The Evolution of the Common Law with Strategic Plaintiffs

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Abstract

A vast number of cases are settled between the plaintiff and a defendant before going to trial. The standard explanation is that settlement avoids a costly litigation. We explore an alternative mechanism in which the parties settle which prevents the court from clarifying and narrowing the law. Indeed, long-lived plaintiffs have strict incentives to settle cases even when litigation is costless. Moreover, unlike with costly litigation, this incentive skews even a short lived defendant’s incentives to make certain choices over others, implicating welfare in both the short and long run.

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1 Introduction

Within the common law tradition, courts are largely reactive institutions. Typically, they do not “seek out specific interpretive occasions, but instead wait for others to bring matters to their attention” (Fiss (1984)). Accordingly, “judge made” law can be viewed as a function of the demand for judicial decisions by plaintiffs. Thus, the trajectory of how a particular law evolves will depend on the “stream of (relevant) cases that are brought before the court by plaintiffs (Zywicki, 2012).

In the modern state, these plaintiffs are often regulatory agencies with strategic concerns regarding the types of cases that they choose to litigate. For example, the Securities and Exchange Commission’s (SEC) or the Federal Trade Commission (FTC) have, over decades, prosecuted various firms for violating regulations. If these regulator’s objectives are dynamic, then the decision to offer a firm a settlement, or take it to trial, will reflect the regulator’s concerns about how that decision (and the court’s decision if they go to trial) will affect future similar cases. Thus, regulators may have incentive to strategically manipulate current enforcement actions to affect the the outcome of future enforcement actions.

One such avenue for strategic manipulation is the decision to settle out of court or take the firm to trial. Specifically, if there is legal ambiguity regarding the permissive threshold of some action, by prosecuting the firm in court, a judge may resolve or clarify this threshold. However, by offering the firm a pre-trial settlement such as non-prosecution agreement, the threshold may remain ambiguous, which will in turn affect decisions of other firms who may choose to commit related violations in the future. Thus, importantly, the plaintiff’s decision to offer the firm a settlement: (a) affects other firms’ (future) decisions to commit a crime, and (b) prevents the law from being clarified, thereby impacting how the law evolves.

The idea that settlement prevents the common law from evolving has been observed by other legal scholars. Indeed, in a well-cited paper “Against Settlement”, Fiss (1994) notes that:

A settlement will thereby deprive a court of the occasion, and perhaps even the ability, to render an interpretation.

The goal of this paper is to understand how the concerns of long-lived plaintiffs, who can opt to offer the firm a pre-trial settlement, affect the evolution of common law. We examine whether plaintiffs have incentive to settle when doing so prevents the law from being clarified,
thereby affecting the future stream of cases that it may encounter. Additionally, we examine how this affects legal evolution.

To investigate these issues we build on previous models that capture the evolutionary process of the common law tradition (see Baker and Mezzetti (2012), Niblett (2013), and Parameswaran (2018)). There is a firm whose production generates a negative externality. The marginal social cost of this externality is uncertain, but its distribution is common knowledge. There is a court that seeks to implement a negligence-type rule in which the firm is only held liable if it produces more than the socially desirable quantity. Given the uncertainty, the case-space can be divided into three regions: those where the firm is known to have not over-produced (‘per se immunity’), those where the firm is known to have over-produced (‘strict liability’), and those where the correct case disposition is unknown (‘ambiguity’). Cases are decided by a social welfare maximizing court. Since, in the per se immunity and strict liability regions, the ideal case disposition is known, the court will mechanically dispose of such cases. By contrast, when confronted with a case in the ambiguous region, an evidentiary trial will be held, in which the court is assumed to perfectly learn whether the firm had over-produced or not. It is only in this region where the court’s role is salient.

When confronted with a case in the ambiguous region, the plaintiff can decide to settle, rather than take the firm to court. As in Parameswaran (2018) and Baker and Mezzetti (2012), going to court clarifies the law because the court rules whether the quantity was above or below the socially efficient level, thereby, reducing the uncertainty concerning the true magnitude of the harm. Unlike Parameswaran (2018) and Baker and Mezzetti (2012), but similar to Niblett (2013), we assume that courts have no discretion in choosing legal thresholds — these are always construed narrowly, reflecting only the court’s information about the efficient quantity. Following the settlement literature, we assume that going to court is costly to both litigants – although, in the dynamic analysis, we study the case where litigation costs are zero, to focus attention on the incentives to clarify the law or not. Our model therefore departs from prior papers by focusing on the role of strategic settlement.

We begin by establishing baseline outcomes in a static model. We show that the firm will either produce the largest output that is guaranteed to not attract litigation (the ‘safe output’), or the output in the ambiguous region that optimally trades-off higher profits against the penalty if held liable by the court. We show that this ‘risky output’ is independent of litigation costs, and is unaffected by whether settlement is anticipated or not. By contrast, the ‘safe output’ is increasing in the plaintiff’s litigation costs, and is above the (de jure) permissive legal threshold (which separates the regions of per se immunity and ambiguity)
whenever litigation costs are positive. Intuitively, if the firm’s output is not too high, then – even if the plaintiff can recover positive damages in expectation – these damages may be insufficient to cover litigation costs. Litigation costs, therefore, create a wedge between the *de facto* and *de jure* permissive threshold (or alternatively, imply a *de facto* broad permissive threshold even though the court’s *de jure* threshold is narrow). We show that the firm produces the ‘risky output’ unless the *de facto* permissive threshold is sufficiently broad.

Since litigation costs only affect the level of the safe output, whenever the firm chooses the risky output (i.e. whenever there is a genuine role for the court), they do not affect the firm’s choice of quantity. A different way to see this is note that, in any settlement offer, the defendant will always compensate the victim for the expected harms suffered (conditional upon being liable). The benefit from settlement, then, is merely the litigation costs avoided – and these are independent of the firm’s output choice. Hence, in the baseline model, the possibility of settlement and the size of litigation costs, generically have no effect on the firm’s output choice.

