1999

A Theory of Legal Presumptions

Antonio E. Bernardo
antonio.bernardo@anderson.ucla.edu

Eric L. Talley
Columbia Law School, etalley@law.columbia.edu

Ivo Welch
ivo.welch@gmail.com

Follow this and additional works at: https://scholarship.law.columbia.edu/faculty_scholarship

Part of the Banking and Finance Law Commons, Business Organizations Law Commons, Jurisprudence Commons, and the Litigation Commons

Recommended Citation
Available at: https://scholarship.law.columbia.edu/faculty_scholarship/1181
A Theory of Legal Presumptions

Antonio Bernardo, Eric Talley, and Ivo Welch

Olin Working Paper No. 99-8

This paper can be downloaded without charge from the Social Science Research Network electronic library at http://papers.ssrn.com/paper.taf?abstract_id=161189
Abstract

This paper develops a theoretical account of presumptions, focusing on their capacity to mediate between costly litigation and \textit{ex ante} incentives. We augment a standard moral hazard model with a redistributational litigation game in which a legal presumption parameterizes how a court “weighs” evidence offered by the opposing sides. Strong pro-defendant presumptions can foreclose lawsuits altogether, but also reduce deterrence and cause shirking. Strong pro-plaintiff presumptions have the opposite effects. Moderate presumptions give rise to equilibria in which productive effort and suit occur probabilistically. The socially optimal presumption trades off litigation costs against agency 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 the model: the business judgment rule in corporations law, fiduciary duties in financially-distressed firms, and the doctrine of \textit{res ipsa loquitur} in accident law.
# Contents

1 Introduction ................................................. 1

2 The Framework ................................................ 4

3 Equilibrium Behavior ....................................... 9
   3.1 Litigation Stage ........................................... 9
   3.2 Filing Stage ............................................... 12
   3.3 Effort Stage ............................................... 13
   3.4 Equilibrium ............................................... 14

4 Optimal Presumptions ..................................... 20
   4.1 Sources of Inefficiency ................................. 20
   4.2 Welfare Analysis ......................................... 21

5 Applications .................................................. 24
   5.1 The Business Judgment Rule ......................... 24
   5.2 Fiduciary Duties and Financial Distress ............... 28
   5.3 The Doctrine of *Res Ipsa Loquitur* .................. 29

6 Judicial Objectives and Abilities ......................... 31

7 Conclusion ..................................................... 33

8 References .................................................... 34

9 Appendix ......................................................... 37
1 Introduction

Few features of American jurisprudence are as fundamental as legal presumptions.\(^1\) Indeed, presumptions—and the concomitant evidentiary burdens to overcome them—are a central concern in virtually every substantive area of law. Some are widely recognized, such as a criminal defendant’s presumption of innocence. Others enjoy less notoriety:

- Within company law, fiduciaries sometimes benefit (though not always) from the “business judgment rule,” which constitutes a strong presumption favoring defendants who are alleged to have breached their fiduciary duties\(^2\);

- In employment discrimination litigation under Title VII of the 1964 Civil Rights Act, the burden of evidentiary production can shift to the defendant if the plaintiff was a qualified (but rejected) applicant and a member of an historically-oppressed group\(^3\);

- The equal protection doctrine in constitutional law requires a court to determine a “level of scrutiny” to apply to a challenged statutory or regulatory classification\(^4\);

- Although commercial debt holders are presumed to enjoy few implied rights beyond those provided by express contractual terms, this presumption is relaxed when the debtor is financially-distressed or insolvent\(^5\);

- The doctrine of \textit{res ipsa loquitur} from accident law shifts the presumption against the defendant if a plaintiff’s injury is of a type that ordinarily happens because of negligence\(^6\).

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.\(^7\) Accordingly, the topic has spawned a vast literature within legal scholarship.\(^8\) 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 general effects.

\(^1\)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.”


\(^7\)See, e.g., Wilkinson (1992), at 907 (“There are few absolute principles in law. Those principles that may appear to be absolute are, in reality, presumptions which may be overcome in appropriate circumstances”).

\(^8\)For a brief review of this rich literature, see Allen (1994).
In this paper, we explore the role of legal presumptions (and the environmental factors that influence them) from agency- and influence-cost perspectives. Our principal focus is on the role of presumptions in mediating between redistributioinal and productive sources of social cost. On the one hand, litigation is a costly redistributioinal enterprise, both to promulgate and to conduct once promulgated. Viewed alone, it is a pure social waste. On the other hand, without the credible threat of litigation, there may be little to deter potential defendants from engaging in self-interested and socially wasteful behavior. We argue below that the evidentiary rules adopted by courts—i.e., initial presumptions and burdens of production—are a primary mechanism for striking an optimal balance between these competing inefficiencies.

Our paper develops a hybrid model: The first stage is an agency model of moral hazard, which is followed by a second stage in which a principal can sue the agent over whether the latter is guilty of malfeasance (“shirking”). The litigation component is an “influence/conflict cost” model, which conceives of the courtroom as a venue for redistributioinal activity. Litigation can induce monetary transfers between individuals, the precise influence of which is governed by evidentiary rules. Although the influence costs approach is not new, the explicit strategic interaction between legal conflict and ex ante incentives is. To examine this interaction requires an asymmetric-information model of conflict, in which the agent’s “type” (i.e., unknown true culpability) at the litigation stage is endogenously determined by the agent’s earlier decision. Our focus is on the tradeoff between the deterrent and redistributioinal effects of legal rules.

The intuitions that emerge from our approach can lend insights to our understanding of existing legal presumptions. For example, the model’s fundamental tension between productive and redistributioional concerns may help explain some of the rough contours in existing fiduciary duty in corporate law. The business judgment rule (BJR) protects corporate officers and directors against shareholder allegations of “negligence.” We interpret the BJR as a strong presumption in favor of the agent in negligence suits. Ordinarily, by favoring an agent who is already in an informationally-advantaged position, the BJR reduces 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

---

9For the most part, our analysis assumes litigation costs to be socially wasteful. 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 4.3.

10Formally, evidence scholars often decompose the “burden of proof” into two parts: (1) the “burden of production”; and (2) the “burden of persuasion.” The former focuses on which of the litigants has a duty to present evidence to the tribunal (or risk losing). The latter refers to the applicable criterion for making inferences from the presented evidence (e.g., preponderance, clear and convincing, beyond a reasonable doubt, etc.). Although our paper focuses principally on burdens of production, the two concepts are obviously related, since the burden of persuasion largely determines who has the burden of production. See Posner (1999).

11See, e.g., Becker (1983); Hirshleifer (1995); Milgrom & Roberts (1990); Welch (1998). These papers focus on influence costs in out-of-court venues, e.g., the boardroom or factory floor.
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, i.e., 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, which suggests that a relaxation of the BJR is socially 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.

Our analysis also offers a number of other interesting insights. The redistributive and productive incentives can have surprising interactions in equilibrium. For example, the principal legislative intent of The Private Securities Litigation Reform Act of 1995 was to reduce litigation rates by (inter alia) enhancing pro-defendant presumptions, requiring plaintiffs to make more specific pleadings and to prove a more stringent scienter element in cases involving “forward-looking statements.” Nevertheless, after an initial decline of approximately 38% during the Act’s first year, the filing rate of federal securities fraud complaints has surpassed its pre-Act level—a full 32% higher by the end of 1998.

In the context of our model, although pro-defendant assumptions indeed make it more difficult for plaintiffs to win, a more protective rule eventually alters potential defendants’ behavior. In equilibrium, to respond to and to deter some of the increase in inappropriate behavior, optimizing plaintiffs may resort to more litigation—and even win more often.

Moreover, the model shows that presumptions can play an important role even if courts have only limited ability to verify information directly. When a defendant’s culpability is unverifiable, if it is cheaper for diligent agents to produce exculpatory evidence than it is for their more culpable counterparts, his litigiousness may be an informative credible signal of his past efforts. In such instances, it may be optimal even for courts with poor verification skills to employ “moderate” presumptions designed specifically to encourage litigation that exploits this signalling separation.

Only a handful of law-and-economics scholars have investigated the effects of evidentiary rules on litigation behavior, but none has combined an asymmetric information model with an agency model, necessary to examine the tradeoffs between presumptions’ deterrent and redistributive effects. Katz (1988) 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 signalling. Daughety & 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 also assumes complete information between the litigants, and does not analyze legal presumptions per se. Similarly, Hay & 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 & 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 (i.e., the productive effort) and the costs associated with “bad” judicial opinions (i.e., false positives and false negatives) as exogenous. Their approach makes it difficult or impossible to examine how evidentiary rules endogenously affect the defendant’s level of culpability. Similarly, Hirshleifer & Osborne (1999) conceive of litigation as a conflict game in which the degree of a party’s “fault” is an exogenous parameter in the model. Finally, Sanchirico (1998) analyzes a mechanism-design model that explicitly links evidence production to primary behavior. While this framework is similar to our own, Sanchirico’s focuses on the conditions under which it is optimal to “decouple” liability determinations from the evidence that interested parties offer in the courtroom. He does not attend to the central problem of our paper: the role of legal presumptions in mediating between agency and influence costs among two unavoidably interested parties. Moreover, our aims are somewhat more positive in nature, exploring applications of our results to legal doctrines that are common within modern civil litigation.

