable influence on the court, taking into account both court presumptions and costs of conducting litigation [see Welch (1997)].³⁰

3.2 Filing Stage

We now step backwards to analyze the principal's filing decision. Should the principal sue, she expects to receive the payoffs from the litigation stage described above, but must pay the fixed costs F of bringing an

30. Note also that whenever $b > 0$, the high-effort agent is a more aggressive litigator than is his shirking counterpart. This difference is due to the marginal cost differences faced by the two agent types (i.e., $c_A^H < c_A^L$). Once suit is filed, the high-effort agent finds it relatively cheap to mount a defense, and therefore presents more evidence (and wins more often) than does the low-effort agent.

action. Consequently, the principal will sue only if the former exceeds the latter. (Because the principal's beliefs are constrained to be sequentially rational, she must still conjecture at this stage that there is an α -probability that the agent had previously given effort.)

If the principal chooses not to litigate, she simply pays the agent the contracted wage, and thus her low-state payoff is

$$V_L - w. \quad (10)$$

Conversely, if the principal files suit, her expected payoff is

$$V_L - w + [\alpha \cdot q_H^* + (1 - \alpha) \cdot q_L^*] \cdot D - c_P L_P^* - F. \quad (11)$$

Let $R_p(\alpha) \equiv [\alpha \cdot q_H^* + (1 - \alpha) \cdot q_L^*] \cdot D - c_P L_P^* - F$ denote the *net gain* the principal expects to receive from suing over abstaining. Clearly the principal will always abstain from litigating (i.e., set $\gamma = 0$) if $R_p(\alpha) < 0$, and will always file suit (i.e., set $\gamma = 1$) if $R_p(\alpha) > 0$. When $R_p(\alpha) = 0$, however, the principal is indifferent, and would be willing to adopt any $\gamma \in [0, 1]$. Using the reduced-form litigation strategies specified above, we prove the following lemma about the principal's filing decision in the appendix:

Lemma 1. The principal's net expected gain from filing suit, $R_p(\alpha)$, is continuous and strictly decreasing in α . Moreover, holding α fixed, $R_p(\alpha)$ is strictly increasing in D and strictly decreasing in F and b .

The fact that $R_p(\alpha)$ decreases in α is not surprising. Indeed, a marginal increase in α implies that the principal believes it more likely that the agent had previously expended effort. Because high-effort agents are more effective litigators than are their shirking counterparts, one would expect the principal's net expected benefits from filing suit to decrease (as the lemma confirms). Holding α fixed, as the stakes involved in the suit (D) increase, the principal's incentive to sue is analogously enhanced; but, as either the filing fees (F) or the court's proagent bias (b) increase, suit becomes less attractive to the principal. Note at this point that Lemma 1 is partial equilibrium in nature because we have not accounted for the equilibrium relation between α and the deep parameters of the model.

3.3 Effort Stage

Finally, consider the agent's ex ante effort choice, anticipating the subsequent equilibrium behavior characterized above. Recall that γ denotes the probability that the principal litigates. Accordingly, the agent's expected payoff from high effort is

$$w - \gamma(1 - p)(q_H^* D + c_A^H L_A^{H*}) - \phi. \quad (12)$$

Conversely, the agent's expected payoff from low effort is

$$w - \gamma p(q_L^* D + c_A^L L_A^{L*}). \quad (13)$$

Let $R_A(\gamma) \equiv \gamma[p(q_L^* D + c_A^L L_A^{L*}) - (1-p)(q_H^* D + c_A^H L_A^{H*})] - \phi$ denote the net gain the agent expects from expending higher effort. The agent always shirks if $R_A(\gamma) < 0$, and always expends effort if $R_A(\gamma) > 0$. When $R_A(\gamma) = 0$, the agent is indifferent, and thus is willing to mix high and low effort levels. We prove the following lemma about the agent's effort decision in the appendix:

Lemma 2. The agent's net expected gain from expending productive effort, $R_A(\gamma)$, is single-valued, continuous, and strictly increasing in γ . Moreover, holding γ and α fixed, $R_A(\gamma)$ is strictly increasing in D and p , and strictly decreasing in ϕ .

An increase in γ implies that the agent becomes increasingly convinced of the principal's threat to file suit should a low state obtain. Because suit involves both the prospect of damages and litigation costs (which are higher on the margin for a shirking agent), the agent has a greater incentive to expend effort, which both minimizes the likelihood of a low state and enhances the agent's ability to defend against suit. Holding γ fixed, the agent's incentive to expend effort increases with the stakes involved in the suit (D) and the importance of the agent's effort (p). On the other hand, as the immediate cost of effort (ϕ) increases, high effort becomes less attractive to the agent. Note that Lemma 2 does not account for the effects of changes in the parameters D , p , and ϕ on equilibrium litigation, γ , and effort, β .

3.4 Equilibrium

As noted above, we employ the notion of sequential equilibrium to predict rational play of the game. Having computed the equilibrium litigation levels of all player types (i.e., L_p^* , L_A^{L*} , L_A^{H*}), all that remains is to specify behavior strategies (β^* , γ^*) implied by the expressions above and a belief structure for the principal (α^*) that is consistent and sequentially rational. Because each of the principal's relevant information sets is reached with positive probability in this game, consistency is trivially established. Regarding sequential rationality, Bayes' rule requires that the agent's behavior strategy (β) and the principal's beliefs (α) be related as

$$\alpha = \frac{(1-p)\beta}{(1-p)\beta + p(1-\beta)} \quad (14)$$

or equivalently, $\beta = p\alpha / (p\alpha + (1-p)(1-\alpha))$.

Rather than articulating all of the equilibria that can emerge from this model, it is more instructive to consider a subset of the parameter space that manifests the principal qualitative equilibrium characteris-

tics.³¹ Accordingly, we shall hereafter restrict our equilibrium analysis to parameter values satisfying the following two assumptions:

$$\textit{Assumption 1. } F \leq D \cdot \left(\frac{\sqrt{c_A^H}}{\sqrt{c_A^L} + \sqrt{c_A^H}} \right)^2.$$

$$\textit{Assumption 2. } \phi \leq (2p - 1) \sqrt{D \cdot F \cdot \frac{c_A^H}{c_A^L}}.$$

Assumption 1 requires that the fixed costs of filing (F) be small enough to ensure that the principal has the incentive to file suit in the event of a low state (at least with a relatively proplaintiff presumption). Analogously, Assumption 2 requires that the agent’s cost of productive effort (ϕ) be sufficiently small to make effort worthwhile if the agent knows that litigation is certain in a bad state (once again, at least with a relatively proplaintiff presumption). Conceptually these assumptions ensure that the court’s choice of b is an effective policy tool for shaping the parties’ effort and litigation incentives.³²

Under these assumptions, the equilibria of the model fall conveniently into three regions:

Region I: <i>Strong Proplaintiff Presumptions</i>	Region II: <i>Intermediate Presumptions</i>	Region III: <i>Strong Prodefendant Presumptions</i>
$b < \underline{b}$ $\equiv \frac{c_A^H}{c_P} \cdot \left(\sqrt{\frac{D}{F}} - 1 \right)$	$\underline{b} \leq b \leq \bar{b}$	$b > \bar{b}$ $\equiv \frac{c_A^L}{c_P} \cdot \left(\sqrt{\frac{D}{F}} - 1 \right)$

(15)

31. A full description of the equilibria, absent parametric restrictions, is available from the authors.

32. Note also that both assumptions must be satisfied when the damage amount (D) grows large. More generally, a sufficiently large value of D is necessary for our problem to be an interesting one. For example, consider the extreme case where $F > D$, so that damages cannot even cover the fixed costs of filing. Here, Region III (*infra*) is the only viable region, and the unique equilibrium involves shirking by the agent and abstention by the principal. The legal presumption is irrelevant. Alternatively, consider the case where $\phi > (2p - 1) \cdot D$, so that damages are so small as to have no deterrent effect on the agent (even for the most potent proprincipal rule). Once again, in such a situation the agent will always choose to shirk regardless of the evidentiary presumption b . (Our Assumptions 1 and 2 are slightly more restrictive than those implied from above for expositional reasons, as they ensure that corner solutions of the litigation game occur only for relatively “extreme” proplaintiff presumptions).

The boundaries of these regions correspond to the critical values of b at which the underlying presumption has a dispositive effect on the principal's litigation strategy—that is, in Region I, the proplaintiff presumption is so strong that the principal would *always* sue, regardless of her beliefs about the agent's prior behavior; in Region III, the prodefendant presumption is so strong that the principal would *never* sue, regardless of her equilibrium beliefs; and in Region II the underlying presumption is relatively moderate, so that the principal's litigation strategy depends on her beliefs about the agent's prior behavior.

So long as Assumptions 1 and 2 are satisfied, all three regions described in Equation (15) exist and contain unique sequential equilibria. We address each region below.

Strong Prodefendant Presumptions: $b \in (\bar{b}, \infty)$. In Region III, the agent benefits from a prodefendant presumption that is sufficiently strong to deter the principal altogether from filing suit, regardless of her equilibrium beliefs. Thus, any equilibrium in this region must prescribe that the principal employs a pure strategy of abstaining from suing. We show in the appendix that the agent also pursues a pure strategy (shirking):

Proposition 1. If $b \in (\bar{b}, \infty)$ then there exists a unique sequential equilibrium in pure strategies with $\beta^* = 0$, $\gamma^* = 0$, and $\alpha^* = 0$. The equilibrium litigation strategies are given by Equation (8).

Proposition 1 states that if the proagent legal presumption, b , grows sufficiently large, the principal poses no credible threat to file suit. Knowing this, the agent is undeterred from shirking, and therefore always expends low levels of effort.³³ The social cost of this equilibrium consists solely of the costs imposed by suboptimal effort.

Strong Proplaintiff Presumptions: $b \in [0, \underline{b})$. Consider now the opposite case in Region I, where a court adheres to a strong proplaintiff presumption. Here the principal has such a clear upper hand in litigation that she always files suit regardless of her beliefs about the agent type she faces. So long as damages impose a sufficiently strong deterrent effect (as embodied by Assumption 2), one can show that the agent also follows a pure strategy of expending effort:

Proposition 2. If $b \in [0, \underline{b})$ and Assumptions 1 and 2 hold, then there exists a unique sequential equilibrium in pure strategies with $\beta^* = 1$, $\gamma^* = 1$, and $\alpha^* = 1$. The equilibrium litigation strategies are given in Section 3.1 and depend on the sign of $bc_p - (\sqrt{c_A^L} \sqrt{c_A^H} - c_A^H)$.

33. Note also that if a court were free to choose damages as well, it could effect the same outcome by specifying small or zero damages (and thus Region III would span all of b -space). Equivalently this proposition does not depend on either Assumption 1 or Assumption 2.

An important consideration within this subregion is the limiting case $b = 0$. Here the proprincipal presumption is sufficiently inviolate that the agent can never prevail in litigation, and thus the principal need only pay the filing fee F to collect damages. Thus, $b = 0$ reflects a form of strict liability rule favoring the plaintiff. Perhaps more illustratively, such a rule is the doctrinal equivalent of an ordinary incentive contract, paying the agent w in the high state and $w - D$ in the low state (though one that costs the principal F to invoke should the low state obtain).

Intermediate Presumptions: $b \in [\underline{b}, \bar{b}]$. Finally, consider what is perhaps the most observationally familiar region, in which the legal presumption is not preclusive in equilibrium. Region II is also the most interesting from a game-theoretic perspective, because the principal cannot be sure, in equilibrium, whether the agent worked, and the agent cannot know whether he will be sued if the low state occurs. This statement is formalized in the following proposition

Proposition 3. If $b \in [\underline{b}, \bar{b}]$ and Assumptions 1 and 2 hold, then there exists a unique equilibrium in mixed strategies with $\beta^* \in (0, 1)$, $\gamma^* \in (0, 1)$, and $\alpha^* \in (0, 1)$. The equilibrium litigation levels are given by Equation (8).