We then consider a two period game with a long lived plaintiff and short lived firm. We find that the plaintiff is willing to accept settlements that are smaller than the settlement amount in the static game *even in the absence of any direct court costs*. Clarifying the law makes the plaintiff strictly worse off. Intuitively, with more information, the firm can make choices that enable it to maximize profits at lower risk of being held liable. These choices may still entail significant harms to the victim, although they are now more likely to go uncompensated. This characteristic of the game has an important implication. First, forward looking plaintiffs may not have an incentive to prosecute a case in court to learn about the law. Consequently, even when there are no exogneous court costs, these “endogenous” information costs again introduce a wedge between the *de facto* and the *de jure* permissive thresholds.

This behavior by the plaintiff also affects the firm’s decisions. Specifically, whereas in the static game with costly litigation, the possibility (or not) of settlement does not affect the firm’s output choice, in the dynamic game, the firm will skew its output choice in order to entice a more desirable settlement offer. Although the firm’s output choice will not affect the compensation for expected harms in the current period, it will affect the plaintiff’s assessment of the future under a less uncertain legal framework, whose thresholds depend on the quantity chosen by the court. This in turn affects the size of settlements that the plaintiff will accept. Settling to avoid clarifying the law, thus, exhibits salient qualitative differences over settling to avoid litigation costs.

These results are significant because an overwhelming percentage of regulatory enforcement
actions result in settlements. For example, around 92% of cases of Foreign Corrupt Practices Act (FCPA) violations are settled out of court (and without going to trial) with the SEC.\textsuperscript{1} And, indeed from an efficiency perspective settlement is usually pareto superior to trial. However, our results suggest that it could prevent the law from being clarified, and further that strategic plaintiffs will not have incentive to clarify the law. \textsuperscript{2}

This paper is organized as follows. In the immediately following subsection we discuss the relevant literature. Section 2 presents the basic legal framework. The third studies the static game and the fourth studies the dynamic (two-period) game with long lived plaintiffs. The final section concludes.

### 1.1 Literature Review

This article contributes to a growing literature that studies the role of learning in judicial decision-making (see, in particular, Hadfield (1991), Baker and Mezzetti (2012), Fox and Vanberg (2014), Callander and Clark (2017) and Parameswaran (2018)). Indeed, our model setup is identical to Parameswaran (2018), except that that paper makes the simplifying assumption that litigation is costless.

All of the above papers focus on dynamic decision making by an informationally constrained court that learns as it hears cases. Of particular interest is when and whether courts construe rules broadly versus narrowly, and the implications of these choices for efficiency of the common law. Baker and Mezzetti (2012) and Callander and Clark (2017) both present models in which the underlying behavior of agents is random and legal-rule invariant. In Baker and Mezzetti (2012), the court trades off the benefit of learning from cases against the explicit adjudication costs. When confronted with a case whose ideal disposition is unknown, the court summarily dispose of the case if it is ‘close enough’ to an existing case with known disposition, and investigate the case otherwise. The court, thus implements, ‘somewhat broad’ legal rules. Baker and Mezzetti (2012) show that, if adjudication costs are not too high, the law will evolve incrementally and eventually converge to the ideal legal rule.

Parameswaran (2018) builds on the Baker and Mezzetti (2012) framework by explicitly modelling the agent behavior that generates cases. Rather than facing a random exogenous stream of cases, the court’s docket will be endogenous to the rules it makes.

\textsuperscript{1}Data is obtained from the Stanford Law School FCPA clearing house.

\textsuperscript{2}Indeed, some legal scholars note that “FCPA enforcement is a legal desert, with guidance often drawn not from binding case law but from a whirl of enforcement patterns.”
(2018) shows that with legal uncertainty, the stream of outputs chosen by the firm will be biased away from the \textit{ex ante} efficient level, which skews the court’s ability to learn. (Hadfield (1991) makes a similar argument in an informal model, although her argument depends crucially on agent heterogeneity. Parameswaran (2018) shows that the insight holds even in a world with a representative agent.) In effect, the adjudication costs in Baker and Mezzetti are replaced with the implicit (bias) costs stemming from endogenous response to legal rules. Parameswaran (2018) shows that the size of this implicit (bias) cost is itself endogenous and increases as the law evolves, creating a dynamic where the law evolves for a finite period before settling. Moreover, legal evolution stops before the court can implement the ideal legal rule.

Callander and Clark (2017) study decision-making by a court in a complicated world, where the ideal rule is non-monotone, causing the court’s learning to be localized. Their model micro-founds the common legal practice of reasoning by analogy, and demonstrates the path-dependence of law, which similarly arises in our model. Additionally, in a hierarchical structure where the superior court can choose which lower court decision to review, Callander and Clark (2017) examine the implications of case-selection on efficient learning.

Our model differs from each of these in that, whereas they are particularly interested in optimal decision making by the court, we consider an essentially passive court. Instead, we focus on the incentives for agents to settle under the shadow of the law, and ask how this affects efficiency in the short run, and the long-run evolution of the common law.

Other dynamic models of judicial decision-making investigate how the common law evolves, and the implications for efficiency, when judges (or courts) have heterogeneous preferences (see Gennaioli and Shleifer (2007), Ponzetto and Fernandez (2008), and Niblett (2013)). Gennaioli and Shleifer (2007), for example, provide foundations for the Cardozo Theorem, which states that the individual biases of judges tend to wash out as law is created piece-meal, and that legal evolution is, on average, efficiency enhancing. Ponzetto and Fernandez (2008) similarly show that the common law converges towards more efficient rules, making it more effective in the long-run than statutory rule making. These models typically do not involve any uncertainty about the ideal legal rule although the game is dynamic, there is no role for learning.