The remainder of this paper consists of six parts. Section 2 develops a multi-stage principal-agent model, incorporating a litigation endgame as the redistributional 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 quite 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 the principal application of the model to corporate fiduciary law, arguing that the model may provide a positive explanation for some of the distinctions currently drawn in managerial entrenchment cases. We also discuss (albeit more briefly) the application of our analysis to debtor-creditor law and to accident 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.

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 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 redistributational 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, non-monitorable 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 non-monetary cost of \(\phi\) 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:

\[
\begin{array}{c|cc}
\text{Effort} & \text{High (}V_H) & \text{Low (}V_L) \\
\hline
\text{No Effort} & p & 1 - p \\
\text{Effort} & 1 - p & p \\
\end{array}
\]

(1)

The parameter \(p \in [1/2, 1]\) 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. 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.\(^{15}\)

In most standard agency-cost models, the optimal contractual solution is to offer incentive pay: i.e., 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 realized state, but may be subject to suit should a low project payoff obtain. We motivate this assumption on a number of grounds. First, our main focus concentrates on the use of default legal rules (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 default rule can substitute for express terms, which themselves are often costly or difficult to draft.\(^{16}\) On a related note, if incentive contracts have enforcement costs (e.g.,

---

\(^{15}\) 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.

\(^{16}\) There is a growing literature on the costs of express contracting, costs that emanate from problems of (among other things) bounded rationality, multi-tasking concerns, complexity, and intra-organizational political concerns. See, e.g., MacLeod (1998).
they require that a court stand ready to verify whether a low or high state has obtained), one can specify a default rule within our framework that is an exact substitute for an incentive contract. Finally, there are (for reasons outside our model) a number of contract doctrines that are immutable in nature, and thus preclude private parties from contracting around them.\footnote{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 paper, however, we do not attempt to provide a reason for immutable rules, other than to recognize that they exist in many circumstances.} In such situations, litigation may be the sole mechanism for enforcing contractual allocations.

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 as follows:

\[\text{[INSERT FIGURE 1 HERE]}\]

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 $V_H - w$.

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 end game of litigation, in which a court must decide whether to find the agent liable. Should liability be found, the agent must pay $D$ dollars to the principal, an amount representing the applicable damages for the complaint in question.\footnote{In order to concentrate on the role played by legal presumptions, 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 suit in either realized state of the world. Doing so, however, adds considerable complication to the analysis without many added insights. We have therefore omitted such an analysis in what follows.} While such prospective recovery is attractive to the principal, litigation does not come without costs. Indeed, in order simply to bring suit, the principal must incur a non-recoverable 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.\textsuperscript{19}

Once invoked, litigation imposes additional \textit{variable} costs on both parties as they argue the case in court.\textsuperscript{20} In particular, we conceive of litigation as a redistributational conflict game, wherein parties expend “litigation effort” producing and presenting evidence before a judge or jury. Let $L_p \geq 0$ denote the amount of incriminating evidence the principal chooses to present against the agent in litigation. Similarly, let $L_L^A \geq 0$ and $L_H^A \geq 0$ denote the amount of exculpatory evidence the low-effort and high-effort agent types, respectively, choose to offer in their own defense. We assume that the principal’s and agent’s decisions are made simultaneously.\textsuperscript{21}

The litigation strategies, $L_p$, $L_L^A$, and $L_H^A$, are intended to summarize the efforts that litigants routinely expend to gather and present evidence to a court (such as eye-witness testimony, expert opinions, documentary evidence, laboratory tests, and the like). Importantly, we make no specific assumption about the inherent truthfulness of either side’s evidence. Indeed, it may be genuine and 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 $c_H^A > 0$, and thus his total evidentiary cost is $c_H^A L_H^A$. If he expended low effort, his marginal litigation cost is $c_L^A > 0$, and thus his total evidentiary cost is $c_L^A L_L^A$. We assume in what follows that $c_L^A > c_H^A$; i.e., shirking agents find it more costly to produce exculpatory evidence than do their high-effort counterparts.\textsuperscript{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, more intensive coaching of friendly witnesses, and perhaps even the payment of explicit or implicit bribes in exchange for false testimony.\textsuperscript{23} As will become apparent below, this cost differential implies that shirking agents will rationally choose to present less evidence than their non-shirking counterparts in equilibrium. Consequently, the litigation effort expended by the agent may be an efficiency-enhancing

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

\textsuperscript{20}We assume that no settlement occurs in this model.

\textsuperscript{21}As a formal matter, of course, the rules of evidence prescribe sequential rather than simultaneous performances, with the plaintiff moving first. \textit{See}, e.g., Fuller (1967). Nevertheless, we motivate our assumption of simultaneity on two 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 & Talley (1999)). Second, as a practical matter litigation is frequently \textit{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.

\textsuperscript{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).

signal of 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\(^\text{24}\)), we adopt a particular functional form for \( q(\cdot) \), in which the principal’s success probability is:

\[
q_j \equiv q(L_P, L_A^j) = \frac{L_P}{bL_A^j + L_P} \iff \left( \frac{q(L_P, L_A^j)}{1 - q(L_P, L_A^j)} \right) = \frac{L_P}{b \cdot L_A^j} \tag{2}
\]

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 \textit{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. 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 (\( 0 < b < \infty \))\(^\text{25}\).

This functional form exhibits a number of useful and intuitive properties.\(^\text{26}\) First, note that it is increasing in \( L_P \) and decreasing in \( L_A^j \): greater litigation effort by either party \textit{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—\textit{i.e.,} its \textit{ex ante} bias in the absence of any production of evidence.\(^\text{27}\)

\(^{24}\)E.g., Hirshleifer (1995).

\(^{25}\)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 inadmissibile. A pro-plaintiff court may tend to admit virtually all of a plaintiff’s offers of proof, while admitting the defendant’s only 70 percent 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.

\(^{27}\)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 non-cooperative play. Our equilibrium concept in what follows is sequential equilibrium (Kreps & Wilson 1982), though even weaker equilibrium concepts would do as well.\(^{28}\) Denote the probability that the agent expends high effort by \(\beta\), and the probability that the principal brings an action in a low state by \(\gamma\). 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 \textit{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 \(\alpha\) 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 \(\alpha\), and are characterized below.\(^{29}\)

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

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

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

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

This condition states that the principal increases her litigation efforts \((L_P)\) until the marginal private

---

\(^{28}\)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 our model because all relevant information sets are reached with positive probability.

\(^{29}\)Though \(\alpha\) is exogenous at this stage, sequential rationality requires its value to be related to the agent’s equilibrium effort choice \(\beta\) via Bayes rule. This constraint is taken up at length \textit{infra} in subsection 3.4.
benefits are just equal to the marginal private costs.\textsuperscript{30}

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:

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

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:

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

For an agent who put forth low effort \((e^L)\), the analogous problem is:

\[
\max_{L_A^L \geq 0} \left[ \frac{L_P}{bL_A^L + L_P} \right] \cdot (-D) - c_A^L L_A^L. \tag{7}
\]

Assuming an interior solution,\textsuperscript{31} the relevant first-order condition is:

\[
\left[ \frac{bL_P}{(bL_A^L + L_P)^2} \right] \cdot D = c_A^L. \tag{8}
\]

As with the principal, the agents’ optimality conditions suggest that each expends litigation costs up to the point where the marginal benefit of reducing his expected liability is equal to the marginal cost of litigation effort.

If both agents’ optimal choice are interior, the unique equilibrium of the continuation game can be found by solving (4), (6), and (8) simultaneously. The reduced-form expressions for the equilibrium litigation levels and the associated indirect liability functions are:

\[
\begin{align*}
L_P^* &= D \cdot b \cdot (\mu_\alpha)^2; \\
L_A^{H*} &= D \cdot \mu_\alpha \cdot [(c_A^H)^{-1/2} - \mu_\alpha]; \\
q_H^* &= \sqrt{c_A^H \cdot \mu_\alpha}; \\
L_A^{L*} &= D \cdot \mu_\alpha \cdot [(c_A^L)^{-1/2} - \mu_\alpha]; \\
q_L^* &= \sqrt{c_A^L \cdot \mu_\alpha},
\end{align*}
\tag{9}
\]

\textsuperscript{30}In this case, as in the others, sufficiency is satisfied by the strict concavity of the objective function in \(L_P\).