(The proof is in the appendix.) The mixed strategy equilibria characterizing Region II are similar to those in asymmetric information models of auditing. To understand the core intuition, consider the agent's best response in this region if he conjectured that the principal would never sue. Undeterred by the spectre of legal action, the agent would never give effort. In response, however, the principal would always sue. But if the agent expected suit with certainty in the event of a low state, he would rationally choose to work hard rather than shirk. This cycling iteration of best responses implies that the only equilibrium in Region II must be in mixed strategies, as stated in the proposition.

Implicit differentiation of the principal's and agent's best response functions yields comparative statistics on the players' equilibrium effort and suit strategies as b changes:³⁴

Proposition 4. If $b \in [\underline{b}, \bar{b}]$ and Assumptions 1 and 2 hold, the agent's equilibrium effort strategy β^* is strictly decreasing in b , and the principal's equilibrium filing strategy γ^* is strictly increasing in b .

The intuition behind this proposition is as follows. Consider first the marginal impact of increasing b on the agent's equilibrium effort choice β^* . As the agent's power increases, he becomes increasingly effective at

34. Because the unique sequential equilibrium is in mixed strategies, it is characterized by the equations $R_p(\alpha^*) = 0$ and $R_A(\gamma^*) = 0$, embodying indifference expressions of the principal's and agent's best-response functions.

fending off litigation—a source of confidence that leads him to shirk more often in equilibrium. One might similarly conjecture that increasing b would have the opposite effect on the principal's filing strategy—that is, facing a presumption that is slightly more biased in favor of the agent, the principal would be less likely to file suit in the event of a bad state. Surprisingly, however, Proposition 4 states that increasing b actually *enhances* the principal's proclivity to litigate in the low state. On first blush, this is a surprising result given Lemma 4: all else being equal, larger values of b should reduce the principal's expected payoff from filing. This reasoning, however, fails to account for the fact that *in equilibrium*, a larger b also induces the agent to reduce his effort in the primary activity. Knowing this, the principal is more confident that the agent's shirking has contributed to the realization of a low state, which increases her incentive to sue. When Assumptions 1 and 2 are satisfied, this indirect equilibrium effect more than offsets the direct incentive effect, thereby leading to a greater likelihood of suit when a low state occurs.³⁵ Note that γ^* is the probability of suit *conditional* on being in a low state. However, the likelihood of arriving in the low state depends on the probability β^* that the agent gives effort and is given by $\beta^*(1 - p) + (1 - \beta^*)p$. From Proposition 4 we also know that the agent is more likely to shirk when b increases (β^* is decreasing), thus the likelihood of arriving at the low state increases and the unconditional probability of suit increases *even more* than the conditional probability of suit when the judicial bias increases in favor of the agent.

The increase in litigation rates predicted by Proposition 4 is not simply a theoretical anomaly. The Private Securities Litigation Reform Act of 1995 mentioned in the introduction favored defendants, yet after an initial decline, litigation increased to unprecedented levels by the end of 1998. In the context of our model, although prodefendant assumptions make it more difficult for plaintiffs to win, a more protective rule leads to more shirking. To respond to and to deter such additional inappropriate behavior, optimizing plaintiffs resort to more litigation and even win more often in equilibrium (see our Section 5.1 *infra* for more details about this application).

A number of corollaries are direct implications of Proposition 4 which deserve particular attention:

Corollary 4.1. If $b \in [b, \bar{b}]$ and Assumptions 1 and 2 hold, the equilibrium rate of plaintiff victories against high-effort agent types, q_H^* , is strictly decreasing in b .

35. It is important to note, of course, that this result is a local one. If b increases so much, say, as to move it out of Region II and into Region III, the probability of litigation would fall discontinuously from γ^* to 0.

Corollary 4.2. If $b \in [\underline{b}, \bar{b}]$ and Assumptions 1 and 2 hold, the equilibrium rate of plaintiff victories against low-effort agent types, q_L^* , is strictly decreasing in b .

Corollary 4.3. If Assumptions 1 and 2 hold, there exists a $\hat{b} \in (\underline{b}, \bar{b})$ such that the ex ante equilibrium rate of plaintiff victories, $\alpha^* q_H^* + (1 - \alpha^*) \cdot q_L^*$, is strictly increasing in b for all $b \in [\hat{b}, \bar{b}]$.

Corollary 4.1 states that the probability of a “false positive” (i.e., a high-effort agent who is nonetheless found liable) decreases over Region II as the presumption becomes more prodefendant. On the other hand, Corollary 4.2 implies that the probability of a “false negative” (i.e., a low-effort agent who is nonetheless exonerated) increases in Region II as the strength of the defendant’s presumption increases.³⁶ Clearly then, the setting of a presumption in this region necessarily involves trading off false positives against false negatives. Stronger prodefendant presumptions minimize the former, while weaker ones minimize the latter.³⁷ While this conclusion seems intuitive, Corollary 4.3 is perhaps more surprising. Indeed, even though the conditional probabilities of plaintiff victory against both agent types decrease in b , the ex ante win rate of the plaintiff *increases* over a portion of Region II. The reason for this observation is similar to that for Proposition 4. As b increases, the agent becomes more likely to shirk in equilibrium, which tends to increase the *average* plaintiff victory rate, even though defendants of both types are getting stronger.

3.5 Numerical Examples

In order to illustrate more concretely the essence of the results reported in Propositions 1–4, we pause here to consider some numerical examples, fixing all parameters of the model except for the legal presumption, b . As an analytic “baseline,” consider the case in which $p = 0.55$, $V_H = 100$, $V_L = 80$, $c_P = 1.5$, $c_A^H = 1.0$, $c_A^L = 1.5$, $\phi = 0.6$, $F = 4$, and $D = 20$.

Figure 2 illustrates the agent’s and principal’s respective equilibrium strategies in this baseline case, as functions of the underlying presump-

36. The probability of a “false negative” is simply $(1 - q_L^*)$. Note that this value does not include the $(1 - \gamma^*)$ fraction of shirking defendants who are never sued, which is also decreasing in b .

37. It should be noted, of course, that simply comparing the probabilities of Type I and Type II errors is often insufficient unless one also has an idea about the costs associated with each. Although it is sometimes possible simply to assume that such costs are exogenous [Rubinfeld and Sappington (1987)], such an approach is clearly inadequate for our purposes. For example, consider the lower portion of Region II, just above \underline{b} . Here the agent’s equilibrium strategy is to expend effort nearly all of the time, and thus most defendants are likely to have worked hard. Consequently the practical cost of false positives is much larger than that of false negatives. The opposite tends to hold true in the upper portion of Region II.

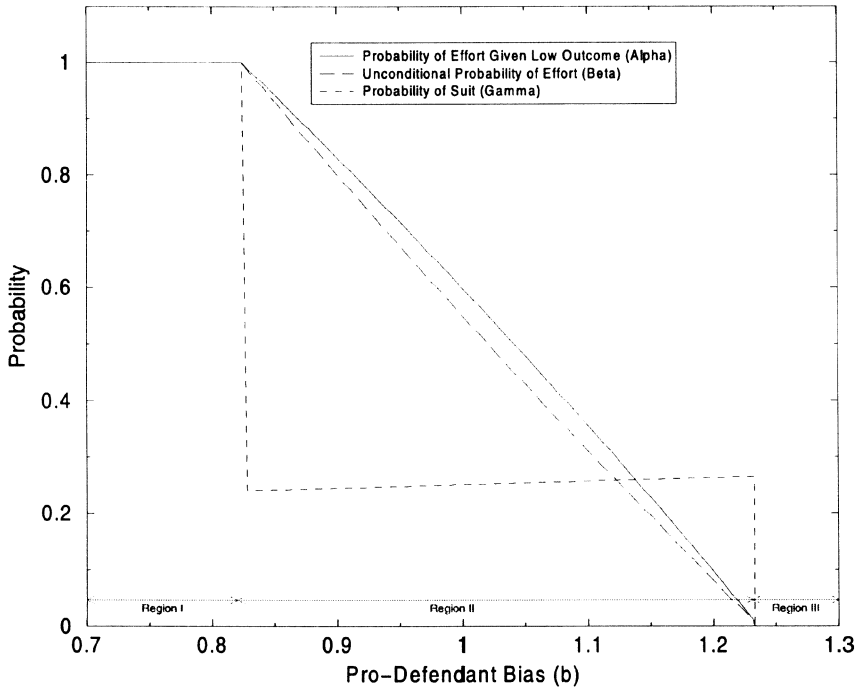


Figure 2. In-equilibrium probability of agent effort and principal litigation as a function of prodefendant bias b . For small values of b (Region I), courts favor the principal, who always sues which in turn induces the agent (manager) to always exert effort. For larger values of b (Region III), courts favor the agent, who always shirks knowing that he will not be sued. For intermediate values of b (Region II), courts have moderate preferences, which induces the agent to sometimes work and the principal to sometimes sue if the outcome is negative. The model parameters for this figure are $\rho = 0.55$, $V_H = 100$, $V_L = 80$, $c_p = 1.5$, $c_A^H = 1.0$, $c_A^L = 1.5$, $\phi = 0.6$, $F = 4$, and $D = 20$.

tion, b . As the figure illustrates, the equilibrium outcome falls into three qualitative regions as b varies. Presumptions in Region I ($b < \underline{b} = 0.825$) favor the plaintiff heavily, and thus generate a unique pure strategy equilibrium in which the agent always gives effort and the principal always files suit. Conversely, Region III presumptions ($b > \bar{b} = 1.236$) favor the defendant heavily, and support a unique equilibrium in which the agent never expends effort and the principal never files suit. Intermediate presumptions in Region II clearly involve mixed strategy equilibria, in which the agent sometimes gives effort and the principal sometimes sues. Note that the figure also illustrates the counterintuitive result (within Region II) that is predicted by Proposition 4: altering the underlying presumption slightly in favor of the defendant decreases the frequency with which the agent expends effort, and increases the probability that the principal files suit. Finally, note from the figure that the principal's equilibrium belief about whether the

agent has worked hard (α^*) is strictly smaller than the agent's actual likelihood of working hard (β^*) because the agent's effort strategy is chosen unconditionally while the principal's beliefs are conditional on a low state obtaining—a contingency that conveys at least some information to the principal about the agent's true actions.

Figure 3 illustrates the principal's probability of winning for all values of b in Region II. The figure assumes essentially the baseline parameters, except we reduce from c_A^H from 1.0 to 0.25 for illustrative purposes. As predicted by Corollaries 4.1–4.3, the principal's win rate is decreasing in b when facing either a high-effort or a low-effort agent. Moreover, for fixed b the probability of success against a low-effort agent is greater than against a high-effort agent. However, as b increases the principal is more likely to face an agent who has shirked, consequently, the principal's *expected* win rate in equilibrium may increase over some range of b in Region II.