This article contributes to the literature on the efficiency of common law more broadly. In a seminal article, Posner (1973) argued that the decisions of efficiency-minded judges would tend to cause the common law to produce efficient rules. Subsequent articles have examined why the common law may tend to efficiency, even if judges are imperfect in their motives,
information or execution. Priest (1977) and Rubin (1977) provide a ‘demand-side’ argument, that inefficient legal rules are more likely to be litigated and subsequently overturned, than efficient ones. Cooter and Kornhauser (1980) provide a formalization of these arguments. By contrast, Hylton (2006) shows that information asymmetries between litigants can cause biased rules, which favor the more informed party, to evolve. Zywicki (2002) stresses the importance of ‘supply-side’ factors, such as institutional rules and norms, in determining the efficiency of common law. Cooter, Kornhauser and Lane (1979) show that incremental rule-making by courts can converge upon efficient rules, even if individual courts are imperfectly informed about the ideal rule. Hadfield (2011) asks whether legal rules will dynamically adapt to new or local conditions. By and large, the primary force that drives the law, in these articles, is case selection (i.e. which cases are litigated). The opposite effect, of the law driving the sorts of cases that arise, is typically left unexplored (although, see Png (1987) and Parameswaran (2018)).

2 Model

Our model builds on Parameswaran (2018) and Baker and Mezzetti (2012). Consider a game with three players: a firm, a plaintiff and a court. In each period $t$, the firm must choose a quantity of output to produce. The firm’s gross (per-period) profit from producing output $q$ is $\pi = q - \frac{1}{2}q^2$. Absent legal incentives, the firm maximizes its profit by producing $q_{max} = 1$.

The firm’s production creates a negative externality that harms a victim. The size of the harm is $\theta q$, where $\theta \in (0, 1)$ is the constant marginal harm. The socially efficient level of output is $q^{eff} = 1 - \theta < q_{max}$, which implies that an unregulated firm will over-produce. The size of the marginal harm $\theta$ is unknown, and all players share common beliefs about its value. For simplicity, we assume that beliefs at the start of the game are uniformly distributed on $[l_0, u_0]$, where $0 < l_0 \leq u_0 < 1$. As we will soon establish, beliefs remain uniform at any period $t$. Given period $t$ beliefs $(l_t, u_t)$, all players know that output $q < 1 - u_t$ will definitely not be above the socially efficient level and output $q > 1 - l_t$ will definitely be inefficiently large. There is uncertainty about whether outputs in the region $(1 - u_t, 1 - l_t)$ are inefficiently large or not.

There is an efficiency-minded court that seeks to implement a negligence-type rule that holds the firm liable only when it has produced more than the socially efficient quantity $q^{eff}$. Given the uncertainty about $q^{eff}$, the legal rule is characterized by a pair of thresholds $(\lambda_t, \mu_t)$ (with $\lambda_t \leq \mu_t$), such that firms producing $q \leq \lambda$ will not held liable, whereas firms
producing \( q \geq \mu \) will definitely be held liable. We thus refer to \( \lambda \) and \( \mu \) as *permissive* and *restrictive* thresholds, respectively. The legal rule is silent as to how cases in the region \( q \in (\lambda, \mu] \) will be decided. Hence, the legal rule is, in effect, an incomplete negligence rule, and the thresholds \( \lambda \) and \( \mu \) are thresholds that determine regions of per se immunity, ambiguity and strict liability.

Since the court is efficiency minded, it will definitely not hold liable a firm producing \( q < 1 - u_t \), and it will definitely hold liable a firm producing \( q > 1 - l_t \). Hence, it must be that \( \lambda_t \geq 1 - u_t \) and \( \mu_t \leq 1 - l_t \). We say the legal rule is narrow if the region of ambiguity coincides with the set of cases whose ideal disposition is unknown – i.e. if the court does not make commitments as to how it will decide cases whose correct dispositions are unknown. If rules are narrow, then \( \lambda_t = 1 - u_t \) and \( \mu_t = 1 - l_t \). By contrast, the legal rule is broad if it dictates the liability status of a case whose ideal status is unknown (i.e. if \( \lambda_t > 1 - u_t \) or \( \mu_t < 1 - l_t \). In both Baker and Mezzetti (2012) and Parameswaran (2018), the question of interest was how courts should optimally choose the thresholds \( \lambda \) and \( \mu \), and whether or when the legal rule should be broad. Since our focus is different, we simplify the analysis by assuming that the court behaves mechanically by always writing narrow rules. Thus, we always have \( \lambda_t = 1 - u_t \) and \( \mu_t = 1 - l_t \), and this is consistent with the approach in Niblett (2013).

If a case arises in the ambiguous region and settlement does not occur, the court fully investigates the case (e.g. by hearing expert testimony), whereupon it perfectly learns whether the chosen output level was above or below the efficient level \( q^{eff} \). The court then updates the legal rule to reflect this new information. For example, suppose at time \( t \), beliefs are uniformly distributed on \([l_t, u_t]\), which implies legal thresholds \( \lambda_t = 1 - u_t \) and \( \mu_t = 1 - l_t \), and that the firm produces \( q_t \in (\lambda_t, \mu_t) \). If the court finds that \( q_t \) is above the efficient level, then it learns that \( \theta > 1 - q_t \). The players’ updated beliefs are now uniformly distributed\(^3\) on \([1 - q_t, u_t]\) (so that, effectively, \( l_{t+1} = 1 - q_t \) whilst \( u_{t+1} = u_t \)), and the court updates the legal rules so that \( \lambda_{t+1} = 1 - u_t \) and \( \mu_{t+1} = q_t = 1 - l_{t+1} \). Alternatively, if the court finds that \( q_t \) is below the efficient level, then it learns that \( \theta < 1 - q_t \). The players’ updated beliefs are now uniformly distributed on \([l_t, 1 - q_t]\) (so that, effectively, \( l_{t+1} = l_t \) whilst \( u_{t+1} = 1 - q_t \)), and the court updates the legal rules so that \( \lambda_{t+1} = q_t = 1 - u_{t+1} \) and \( \mu_{t+1} = 1 - l_t \).

Whenever the firm is held liable it must pay a penalty to the victim. As is customary in the common law, the court awards compensatory damages which requires the firm to pay an amount equal to the expected harm inflicted upon the victim: \( P(q_t, l_{t+1}, u_{t+1}) = q_t E_{t+1}[\theta] = \)

\(^3\)That the posterior remains uniform is a consequence of uniform priors, and the fact that learning simply truncates the support of the distribution over \( \theta \).
Our focus in this paper is on settlements arising out of an incentive other than to avoid legal costs. Accordingly, much of our analysis will assume that litigation costs are zero. Nevertheless, to make clear how our mechanism relates to the cost-avoidance explanation, we allow for potentially costly litigation. We assume the costs to the firm (defendant) and plaintiff are $c_D$ and $c_P$, respectively, and these costs are incurred only for cases that go to trial.