\textsuperscript{31}It turns out that an interior solution for the low-effort agent need not exist. In particular the optimal choice is interior if and only if \(bc_{pP} > \alpha \left( \sqrt{c_A^H} - c_A^H \right) \).
where \( \mu_{\alpha} \equiv \left( \frac{\alpha \sqrt{c_{PA}^L} + \alpha \sqrt{c_{PA}^H}}{bc_{A} - \alpha \sqrt{c_{PA}^H}} \right) \), if the solution is interior. However, if the court employs a strong pro-plaintiff presumption, so that 
\[ b < \frac{\alpha}{c_{PA}} \left( \sqrt{c_{PA}^H c_{PA}^L} - c_{PA}^H \right), \]
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:

\[
\begin{align*}
L_p^* &= D \cdot b \cdot \alpha \cdot \frac{\alpha c_{PA}^H}{(\alpha c_{PA}^H + bc_{A})} \\
L_H^* &= D \cdot \alpha \cdot \frac{bc_{A}}{(\alpha c_{PA}^H + bc_{A})} \\
L_L^* &= 0
\end{align*}
\]

(10)

Inspection and/or piecewise differentiation of the above expressions yields the following results for the principal:

**Lemma 1** The principal’s equilibrium litigation level, \( L_p^* \), is:

- increasing in \( D \);
- increasing in \( b \) if (i) \( bc_{A} < \alpha c_{PA}^H + (1 - \alpha)c_{PA}^L \) and \( L_L^* > 0 \); or (ii) \( bc_{A} < \alpha c_{PA}^H \) and \( L_L^* = 0 \).
- decreasing in \( b \) if (i) \( bc_{A} > \alpha c_{PA}^H + (1 - \alpha)c_{PA}^L \) and \( L_L^* > 0 \); or (ii) \( bc_{A} > \alpha c_{PA}^H \) and \( L_L^* = 0 \).

As one might guess, the principal is more likely to expend more resources litigating (all else constant) if there is more at stake (i.e., \( D \) is large). Further, there is an interior \( b \) that induces the principal to be most litigious. This also comports with intuition, since 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 (1998)).

An analogous set of results can be obtained for both the high-effort and the low-effort agent types:

**Lemma 2** The high-effort agent’s equilibrium litigation level, \( L_H^* \), is strictly greater than the low-effort agent’s equilibrium litigation level, \( L_L^* \), and is:

- increasing in \( D \);
- increasing in \( b \) if (i) \( bc_{A} < \alpha c_{PA}^H + (1 - \alpha)c_{PA}^L \) and \( L_L^* > 0 \); or (ii) \( bc_{A} < \alpha c_{PA}^H \) and \( L_L^* = 0 \).
- decreasing in \( b \) if (i) \( bc_{A} > \alpha c_{PA}^H + (1 - \alpha)c_{PA}^L \) and \( L_L^* > 0 \); or (ii) \( bc_{A} > \alpha c_{PA}^H \) and \( L_L^* = 0 \).
Lemma 3 The low-effort agent’s equilibrium litigation level, $L^*_A$, is equal to zero if $bc_p < \alpha(\sqrt{c_H} - c_A^L) \sqrt{c_A^L}$ and otherwise is:

- increasing in $D$;
- increasing in $b$ if $bc_p < \alpha(2\sqrt{c_H} - c_A^L) + (1 - \alpha)c_A^L$;
- decreasing in $b$ if $bc_p > \alpha(2\sqrt{c_H} - c_A^L) + (1 - \alpha)c_A^L$.

Like principals, agents are more inclined to defend themselves if more is at stake and if their net “power” (taking into account judicial presumptions and costs of litigation) is roughly commensurate with that of the principal. Note that both the principal’s and the agent’s actions depend on the principal’s assessment that the agent has exerted effort ($\alpha$). Although we treat $\alpha$ as exogenous at this final stage of the game, the principal’s belief may be sensitive along the equilibrium path to variations in the value of $b$. (A higher $b$ tends to reduce agent effort, which in turn reduces $\alpha$). This equilibrium effect, however, does not vitiate the intuition that litigation increases when damages are higher and when the legal rule serves to equalize the influence of the plaintiff and the defendant.

It is also important to note that for all values of $b > 0$, the high-effort agent is a more aggressive litigator than is his shirking counterpart. This difference in litigiousness is an artifact of 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.

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 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 $\alpha$-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:

$$V_L - w. \quad (11)$$

Conversely, if the principal files suit, her expected payoff is:
\[ V_L - w + [\alpha \cdot q_H^* + (1 - \alpha) \cdot q_L^*] \cdot D - c_pL^*_p - F. \]

Let \( R_P(\alpha) \equiv [\alpha \cdot q_H^* + (1 - \alpha) \cdot q_L^*] \cdot D - c_pL^*_p - F \) 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 4** The principal’s net expected gain from filing suit, \( R_P(\alpha) \), is continuous, and strictly decreasing in \( \alpha \) \( \forall \alpha \in [0, 1] \). Moreover, holding \( \alpha \) fixed, \( R_P(\alpha) \) is strictly increasing in \( D \) and strictly decreasing in \( F \) and \( b \).

The fact that \( R_P(\alpha) \) decreases in \( \alpha \) is not surprising. Indeed, a marginal increase in \( \alpha \) 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 \( \alpha \) 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 pro-agent bias (\( b \)) increase, suit becomes less attractive to the principal. Note that at this point that Lemma 4 is partial equilibrium in nature because we have not accounted for the equilibrium relation between \( \alpha \) and the deep parameters of the model.

3.3 Effort Stage

Consider now the agent’s *ex ante* effort choice, anticipating the subsequent equilibrium behavior characterized above. Recall that \( \gamma \) denotes the probability that the principal litigates. Accordingly, the agent’s expected payoff from high effort is:

\[ w - \gamma (1 - p)(q_H^* D + c_H^* t_H^*) - \phi. \]

Conversely, the agent’s expected payoff from low effort is:

\[ w - \gamma p(q_L^* D + c_L^* L_A^*). \]

Let \( R_A(\gamma) \equiv \gamma \left[ p(q_L^* D + c_L^* L_A^*) - (1 - p)(q_H^* D + c_H^* t_H^*) \right] - \phi \) 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 willing to mix over high and low effort levels. We prove the following lemma about the agent’s effort decision in the appendix:

**Lemma 5** The agent’s net expected gain from expending productive effort, $R_A(\gamma)$, is single-valued, continuous, and strictly increasing in $\gamma \forall \gamma \in [0, 1]$. Moreover, holding $\gamma$ and $\alpha$ fixed, $R_A(\gamma)$ is strictly increasing in $D$ and $p$, and strictly decreasing in $\phi$.

An increase in $\gamma$ 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 $\gamma$ fixed, the agent’s incentive to expend effort increase 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 ($\phi$) increases, high effort becomes less attractive to the agent. Note that Lemma 5 does not account for the effects of changes in the parameters $D$, $p$, and $\phi$ on equilibrium litigation, $\gamma$, and effort, $\beta$.

### 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., $L^{*}_P$, $L^{*}_A$, $L^{H*}_A$), all that remains is to specify behavior strategies ($\beta^{*}$, $\gamma^{*}$) implied by the expressions above, and a belief structure for the principal ($\alpha^{*}$) 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 ($\beta$) and the principal’s beliefs ($\alpha$) be related as follows:\(^{32}\)

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

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 characteristics.\(^{33}\) Accordingly, we shall hereinafter restrict our equilibrium analysis to parameter values satisfying the following two assumptions:

\(^{32}\)Or equivalently, $\beta = \frac{p\alpha}{p\alpha+(1-p)(1-\alpha)}$.

\(^{33}\)A full description of the equilibria, absent parametric restrictions, is available from the authors.
Assumption 1 \[ F \leq D \cdot \left( \frac{\sqrt{c_A}}{\sqrt{c_A} + \sqrt{c_L}} \right)^2 \]

Assumption 2 \[ \phi \leq (2p - 1) \sqrt{D \cdot F \cdot \frac{c_H}{c_A}} \]

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 pro-plaintiff presumption). Analogously, Assumption 2 requires that agent’s cost of productive effort \((\phi)\) be sufficiently small to make effort worthwhile if the agent knows that litigation is certain in a bad state \((\gamma = 1)\). Note that both assumptions are always satisfied when damages \((D)\) grow large.\(^{34}\)

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

<table>
<thead>
<tr>
<th>Region I:</th>
<th>Region II:</th>
<th>Region III:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong Pro-Plaintiff Presumptions</td>
<td>Intermediate Presumptions</td>
<td>Strong Pro-Defendant Presumptions</td>
</tr>
<tr>
<td>(b &lt; \overline{b} \equiv \frac{c_A}{c_P} \cdot \left( \sqrt{\frac{D}{F}} - 1 \right))</td>
<td>(b \leq \bar{b} )</td>
<td>(b &gt; \overline{b} \equiv \frac{c_A}{c_P} \cdot \left( \sqrt{\frac{D}{F}} - 1 \right))</td>
</tr>
</tbody>
</table>

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—\(i.e.,\) in Region I, the pro-plaintiff presumption is so strong that the principal would always sue, regardless of her beliefs about the agent’s prior behavior; in Region III, the pro-defendant 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 the table above contain unique sequential equilibria. We address each region below.