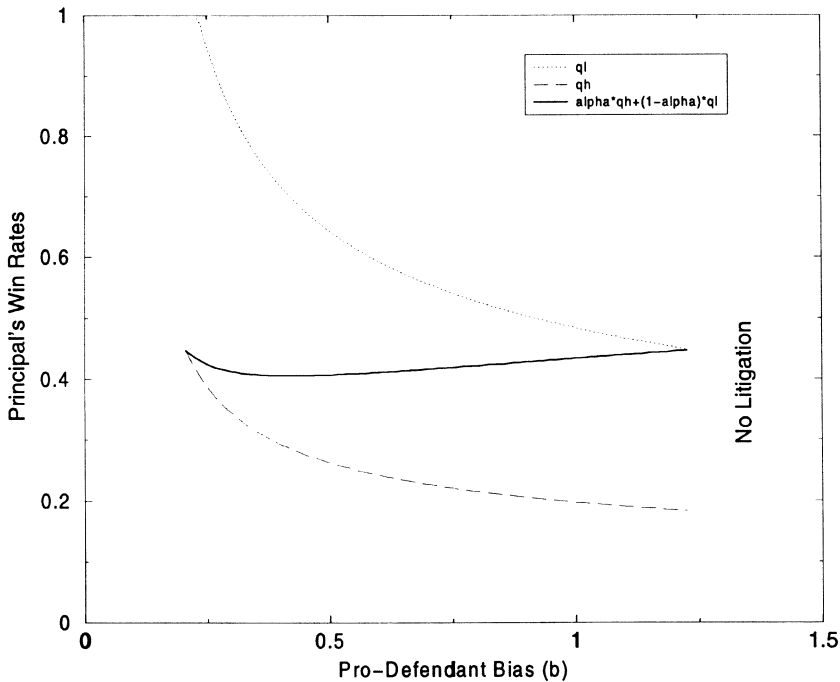


Figure 3. In-equilibrium probabilities of winning a suit. Holding agent effort constant, the probability that the principal wins decreases in the court bias in favor of the defending agent. However, this induces the agent to shirk more often. The in-equilibrium probability of the principal winning a legal action if brought by the principal first decreases and then increases with the prodefendant legal presumption. The model parameters for this figure are $p = 0.55$, $V_H = 100$, $V_L = 80$, $c_P = 1.5$, $c_A^H = 0.25$, $c_A^L = 1.5$, $\phi = 0.6$, $F = 4$, and $D = 20$.

4. Optimal Presumptions

Given the equilibrium behavior specified above, it is now possible to ask how a welfare-maximizing court might wish to set its evidentiary presumption b .³⁸ It is here where the fundamental trade-off of interest in this article takes center stage. Indeed, by combining the costs of moral hazard and redistributive efforts, the model exposes two fundamental sources of economic waste: (1) suboptimal effort by the agent, and (2) costly litigation. Although the welfare considerations in the model are somewhat complex, all of them involve an attempt to balance these competing two sources of economic waste.³⁹

4.1 Sources of Inefficiency

The first potential source of waste emerges from the moral hazard problem of the agent. If the agent gives effort, the total value to society is $pV_H + (1 - p)V_L - \phi$, but if the agent does not give effort the total value is $(1 - p)V_H + pV_L$. Thus if the agent puts forth effort with probability β^* , the cost to society of suboptimal effort is

$$(1 - \beta^*)[(2p - 1) \cdot (V_H - V_L) - \phi]. \quad (16)$$

The second potential source of waste emerges from the resources expended by the parties in the litigation stage. Because litigation is a zero-sum redistributive game, the costs borne in conducting it are dissipative. Conditional on being in the low state, the expected equilibrium litigation costs are

$$\gamma^* \cdot [\alpha^* \cdot (c_A^H L_A^{H*}) + (1 - \alpha^*)(c_A^L L_A^{L*}) + c_P L_P^* + F]. \quad (17)$$

If the agent puts forth effort with probability β^* , then the probability of a low state obtaining is $\beta^*(1 - p) + (1 - \beta^*)p$. Thus the ex ante expected litigation costs are

$$\gamma^* \cdot [\beta^*(1 - p) + (1 - \beta^*)p] \cdot [\alpha^* \cdot c_A^H L_A^{H*} + (1 - \alpha^*) \cdot c_A^L L_A^{L*} + c_P L_P^* + F]. \quad (18)$$

38. Such an inquiry presupposes, of course, that courts have the ability to commit the jury (when present) to such a presumption. Some mechanisms for doing so (such as exclusion of evidence) are likely to be extremely effective, while others (such as admission of evidence for limited purposes) are probably less so. To this end, jury commitment problems constitute a constraint of our normative inquiry.

39. In the analysis that follows we ignore the effects of external costs and benefits of litigation. For instance, if the parties' use of the court system is partially subsidized by the public, the welfare analysis below would tend to understate the social costs of litigation. If, on the other hand, the precedents that emanate from litigation represent a valuable public good for future litigants [e.g., Fiss (1984)], then the analysis would tend to overstate the social costs of litigation. Adding these various costs and benefits to the analysis below is possible, but its effects are largely quantitative rather than qualitative.

4.2 Welfare Analysis

Given the two components of inefficiency described above, we can now consider the problem of choosing the value of b that maximizes social welfare (or, equivalently, minimizes social waste). Because the social welfare considerations in this model are complex, we find it more convenient to illustrate them in a series of examples. To this end, Figure 4 illustrates the productive waste—litigative waste and total waste—that the model can generate.⁴⁰ The optimal presumption b is indicated by the arrow.

Figure 4A introduces the parameter base case: $p = 0.55$, $V_H = 100$, $V_L = 80$, $c_P = 1.5$, $c_A^H = 1.0$, $c_A^L = 1.5$, $\phi = 0.6$, $F = 4$, and $D = 20$. Here the optimal presumption is in Region III, and is so defendant-friendly ($b^* \geq \bar{b} = 1.236$) as to be tantamount to absolute immunity. Such an outcome is justified from a social-welfare perspective if the value from effort does not justify its direct and indirect costs. In particular, an immunity rule is globally optimal when the social benefit from effort ($p \cdot (V_H - V_L)$) is low relative to the costs of effort (ϕ) and/or the fixed costs of litigation (F).⁴¹

In Figure 4B, we reduce the fixed costs of litigation to $F = 2.75$. Here filing costs are sufficiently small relative to the benefits of effort that the optimal legal presumption b becomes extremely plaintiff friendly (indeed zero), thus inducing the principal always to file suit. Moreover, after sinking the filing fee F , the principal need only spend a minute amount in court to ensure victory.⁴² Likewise, the proplaintiff presumption is so strong that defendant never mounts a defense, regardless of whether he previously exerted high or low effort. Finally, knowing that he will be held strictly liable in the event of a low state, the agent always expends effort.

40. The parameter values used for our comparative statics illustrations below may sometimes violate Assumptions 1 and/or 2. In such cases, there may exist multiple equilibria in Regions I and II. However, when more than one equilibrium exists we consider only the equilibrium that minimizes social waste.

41. It is straightforward to show that if the social costs of effort exceed the benefits (that is, if $(2p - 1) \cdot (V_H - V_L) \leq \phi$), then the optimal—in fact the first-best—legal presumption is any $b > \bar{b}$. But even in situations where the agent's effort is socially desirable viewed alone, an effective immunity rule may still be optimal when the costs of filing suit (F) are large.

42. Indeed, the optimal proplaintiff presumption in Region I ($b = 0$) yields less equilibrium waste than does the optimal prodefendant presumption in Region III ($b > \bar{b}$) if and only if $(1 - p)F < (2p - 1)(V_H - V_L) - \phi$. Once again, we reiterate that our analysis excludes the possibility of suit in the high-payoff state. Were it possible for the principal to sue and recover the same damages in the high-payoff state, then extremely proplaintiff presumptions would never be optimal, because the principal would always file suit (and win) and thus the agent would never expend effort. Such an outcome would be dominated by an extremely prodefendant rule, as it would obviate filing costs with no effect on effort.

Figure 4C deviates from the base case in a different fashion, reducing the high-effort agent's marginal litigation costs to $c_A^H = 0.5$. Here, interestingly, the optimal presumption is now in Region II, at $b^* = \underline{b} = 0.412$, somewhere between a rule of absolute immunity (as in Figure 4A) and strictly liability (as in Figure 4B). The reason for this intermediate optimum stems from the fact that the marginal cost "wedge" separating high-effort and low-effort agent types is now relatively large. As such, the expected litigation costs and damages visited upon a shirking defendant in equilibrium are much larger than for a working defendant, who can use her cost advantage to mount a relatively successful defense. Moreover, although the litigation costs are still significant ($F = 4$), the threat of litigation creates an important deterrence effect, thereby justifying (probabilistic) costs of filing suit in the mixed strategy equilibrium.⁴³

A curious feature of Figure 4C is that the optimal presumption is on the left-hand boundary of Region II. One might justifiably wonder whether it is possible to have an optimal presumption in Region II that lies strictly on the interior of the region. It turns out that it is possible, as demonstrated in Figure 4D, which reduces the high-effort agent's litigation costs even further to $c_A^H = 0.25$. In cases like this one, the trade-off between productive and litigation waste is most palpable: as b increases, waste due to suboptimal effort increases, while litigation waste decreases. The interior optimum occurs at the point where the marginal costs of suboptimal effort are exactly offset by the marginal benefits of reducing litigation waste.⁴⁴

Figure 5 illustrates the effect of increases in c_A^H on the optimal legal presumption. In general, as the difference between c_A^H and c_A^L increases, the expenditure of litigation expenses becomes a more efficient mechanism for signaling effort. In such situations, it tends to be optimal to move away from either a strong proplaintiff or prodefendant presumption.

Finally, Figure 6 illustrates how the optimal b tends to respond to changes in $((2p - 1)(V_H - V_L))/\phi$ the ratio of the principal's benefits from effort to the agent's costs of effort. When this ratio is small [i.e., p

43. For very small fixed costs F , of course, it is optimal to set $b = 0$ because litigation costs will only involve filing fees and the agent will give effort with probability one. For higher values of F (as in Figure 4C), however, it may be optimal to choose intermediate values of b in order to induce probabilistic litigation and economize on fixed costs. While this also increases marginal litigation costs, it also increases deterrence and economizes on the fixed costs of filing suit.

44. As should be clear from Figure 4C, the optimum presumption in Region II sometimes occurs at the boundary of the region. The reason for this effect is simple. Although increasing b always increases effort waste, it can either increase or decrease litigation waste on the margin; in particular, the variable costs of litigation (once invoked) depend on whether the increased b moves the relative litigation strengths of the parties toward equality or further tips the balance in favor of the agent.

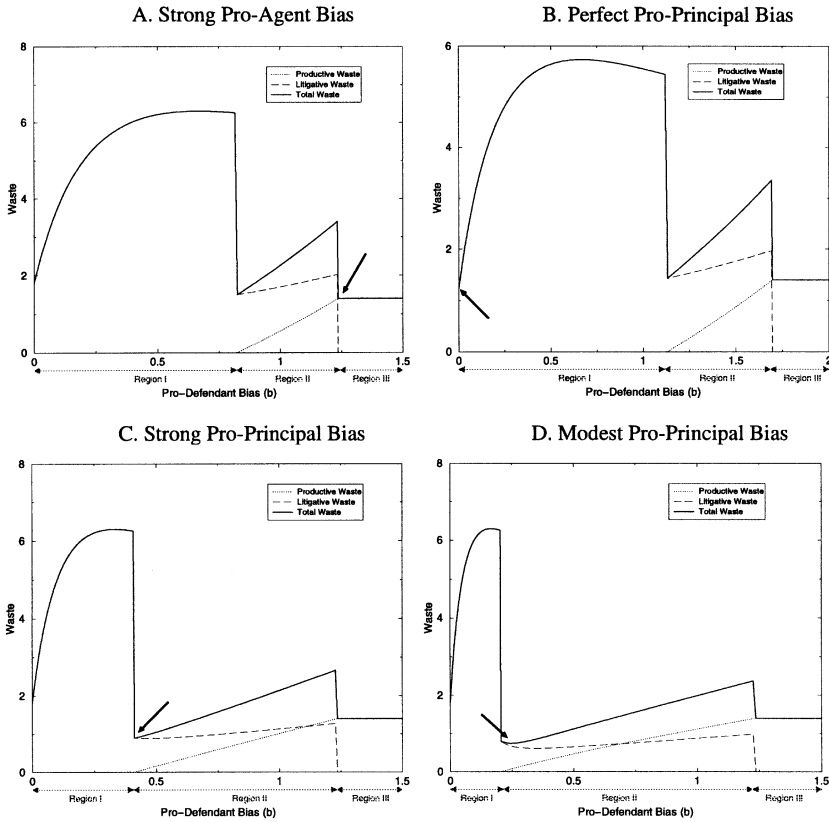


Figure 4. Social waste as a function of prodefendant bias. These figures plot social waste, consisting of productive and litigative waste for four different sets of parameters, a base case (A) and three variations thereon. Graph A shows a case in which parameters are such that courts should favor the defendant to preclude litigation. (The arrow indicates the optimal presumption b .) Graph B shows a case in which courts should favor the principal so that she always files suit and wins. Graph C shows a case in which courts should moderately favor the principal, so that she files suit only sometimes, which economizes on socially wasteful litigation filing costs. Graph D shows that parameters can be such that the optimal presumption is a smooth interior: agents sometimes work and principals sometimes sue. The parameters in the base case (A) are $\rho = 0.55$, $V_H = 100$, $V_L = 80$, $c_P = 1.5$, $c_A^H = 1.0$, $c_A^L = 1.5$, $\phi = 0.6$, $F = 2.75$, and $D = 20$. Graph B reduces the fixed cost of filing suit (F) to 2.75. Graph C reduces the marginal cost of filing suit for a hard working agent (c_A^H) to 0.5. Graph D reduces c_A^H to 0.25.