The firms and the plaintiff can avoid litigation cost by settling out of court. After observing $q$, the plaintiff may initiate legal proceedings, whereupon the firm and plaintiff bargain over a settlement offer $s$. (We provide further details of the bargaining protocol in the following section.) If a settlement is agreed to, the firm pays $s$ to the plaintiff, and there is no learning about $\theta$. In doing so, both parties avoid paying litigation costs, and the firm additionally avoids any expected fines. If there is no agreement, the plaintiff must decide whether to go to court or drop the case. If the case goes to trial, the court decides the case and updates the legal rule, as per the above procedure.

The timing of this game is depicted in Figure 1.

A strategy for the firm is a function $q_t(l, u; c_D, c_P, \phi) \in [0, 1]$ that determines a quantity to be produced in each period. A strategy for the plaintiff is a decision $a_t(s; q, l, u, c_D, c_P, \phi) \in \{0, 1\}$ about whether to go to accept a settlement offer $s$ or go to court. A bargaining solution $s_t(q, l, u, c_D, c_P; \phi) \in \mathbb{R}$ selects an optimal settlement offer to paid by the defendant to the plaintiff. A triple $\{q_t, a_t, s_t\}$ is a Bayesian Perfect Equilibrium if, for each $t$: 

$$q_{t+1} = \frac{u_{t+1} + t_{t+1}}{2} q_t.$$ (We use period $t + 1$ beliefs, since these are the updated beliefs after the possible arrival of information during the trial.)
1. $q_t$ maximizes the firm’s expected discounted stream of profits, taking as given the future behavior of the plaintiff, the anticipated bargaining outcome, and the evolution of the legal rule.

2. $a_t$ minimizes the plaintiff’s expected discounted stream uncompensated harms from the externality.

3 Static Game

We begin by studying the optimal behavior in the static game (where there is no benefit to clarifying the law). Our analysis in this section assumes positive litigation costs, and thus gives the standard account of settlement within our framework. In the following section, we analyze the dynamic model assuming no litigation costs, and compare the qualitative features of equilibrium behavior stemming from these distinct mechanisms.

3.1 No Settlement

Our analysis proceeds by backward induction. Since settlement occurs in the shadow of the law, we first analyze outcomes in the subgame where the players fail to reach a settlement agreement. Of course, if the firm’s output is in either the per se immunity or strict liability regimes, the legal consequences are immediate. Thus, we focus our analysis on the case when the firm produces in the ambiguous region.

Suppose $q \in (\lambda, \mu)$. If the case goes to trial, the expected damages that the victim will receive is given by:

$$
\Pr[\theta > 1 - q] \cdot E[\theta|\theta > 1 - q] \cdot q = \frac{u^2 - (1 - q)^2}{2(u - l)} \cdot q
$$

Of course, since litigation is costly, the plaintiff’s threat to go to trial may not be credible. The plaintiff can only credibly threaten to take the firm to court if the cost of litigation is smaller than the expected damages. I.e. if:

$$
\left(\frac{u^2 - (1 - q)^2}{2(u - l)}\right) q > c_P. 
$$

(1)
This is the plaintiff’s individual rationality condition. Let $c_P$ be defined by $c_P = \frac{u^2}{2(u-l)}$.

Individual rationality implies:

**Lemma 1** Credible threats for the plaintiff require that $c_P \leq \tau_P$. If so here exists a $\hat{\lambda}(c_P) \in (1 - u, 1)$ such the prosecution is credible whenever the firm produces $q \geq \hat{\lambda}$. Moreover:

- $\hat{\lambda}(c_P)$ is monotonically increasing, and
- $\hat{\lambda}(0) = 1 - u$ and $\hat{\lambda}(c_P) = 1$.

$\hat{\lambda}(c_P)$ denotes the minimum output that the firm would need to produce to make it worthwhile for the plaintiff to take the case to court. Note that $\hat{\lambda}(c_P) > \lambda = 1 - u$, whenever $c_P > 0$. Even though the legal rule is narrow, there are a set of cases that court could potentially decide in the plaintiff’s favor, but which are not brought because litigation is costly. This implies that the effective region of *per se* immunity is larger from the firm’s perspective than is implied by the legal rule. The firm operates under a *de facto* broad permissive rule, even thought the *de jure* rule is narrow. Of course, if $c_P = 0$, then $\hat{\lambda}(c_P) = \lambda = 1 - u$, and the *de facto* and *de jure* rules coincide. Additionally, when $c_P$ becomes sufficiently large, the *de facto* rule becomes sufficiently broad as to cause the effective region of ambiguity to disappear.

We formalize this result concerning the distinction between the *de facto* and *de jure* legal rule in the following proposition:

**Proposition 1** The *de facto* permissive rule is:

- narrow $(\hat{\lambda}(c_P) = \lambda = 1 - u)$ if $c_P = 0$.
- somewhat broad $(1 - u = \lambda < \hat{\lambda}(c_P) < \mu = 1 - l)$ if $c_P \in (0, \frac{u+l}{2}(1-l))$.
- maximally broad $(\hat{\lambda}(c_P) > \mu = 1 - l)$ if $c_P \geq \frac{u+l}{2}(1-l)$, such that there is no effective region of ambiguity.

We briefly note an analogy to Baker and Mezzetti (2012). In that paper, the *court* faces explicit adjudication costs (whilst the incentives for litigants is left unmodeled). Baker and Mezzetti (2012) show that rules will be optimally broad, when adjudication is costly, and that the breadth of rules increases as adjudication costs increase. Moreover, beyond some threshold cost, rules will be maximally broad and there will be no ambiguity in the law. Our model shows that similar qualitative features can arise when the burden of costs fall upon litigants rather than the court.
3.2 Settlement

The previous subsection characterized the subset of cases where the threat of litigation was credible. We now analyze optimal settlements arising from the threat of litigation. Obviously, if litigation is not credible, the firm will reject any positive settlement offer, and the plaintiff will drop the case. We focus on the more interesting case, where litigation is credible.