\(^{34}\)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 pro-principal 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 for expositional reasons, as they ensure that corner solutions of the litigation game occur only for relatively “extreme” pro-plaintiff presumptions).
Strong Pro-Defendant Presumptions: $b \in (\bar{b}, \infty)$. In Region III, the agent benefits from a pro-defendant 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:

\[
\begin{align*}
L^H_A &= D \cdot \mu_0 \cdot [c^H_A]^{-1/2} - \mu_0]; \\
L^L_A &= D \cdot \mu_0 \cdot [c^L_A]^{-1/2} - \mu_0]; \\
L^*_P &= D \cdot b \cdot (\mu_0)^2.
\end{align*}
\]

Proposition 1 states that if the pro-agent 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. The social cost of this equilibrium consists solely of the costs imposed by sub-optimal effort.\(^{35}\) The social cost of this equilibrium consists solely of the costs imposed by sub-optimal effort.

Strong Pro-Plaintiff Presumptions: $b \in [0, \bar{b})$. Consider now the opposite case in Region I, where a court adheres to a strong pro-plaintiff 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 $b \in [0, \bar{b})$ 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 2.2 and depend on the sign of $bc_p - (\sqrt{c^L_A} - \sqrt{c^H_A})$.

An important consideration within this subregion is the limiting case $b = 0$. Here, the pro-principal presumption is sufficiently inviolate that 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).

\(^{35}\)Note also that if a court were free to choose damages as well, $D$, 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.
Intermediate Presumptions: $b \in [b, \bar{b}]$. 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:36

Proposition 3 If $b \in [b, \bar{b}]$ 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:

\[
\begin{align*}
L^H_A &= D \cdot \mu_{\alpha^*} \cdot [(c^H_A)^{-1/2} - \mu_{\alpha^*}]; \\
L^L_A &= D \cdot \mu_{\alpha^*} \cdot [(c^L_A)^{-1/2} - \mu_{\alpha^*}]; \\
L^P &= D \cdot b \cdot (\mu_{\alpha^*})^2.
\end{align*}
\]

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, which in turn would induce the agent 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 the players’ equilibrium effort and suit strategies as $b$ changes:37

Proposition 4 If $b \in [b, \bar{b}]$ and Assumptions 1 and 2 hold, the agent’s equilibrium effort strategy $\beta^*$ is strictly decreasing in $b$, and the principal’s equilibrium filing strategy $\gamma^*$ 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 $\beta^*$. As the agent’s power increases, he becomes increasingly effective at 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—i.e., 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, this is not what we find. Rather, the above proposition states that increasing $b$ actually enhances principal’s proclivity to litigate in the low state. On first blush, this is a surprising result given Lemma 4: all else

36The proof of this proposition appears in the Appendix.
37Because 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.
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.\(^{38}\) Note that $\gamma^*$ 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 $\beta^*$ 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 ($\beta^*$ 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 is not a model 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 pro-defendant assumptions indeed 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.

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

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

**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 $\bar{b} \in (\underline{b}, \bar{b})$ such that the ex ante equilibrium rate of plaintiff victories, $\alpha^* q_H^* + (1 - \alpha^*) q_L^*$, is strictly increasing in $b$ for all $b \in [\underline{b}, \bar{b}]$.

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 pro-defendant. 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.\(^{39}\) Clearly, then, the setting of a presumption in this region necessarily involves trading

\(^{38}\) It is important to note, of course, that this “invariance” result is a local one. If we increase $b$ so far as to move it out of, say, Region II and into Region III, the probability of litigation would discontinuously fall from $\gamma^*$ to 0.

\(^{39}\) 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 $b$. 

18
off false positives against false negatives. Stronger pro-defendant presumptions minimize the former, while weaker ones minimize the latter.\footnote{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 & Sappington (1987)), such an approach is clearly inadequate for our purposes. For example, consider the lower portion of Region II, just above \( b \). 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.} 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 \textit{ex ante} win rate of the plaintiff \textit{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 \textit{average} plaintiff victory rate even though defendants of both types are getting stronger.

The results reported in Propositions 1 - 4 are illustrated in Figure 2, which plots the agent’s and principal’s equilibrium strategies, respectively, as functions of the underlying presumption, \( b \). Figure 2—as well as those illustrated later—assume as a base-line case of \( p = 0.55, V_H = 100, V_L = 80, c_P = 1.5, c_H^A = 1.0, c_L^A = 1.5, \phi = 0.6, F = 4, \) and \( D = 20 \).

[INSERT FIGURE 2 ABOUT HERE]

As the figure illustrates, presumptions in Region I \((b < \hat{b} = 0.825)\) generate a unique pure strategy equilibrium in which the agent always gives effort and the principal always files suit. Likewise, Region III presumptions \((b > \bar{b} = 1.236)\) 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. Note that in this intermediate region, the agent’s effort strategy is decreasing in \( b \) while the principal’s filing strategy is increasing. Finally, the principal’s equilibrium belief about whether the agent has worked hard \((\alpha^*)\) is strictly smaller than the agent’s probabilistic strategy of working hard \((\beta^*)\) because the effort agent’s strategy is chosen unconditionally while the principal’s beliefs are conditional on \( V_L \) obtaining—a state that conveys information to the principal about the agent’s true actions.

[INSERT FIGURE 3 ABOUT HERE]

Figure 3 illustrates the principal’s probability of winning for all values of \( b \) in Region 2. In this figure we used the base-line parameters except we set \( c_H^A = 0.25 \). 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 equilibrium expected win rate may increase over some range of $b$ in Region 2.

4 Optimal Presumptions

Given the equilibrium behavior specified above, it is now possible to ask how an efficiency-minded court might wish to set its evidentiary presumption $b$ so as to maximize expected social wealth. It is here where the fundamental trade-off of interest in this paper takes center stage. Indeed, by combining the costs of moral hazard and redistributional efforts, the model exposes two fundamental sources of economic waste: (1) sub-optimal 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 sources of economic waste.

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 $\beta^*$ the cost to society of sub-optimal effort is:

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

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

$$\gamma^* \cdot [\alpha^* \cdot (c_A^H L_A^H) + (1 - \alpha^*) (c_A^L L_A^L) + c_p L_p^* + F].$$

If the agent puts forth effort with probability $\beta^*$ then the probability of entering the state should a low state occur is given by:

$$\beta^* (1 - p) + (1 - \beta^*) p.$$
\[ \gamma^* \cdot [\beta^*(1-p) + (1-\beta^*)p] \cdot [\alpha^* \cdot c_A^H L_A^H + (1-\alpha^*) \cdot c_A^L L_A^L + c_p L_p^s + F]. \] (18)

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). As an initial matter, it is important to recognize that there may be situations in which a trade-off between productive and redistributational costs does not exist. Indeed, while the equilibrium expected social costs of litigation are always positive, the expected costs of low effort need not be. Inspection of (15) immediately reveals that if either \((V_H - V_L)\) or \( p \) is small relative to \( \phi \), then even disregarding the costs of litigation, expenditure of productive effort is socially undesirable. In such a circumstance, it is optimal for a court to adopt an extremely strong pro-agent presumption, in order to ensure both that the agent efficiently shirks (\( \alpha^* = \beta^* = 0 \)), and that no litigation occurs (\( \gamma^* = 0 \)) along the equilibrium path. This reasoning immediately gives rise to the following proposition:

**Proposition 5** If \((2p-1)(V_H - V_L) \leq \phi\), then the optimal legal presumption is any \( b \) satisfying \( b > \bar{b} \equiv \frac{c_L}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) \). Moreover, any \( b > \bar{b} \) is first-best efficient.

The analysis is somewhat more complicated when \((2p-1)(V_H - V_L) > \phi\) for three reasons. While it is now socially desirable (all else constant) for the agent to expend productive effort, inducing him to do so necessitates a softer pro-agent presumption than that described above—one that entails some equilibrium litigation waste. As such, a first-best outcome will generally be unattainable, and the optimal outcome is second-best in nature, trading off productive and redistributational inefficiencies.

Accordingly, we can now analyze the problem of choosing the optimal \( b \) when effort expenditure is socially desirable. Perhaps the easiest case to analyze is Region III, corresponding to a strong pro-agent presumption \((b > \bar{b})\). As already noted, for any \( b \) in this subregion there is a unique equilibrium in which \( \beta^* = 0 \) and \( \gamma^* = 0 \), and thus there is no litigation waste. The waste due to suboptimal effort is given by \((2p-1)(V_H - V_L) - \phi > 0\) for all \( b \) in this subregion. Note that even though effort expenditure is efficient, the downstream litigation costs needed to make effort incentive-compatible may—in some situations—be sufficiently large such that it is still second-best efficient to adopt a strong pro-agent presumption and allow equilibrium shirking.