is small, ($V_H - V_L$) is small, or ϕ is large], the principal's benefit from effort does not justify inducing the agent to incur the private cost of effort, and thus eliminating litigation waste is more important than deterrence. By making b large enough (favoring the agent) the court can guarantee a no-effort, no-litigation equilibrium. Conversely, when the ratio is high, it is more important to eliminate waste due to

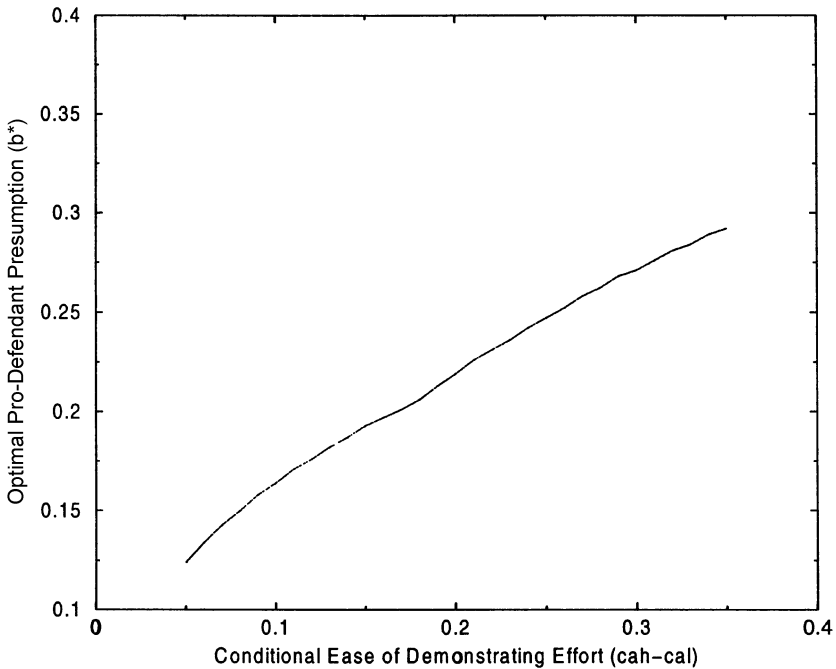


Figure 5. The socially optimal legal presumption as a function of differential court costs for shirking and nonshirking agents. As it becomes more difficult for a shirking agent to mount a defense (c_A^L increases relative to c_A^H), the socially optimal legal presumption b^* shifts in favor of the principal to continue encouraging in-equilibrium litigation. This in turn allows hardworking agents to separate themselves from shirkers. The model parameters for this figure are $p = 0.55$, $V_H = 100$, $V_L = 80$, $c_p = 1.5$, $c_A^L = 1.5$, $\phi = 0.6$, $F = 4$, and $D = 20$.

suboptimal effort. By choosing b small enough the court can make litigation more likely, which gives the agent incentive to give effort to avoid the low state.

5. Applications

The analytical arguments presented above provide useful predictions and intuitions that facilitate one's understanding both of positive and normative characteristics of legal presumptions. This section explores three such applications: (1) the surprising trends in federal class action litigation since the passage of the Private Securities Litigation Reform Act of 1995; (2) the "business judgment rule" (BJR) in corporate fiduciary law; and (3) the application of fiduciary principles in debtor-creditor relations.

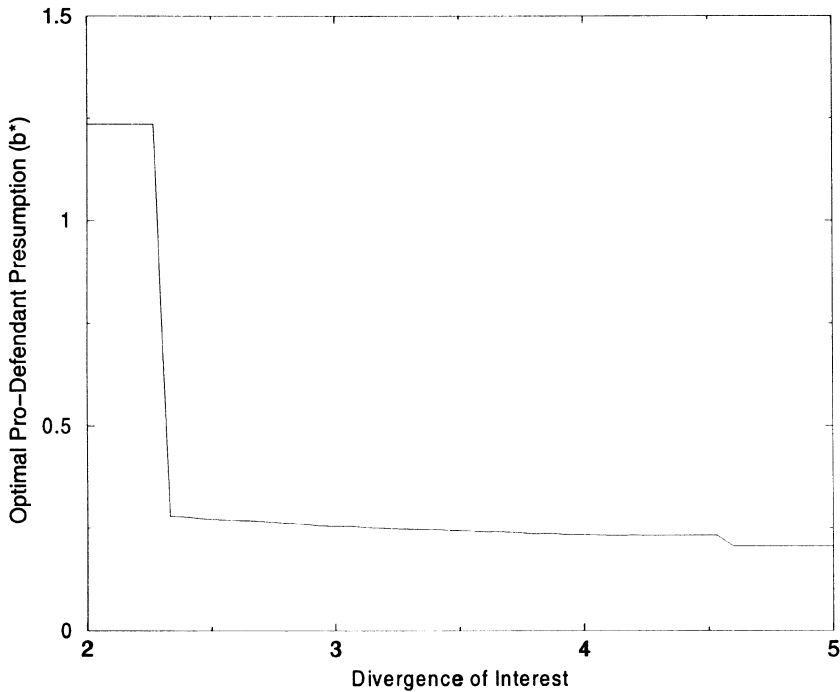


Figure 6. The socially optimal legal presumption as a function of the conflict of interest between principal and agent. When the conflict of interest between principal and agent is low [defined as $(2p - 1)(V^H - V^L) / \phi$], as it is in ordinary times, the socially optimal legal presumption b^* is solidly in favor of the agent (the manager) in order to discourage redistributive rent seeking. When the conflict of interest increases, as it does in a hostile takeover situation and especially when there are competing nonfriendly bidders, the socially optimal legal presumption b^* shifts in favor of the principal (the shareholders). The model parameters for this figure are $V_H = 100$, $V_L = 80$, $c_P = 1.5$, $c_A^H = 1.0$, $c_A^L = 1.5$, $\phi = 0.6$, $F = 4$, and $D = 20$.

5.1 Federal Securities Litigation after the 1995 Reform Act

In December 1995, Congress overrode a presidential veto to enact the Private Securities Litigation Reform Act (PSLRA).⁴⁵ The act, which became effective in January 1996, altered discernibly the substantive and procedural hurdles for filing a securities class action under federal law. Although the PSLRA's procedural reforms were multifaceted, virtually all of them had the intent and effect of advantaging securities fraud defendants relative to the status quo ante. For instance, the act requires plaintiffs who seek money damages now to plead with particu-

45. Private Securities Litigation Reform Act, Pub. L. No. 104-67, 109 Stat. 737 (1995) (codified in scattered sections of 15 U.S.C.).

larity facts giving rise to a strong inference that the defendant acted with the required state of mind for the underlying offense (1934 Act § 21D(b)(2)). Moreover, most circuit courts have interpreted the act as elevating the scienter requirement itself, and many now mandate that the plaintiff specifically allege and prove an extreme form of recklessness, and even a knowing state of mind in cases involving forward-looking statements within the act's safe-harbor provision.⁴⁶ In addition, the PSLRA requires (among other things) a mandatory stay on all pretrial discovery pending the resolution of any motions to dismiss.⁴⁷

A principal articulated purpose of the PSLRA was to reduce litigation rates.⁴⁸ Surprisingly, however, the act appears substantially to have failed in this regard, at least in the medium term. Figure 7 illustrates the number of publicly traded companies against whom federal class actions were filed in each quarter from 1991 through the second quarter of 1999. As one can see from the figure, the act was apparently successful (at least initially) in dampening the filing of class action lawsuits. However, by midway through 1997, the number of firms sued had returned roughly to the average pre-1996 level. By the end of 1998 it was more than 30% above its preact level, and is once again on a record pace in 1999.

46. The act imposes a "safe harbor" for any forward-looking projection that also conveys meaningful cautionary language about the potential lack of accuracy of such projections. This safe harbor applies regardless of whether the private action is brought by the Securities Act of 1933 or the Securities Exchange Act of 1934 (see 1933 Act § 27A; 1934 Act § 21E). As to cases not involving forward-looking statements, the exact quantum of scienter required has become an item of disagreement among the Circuit Courts. The Second and Third Circuits require that a plaintiff plead recklessness, but deem the test to be satisfied circumstantially if the plaintiff can allege with specificity that the defendant had a clear motive and opportunity to commit securities fraud [*Donald Press, et al. v. Chemical Investment Services Corp., et al.*, 166 F.3d 529 (2nd Cir. 1999)]; In Re: Advanta Corp. Securities Litigation, 180 F.3d 525 (3rd Cir. 1999)]. This test was considered to be the most restrictive in the country before PSLRA, but now may be the weakest. The Sixth Circuit has adopted a more stringent test, requiring direct proof sufficient to create "a strong inference of reckless behavior" and disallowing circumstantial proof. (In Re: Comshare, Incorporated Securities Litigation, 1999 WL 460917, Fed.Sec.L.Rep. 90,513.) Finally, the Ninth Circuit has adopted the harshest test of all, also disallowing circumstantial proof and requiring that the plaintiff establish "deliberate or conscious recklessness." [In Re: Silicon Graphics Inc. Securities Litigation, 1999 WL 595194, Fed.Sec.L.Rep. P90,512, 99 Cal. Daily Op. Serv. 6339 (9th Cir. 1999).]

47. In addition to these reforms, the PSLRA also mandated proportional (rather than joint and several) liability for all but knowing violations of law, and mandated that courts conduct a "Rule 11" inquiry as a matter of course at the end of an action.

48. See, for example, H.R. Rep. 104-50, 104th Cong., 1st Sess. 16 (1995) ("H. Rep."); Statement of Managers, "Private Securities Litigation Reform Act of 1995," H.R. Rep. 104-369, 104th Cong. 1st Sess. at 31). Of particular importance to members of Congress was the degree to which securities litigation involved meritless claims. 141 Cong. Rec. H13699 (daily ed. Nov. 28, 1995) ("Statement of Managers").

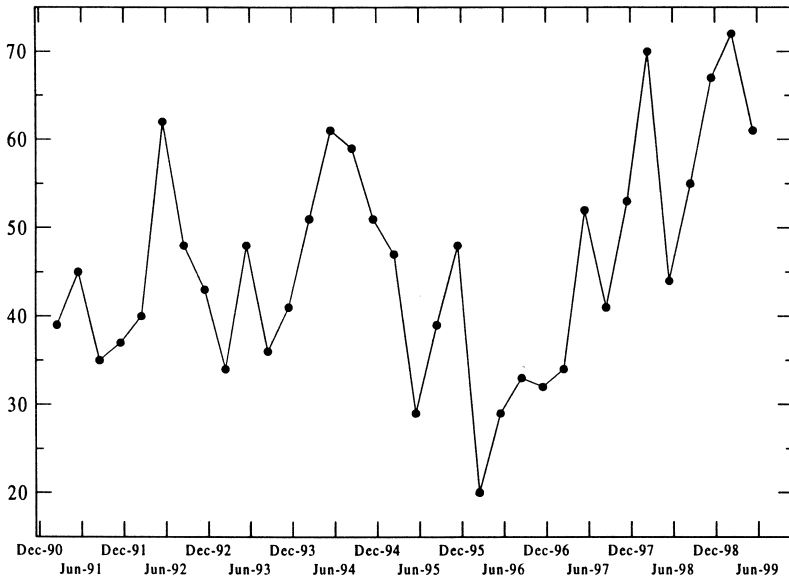


Figure 7. Class-action filing against publicly traded firms before and after the 1995 PSLRA. The figure tracks quarterly filings by the number of firms sued (rather than by total number of suits). The source is the *Securities Class Action Alert*.