Suppose \( q \) is in the ambiguous region. For notational simplicity, let 
\[
I(q, l, u) = q \cdot \frac{u^2 - (1-q)^2}{2(u-l)}
\]
be the expected damages that will be assessed after observing the firm’s choice of \( q \).

It is well known that equilibrium settlement outcomes are sensitive to the bargaining protocol that generated them. To ensure that our results are not simply an artifact of some particular bargaining protocol, we use a fairly general bargaining framework that embeds several common special cases. We assume that the settlement offer is determined by asymmetric Nash Bargaining between the plaintiff and firm. Let \( \phi \in [0,1] \) be a parameter that captures the bargaining strength of the plaintiff. The equilibrium settlement offer is characterized by:

\[
S = \arg \max_{s \geq 0} \left[ s - (I(q, l, u) - c_P) \right]^\phi \left[ -s + (I(q, l, u) + c_D) \right]^{1-\phi},
\]

The Nash bargaining approach includes, as special cases, the well studied scenarios where either the plaintiff (\( \phi = 1 \)) or the defendant (\( \phi = 0 \)) can make a take-it-or-leave-it offer. When \( \phi \in (0,1) \), Imai and Salonen (2000) and Parameswaran and Murray (N.d.) show that the Nash Bargaining approach coincides with the limit case of bargaining between the players à la Baron and Ferejohn (1989) as players can make arbitrarily rapid counter-proposals, where \( \phi \) is the plaintiff’s recognition probability.

Lemma 2 The equilibrium settlement is given by:

\[
S = \begin{cases} 
0 & \text{if } q \leq \hat{\lambda}(l, u, c_P) \\
I(q, l, u) - c_P + \phi(c_D + c_P) & \text{if } q > \hat{\lambda}(l, u, c_P)
\end{cases}
\]

where \( \hat{\lambda}(q, l, u) \) is derived in Lemma 1.

We notice two features of this equilibrium offer. First, under Nash Bargaining, the settlement offer always gives the plaintiff her expected payoff from going to trial, \( I(q, l, u) - c_P \), which is the expected penalty less the plaintiff’s legal costs. Additionally, the plaintiff receives a
fraction $\phi$ of total litigation costs that are avoided by settling out of court. Intuitively, settlement generates a surplus of $(c_D + c_P)$, and the parameter $\phi$ simply determines what fraction of this surplus is received by the plaintiff. Hence, we see that, varying $\phi$ as appropriate, we can achieve any desired distribution of the surplus between the parties.

Second, note that, under Nash Bargaining, the marginal cost (including expected settlement costs) to the firm of producing $q$ is the same for all $\phi \in [0, 1]$. Hence, the firm’s optimal output choice (anticipating the settlement bargaining that will follow) is invariant to the choice of bargaining weights (i.e. the bargaining protocol). Additionally, the marginal cost of producing $q$ is the same whether the settlement is anticipated or not. Hence, the possibility of settlement does not affect the firm’s choice about how much to produce.

### 3.3 Profit maximizing quantity

We now study the firm’s profit maximizing choice of $q$. A firm can choose its quantity in one of three regions: $q \leq \hat{\lambda}$ (de facto no-liability), $q \geq \mu$ (strict liability), or $q \in (\hat{\lambda}, \mu]$ (the region of de facto ambiguity). Since the sanctions vary across regions, the profits (and the profit maximizing quantity) will also vary across regions. The firm’s problem is:

$$
\max_q \Pi(q) = \begin{cases} 
q - \frac{1}{2}q^2 & \text{if } q \leq \hat{\lambda}(l, u, c_P) \\
q - \frac{1}{2}q^2 - I(q, l, u) + (1 - \phi)c_P - \phi c_D & \text{if } q \in [\hat{\lambda}(l, u, c_P), 1 - l] \\
q - \frac{1}{2}q^2 - q\frac{u+l}{2} & \text{if } q > 1 - l
\end{cases}
$$

where we assume $\hat{\lambda}(l, u, c_P) < 1 - l$, which ensures that the de facto region of ambiguity is non-empty. We also make the (conservative) assumption that, if the firm produces in the strict liability region, the parties will not incur legal costs, since the case is decided summarily. As we will see, even when it is costless to produce $q = 1 - l$, it is never optimal to make this choice; making this choice costly will then make even less desirable.

Notice importantly that litigation costs do not affect the firm’s profits at the margin. The size of the plaintiff’s costs are important, however, in determining the boundary between the per se immunity and ambiguous regions.

Let $q_A = 1 - \frac{1-(u-l)+\sqrt{(1-(u-l))2+3u^2}}{3}$ be the solution to the first order condition implied by the firm’s incentives in the ambiguous region. It is easily shown that $q_A < 1 - \frac{u+l}{2} = q_E$, where $q_E$ is the ex ante socially efficient output.
The firm’s equilibrium output choice is given by:

**Proposition 2** There exists a threshold \( \lambda^*(l, u) \geq \lambda = 1 - u \) s.t.

\[
q^*(l, u, c_P) = \begin{cases} 
q_A(l, u) & \text{if } \hat{\lambda}(l, u, c_P) < \lambda^*(l, u) \\
\hat{\lambda}(l, u, c_P) & \text{if } \hat{\lambda}(l, u, c_P) \geq \lambda^*(l, u)
\end{cases}
\]

Moreover, \( \lambda^*(l, u) = 1 - u \) if \( u - l \geq 1 - u \) and \( \lambda^*(l, u) > 1 - u \) otherwise.

Proposition 2 is a special case of Proposition 1 in Parameswaran (2018), assuming the relevant thresholds are the *de facto* ones. For a detailed explanation of the properties of Proposition 1, we refer the interested reader to that paper. Here we simply describe the main feature salient to this paper.