Now consider Region I, corresponding to a strong pro-principal presumption \((b < \bar{b})\). Recall that in this region, the only equilibrium is one in which the principal always sues (\( \gamma^* = 1 \)) and the agent always expends productive effort (\( \beta^* = 1 \)). Therefore, there is no productive waste in this region, and the optimal presumption is that which minimizes litigation waste. It is straightforward to show that the
lower bound of this region, \( b = 0 \), corresponds with the waste-minimizing rule. Indeed, granting the principal a conclusive presumption ensures that total litigation waste in the low state consists solely of the filing-cost component, \( F \). Since the agent knows he will always lose regardless of the defense he mounts, he optimally chooses to expend no resources on litigation. Anticipating the agent’s behavior, the principal optimally chooses to expend an arbitrarily small amount on litigation, and thereby guarantees victory. Consequently, the \textit{variable} component of litigation costs is arbitrarily small at \( b = 0 \). For any larger value of \( b \) in this subregion, the principal still litigates with probability one, but both the agent and principal will incur variable litigation costs in equilibrium, and thus total waste will always be greater for such choices of \( b \). (Recall that setting \( b = 0 \) is tantamount to a conventional incentive contract, but one that costs \( F \) dollars to enforce when a low state comes about). Thus, comparing the equilibrium waste generated by the optimal \( b \) in Region I to that in Region III, the following proposition emerges:

\textbf{Proposition 6} \textit{The optimal pro-plaintiff presumption in Region I (} \( b = 0 \) \textit{) yields less equilibrium waste than does the optimal pro-defendant presumption in Region III (} \( b > \bar{b} \) \textit{) if and only if } \( (1 - p)F < (2p - 1)(V_H - V_L) - \phi \).

The proposition implies that whenever effort by the agent is socially desirable, the optimal choice between strong pro-principal and strong pro-agent presumptions entails choosing between pure administrative waste (\( b = 0 \)) and pure productive waste (\( b > \bar{b} \)). When the fixed costs of bringing suit are relatively small, it is possible (using a conclusive pro-principal presumption) to implement an incentive contract at a relatively low cost (the fixed cost \( F \)). Moreover, from an \textit{ex ante} perspective, the implementation cost is extremely small when the agent’s actions have a large effect on the firm’s success (i.e., \( p \) is relatively large). Conversely, when \( p \) is relatively small, and/or the private costs of effort (\( \phi \)) are high, and/or the difference in the firm’s high and low payoff (\( V_H - V_L \)) is small, then it becomes optimal to forsake the benefits of effort so as to avoid the administrative costs of litigation.

Finally, consider Region II, which corresponds to an intermediate presumption, such that \( \bar{b} \leq b \leq \bar{b} \). In this region there is a unique mixed strategy equilibrium in which \( \beta^* \) is decreasing in \( b \) and \( \gamma^* \) is increasing in \( b \) (see Propositions 3 and 4). Thus, as \( b \) increases, waste due to sub-optimal effort clearly increases. On the other hand, total litigation waste could increase or decrease as \( b \) increases. The reason for the latter ambiguous effect is as follows: although increasing \( b \) unambiguously increases the likelihood of litigation, the variable costs of litigation (once invoked) depend on whether the increased \( b \) moves the relative litigation strengths of the parties towards equality, or further tips the balance further in favor of the agent. The net result of these effects is indeterminate, and depends on deep parameters of the model. However, it is possible to generate examples in which intermediate presumptions dominate the extreme form of presumptions discussed above.
Collecting all of these possible subregions, it is possible to demonstrate numerically the core welfare attributes for various values of \( b \). Once again, the base case calibration uses the values \( p = 0.55, V_H = 100, V_L = 80, c_P = 1.5, c_H^A = 1.0, c_A^L = 1.5, \phi = 0.6, F = 4, \) and \( D = 20 \). The most important question of our paper revolves around determining which value of \( b \) is optimal in the sense of minimizing social waste. To this end, consider the figures below.

Figures 4A-4D illustrate productive waste, litigative waste, and total waste as a function of the judicial bias \( b \). Figure 4A represents the base case in which we find that the optimal bias is sufficiently large (\( b^* \geq \bar{b} = 1.236 \)) to preclude equilibrium litigation. In Figure 4B we reduce the fixed costs of litigation to \( F = 2.75 \) and find that \( b^* = 0 \) as predicted by Proposition 6. In Figure 4C we reduce the agent’s litigation costs if they expend high effort to \( c_H^A = 0.5 \) and find that the optimal bias is \( b^* = b = 0.412 \). It is insightful to compare this choice of \( b \) to the choice \( b = 0 \). For very small fixed costs of litigation \( F \) it is optimal to set \( b = 0 \) because litigation costs will only involve the small fixed cost and the agent will give effort with probability one. For high values of \( F \) it may be optimal to choose intermediate values of \( b \) which will reduce the likelihood of litigation and economize on fixed costs. This also increases marginal litigation costs but perhaps by less than the savings on fixed costs. Finally, in Figure 4D we reduce the high-effort agent’s litigation costs to \( c_H^A = 0.25 \) and find that the optimal \( b \) again occurs in Region 2 but at a point \( b^* > b \). Although there will be more litigation and less effort at \( b^* \) than \( b \) the marginal litigation costs, conditional on litigation, are sufficiently smaller to reduce social waste.

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 pro-plaintiff or pro-defendant presumption.

As demonstrated in Figure 6, the optimal \( b \) tends to decrease in \( \frac{(2p-1)(V_H-V_L)}{\phi} \) the ratio of the principal’s benefits to the agent’s benefits. The intuition is that when \( p \) is low, the agent’s effort has little

---

41The parameter values used for our comparative statics analysis may violate Assumptions 1 and/or 2. In such cases, there may exist multiple equilibria in Regions 1 and 2. However, when more than one equilibrium exists we consider only the equilibrium that minimizes social waste - this is the Pareto criterion for equilibrium selection.
effect on the final outcome and it becomes more important to eliminate litigation waste than waste due to sub-optimal effort. By making $b$ large enough (favoring the agent) the court can guarantee a no-effort no-litigation equilibrium. Conversely, when $p$ is high it is more important to eliminate waste due to sub-optimal 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. The same intuition applies to how different values of $(V_H - V_L)$ affect the optimal presumption. When $\phi$ increases it is less valuable to induce a high-effort equilibrium and thus the optimal $b$ tends to be larger.

5 Applications

The analytical arguments presented above provide useful intuitions for understanding existing legal presumptions. This section explores three such applications: (1) the “business judgment rule” (BJR) in corporate fiduciary law; (2) the application of fiduciary principles in debtor-creditor relations; and (3) the *res ipsa loquitur* doctrine from accident law. Each example represents an area of litigation in which courts abandon the “usual” presumption in favor of an alternative one under specific factual circumstances.

5.1 The Business Judgment Rule

Perhaps no doctrine is as ubiquitous to business law as the concept of *fiduciary obligation*. 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. 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. The duty of loyalty proscribes managerial conflicts of interest, and prohibits fiduciaries from engaging in unfair self-dealing at the expense of shareholders.  

---

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

43 *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. *E.g.*, Smith v. Van Gorkom, 488 A.2d 858 (Del. 1985).

44 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. *E.g.*, 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 manifestation 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,\(^{45}\) 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.\(^ {46}\) Although the BJR does not impose an absolute bar on duty-of-care actions, there is a consensus that, when applicable, a shareholder-plaintiff must carry a heavy burden of demonstrating that a corporate fiduciary acted in a willful, reckless or grossly negligent fashion when becoming informed about the specifics of a decision.\(^ {47}\) Moreover, if a shareholder-plaintiff cannot demonstrate that the fiduciary lacked information at the decision-making stage, his evidentiary burden becomes virtually insurmountable: it is for all practical purposes impossible to challenge the substance of a fiduciary’s informed decision, no matter how foolish or ill-conceived it may seem.\(^ {48}\)

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.\(^ {49}\)

---

\(^{45}\)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...”).

\(^{46}\)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 _ (quoting Aronson v. Lewis, 473 A.2d 805, 812 (Del. 1984)) (emphasis added).


\(^{48}\)On some rare occasions, a plaintiff has been able to make such a showing by demonstrating corporate “waste”: _i.e._, that the fiduciary had adopted an objective that was anathema to shareholders’ interests. See Dodge v. Ford Motor Co., 170 N.W. 668 (Mich. 1919). In modern practice, however, directors and officers can easily avoid liability for corporate waste through two distinct mechanisms. First, they can argue that they determined in good faith that their actions would serve shareholder interests indirectly or over the long term even though the immediate effects are almost certainly destructive. Kamin v. American Express Company, 383 N.Y.S.2d 807, aff’d, 387 N.Y.S.2d 993 (NY 1976). Second, a number of states now afford corporate fiduciaries the immutable right to consider non-shareholder constituencies (such as employees, creditors, customers, and the surrounding community) in discharging their fiduciary obligations. See, e.g., Penn. Con. Stats. Ann. § 1715.

\(^{49}\)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.