The trend noted in Figure 7 is robust to a number of alternative measurement approaches. Indeed, a virtually identical pattern recurs if one measures litigation *rates* rather than aggregate numbers of filings.⁴⁹ Moreover, if one accounts for the fact that securities actions are historically countercyclical with market performance, the growth in filings during 1997 and the first half of 1998 (when capital markets were booming) appear to be particularly stark.⁵⁰

49. The litigation rates for securities class actions (i.e., number of companies sued as a fraction of total public corporations) has once again regained its preact prominence. From 1993 to 1999, the annual litigation rates are as follows:

1993	1.81%
1994	2.34%
1995	1.89%
1996	1.36%
1997	1.42%
1998	2.03%
1999*	2.43%

(B12)

**Estimated*. Source: Securities Class Action Alert, at 50 (June 1999).

50. Foster et al. (1999) estimate that the market-corrected litigation rate has increased by more than half since 1995.

The unambiguous medium-term effects of the PSLRA on class action litigation rates have left a number of legal experts searching for a cogent explanation [Grundfest, Lerach, and Snow (1999)]. However, such effects are perfectly consistent with the predictions of our model. If (as seems apparent) the Reform Act has functioned systematically to benefit defendants, then the aggregate effect of the PSLRA can be represented by a small increase in the prodefendant bias as measured by the parameter b . Recall that one of the more surprising results from our model concerns the relationship between the underlying presumption and litigation rates. Our analysis predicted—seemingly ironically—that marginally increasing b would generally result in a *higher* probability of suit within a given plaintiff-defendant pair (both conditional on a harm occurring and unconditionally).⁵¹ Aggregating this effect across firms, the increased likelihood of suit per issuer should manifest itself in the long run as a larger rate of filings within the population—exactly the trend we observe empirically.⁵²

This reasoning, of course, does not shed light on the obvious *initial decline* in federal class action filings during 1996 and early 1997. However, there are a number of possible explanations for these short-term effects, all of which are consistent (or at least not inconsistent) with our model. For example, the initial decline may well have represented a disequilibrium effect, if—as is often true—there is some time lag between the alleged act(s) of fraud and its detection and/or filing of an action. In the presence of an enforcement lag, suits filed just after the effective date of PSLRA would necessarily involve allegations of fraud that occurred principally during the *preact* period—a time in which defendants enjoyed less protection under a weaker presumption, and thus (the model would predict) were more deterred from engaging in misconduct. Consequently, the representative plaintiff considering filing a case in early 1996 would tend to believe that her complaint was about as meritorious as one filed in 1995, but that she would now have to overcome a more difficult set of procedural hurdles. After defendants start to adjust their primary behavior to the reformed law, however,

51. This assumes, of course, that both the pre- and postreform presumption is within the “intermediate” Region II. Clearly, an extremely large reform that increased the prodefendant presumption by an arbitrarily large amount would foreclose any litigation whatsoever. This has obviously not occurred.

52. It is important to note that Figure 7 tracks *filing* rates rather than win rates to measure the equilibrium effects of legal change. As Priest and Klein (1984) have aptly demonstrated, the selection biases created by settlement activity significantly conflate the task of measuring legal change by examining equilibrium win rates. On the other hand, filing rates are more closely associated with the expected value of a legal action (regardless of whether the action is eventually resolved through settlement or litigation).

plaintiffs may once again become sufficiently confident to file suit.⁵³ Alternatively, the initial downward effect may well have reflected an initial migration of filings away from federal and toward state courts [Perino (1997)]—a trend that appears to have reversed itself in recent years on its own accord, and was virtually eliminated this year when the Uniform Standards Act of 1998 went into effect, preempting most class actions filed under state blue-sky laws with federal securities law.⁵⁴ But whatever the reason for this initial decline, it seems clear that if anything, the longer-term effect of the PSLRA has been to increase rather than decrease the incidence of securities litigation. Our model offers a plausible reason why.

5.2 The Business Judgment Rule

In addition to shedding light on the empirical effects of litigation reform experiments, our analysis also animates possible efficiency interpretations of a number of existing legal doctrines. One such application that seems particularly relevant is fiduciary duty law. Within every American jurisdiction, corporate officers and directors (i.e., “fiduciaries”) are legally bound when making managerial decisions to subordinate their own interests to that of the company.⁵⁵ Under prevailing doctrine, courts distinguish between fiduciary duties of *care* and *loyalty*. The *duty of care* proscribes managerial negligence, requiring that a corporate fiduciary exercise the same degree of skill and diligence that a reasonably prudent person would exercise.⁵⁶ The *duty of loyalty* proscribes managerial conflicts of interest, and prohibits fiduciaries from engaging in unfair self-dealing at the expense of shareholders.⁵⁷

53. An obvious objection to this argument is that one might expect rational defendants to anticipate the lag effect and alter their primary behavior sometime before the effective date of the statute. While possible, this objection is somewhat unlikely on at least two grounds. First, the lag between fraudulent activity and realization of harm may not be known with certainty, and thus issuers might have been reluctant to alter their strategies until the act was in effect. And second, the PSLRA was enacted over a presidential veto, and the willingness (if not the ability) of Congress to override the veto remained unclear until December 22, 1995.

54. Securities Litigation Uniform Standards Act of 1998 (“Uniform Standards Act”) (codified in scattered sections of 15 U.S.C.).

55. For example, *Dodge v. Ford Motor Co.*, 170 NW 688 (Mich 1919). Fiduciary duties are present not only in corporations, but also in partnerships, limited partnerships, limited liability companies, and other statutory forms of business organization. For a review, see Talley (1999).

56. See Clark (1986). In a typical duty-of-care case, a shareholder might argue that an officer or director spent inadequate time becoming informed about the substantive terms of a merger agreement. For example, *Smith v. Van Gorkom*, 488 A.2d 858 (Del. 1985).

57. In a typical duty-of-loyalty complaint, a shareholder might allege that a fiduciary unfairly engaged in interested transactions with the firm on lopsided terms, or appropriated new business opportunities for her own account without giving the firm a right of first refusal. For example, *Broz v. Cellular Information Systems*, 673 A.2d 148 (Del. 1996). For a general review, see Talley (1998).

Both the care and loyalty doctrines involve classic problems of hidden action, in which the corporate fiduciary reduces shareholder welfare by acting in a self-interested fashion (by either withholding effort or converting corporate property). Nevertheless, the judicial treatment of duty-of-care and duty-of-loyalty cases is distinct. The largest symptom of this difference is the well-known “business judgment rule” (BJR), which applies solely to duty-of-care cases. Although generally omitted from corporate statutes,⁵⁸ the BJR is nearly universally utilized by courts, and it embodies a strong legal presumption that the fiduciary has exercised due care in discharging her duties.⁵⁹ Although the BJR is not completely preclusive, when applicable it imposes on a shareholder-plaintiff a heavy burden of demonstrating willful, reckless, or grossly negligent behavior by a corporate fiduciary.⁶⁰

In contrast, the BJR is largely inapplicable within duty-of-loyalty suits. In fact, a plaintiff alleging disloyalty need only demonstrate the existence of a corporate transaction or action that involves a conflict of interest with a director or officer, at which point the evidentiary burden shifts, and the defendant must demonstrate either that the transaction was “fair” to the corporation, or (more commonly) that it was procedurally authorized, approved, or ratified by disinterested board members or shareholders (8 Del.C. § 144 (a)–(c)). Because of the BJR’s inapplicability in the duty-of-loyalty context, such cases are perceived to be easier for shareholders to win than are their duty-of-care counterparts.

Because of this disjuncture, perhaps the most interesting fiduciary duty cases are those that involve both care and loyalty concerns. In

58. The Revised Model Business Corporation Act’s Section 8.30, for example, attempts to spell out general duties for corporate directors, but it does not articulate the standards by which their comportment is judged. RMBCA § 8.30 (off’l cmt.) (“In light of . . . continuing judicial development, section 8.30 does not try to codify the business judgment rule That is a task left to the courts and possibly to later revisions of this Act”).

59. In perhaps the most famous duty-of-care case of the last generation, *Smith v. Van-Gorkom*, 488 A.2d 858 (Del. 1985), the Delaware Supreme Court described the BJR as follows:

Under Delaware law, the business judgment rule is the offspring of the fundamental principle, codified in 8 Del.C. § 141(a), that the business affairs of a Delaware corporation are managed by or under its board of directors *The rule itself ‘is a presumption that in making a business decision, the directors of a corporation acted on an informed bases, in good faith, and in the honest belief that the action taken was in the best interests of the company’*

Id. at 872 (quoting *Aronson v. Lewis*, 473 A.2d 805, 812 (Del. 1984)) (emphasis added).

60. See, for example, Ind. Code Ann. § 23-1-35(1)(e)(2) (1998) (requiring either “willful misconduct or recklessness”). In addition, in most jurisdictions the shareholder-plaintiff must demonstrate the fiduciary’s recklessness in *investigating* the decision (shielding the fiduciary’s exercise of judgment once the investigation is complete).

particular, in the context of hostile takeovers, fiduciaries of target corporations typically have mixed motives for resisting outside suitors. On the one hand, because hostile acquisitions frequently forebode managerial shake-ups [e.g., Martin and McConnell (1991)], incumbent fiduciaries may well have self-preservational incentives for implementing defensive measures. On the other hand, if managers were unable to resist, a tender offer could undershoot the firm's true residual value if prevailing share prices are depressed (due, for instance, to transitory market pathologies or as yet undisclosed corporate profitability). Moreover, by resisting, managers may induce potential suitors to up the ante in their bids for control.

Perhaps not surprisingly, courts have had a difficult time categorizing these hostile-takeover cases. Delaware, for example, has oscillated on the level of scrutiny afforded defensive measures. Historically, Delaware courts had applied the BJR to all such cases unless the complaining shareholders could demonstrate that the primary motive behind the defense was managerial/directorial entrenchment [e.g., *Johnson v. Trueblood*, 629 F.2d 287, 292-3 (3rd Cir. 1980) (applying Delaware law)]. The ease with which managers could obscure their motivations, however, made for a relatively toothless doctrine, and in the mid-1980s Delaware adopted a somewhat less deferential test for defensive measures. In *Unocal v. Mesa Petroleum Co.* (493 A.2d 946 (Del. 1985)), the Delaware Supreme Court adopted a doctrine requiring resisting managers to prove (1) that their action was a good-faith response to a perceived *threat* to the corporation; and (2) that the defensive measures were *proportional* in relation to the threat posed.

Although the *Unocal* doctrine purports to abandon the BJR's heavy presumption favoring incumbent directors, its subsequent application suggests a significantly more modest departure. Indeed, it now appears that the "threat" to which the doctrine refers need not implicate shareholder value exclusively, but rather could involve either short- or long-term threats to numerous nonmanagerial constituency within the firm, such as employees, creditors, customers, or the community at large, in addition to shareholders. Moreover, some 4 years later in *Paramount Communications v. Time* (571 A.2d 1140 (1989)), the Delaware Supreme Court substantially weakened the second "proportionality" prong of *Unocal*. In essence, it held that a corporate board of directors frequently has an option to "just say no" to all potential suitors, so long as the response reflects a good-faith belief of a threat to corporate welfare; outside of extreme situations (e.g., involving "coercive" or "preclusive" measures), the proportionality of a just-say-no defense does not appear to be a significant constraint. In practice, then, the *Unocal* test may be hardly discernible from the BJR, despite the formal inversion of evidentiary burdens.