The firm’s output decision amounts to choosing between two output levels, which we refer to as the ‘safe’ and ‘risky’ options. The safe option is the highest output that will definitely not attract litigation (i.e. \( q = \hat{\lambda}(c_P) \)). The risky option is the output that maximizes profit within the ambiguous region (i.e. \( q = q_A \)). It is never optimal to choose an output for which the firm will definitely be penalized. Proposition 2 states that the firm will choose the ‘safe option’ when the *de facto* legal rule is sufficiently broad, and the ‘risky option’ otherwise. Choosing the risky option has the benefit of earning the firm larger pre-penalty profits, but this comes with the risk of incurring a penalty. If the safe option is low, then the pre-penalty profits forgone from choosing the safe option will be large, and this incentivizes the firm to choose the risky option. By contrast, if the safe option is high, the pre-penalty profits forgone will be low relative to the expected penalty from the risk option, and so the safe option is preferred.

Naturally, how large the safe output needs to be depends on the extent of uncertainty about \( \theta \). Indeed, as uncertainty increases (i.e. \( u - l \) becomes larger) the safe output must also be larger in order to be chosen in preference to the risky output. Moreover, when the degree of uncertainty is sufficiently small (\( u - l < 1 - u \)), then even a perfectly narrow permissive rule will cause the safe output to be sufficiently large. If so, the firm is guaranteed to choose the safe option.

Since, in the following section, we will be particularly concerned about decision-making when litigation is costless, we note the following:
Corollary 1 If \( c_P = 0 \), then the firm’s optimal output satisfies:

\[
q^*(l, u) = \begin{cases} 
\hat{\lambda} = 1 - u & \text{if } u - l \leq 1 - u \\
q_A(l, u) & \text{if } u - l > 1 - u.
\end{cases}
\]

When litigation is costless to the plaintiff, there is no distinction between the de facto and the de jure thresholds. Consequently, \( \hat{\lambda} = \lambda = 1 - u \). Therefore, either the firm chooses \( q = \lambda = 1 - u \) when the degree of uncertainty is sufficiently small, otherwise, it chooses \( q_A \).

Given the above discussion, and recalling (by Lemma 1) that the de facto permissive threshold is increasing in \( c_P \), we have the following result:

Lemma 3 Let beliefs be given by \((l, u)\). There exists a \( c^*(l, u) \) satisfying \( \hat{\lambda}(c^*(l, u)) = q_A(l, u) \), such that the firm’s optimal choice is:

\[
q^*(c_P, l, u) = \begin{cases} 
q_A(l, u) & \text{if } c_P < c^*(l, u) \\
\hat{\lambda}(c_P) & \text{if } c_P \geq c^*(l, u)
\end{cases}
\]

As Lemma 3 makes clear, whenever litigation costs are sufficiently low that the plaintiff’s threat to prosecute is credible, the firm’s optimal output is independent of litigation costs. By contrast, when litigation costs (and thus the safe output) are sufficiently high, then the firm will choose the safe output. Hence, the firm’s output choice is never responsive to its own litigation costs, and is only responsive to plaintiff’s litigation costs when these are sufficiently high. (Note that, in such situations, prosecution is not credible.)

In summary, we have shown that costly litigation creates an incentive for pre-trial settlement. However, the settlement negotiations merely divide the total litigation costs (which are independent of the firm’s output choice) saved between the parties. Furthermore, the fact of costly litigation does not affect the firm’s pre-trial output choice, unless the plaintiff’s costs are sufficiently large that prosecution is not credible. In the next section, we explore a different mechanism that generates settlement, and show that this mechanism does create incentives that skew the firm’s output choice.
4 Dynamic Model

4.1 Long-lived plaintiff

We now consider a two period model $t = \{1, 2\}$ with a “long lived” plaintiff who lives for both periods and a sequence of short lived firms who each live for one period. The timing of the game in each period is identical to that described in figure 2, with beliefs regarding the support of $\theta$ and the court’s thresholds evolving according to the decisions in the previous period. Specifically, in each period the firm first chooses $q_t$. The plaintiff observes $q$ and based on his beliefs regarding $\theta$ and $(\lambda, \mu)$ decides whether to settle or prosecute the firm. If the case goes to court (because the firm chose a quantity in the region of ambiguity), the court decides whether $q_t$ is inefficiently large or not. That is, whether $q_t > 1 - \theta$. Since the court’s ruling is always narrow, it follows that $\mu_{t+1} = q_t$. This decision is public, therefore, firms in the next period may use this updated distribution concerning the expected value of $\theta$ and the court’s thresholds.

To characterize this game, we find it useful to write the firm’s quantities in period $t$ as, $q_t(l_t, u_t)$. Further, since the settlement offers need not be the same in the two periods we write the settlement amount: $S_t$.

Before proceeding with our analysis, It is useful to make some observations concerning the equilibrium behavior in this dynamic game. First, note that the analysis in proposition 1 fully characterizes the equilibrium behavior in $t = 2$ given the players’ beliefs at the beginning of the second period $[l_2, u_2]$. Consequently, second, if $q_2 = q_A(l_{t+1}, u_{t+1})$, then the settlement occurs in period 2 (since it is always weakly preferred to going to court, even when costs are 0). Last, condition (1) determines whether the plaintiff can credibly threaten to take the firm to court in period 2 (given $l_{t+1}, u_{t+1}$). However, this condition is no longer sufficient or necessary for the plaintiff to take the firm to court in period one. Indeed, even when (1) is satisfied, a plaintiff may choose not to go to court at $t = 1$ because doing so reveals new information about the distribution of $\theta$, which may reduce its two-period payoffs.

To focus on the plaintiff’s incentives to clarify the law (regardless of court costs), we study the case with $c_P = c_D = 0$. Thus, in the second period the plaintiff can always credibly “threaten” to take the firm to court. Furthermore, in the second period, settlement is always a weakly dominant strategy if the firm’s quantity lies in the ambiguous region. Hence, the key question is to examine the plaintiff’s decision to settle in period $t = 1$ when $\lambda < \lambda^*(l_1, u_1)$, so that the firm chooses $q_1^* = q_A$. (If $q_1^* = \lambda$ then the choice of settlement is moot.)
To analyze the first period’s settlement offer, we must first determine whether at $t = 1$ going to court is individually rational for the plaintiff. Importantly, the two-period payoffs of going to court depend on whether or not the court finds the firm liable in the first period, and how this effects the evolution of beliefs concerning the distribution of $\theta$. Thus, to proceed we first identify the evolution of beliefs regarding $\theta$ assuming that the firm chooses a quantity in the ambiguous region. Otherwise, beliefs do not change.