A substantial amount of litigation involves interstitial cases that entail both care and loyalty concerns. In the law governing hostile takeovers, fiduciaries of target corporations frequently have mixed motives for resisting outside suitors. On the one hand, because hostile acquisitions frequently forebode managerial shake-ups, incumbent fiduciaries may well have self-preservational incentives for resisting. 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, either to market pathologies or yet-undisclosed corporate profitability). Moreover, by resisting, managers may induce potential suitors to up the ante in their bids for control.

Courts have had a difficult time categorizing these interstitial 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. The ease with which managers could obfuscate their motivations, however, made for a relatively toothless doctrine, and in the mid-1980s Delaware adopted a less deferential test for defensive measures. In Unocal v. Mesa Petroleum Co., 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 appeared to abandon the BJR’s presumption favoring incumbent directors, its subsequent application suggests a significantly more modest departure. Indeed, it is generally now agreed that the “threat” to which the doctrine refers need not implicate shareholder value exclusively, but rather could involve any short- or long-term threat to any non-managerial constituency at the firm (such as employees, creditors, customers, or the community at large). Moreover, some four years later (in Paramount Communications v. Time), the Delaware Supreme Court arguably abandoned the second “proportionality” prong of the Unocal. In essence, it held that a corporate board of directors always 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; the proportionality of a just-say-no defense does not appear to be relevant. 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. One

---

51 See, e.g., Johnson v. Trueblood, 629 F.2d 287, 292-3 (3rd Cir. 1980) (applying Delaware law).
52 493 A.2d 946 (Del. 1985).

26
year after the Unocal decision, 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."\(^{54}\) 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 towards shareholders.

In the context of our model, the pro-defendant deference of the BJR and Unocal is represented by a strong presumption in favor of corporate management (\(b > \bar{b}\)). As our model demonstrates, such strong presumptions tend to preclude the filing of suit, which has the dual equilibrium effects of (i) encouraging shirking by the agent, and (ii) reducing costly legal wrangling. So interpreted, the BJR seems most defensible in our model in situations where the redistributional sources of waste tend to swamp the non-productive sources of waste. In other words, strong pro-management 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 (\(\phi\)), or to the more indirect costs of litigation (\(F, c_p, c_A^H, \text{ and } c_L^A\)). 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. While these choices can certainly affect share prices over time, encouraging litigation over individual decisions seems an inefficient institutional response in light of the available (albeit imperfect) alternatives.\(^{55}\)

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.\(^{56}\)

\(^{54}\)Revlon Inc. v. MacAndrews & Forbes Holdings, Inc., 506 A.2d 173 (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).

\(^{55}\)For example, reputational labor markets and internal governance structures may be better equipped to respond to the aggregated effects of piecemeal shirking by managers over time.

\(^{56}\)In Paramount v. QVC, for instance, the ultimate control premium paid by Viacom was in excess of 50% of the pre-contest share price of Paramount.
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 \( \phi \) relatively small), thereby justifying a relaxation of a strong pro-defendant 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 break-up 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 end-game 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.

### 5.2 Fiduciary Duties and Financial Distress

In most states, creditors of a corporation do share the equity holders’ right to sue managers for being “disloyal” (or otherwise breaching fiduciary duties). Instead, “fixed” claimants must either depend on 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.57 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 pro-defendant pro-management presumption that is analogous to the BJR.58

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*,59 for example, Delaware Chancellor Allen used fiduciary

---

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

58 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).

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.60

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 in 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.61 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.

Our analysis may provide a rationale for the emerging application of fiduciary law to debtor-creditor relationships. The strong pro-defendant 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 \( V_H \approx V_L \). Indeed, solvency implies that the loss in the event of a “bad state” predominantly falls on the shareholders. In non-distressed situations, affording creditors with a lower evidentiary burden would simply bring about redistributional 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.

5.3 The Doctrine of Res Ipsa Loquitur

Our two previous applications focused on takeover and financial distress, commercial environments in which there are large short-term changes in the social value of aligning principal and agent interests.

60Id. at 226.
Still, a similar approach may hold relevance for other non-commercial areas of law where agency costs and evidentiary presumptions interact. Although a catalog of these applications is beyond our current purposes, one example stands out: the *res ipsa loquitur* doctrine in accident law. *Res ipsa* is doubly interesting in this respect because it suggests a role for legal presumptions in exploiting intrinsic differences in litigative ability between plaintiffs and defendants of different types (*i.e.*, $c_A^H$ and $c_A^L$ in our model), and thereby on how legal presumptions can reduce the litigative waste in equilibrium.

Much of American tort law revolves around a theory of negligence, requiring that an injured plaintiff demonstrate through a preponderance of evidence that the alleged tort-feasor acted in a way that breached a duty to exercise ordinary care in conducting some activity. Nevertheless, during the last century, Anglo-American tort law has changed evidentiary rules for injuries that are ordinarily brought about by someone’s negligence (*e.g.*, a post-operative surgical patient who discovers that a pair of tweezers has been left inside his body cavity). For such injuries, modern courts are likely to invoke the doctrine of *res ipsa*, which effectively acts as a pro-plaintiff presumption, flipping the burden of evidentiary production to the defendant to demonstrate that her behavior was consistent with the exercise of due care.\(^{62}\) Although the invocation of the doctrine does not necessarily lead to a judicial finding of negligence *per se*, it is widely recognized to be a powerful weapon when made available to plaintiffs’ attorneys.

Since its inception, *res ipsa* has attracted significant interest from a number of legal scholars attempting to provide a positive account of its existence and purpose. The two most prominent accounts are widely attributed to Prosser (1984, 5th ed.) and Wigmore (1940, 3rd ed.). Prosser 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, in contrast, posited that the doctrine to be a type of “information-forcing” mechanism when the defendant has private information about whether she was negligent, and the rule forces her to produce evidence of her behavior. The Prosser-Wigmore debate over the proper interpretation of *res ipsa* has since waged for over 50 years, easily outliving its progenitors.

Our model may be able to account for both Prosser’s and Wigmore’s arguments. The Prosserian *res ipsa* view applies to a situation in which the principal’s (defendant’s) precaution expenditure is highly determinative of subsequent injuries.\(^{63}\) It is important to favor principals when the effectiveness of precautions ($p$) and the stakes involved ($V_H - V_L$) are relatively high. As our model suggests, such circumstances lend support to an optimal presumption that leans against pro-defendant presumptions and strongly in favor of the plaintiff (*i.e.*, $b < \bar{b}$): indeed, as $p$ grows large, it becomes increasingly

---

\(^{62}\)Cal. Evidence Code 646(b) (stating, “The judicial doctrine of res ipsa loquitur is a presumption affecting the burden of producing evidence”).

\(^{63}\)The agency problems in the torts context are similar to those discussed above, with “care” supplanting “effort” as the agent’s primary strategy choice.
certain that the victim’s harm (i.e., \( V_H - V_L \)) must have come about by defendant carelessness; So long as the social value of injurer precautions are sufficiently large, the optimal rule may induce deterrence with as few litigation costs as possible. Effectively, a court subscribing to Prosser’s view might endorse a strict interpretation of the *res ipsa* doctrine—one that is essentially an irrebuttable presumption.

Similarly, a court subscribing to Wigmore’s account of *res ipsa* would resist a strong pro-defendant presumptions when the effectiveness of precautions and victim stakes are high. Unlike the Prosserian court, however, such a court would stop short of endorsing a strong pro-victim presumption calculated to induce high effort but foreclose legal wrangling altogether. To the contrary, Wigmore’s information-forcing approach would advocate legal conflict in order to exploit differences between the low-effort (“negligent”) and high-effort (“non-negligent”) defendants’ respective marginal costs of producing exculpatory evidence. In other words, when \( c_L^A \) is significantly larger than \( c_H^A \) (and care is socially desirable), Wigmore would favor a moderate value of \( \beta \) (i.e., between \( \overline{b} \) and \( \bar{b} \)) for its signalling efficiencies. Such a rule encourages both parties to expend resources on litigation expenses in equilibrium, but it does so in order to capture the benefit of separating signals among defendant types. In sum, then, our model predicts a role for the *res ipsa* doctrine under either approach, although courts subscribing to the Prosserian view would favor a doctrine that is substantially more potent than that favored by their Wigmorian counterparts.