Nevertheless, in situations where fiduciaries are not merely resisting a control transaction, but are instead favoring one acquiror over another,

Delaware law has remained significantly more resolute. In *Revlon v. MacAndrews & Forbes* (and later in *Paramount v. QVC*), the court held that when the target company faces an imminent break-up or change of control, the duty of target firm directors mutates from “defenders of the corporate bastion to auctioneers charged with getting the best price for the stockholders at a sale of the company.”⁶¹ Under *Revlon*, corporate fiduciaries can still favor one contestant over others, but only if they demonstrate that their actions were reasonably calculated to maximize shareholder’s value in the short term. Thus, relative to *Unocal* (where judicial deference to management’s discretion appears to mimic the BJR), *Revlon* duties shift the balance of litigation power toward shareholders.

Applying our model to this context, the prodefendant deference of the BJR and *Unocal* might be represented by a strong presumption in favor of corporate management ($b > \bar{b}$). As demonstrated above, such strong presumptions tend to preclude the filing of suits, which has the dual equilibrium effects of (1) encouraging shirking by the agent, and (2) reducing costly legal wrangling. So interpreted, judicial deference seems most defensible in our model in situations where the *redistributive sources of waste tend to swamp the nonproductive sources of waste*. In other words, strong promanagement presumptions in Region III tend to be optimal when the principal’s marginal benefits from the agent’s productive effort [as reflected through both p and the value of $(V_H - V_L)$] are small relative either to the agent’s private costs of effort (ϕ), or to the more indirect costs of litigation (F , c_P , c_A^H , and c_A^L). In terms of our model, a BJR-like presumption is most appropriate.

This last observation may, in large part, distinguish at least some takeover situations from day-to-day business decisions. Within the ordinary course of business, discrete managerial choices (e.g., whether to purchase/retire a machine, whether to extend the hours of operation, etc.) are likely to have only modest effects on shareholder welfare.⁶²

61. *Revlon Inc. v. MacAndrews & Forbes Holdings, Inc.*, 506 A.2d 173, 182 (Del. 1986); *Paramount Communications, Inc. v. QVC Network, Inc.*, 637 A.2d 34 (Del. 1994) (expanding *Revlon*’s “imminent break-up” test to any transaction that moved control from a fluid aggregation of unaffiliated stockholders into unified hands, and generalizing the “duty to auction” into a duty to implement measures reasonably calculated to maximize short-term shareholder value).

62. Not all potential duty-of-care cases, of course, involve day-to-day business decisions. Some may involve discrete nonhostile-takeover events, such as deciding to make a large capital investment in a new factory abroad. Here, too, corporate fiduciaries enjoy the protection of the BJR. For such situations, the discussion in the text is somewhat less helpful in rationalizing the BJR. However, our results might still provide some limited insights. For example, it may be that in cases like that described above, producing exculpatory evidence is relatively simple, and thus culpable and nonculpable defendants face roughly equivalent costs in producing evidence (i.e., $c_A^H \approx c_A^L$). If so, then intermediate presumptions (Region II) are no longer very attractive or feasible. In such situations, courts may opt for a protective presumption anticipating that extra-legal mechanisms for providing incentives—such as express contracts, reputational labor markets, and internal governance structures—are more effective mechanisms.

While these choices can certainly affect share prices over time, encouraging litigation over individual decisions seems an inefficient institutional response in light of the alternative incentive devices available.⁶³

With hostile takeovers, however, the stakes for shareholders are considerably higher. In addition to affecting overall corporate profitability and policy, takeover activity implicates a potential “endgame” phenomenon for the shareholders: should the bidder ultimately succeed in wresting control, public shareholders will be forced to step aside, extracting whatever “control premium” they can as they depart. When paid, such control premia can be a significant financial component of stock ownership,⁶⁴ and incumbent management may play a critical role in their existence/magnitude (by, for instance, chilling the arrival of new bidders or encouraging an auction of the firm that could result in a higher payoff to shareholders). Moreover, in such situations the privately borne costs of effort to create such market interest may be negligible (or even negative). Thus at least some takeover contexts may be ones where p and $(V_H - V_L)$ are relatively large (and ϕ relatively small), thereby justifying a relaxation of a strong prodefendant presumption.

Moreover, this reasoning may help differentiate between the application of *Unocal* and *Revlon* within the takeover-defense context. As noted above, the stricter *Revlon* duty is invoked against defensive measures when either breakup or control change of the firm is inevitable, whereas the *Unocal* duty applies to situations where managerial actions are strictly preservational in nature. In other words, *Revlon* governs situations where the aforementioned endgame for the shareholders has already arrived, and the only decision to be made revolves around who pays the control premium and how large it is. On the other hand, *Unocal* governs those circumstances where the purpose and effect of managerial resistance is simply to delay the control premium contest for another day. This distinction seems sensible from the standpoint of our model, since managerial decisions about merely the timing of a control contest (i.e., auction now versus auction later) probably involve smaller stakes for shareholders than do decisions to manipulate a contest that has already commenced.

5.3 Fiduciary Duties and Financial Distress

In most states, creditors of a corporation do not share the equity holders’ right to sue managers for being “disloyal” (or otherwise breaching fiduciary duties). Instead, “fixed” claimants must either depend on

63. Indeed, the extra-legal mechanisms noted above may also be equipped to respond to the aggregated effects of piecemeal shirking by managers over time.

64. In *Paramount v. QVC*, for instance, the ultimate control premium paid by Viacom was in excess of 50% of the precontest share price of Paramount.

those rights explicitly governed by covenants in their indenture agreement or rights under the implied duty of *good faith and fair dealing* (GFFD), which applies generically to all contracts.⁶⁵ In the absence of express contractual rights, however, the creditor's prospects for relief under the GFFD are dim, as the doctrine requires her to overcome a prodefendant promanagement presumption that is analogous to the BJR.⁶⁶

Nevertheless, some recent doctrinal developments suggest that corporate directors and officers may owe a fiduciary duty to debtholders once a firm moves sufficiently close to insolvency. In *Credit Lyonnais Bank v. Pathe Communications* (1991 Del. Ch. LEXIS 215), for example, Delaware Chancellor Allen used fiduciary principles as the basis for upholding a decision by a financially distressed firm's board of directors to resist pressure from a dominant shareholder to sell off certain corporate assets:

At least where a corporation is operating in the vicinity of insolvency, a board of directors is not merely the agent of the residual risk bearers, but owes its duty to the corporate enterprise [T]he board . . . had an obligation to the community of interest that sustained the corporation, to exercise judgment in an informed, good faith effort to maximize the corporation's long-term wealth creating capacity (1991 Del. Ch. LEXIS 226).

The application of fiduciary principles to financially distressed debtors apparently transcends the specific factual context of *Credit Lyonnais* (in which such principles were invoked defensively by directors to shield themselves from shareholder complaints). Indeed, courts have also allowed creditors to marshal such arguments offensively, in suits against directors of a distressed or insolvent firm. Most of these cases involve either close corporations or duty of loyalty claims—both situations in which the business judgment rule, protecting the firm from creditor demands, is often significantly relaxed or absent [see generally Lin (1993)]. The new legal presumption allows creditors to benefit from both a stronger evidentiary presumption and more generous damages than they would receive under more conventional approaches.

65. In addition, creditors sometimes have a limited right under the law of fraudulent conveyance to void certain transactions by the firm.

66. The duty of good faith and fair dealing has been notoriously unhelpful to creditors attempting to enforce rights that are not explicitly provided in express debt covenants, and fraudulent conveyance law requires a plaintiff (or bankruptcy trustee) to show either an actual intent to defraud or a transaction on grossly disproportionate terms. The limited assistance of both areas of law to creditors is perhaps most clear in the LBO context. See *Metropolitan Life Ins. Co. v. RJR Nabisco, Inc.*, 716 F. Supp. 1504 (SDNY 1989).

Our analysis may provide a rationale for the emerging application of fiduciary law to debtor-creditor relationships. The strong prodefendant presumption under the doctrine of GFFD is most efficient when the benefit of managerial effort for creditors (the principal in this case) is low relative to the manager's personal cost of effort. Such may well be the case when a firm is healthy, since the agent's actions are likely to have only a modest effect on the creditor's expected welfare ($V_H \sim V_L$). Indeed, solvency implies that the loss in the event of a "bad state" predominantly falls on the shareholders. In nondistressed situations, affording creditors with a lower evidentiary burden would simply bring about redistributive litigation that is too costly to justify its productive effects. Conversely, when a firm's equity cushion becomes sufficiently thin, managerial effort becomes more important to creditors ($V_H > V_L$). If these stakes grow sufficiently large, it may be optimal to reduce a plaintiff's evidentiary burden so as to facilitate equilibrium litigation, thereby engendering efficiency-enhancing deterrence effects.

6. Judicial Objectives and Abilities

Our analysis has thus far characterized how legal presumptions can mediate between redistributive and productive incentives. In our model, while courts did not have an intrinsically better ability to render judgment, they could still play an important efficiency role (on both dimensions) by regulating the legal lobbying game. Significantly, however, while the results in Sections 3 and 4 helped predict how litigants might respond to such regulation, they did not generate predictions about the content of the law itself. Thus, in order to articulate a positive account of various legal rules, it was necessary in much of Section 5 to ascribe some institutional objective to courts, which we did by assuming courts to be efficiency-minded, thereby formulating legal rules in order to maximize the expected joint wealth of the parties. Imposing this normative criterion facilitated positive predictions and some comparative statics on optimal legal presumptions.

Consequently, then, some of our positive analysis may be limited by the fact that courts (and/or legislatures) are not always beholden to the goal of maximizing joint wealth.⁶⁷ Most obviously, judges may pursue more deontological goals such as fairness, accuracy, or integrity,⁶⁸ paying scant attention to administrative or productive costs. Indeed, law students routinely learn that advocates play a fundamental role in uncovering "the truth." This aspirational goal is often imported by

67. Note, however, that the first application of our model—interpreting the surprising effects of the 1995 PSLRA—did not turn on any posited goal for the courts.

68. See, for example, Dworkin (1986). Note, however, that even from an efficiency perspective, one reason to value "truth" is that doctrine creates a public good for future litigants to look at. Such concerns are outside our model. See also Hirshleifer and Osborne (1996).

attorneys into practice; some carry it with them even further, as they become judges, policymakers, or lobbyists. The subordination of efficiency to accuracy, then, may come naturally to such actors, and the social costs of uncovering the truth may be either unapparent or irrelevant to them at the time they act. Alternatively, courts might pursue other, less laudable, goals when crafting legal rules. For instance, judges may simply attempt to minimize their workloads, or (conversely) they may be captured by local bar associations who wish to engender a large demand for legal representation by encouraging protracted litigation.⁶⁹

If courts pursued such nonefficiency goals, our analysis may still render informative predictions. Suppose, for example, that judges cared most about accuracy in adjudication [i.e., minimizing the frequency of type-I and type-II errors, as in Rubinfeld and Sappington (1987)] irrespective of costs. As noted above, litigation in our model is most likely to reveal the agent's type when a hard-working agent has much smaller costs of mounting a defense than his shirking counterpart ($c_A^H \ll c_A^L$). As such, an accuracy-maximizing court might implement legal rules that encourage litigation along the equilibrium path (i.e., moderate values of b), along with rules that magnify the stakes thereto.⁷⁰ Such a combination would lead to the greatest amount of separation among agent types (albeit at the expense of ex ante efficiency concerns). Thus our model can make some predictions about the rules that might emerge even from non-efficiency-minded judges.⁷¹

Another possible limitation to our analysis is that judges, for a variety of reasons, might fail to adopt optimal presumptions *even when* they are motivated solely by efficiency. First, the task of doing so may be too complex for a time-constrained judge. Recall that choosing the optimal value of b in our model requires one to identify the relative values of

69. The overlapping moral dimension easily obscures any conscious or subconscious motives: after all, finding the truth may not only be somewhat more likely when there is a lot of argument, it may also just happen to shift resources from the productive economy toward the legal system. Consciously or subconsciously, the legal system can thus reinforce its own importance and needs.