The ordered pair of second period beliefs,

$$ (l_2, u_2) = \begin{cases} (l_1, 1 - q_1) & \text{if } q_1 < (1 - \theta) \\ (1 - q_1, u_1) & \text{if } q_1 \geq (1 - \theta) \end{cases} $$

Note that if at $t = 1$ the firm is found liable then $l$ rises at the beginning of the second period, whereas if found not liable then $u$ falls. This evolution of beliefs allows us to rule out some second-period firm choices. Specifically, from Corollary (1) we know that a firm chooses the safe output if $u - l < l - u$. Thus, if $u$ is not too large, then if a firm is found liable in the first period, the firm in the second period chooses the safe output.

We make this assumption explicit

**Assumption 1** First period beliefs $(l_1, u_1)$ satisfy $0.2 \leq l_1 < u_1 \leq 0.8$.

The plaintiff’s IR constraint depends whether or not the firm was found liable in period 1 and the period two firm’s behavior. For example, suppose that if in the first period the firm was found liable, the period two firm chooses the safe output, but if the first period firm is found not liable, $q_2$ is in the ambiguous region, then the IR constraint is,

$$ I(q_1, l_1, u_1) + \text{Prob}(\theta \geq 1 - q_1) \left( -\frac{l_2 + u_1}{2} \right) q_2(l_2, u_1) $$

$$ + \text{Prob}(\theta < 1 - q_1) \left( \frac{(1 - q_1)^2 - l_1^2}{2(u_2 - l_1)} - \frac{l_1 + u_2}{2} \right) q_2(l_1, u_2) \geq 0 \quad (3) $$

Observe that the first term $I(q_1, l_1, u_1)$ is strictly positive. However, the second and third terms are negative because in expected terms the fine is always less than the harm given some set of beliefs $(l, u)$. This inequality is stronger than the inequality in Lemma 1 (evaluated at $c_P = 0$). Thus, despite assuming that court costs are 0, a plaintiff may not have incentive to go to court if $q_1$ is sufficiently small. Indeed, as $q_1 \to 0$, this condition is violated, so that going to court is no longer credible. Whereas, in the static game when $c_P = 0$ going to court
is always a credible option for the plaintiff even as \( q \to 0 \). As we show in the appendix, similar reasoning applies to the other possible IR constraints. We summarize this formally in the following proposition.

**Proposition 3** Compared to the static game, the threat to take the defendant to court for a long-lived plaintiff is credible for a smaller range of \( q \). Further, there exists a \( \hat{\lambda}_D > 1 - u_1 \), such that a prosecution is credible whenever the firm produces \( q \geq \hat{\lambda}_D \).

In the static game, when \( C_P = 0 \) the plaintiff’s threat is always credible for any \( q \in (1 - u, 1 - l) \). In contrast, even when costs are 0 this proposition reveals that the plaintiff’s threat to take the firm to court is only credible for a proper subset of the ambiguous region \((1 - u, 1 - l)\). Similar to the static game (lemma 1), this result arises because going to court is too costly for the plaintiff. However, the source of the costs here is critically different from those in the static game. In the static game, the costs were the direct, exogenous, costs of prosecution. Here the costs are ‘information costs’ that endogenously arise when the court makes a ruling in the first period. For example, if the ruling finds the firm liable in the first period, then the second period firm chooses the safe quantity. This lowers the expected gain to the plaintiff, thereby reducing its incentive to clarify the law in the first plaintiff is not risk averse.

Assuming that the IR constraint holds (which we verify in equilibrium), consider the plaintiff’s payoffs if she settles at both \( t = 1, 2 \). Since no learning occurs, the two period payoffs are,

\[
S_1 + I(q_A, l_1, u_1) - (\frac{l_1 + u_1}{2})q_A(l_1, u_1) - (\frac{l_1 + u_1}{2})q_1,
\]

where it should be noted that the previous expression utilizes the fact that \( S_2 = I(q_A, l_1, u_1) \) because costs are 0. If instead she chooses to prosecute the firm in court, her payoffs are,

\[
I(q_1, l_1, u_1) - q_1 \frac{u_1 + l_1}{2} + \text{Prob}(\theta \geq 1 - q_1) \left( -\frac{l_2 + u_1}{2} \right) q_2(l_2, u_1) + \text{Prob}(\theta < 1 - q_1) \left( \frac{(1 - q_1)^2 - l_1^2}{2(u_2 - l_1)} - \frac{l_1 + u_2}{2} \right) q_2(l_1, u_2).
\]

Comparing expressions (5) with (6) yields the following result.

**Proposition 4** Assume \( \frac{1 - l_1}{2} < 2(1 - u_1) \). Then if the firm produces the risky output in the first period, a long-lived plaintiff has a strict incentive to settle (in the first period). The plaintiff will accept any offer \( S_1 \geq \hat{S} \), where \( \hat{S} \) is smaller than the expected penalty it will be awarded by the court in the first period.
The intuition for Proposition 4 is as follows: Clarifying the law will have one of two effects. It may either reveal that $\theta$ is larger than expected, in which case, the firm will respond by choosing a lower output, or it will reveal that $\theta$ is smaller than expected, in which case, the firm will respond by choosing a larger output. However, because in the second period, there is less uncertainty about $\theta$, the firm will be better able to make an output choice that avoids the threat of litigation, or for which the expected damages are lower. (This is an immediate consequence of Corollary 2 in Parameswaran (2018).) Recall – the victim is not compensated for all harms; only if the firm’s output was above the socially acceptable level. Now, although the expected future output may either be larger or smaller than would be the case if the law was not clarified (depending on the firm’s choice of $q$ in period 1), the damages that the victim can expect to receive will be unambiguously lower. Hence, clarifying the law makes the plaintiff and victim worse-off in expectation, relative to leaving the law unchanged.