## 6 Judicial Objectives and Abilities

Our analysis has thus far characterized how legal presumptions can mediate between redistributional 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. Importantly, however, while the results in Section 3 helped predict how litigants might respond to such regulation, they did not generate predictions about content of the law itself. To make such predictions, it was necessary in Section 4 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, 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. Most obviously, judges may pursue more deontological goals such as fairness, accuracy, or integrity, paying scant attention to

---

64 See, e.g., 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.
administrative or productive costs. Indeed, from their first days in law school, lawyers are trained that advocates play a fundamental role in uncovering “the truth.” This aspirational goal is often imported by attorneys into the courtroom; some carry it with them even further, as they become judges, policy makers or lobbyists. The subordination of efficiency to accuracy, then, may come naturally to such actors, and any long-term market implications 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.\footnote{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 towards the legal system. Consciously or subconsciously, the legal system reinforces its own importance and needs.}

If courts pursued such non-efficiency goals, our analysis may still render informative predictions. Suppose, for example, that judges cared most about accuracy in adjudication (\textit{i.e.}, minimizing the frequency of type-I and type-II errors)\footnote{See 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 \((c^H_A \ll c^L_A)\). As such, an accuracy-maximizing court might implement legal rules that encourage litigation along the equilibrium path (\textit{i.e.}, moderate values of \(b\)), along with rules that magnify the stakes thereto.\footnote{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.} Such a combination would lead to the greatest amount of separation among agent types (albeit at the expense of \textit{ex ante} efficiency concerns). Thus, our model can make some predictions about the rules that might emerge even from non-efficiency-minded judges.\footnote{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, \textit{e.g.}, 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.}

Another possible limitation to our analysis is that judges, for a variety of reasons, might fail to adopt optimal presumptions \textit{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 other deep parameters in our model (that is, \(V_H,V_L,c^H_A,c^L_A,\phi\), 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 redistributional activities.\footnote{A related point is also made in 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 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 law-makers. 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 little attention.

In this paper, we have demonstrated how legal presumptions can simultaneously shape both productive and redistributional incentives. In addition to a positive account of a number of existing legal doctrines discussed herein, our approach raises to a number additional questions. For instance, our model makes 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. From a more normative perspective, to the extent that evidentiary rules play a central role in shaping primary incentives, it somewhat more difficult to justify a unified body of civil procedure or evidence law. Although these possibilities are intriguing, we leave them for another day.

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


**Cases and Statutes:**

9 Appendix

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

Proof of Lemma 4: 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 for \( R_P(\alpha) \) yields:

\[
R_P(\alpha) = D \left( \alpha c_A^H + (1 - \alpha) c_A^L \right) \mu_\alpha^2 - F,
\]

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

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 \( \alpha \) yields:

\[
\frac{\partial R_P(\alpha)}{\partial \alpha} = -D \left[ \left( \alpha c_A^H + (1 - \alpha) c_A^L \right)^2 + \left( 3bc_p - \sqrt{c_A^H c_A^L} \right) \left( \alpha c_A^H + (1 - \alpha) c_A^L \right) + bc_p \sqrt{c_A^H c_A^L} \right] \times \frac{bc_p + \alpha c_A^H + (1 - \alpha) c_A^L}{(\sqrt{c_A^L} - \sqrt{c_A^H})(\alpha \sqrt{c_A^H} + (1 - \alpha) \sqrt{c_A^L})}
\]

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 \( \Psi \)) is also positive. Thus, we confine our attention to that term. Imposing the condition that \( bc_p > \alpha \left[ \sqrt{c_A^H c_A^L} - c_A^H \right] \), the following emerges:

\[
\Psi \equiv (\alpha c_A^H + (1 - \alpha) c_A^L)^2 + (3bc_p - \sqrt{c_A^H c_A^L}) (\alpha c_A^H + (1 - \alpha) c_A^L) + bc_p \sqrt{c_A^H c_A^L} > 0
\]

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 (12), we obtain:
\[ R_P(\alpha) = -D \cdot \left[ \frac{2\alpha^2 b c_p c_H^2 + \alpha b^2 c_p^2}{(b c_p + \alpha c_H^2)^2} \right] + D - F. \]  

(20)

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

\[ \frac{\partial R_P(\alpha)}{\partial \alpha} = -D \cdot \left[ \frac{b^2 c_p^2 (b c_p + 3 \alpha c_H^2)}{(b c_p + \alpha c_H^2)^3} \right] < 0. \]  

(21)

Finally, it is straightforward to show that the values \( R_p(\alpha) \) are equal at the boundary of Regions A and B, i.e. when \( \alpha = \frac{b c_p}{\sqrt{c_A^L c_A^H} - c_A^H} \).

**Proof of Lemma 5:** 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 \( R_A(\gamma) \):

\[ R_A(\gamma) = \gamma \cdot D \cdot \left[ p(2\sqrt{c_A^L \mu_A} - c_A^L \mu_A^2) - (1 - p)(2\sqrt{c_A^H \mu_A} - c_A^H \mu_A^2) \right] - \phi \]

Taking derivatives with respect to \( D, \phi, \) 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 \( \gamma \), noting that \( p \geq 1/2 \), and imposing the parameter restriction that defines Region A (i.e., \( b c_p > \alpha[\sqrt{c_A^H c_A^L} - c_A^H] \)) yields:

\[ \frac{\partial R_A(\gamma)}{\partial \gamma} = D \cdot \left[ p(2\sqrt{c_A^L \mu_A} - c_A^L \mu_A^2) - (1 - p)(2\sqrt{c_A^H \mu_A} - c_A^H \mu_A^2) \right] \]

\[ > 0 \]

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

\[ R_A(\gamma) = \gamma D p - \gamma D (1 - p) \cdot \left( \frac{(\alpha c_H^2)^2 + 2abc_H}{(b c_p + \alpha c_H^2)^3} \right) - \phi \]

Once again, taking derivatives with respect to \( D, \phi, \) 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 \( \gamma \) and noting that \( p \geq 1/2 \) yields:

\[
\frac{\partial R_A(\gamma)}{\partial \gamma} = Dp - D(1-p) \cdot \left[ 1 - \left( \frac{bc_p}{bcp + a\alpha} \right)^2 \right] \\
\geq D \cdot (2p - 1) \geq 0 \quad Q.E.D.
\]

**Lemma A**: If Assumptions 1 and 2 hold then \( R_A(1) \geq 0 \) for all \( \alpha \in [0, 1] \) and all \( b \in \left[ 0, \frac{c_A}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) \right] \).

**Proof of Lemma A**: Fix \( \alpha \). First, consider situations with interior litigation strategies, i.e., \( b \in \left[ \frac{\alpha}{c_p} \left( \sqrt{\frac{H}{A}} \sqrt{c_A} - c_H \right), \frac{c_A}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) \right] \) in which case, the statement of the lemma is equivalent to showing that Assumption 1 and 2 imply \( \Phi \leq \Phi_{\alpha} \equiv D\mu_{\alpha} [2(p\sqrt{c_A} - (1-p)\sqrt{c_H}) - \mu_{\alpha}(pc_A - (1-p)c_H)] \) for all such \( b \) and for all \( \alpha \in [0, 1] \). The proof proceeds as follows:

(i) \( \frac{\delta \Phi_{\alpha}}{\delta b} = 2D \frac{\delta \Phi_{\alpha}}{\delta \alpha} [(p\sqrt{c_A} - (1-p)\sqrt{c_H}) - \mu_{\alpha}(pc_A - (1-p)c_H)] \). The term in [ ] is negative when \( b = \frac{\alpha}{c_p} \left( \sqrt{\frac{H}{A}} \sqrt{c_A} - c_H \right) \) thus the derivative \( \frac{\delta \Phi_{\alpha}}{\delta b} \geq 0 \) at \( b = \frac{\alpha}{c_p} \left( \sqrt{\frac{H}{A}} \sqrt{c_A} - c_H \right) \) since \( \frac{\delta \Phi_{\alpha}}{\delta b} < 0 \).

Furthermore, \( \Phi_{\alpha} \) is either increasing over the region \( b \in \left[ \frac{\alpha}{c_p} \left( \sqrt{\frac{H}{A}} \sqrt{c_A} - c_H \right), \frac{c_A}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) \right] \) or is single-humped, thus \( \Phi_{\alpha} \) achieves its minimum at either \( b = \frac{\alpha}{c_p} \left( \sqrt{\frac{H}{A}} \sqrt{c_A} - c_H \right) \) or \( b = \frac{c_A}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) \) for all values of \( \alpha \).

(ii) \( \frac{\delta \Phi_{\alpha}}{\delta \alpha} = 2D \frac{\delta \Phi_{\alpha}}{\delta \alpha} [(p\sqrt{c_A} - (1-p)\sqrt{c_H}) - \mu_{\alpha}(pc_A - (1-p)c_H)] \). If \( b = \frac{\alpha}{c_p} \left( \sqrt{\frac{H}{A}} \sqrt{c_A} - c_H \right) \) the term in [ ] is negative and \( \frac{\delta \Phi_{\alpha}}{\delta \alpha} > 0 \) thus \( \frac{\delta \Phi_{\alpha}}{\delta \alpha} \leq 0 \). Thus, when \( b = \frac{\alpha}{c_p} \left( \sqrt{\frac{H}{A}} \sqrt{c_A} - c_H \right) \), \( \Phi_{\alpha} \) achieves its minimum at \( \alpha = 1 \). If \( b = \frac{c_A}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) \) the term in [ ] is positive and \( \frac{\delta \Phi_{\alpha}}{\delta \alpha} \leq 0 \) thus \( \frac{\delta \Phi_{\alpha}}{\delta \alpha} \leq 0 \). Thus, when \( b = \frac{c_A}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) \), \( \Phi_{\alpha} \) achieves its minimum at \( \alpha = 1 \).