70. Courts can do a number of things to increase the stakes from litigation, such as increasing damages or adopting the European convention of forcing the losing party in court to compensate the winning party for some of its legal expenses.

71. Similarly, if judges care only about maximizing the market for legal services, they would favor rules that "equalize" the strength of plaintiff and defendant (in light of the parties' respective marginal costs of producing evidence). Such concerns might not only affect the presumption adopted by such courts, but also other controllable parameters of the model. For example, courts might reduce filing costs to equalize the strength of defendants and plaintiffs, such as by granting plaintiffs a permission to roll up small claims into a single class action or derivative suit. In many such cases, individual plaintiffs receive only trivial sums and most of the redistributive activity is from the defendant to the parties' attorneys.

other deep parameters in our model (i.e., V_H , V_L , c_A^H , c_A^L , ϕ , and p). These parameters can often elude simple verification themselves. Second, even a disinterested court may succumb to lobbying about the presumption it should apply. Because the plaintiff does not bear all the expected costs of litigation, her incentives to file suit may lead to superoptimal redistributive activities [see also Shavell (1996)]. If judges are not aware of this systematic bias, they may mistakenly fine tune the applicable presumption so as to favor the most strategically savvy player. And finally, in order to implement an optimal presumption, the court must *credibly commit* to that presumption even after the parties' evidence is submitted. Such commitment is often easier said than done. For example, as demonstrated above, a moderate presumption tends to support litigation in equilibrium, thereby leading low- and high-cost defendants to adopt separating strategies in presenting evidence. Consequently, it is possible to infer the agent's type simply by examining the amount of evidence she presented. Nevertheless, the applicable legal rule would still require some false positives and false negatives to emerge in equilibrium, even at an optimum (i.e., low-effort agents are exonerated with some small probability, and high-effort agents are found liable with an analogously small probability).

If efficiency-seeking judges fail to converge on the specific optimal presumptions described above, our analysis still has normative implications for judges and lawmakers. For example, it can illuminate the important factors for determining the optimal legal rule, which states might codify in statutes that have compelling authority. Or alternatively, it may help to expose to a judge what facts she might wish to verify if she sought efficiency but was somehow unable to implement it.

7. Conclusion

It is no longer revolutionary to think of legal rules in a transaction cost context. Indeed, there is now a substantial law and economics literature that portrays substantive law as a judicial mechanism for solving problems of incomplete contracts, information asymmetry, bounded rationality, and opportunism. Yet legal rules of procedure and evidence may be as important as their substantive cousins, but have received relatively sparse attention. In this article we have demonstrated how legal presumptions in various commercial contexts can simultaneously shape both productive and redistributive incentives.

In addition to those applications discussed herein, however, our approach raises a number of additional questions. In particular, it may be possible to extend our analysis beyond the commercial environment to examine the role of presumptions in other areas of law. In accident law, for example, the doctrine of *res ipsa loquitur* generally operates to invert the applicable presumption against the defendant for injuries that

are ordinarily brought about by negligence.⁷² Twentieth-century legal scholars have spent much ink on the problem of providing a positive rationale for the *res ipsa* doctrine, with the most notorious debate having been joined by Prosser and Wigmore. Prosser (1984) portrayed the doctrine as a device for economizing on the administrative costs of litigation in cases where it seems unlikely that the injury could have occurred absent the defendant's negligence. Wigmore (1940), in contrast, posited the doctrine to be a type of "information-forcing" mechanism for situations when a defendant has private information about whether she was negligent. Our analysis may help to identify the Prosser–Wigmore debate as one representing a quasi-empirical disagreement about the relative magnitude of the deep parameters in our model within the broader population.⁷³ That the debate has lingered for so long may reflect the heterogeneity of circumstances in which the doctrine might fruitfully be applied.

In addition to this extension, a number of others are possible. For example, our analysis afforded some predictions about how litigation behavior responds to perturbations in the underlying presumption—predictions that lend themselves to more rigorous empirical testing than that attempted here. We have also excluded the possibility of pretrial settlement from the analysis, which would almost certainly decrease the expected redistributive costs of litigation.⁷⁴ Finally, from a more normative perspective, to the extent that evidentiary rules play a central role in shaping primary incentives, it is somewhat more difficult to justify a unified body of civil procedure or evidence law that is separate from substantive law.⁷⁵ These extensions, while interesting, we leave for another day.

72. See, for example, Cal. Evidence Code 646(b) (stating, "The judicial doctrine of *res ipsa loquitur* is a presumption affecting the burden of producing evidence").

73. In particular, the Prosserian perspective would seem optimal in those cases where the defendant's "effort" (expenditure of care) is highly determinative of subsequent injury [i.e., $p \cdot (V_H - V_L)$ is relatively high]. As our analysis suggests, such circumstances lend support to an optimal presumption that leans strongly in favor of the plaintiff (i.e., in Region I). A court subscribing to Wigmore's account of *res ipsa*, in contrast, would relax an initial prodefendant presumption not so much because the relative social value of care is large as because negligent and diligent defendants face highly differential costs of producing exculpatory evidence. (i.e., $c_A^L \gg c_A^H$). Here, however, the Wigmorean court would choose an intermediate presumption that systematically encourages litigation (in Region II), so as to exploit these signaling benefits.

74. In particular, a shirking agent may possibly have an incentive to concede culpability and settle the case before having to incur the litigation costs. However, because the agent has private information about his previous actions, it is unlikely that all cases would settle before trial, and thus the *qualitative* trade-off between redistributive and productive forms of inefficiency would still persist. See Spier (1997).

75. The advocates for a case-by-case system of evidence date back (at least) to Bentham (1827).

Appendix

This appendix sketches the proofs of some of the results from the text.

Proof of Lemma 1. We construct a proof by subdividing the parameter space into two regions: “Region A,” in which all player types adopt strictly positive litigation levels, and “Region B,” in which the low-effort agent’s optimal litigation level is zero. We analyze these two regions below, *ad seriatim*.

Region A. As noted in the text, an interior equilibrium of the litigation game exists when and only when $bc_p > \alpha(\sqrt{c_A^H c_A^L} - c_A^H)$, which defines the relevant region of the parameter space. Substituting the reduced form terms into the definition of $R_p(\alpha)$ yields

$$R_p(\alpha) = D(\alpha c_A^H + (1 - \alpha)c_A^L)\mu_\alpha^2 - F, \quad (\text{A1})$$

where, the reader will recall, $\mu_\alpha \equiv (\alpha\sqrt{c_A^H} + (1 - \alpha)\sqrt{c_A^L})/(bc_p + \alpha c_A^H + (1 - \alpha)c_A^L)$.

Differentiating $R_p(\alpha)$ with respect to D , b , and F immediately reveals that it is strictly increasing, decreasing, and decreasing in these parameters. Differentiating $R_p(\alpha)$ with respect to α yields

$$\begin{aligned} & \frac{\partial R_p(\alpha)}{\partial \alpha} \\ &= -D \frac{\left[(\alpha c_A^H + (1 - \alpha)c_A^L)^2 + (3bc_p - \sqrt{c_A^H c_A^L}) \right. \\ & \quad \left. \times (\alpha c_A^H + (1 - \alpha)c_A^L) + bc_p \sqrt{c_A^H c_A^L} \right]}{(bc_p + \alpha c_A^H + (1 - \alpha)c_A^L)^3} \\ & \quad \times (\sqrt{c_A^L} - \sqrt{c_A^H})(\alpha\sqrt{c_A^H} + (1 - \alpha)\sqrt{c_A^L}). \end{aligned} \quad (\text{A2})$$

Note that because all other terms are strictly positive, the derivative is strictly negative when and only when the square-bracketed terms in the numerator (denoted as Ψ) are also positive. Thus we confine our attention to that term. Imposing the condition that $bc_p > \alpha[\sqrt{c_A^H c_A^L} - c_A^H]$, the following emerges:

$$\begin{aligned} \Psi &\equiv (\alpha c_A^H + (1 - \alpha)c_A^L)^2 + (3bc_p - \sqrt{c_A^H c_A^L})(\alpha c_A^H + (1 - \alpha)c_A^L) \\ & \quad + bc_p \sqrt{c_A^H c_A^L} \\ &> (\alpha c_A^H + (1 - \alpha)c_A^L) \cdot \left[(1 - \alpha)(c_A^L - \sqrt{c_A^H c_A^L}) + 2bc_p \right] \\ & \quad + bc_p \sqrt{c_A^H c_A^L} \\ &> 0. \end{aligned} \quad (\text{A3})$$

Region B. As noted in the text, a corner solution of the litigation game exists whenever $bc_p \leq \alpha(\sqrt{c_A^H c_A^L} - c_A^H)$, which defines this region of the parameter space. Substituting the appropriate reduced form for the terms in Equation (11), we obtain

$$R_p(\alpha) = -D \cdot \left[\frac{2\alpha^2 bc_p c_A^H + \alpha b^2 c_p^2}{(bc_p + \alpha c_A^H)^2} \right] + D - F. \tag{A4}$$

Differentiating $R_p(\alpha)$ immediately reveals that it is strictly increasing in D and strictly decreasing in b and F . Differentiating with respect to α yields

$$\frac{\partial R_p(\alpha)}{\partial \alpha} = -D \cdot \left[\frac{b^2 c_p^2 (bc_p + 3\alpha c_A^H)}{(bc_p + \alpha c_A^H)^3} \right] < 0. \tag{A5}$$

Finally, it is straightforward to show that the values $R_p(\alpha)$ are equal at the boundary of Regions A and B, that is, when $\alpha = bc_p / \sqrt{c_A^H c_A^L} - c_A^H$. ■

Proof of Lemma 2. Again, subdivide the parameter space into Regions A and B, as defined above. We analyze them *ad seriatim*.

Region A. Substituting the equilibrium values computed above yields the corresponding expression for $R_A(\gamma)$:

$$R_A(\gamma) = \gamma \cdot D \cdot \left[p(2\sqrt{c_A^L} \mu_\alpha - c_A^L \mu_\alpha^2) - (1-p)(2\sqrt{c_A^H} \mu_\alpha - c_A^H \mu_\alpha^2) \right] - \phi. \tag{A6}$$

Taking derivatives with respect to D , ϕ , and p immediately yields the result that $R_A(\gamma)$ is strictly increasing, decreasing, and increasing in these respective parameters. Taking the derivative with respect to γ , noting that $p \geq 1/2$, and imposing the parameter restriction that defines Region A (i.e., $bc_p > \alpha[\sqrt{c_A^H c_A^L} - c_A^H]$) yields

$$\begin{aligned} \frac{\partial R_A(\gamma)}{\partial \gamma} &= D \cdot \left[p(2\sqrt{c_A^L} \mu_\alpha - c_A^L \mu_\alpha^2) - (1-p)(2\sqrt{c_A^H} \mu_\alpha - c_A^H \mu_\alpha^2) \right] \\ &\geq D\mu_\alpha \cdot \frac{(\sqrt{c_A^L} - \sqrt{c_A^H})}{2} \cdot \left[2 - (\sqrt{c_A^L} + \sqrt{c_A^H}) \mu_\alpha \right] \\ &> D\mu_\alpha \cdot \frac{(\sqrt{c_A^L} - \sqrt{c_A^H})}{2} \cdot \left[1 - \sqrt{c_A^H/c_A^L} \right] \\ &> 0. \end{aligned} \tag{A7}$$

Region B. Substituting the equilibrium values computed above yields the following expression for $R_A(\gamma)$:

$$R_A(\gamma) = \gamma Dp - \gamma D(1-p) \cdot \left(\frac{(\alpha c_A^H)^2 + 2\alpha b c_A^H c_p}{(b c_p + \alpha c_A^H)^2} \right) - \phi. \quad (\text{A8})$$

Once again, taking derivatives with respect to D , ϕ , and p immediately yields the result that $R_A(\gamma)$ is strictly increasing, decreasing, and increasing in these respective parameters. Taking the derivative with respect to γ and noting that $p \geq 1/2$ yields

$$\begin{aligned} \frac{\partial R_A(\gamma)}{\partial \gamma} &= Dp - D(1-p) \cdot \left[1 - \left(\frac{b c_p}{b c_p + \alpha c_A^H} \right)^2 \right] \\ &\geq D \cdot (2p - 1) \geq 0 \quad \text{Q.E.D.} \end{aligned} \quad (\text{A9})$$

Lemma A. If Assumptions 1 and 2 hold then $R_A(1) \geq 0$ for all $\alpha \in [0, 1]$ and all $b \in [0, (c_A^L/c_p)(\sqrt{D/F} - 1)]$.