(iii) To find the sharpest bound on \( \Phi \) we only have to find the minimum of \( \Phi_{\alpha} \) evaluated at the points \( b = \frac{\alpha}{c_p} \left( \sqrt{\frac{H}{A}} \sqrt{c_A} - c_H \right) \) and \( b = \frac{c_A}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) \).

(iv) \( \Phi_{\alpha} = D \left[ (p - 1)(1-p) \left( 2\sqrt{\frac{c_A}{c_A} - \frac{c_H}{c_A}} \right) \right] \geq (2p - 1)D \) since \( 2\sqrt{\frac{c_A}{c_A} - \frac{c_H}{c_A}} \leq 1 \).

(v) \( \Phi_{\alpha} = D \bar{\mu}_{\alpha} \left[ 2(p\sqrt{c_A} - (1-p)\sqrt{c_H}) - \bar{\mu}_{\alpha}(pc_A - (1-p)c_H) \right] \) where \( \bar{\mu}_{\alpha} \equiv \mu_{\alpha} (b = \frac{c_A}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) = \frac{\sqrt{c_A}}{c_A \sqrt{D/F} + c_A} \). Using Assumption 1 it can be shown that \( \bar{\mu}_{\alpha} \leq \frac{1}{\sqrt{c_A + c_A}} \) and it can also be shown that \( \bar{\mu}_{\alpha} \geq \frac{\sqrt{c_A}}{c_A \sqrt{D/F}} \). With these facts simple algebra yields \( \Phi_{\alpha} (b = \frac{c_A}{c_p} \left( \sqrt{\frac{D}{F}} - 1 \right) \geq \sqrt{\frac{DFc_H}{c_A}} (2p - 1) \).
(vi) Since \( \sqrt{\frac{DFc_H}{c_A}}(2p - 1) \leq (2p - 1)D \) we have \( \phi_1(b) = \frac{\alpha}{c_p}(\sqrt{c_A} \sqrt{c_L} - c_H) \geq \sqrt{\frac{DFc_H}{c_A}}(2p - 1) \).

Thus, we have shown that \( \phi \leq \phi_1 \) for all \( b \in \left[ \frac{\alpha}{c_p}(\sqrt{c_A} \sqrt{c_L} - c_H), \frac{\alpha}{c_p} \left( \sqrt{\frac{DF}{p}} - 1 \right) \right] \) and for all \( \alpha \in [0, 1] \) if Assumptions 1 and 2 hold.

(vii) Finally, if \( b < \frac{\alpha}{c_p}(\sqrt{c_A} \sqrt{c_L} - c_H) \) then \( L^*_A = 0 \) and \( R_A(1) = pD - (1 - p) \frac{(\alpha c_H^2 + 2abc_H^2 c_p)}{(\alpha c_H^2 + bc_p)^2} D - \phi \geq (2p - 1)D - \phi \geq 0 \) which completes the proof.

Proof of Proposition 1: Lemma 4 establishes that \( R_P(\alpha) \), the principal’s net gain from litigating, is continuous and strictly decreasing in \( \alpha \). Thus, if \( R_P(0) < 0 \), then we know that \( R_P(\alpha) < 0 \) \( \forall \alpha \in [0, 1] \). Noting that \( \alpha = 0 \Rightarrow [(c_A^H)^{-1/2}] > \mu \) (and thus the optimal litigation level is interior for all player-types), imposing \( \alpha = 0 \) on the appropriate expression for \( R_P(\alpha) \) yields:

\[
R_P(0) = D \cdot \left( \frac{c_A^H}{bc_p + c_A^L} \right)^2 - F,
\]

which is negative \( \forall \{b : b > c_A^L/c_p(\sqrt{D/F} - 1)\} \), thereby implying avoiding 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 \( B^* = 0 \). Sequential rationality requires, then, that \( \alpha^* = 0 \) as well. Imposing \( \alpha^* = 0 \) on the litigation end-game 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, i.e. \( \gamma^* = 1 \), 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, i.e. \( B^* = 1 \) and \( \alpha^* = 1 \).

Proof of Proposition 3: Fix \( b \in \left( \frac{c_A^H}{c_p} \left( \sqrt{\frac{DF}{p}} - 1 \right) \right. \middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle\middle

Proof of Proposition 4: To prove part (i) implicitly differentiate \( R_P(\alpha) \) to find
\[
\frac{\delta \alpha^*}{\delta b} = \frac{-\delta R_p(\alpha)/\delta b}{\delta R_p(\alpha)/\delta \alpha} = \frac{-2c_p(\alpha^* \sqrt{c_A^H + (1-\alpha^*) \sqrt{c_A^L}})}{(\sqrt{c_A^H} - \sqrt{c_A^L})((\alpha^* c_A^H + (1-\alpha^*) c_A^L)_b + 3bc_p - \sqrt{c_A^H} c_A^H + \frac{bc_p \sqrt{c_A^L}}{\alpha^* c_A^H + (1-\alpha^*) c_A^L}) \leq 0}
\]

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 \(\frac{\delta \gamma^*}{\delta b} = -\left(\frac{\delta R_A(\gamma)}{\delta b} + \frac{\delta R_A(\gamma) \delta \alpha}{\delta \alpha} \right) / \frac{\delta R_A(\gamma)}{\delta \gamma} \geq 0\).

**Proofs of Corollaries 4.1 - 4.3:** If \(b \in [\hat{b}, \bar{b}]\) and Assumptions 1 and 2 hold then it can be shown that \(L_A^{Lx} \geq 0\), i.e., 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 \(\mu_\alpha\) with respect to \(b\) and using the value of \(\frac{\delta \alpha^*}{\delta b}\) 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 \(\alpha^* q_H^* + (1-\alpha^*) \cdot q_L^* = |\alpha^* \sqrt{c_A^H} + (1-\alpha^*) \sqrt{c_A^L}| \mu_\alpha = \frac{|\alpha^* \sqrt{c_A^H} + (1-\alpha^*) \sqrt{c_A^L}|^2}{bc_p + \alpha^* c_A^H + (1-\alpha^*) c_A^L}\). 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.
Figure 1: Extensive Form of the Game
Figure 2. In-Equilibrium Probability of Agent Effort and Principal Litigation As a Function of Pro-Defendant 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 large 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 modest 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 $p = 0.55, V_H = 100, V_L = 80, c_P = 1.5, c_A^H = 0.25, c_A^L = 1.5, \phi = 0.6, F = 4$, and $D = 20$. 

[Diagram showing regions I, II, and III with corresponding probability values]
Figure 3. In-Equilibrium Probabilities of Winning 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 surprisingly increases with the pro-defendant legal presumption. The model parameters for this figure are $p = 0.55$, $V_H = 100$, $V_L = 80$, $c_P = 1.5$, $c^H_A = 1.0$, $c^L_A = 1.5$, $\phi = 0.6$, $F = 4$, and $D = 20$. 

**Equation:**

$$\text{Principal's Win Rates} = \alpha q_h + (1 - \alpha) q_l$$
Figure 4. Social Waste As a Function of Pro-Defendant 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. The top-left 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 $b$.) The top right graph (B) shows a case in which courts should favor the principal so that she always files suit and wins. The bottom left 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. The bottom right 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: $p = 0.55$, $V_H = 100$, $V_L = 80$, $c_F = 1.5$, $c_A^H = 1.0$, $c_A^L = 1.5$, $\phi = 0.6$, $F = 2.75$, 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 C reduces $c_A^H$ to 0.25.
Figure 5. The Socially Optimal Legal Presumption As A Function of Differential Court Costs For Shirking and Non-shirking Agents. As it becomes more difficult for a shirking agent to mount a defense ($c_{L_k}$ increases relative to $c_{H_k}$), the socially optimal legal presumption $b^*$ shifts in favor of the principal to continue encouraging in-equilibrium litigation. This in turn allows hard-working agents to separate themselves from shirkers. This figure varies $p$, the effectiveness of agent effort, but the figure is qualitatively the same if either $V_H - V_L$ or (the inverse of) $\phi$ is varies. The model parameters for this figure are $p = 0.55$, $V_H = 100$, $V_L = 80$, $c_p = 1.5$, $c_{L_k} = 1.5$, $\phi = 0.6$, $F = 4$, and $D = 20$. 
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 $b^\star$ is solidly in favor of the agent (the manager) in order to discourage redistributitional rent-seeking. When the conflict of interest increases, as it does in a hostile takeover situation and especially when there are competing non-friendly bidders, the socially optimal legal presumption $b^\star$ shifts in favor of the principal (the shareholders). The model parameters for this figure are $V^H = 100, V^L = 80, c_P = 1.5, c_H^A = 1.0, c_L^A = 1.5, \phi = 0.6, F = 4,$ and $D = 20.$