Proof of Lemma A. Fix α . First, consider situations with interior litigation strategies, that is, $b \in [(\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H), (c_A^L/c_p)(\sqrt{D/F} - 1)]$ in which case, the statement of the lemma is equivalent to showing that Assumption 1 and 2 imply $\phi \leq \phi_\alpha^c \equiv D\mu_\alpha[2(p\sqrt{c_A^L} - (1-p)\sqrt{c_A^H}) - \mu_\alpha(pc_A^L - (1-p)c_A^H)]$ for all such b and for all $\alpha \in [0, 1]$. The proof proceeds as follows:

- (i) $\partial\phi_\alpha^c/\partial b = 2D(\partial\mu_\alpha/\partial b) [(p\sqrt{c_A^L} - (1-p)\sqrt{c_A^H}) - \mu_\alpha(pc_A^L - (1-p)c_A^H)]$. The term in $[\cdot]$ is negative when $b = (\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)$, thus the derivative $\partial\phi_\alpha^c/\partial b \geq 0$ at $b = (\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)$ since $\partial\mu_\alpha/\partial b < 0$. Furthermore, ϕ_α^c is either increasing over the region $b \in [(\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H), (c_A^L/c_p)(\sqrt{D/F} - 1)]$ or is single-humped, thus ϕ_α^c achieves its minimum at either $b = (\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)$ or $b = (c_A^L/c_p)(\sqrt{D/F} - 1)$ for all values of α .
- (ii) $\partial\phi_\alpha^c/\partial\alpha = 2D(\partial\mu_\alpha/\partial\alpha)[(p\sqrt{c_A^L} - (1-p)\sqrt{c_A^H}) - \mu_\alpha(pc_A^L - (1-p)c_A^H)]$. If $b = (\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)$ the term in $[\cdot]$ is negative and $\partial\mu_\alpha/\partial\alpha > 0$, thus $\partial\phi_\alpha^c/\partial\alpha \leq 0$. Thus when $b = (\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)$, ϕ_α^c achieves its minimum at $\alpha = 1$. If $b = (c_A^L/c_p)(\sqrt{D/F} - 1)$ the term in $[\cdot]$ is positive and $\partial\mu_\alpha/\partial\alpha \leq 0$, thus $\partial\phi_\alpha^c/\partial\alpha \leq 0$. Thus when $b = (c_A^L/c_p)(\sqrt{D/F} - 1)$, ϕ_α^c achieves its minimum at $\alpha = 1$.

- (iii) To find the sharpest bound on ϕ we only have to find the minimum of ϕ_1^c evaluated at the points $b = (\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)$ and $b = (c_A^L/c_p)(\sqrt{D/F} - 1)$.
- (iv) $\phi_1^c(b = (\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)) = D[p - (1-p)(2\sqrt{c_A^H/c_A^L} - c_A^H/c_A^L)] \geq (2p-1)D$ since $(2\sqrt{c_A^H/c_A^L} - c_A^H/c_A^L) \leq 1$.
- (v) $\phi_1^c(b = (c_A^L/c_p)(\sqrt{D/F} - 1)) = D\bar{\mu}_1[2(p\sqrt{c_A^L} - (1-p)\sqrt{c_A^H}) - \bar{\mu}_1(pc_A^L - (1-p)c_A^H)]$, where $\bar{\mu}_1 \equiv \mu_1(b = (c_A^L/c_p)(\sqrt{D/F} - 1)) = \sqrt{c_A^H}/(c_A^L(\sqrt{D/F} - 1) + c_A^H)$. Using Assumption 1 it can be shown that $\bar{\mu}_1 \leq 1/(\sqrt{c_A^H} + \sqrt{c_A^L})$ and it can also be shown that $\bar{\mu}_1 \geq \sqrt{c_A^H}/(c_A^L\sqrt{D/F})$. With these facts, simple algebra yields $\phi_1^c(b = (c_A^L/c_p)(\sqrt{D/F} - 1)) \geq \sqrt{DFc_A^H/c_A^L}(2p-1)$.
- (vi) Since $\sqrt{DFc_A^H/c_A^L}(2p-1) \leq (2p-1)D$ we have $\phi_1^c(b = (\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)) \geq \sqrt{DFc_A^H/c_A^L}(2p-1)$. Thus we have shown that $\phi \leq \phi_1^c$ for all $b \in [(\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H), (c_A^L/c_p)(\sqrt{D/F} - 1)]$ and for all $\alpha \in [0, 1]$ if Assumptions 1 and 2 hold.
- (vii) Finally, if $b < (\alpha/c_p)(\sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)$ then $L_A^{L*} = 0$ and $R_A(1) = pD - (1-p)(\alpha^2 c_A^{H2} + 2\alpha bc_A^H c_p)/(\alpha c_A^H + bc_p)^2)D - \phi \geq (2p-1)D - \phi \geq 0$, which completes the proof. ■

Proof of Proposition 1. Lemma 1 establishes that $R_p(\alpha)$, the principal's net gain from litigating, is continuous and strictly decreasing in α . Thus if $R_p(0) < 0$, then we know that $R_p(\alpha) < 0 \forall \alpha \in [0, 1]$. Noting that $\alpha = 0 \Rightarrow [(c_A^L)^{-1/2} > \mu]$ (and thus the optimal litigation level is interior for all player types), imposing $\alpha = 0$ on the appropriate expression for $R_p(\alpha)$ yields

$$R_p(0) = D \cdot \left(\frac{c_A^L}{bc_p + c_A^L} \right)^2 - F, \tag{A10}$$

which is negative $\forall \{b : b > c_A^L/c_p(\sqrt{D/F} - 1)\}$, thereby implying avoid-ing litigation is strictly dominant for the principal, and hence $\gamma^* = 0$. But knowing that the principal will never litigate, the agent's net expected gain from effort is $R_A(\gamma) = -\phi < 0$, which implies that the agent will never wish to expend effort, and thus $\beta^* = 0$. Sequential rationality requires then that $\alpha^* = 0$ as well. Imposing $\alpha^* = 0$ on the litigation endgame yields the specified litigation levels (though litigation, of course, is never on the equilibrium path). Because we have constructed the equilibrium by iterated dominance arguments, it is clearly unique. ■

Proof of Proposition 2. By construction, it is optimal for the principal to always litigate, that is, $\gamma^* = 1$, in this subregion. From Lemma A we know that Assumptions 1 and 2 imply $R_A(1) \geq 0$ for all $\alpha \in [0, 1]$ and b in this subregion thus the agent will always want to give effort, that is, $\beta^* = 1$ and $\alpha^* = 1$. Because we have constructed the equilibrium by iterated dominance arguments, it is clearly unique. ■

Proof of Proposition 3. Fix $b \in ((c_A^H/c_P)(\sqrt{D/F} - 1), (c_A^L/c_P)(\sqrt{D/F} - 1))$. Assumption 1 implies $bc_P \geq \sqrt{c_A^H} \sqrt{c_A^L} \geq (\alpha \sqrt{c_A^H} \sqrt{c_A^L} - c_A^H)$, therefore we have interior solutions for all of the litigation strategies. It is straightforward to show that $R_P(0) \geq 0$, $R_P(1) \leq 0$, and $\partial R_P/\partial \alpha < 0$, thus there is a unique $\alpha^* \in (0, 1)$ such that $R_P(\alpha^*) = 0$. Furthermore, $R_A(0) = -\phi < 0$, $R_A(1) = \phi_c^c - \phi > 0$ by Assumption 1, and $\partial R_A(\gamma)/\partial \gamma > 0$, thus there is a unique $\gamma^* \in (0, 1)$ such that $R_A(\gamma^*) = 0$. Note that since $R_P(0) \geq 0$, the principal will always want to litigate when the agent never gives effort, however, $R_A(1) \geq 0$, thus the agent always wants to give effort when the principal always litigates, thus $\alpha = 0$ and $\gamma = 1$ is not a pure strategy equilibrium. Similarly, $\alpha = 1$ and $\gamma = 0$ is not a pure strategy equilibrium. ■

Proof of Proposition 4. To prove part (i) implicitly differentiate $R_p(\alpha)$ to find

$$\begin{aligned} \frac{\partial \alpha^*}{\partial b} &= \frac{-\partial R_p(\alpha)/\partial b}{\partial R_p(\alpha)/\partial \alpha} \\ &= \frac{-2c_P(\alpha^* \sqrt{c_A^H} + (1 - \alpha^*) \sqrt{c_A^L})}{(\sqrt{c_A^L} - \sqrt{c_A^H})(\alpha^* c_A^H + (1 - \alpha^*) c_A^L)} \\ &\quad + 3bc_P - \sqrt{c_A^H c_A^L} + \frac{bc_P \sqrt{c_A^H c_A^L}}{\alpha^* c_A^H + (1 - \alpha^*) c_A^L} \\ &\leq 0, \end{aligned} \tag{A11}$$

since $bc_P \geq \sqrt{c_A^H} \sqrt{c_A^L}$ in Region 2. To prove part (ii) implicitly differentiate $R_A(\gamma)$ to find $\partial \gamma^*/\partial b = -(\partial R_A(\gamma)/\partial b + (\partial R_A(\gamma)/\partial \alpha)(\partial \alpha/\partial b))/(\partial R_A(\gamma)/\partial \gamma) \geq 0$. ■

Proofs of Corollaries 4.1–4.3. If $b \in [\underline{b}, \bar{b}]$ and Assumptions 1 and 2 hold then it can be shown that $L_A^{L^*} \geq 0$, that is, the agent's litigation strategies are interior, in which case $q_H^* = \sqrt{c_A^H} \mu_\alpha$ and $q_L^* = \sqrt{c_A^L} \mu_\alpha$. Differentiating μ_α with respect to b and using the value of $\partial \alpha^*/\partial b$ given in the proof of Proposition 4 yields the results in Corollaries 4.1 and 4.2.

The ex ante equilibrium rate of plaintiff victories $\alpha^* q_H^* + (1 - \alpha^*) \cdot q_L^* = [\alpha^* \sqrt{c_A^H} + (1 - \alpha^*) \sqrt{c_A^L}] \mu_\alpha = [\alpha^* \sqrt{c_A^H} + (1 - \alpha^*) \sqrt{c_A^L}]^2 / (bc_P + \alpha^* c_A^H + (1 - \alpha^*) c_A^L)$. Differentiating with respect to b you find that the derivative is positive when evaluated at $\alpha = 0$. We know, however, that $\alpha^* = 0$ at $b = \bar{b}$, thus by continuity there must exist a region $b \in [\hat{b}, \bar{b}]$ such that the ex ante equilibrium rate of plaintiff victories is increasing. ■

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