An implication of the previous insight is that the plaintiff would be willing to ‘pay’ to have a case settled rather than have it litigated. Recall, in the static game, the plaintiff will demand a settlement offer that at least covers the expected damages it could recover from the court. Now, in the dynamic game, the plaintiff will accept a less generous offer. Moreover, this will be true even if litigation costs are zero. In fact, if clarifying the law is sufficiently costly to the plaintiff, than the minimum settlement it will accept may fall to zero (see observation 1). This amounts to litigation no longer being individually rational for the plaintiff in the first period.

**Lemma 4** The firm’s first period output choice in the dynamic game will generically differ from its choice in the static game. I.e. $q_1(l, u) \neq q_A(l, u)$.

Lemma 4 implies that settlement dynamics create an incentive for the firm to choose differently from the output it would choose in the static game. This is not trivial. If the parties settle, then the firm’s period 1 choice does not affect the period 2 environment – in fact the legal rule and beliefs will be the same in both periods. Nevertheless, the firm will choose differently in the first period, in order to manipulate the settlement offer it can expect from the plaintiff in the first period. Since different choices of $q_1$ make the continuation game more of less desirable from the perspective of the plaintiff, they will entail different equilibrium offers in the settlement game.

Lemma 4 highlights an important difference between the mechanism that drives our results and the cost-avoidance mechanism that drives settlements in the standard literature. In
the extant literature, the surplus from settling is simply the litigation costs avoided, and these are independent of the firm’s choice. By contrast, in our framework, the surplus from settling (assuming zero litigation costs), is the gain to the plaintiff from having the law left unclarified. This latter surplus does depend on the firm’s output choice, and a strategic firm will manipulate its output choice accordingly.

To simplify our analysis, in this section we assumed that costs \( c_P = 0 \). If \( c_P > 0 \), then \( S_1 \) would be even smaller than when costs are 0.

### 4.2 Long-lived Defendant

An important insight from the previous subsection is that, clarifying the law generically benefits the firm by enabling it to make better informed choice that make it less likely to be penalized. This is consistent with the basic insight that more information typically will not make agents worse off. By assuming short-run defendants, we ignored the defendant’s incentive to actively seek out litigation (e.g. to instigate test cases).

In this section, we enhance the model by allowing for long-lived defendants. Of particular concern is that, if clarifying the law is sufficiently valuable to defendants, then there may be no offer from the plaintiff that can entice the defendant to settle. Thus, we seek conditions under which the parties are likely to settle, and conditions under which the equilibrium outcome is to go to trial.

[To do]

### 5 Conclusion

A vast proportion of enforcement actions by regulators often involve pre-trial settlements with malfeasors (see footnote 1 for examples). Such settlements are often encouraged because they avoid costly litigation in court. Indeed, from an economic standpoint settlement is often shown to be efficient.

This paper finds that settlement can prevent common law from evolving (and the law from narrowing). We show that both short and long lived plaintiffs have incentive to settle instead of going to court where the law will be clarified. Further, even when court costs are 0, a
long lived plaintiff may not want to take the defendant to court (but prefers to settle) because doing so narrows the law, which in turn (negatively) affects its expected payoffs. This behavior in turn alters the choices of even short lived firms, thereby affecting welfare. Thus, both plaintiffs and defendants do not necessarily have any incentive to go to court to facilitate the reduction in legal ambiguity.

Taken together, these results show that strategic concerns of long lived plaintiffs can affect the stream of cases that arise in court. This, in turn affects the type of cases that the court reviews, influencing the law’s evolution and its efficacy. Our paper, therefore, cautions against too quickly concluding that the common law usually yields efficient outcomes (Rubin (1977)).

6 Appendix

Proof of Lemma 1. Recall that the plaintiff’s IR constraint (1) is,

\[
\left(\frac{u^2 - (1 - q)^2}{2(u - l)} \right) p \geq c_P.
\]

Note that the relevant domain for the LHS of this quality \( q \in [1 - u, 1] \). Over this domain LHS is increasing and concave in \( q \). Further, at \( q = 1 - u \), LHS is 0 and at \( q = 1 \) LHS is \( \frac{u^2 - 1}{2(u - l)} \). Hence, by the intermediate value theorem if (1) in lemma (1) is satisfied there exists a \( q \equiv \hat{\lambda} \) where 1 is satisfied at a strict equality. Clearly, \( \hat{\lambda} \in (1 - u, 1) \).

The remaining claims of lemma 1 follow from an application of the implicit function theorem to the IR constraint satisfied at an equality.

Proof of Proposition 1.

From the proof of lemma 1 we know that \( \hat{\lambda} = 1 - u \) at \( c_P = 0 \), and 1 when \( c_P = \frac{u^2}{2(u - l)} \), and further that \( \hat{\lambda} \) is increasing and continuous in \( c_P \) for any \( q \geq 1 - u \). Hence, by the intermediate value theorem, there exists a threshold \( c_P, \varepsilon_P > 0 \) such that \( \hat{\lambda} = 1 - l < 1 \).

Proof of Lemma 2. If \( q \leq \hat{\lambda}(l, u, c_P) \), then the plaintiff cannot credibly threaten to take the case to trial. The Firm will not accept any settlement offer, and the plaintiff will accept any non-negative settlement offer. Hence \( S = 0 \).
Next, suppose \( q > \hat{\lambda}(l, u, c_P) \). Then the trial threat is credible. The optimal settlement offer is the one that solves (2). The result follows directly from the first order conditions.

**Proof of Proposition 2.** Under Assumption 1, we have \( \frac{1-l}{2} < 2(1-u_1) \). Thus, there are three cases to consider.

**Case 1** Suppose \( \hat{\lambda}(l, u, c_P) < 1-l \). We first show that the firm would never choose \( q > 1-l \). To see this, note that when \( q > 1-l \), the firm’s marginal profit is \( (1-u+l) - q < 0 \), and so the firm would prefer to choose \( q = 1-l \) to any \( q > 1-l \). Next, we show that the firm always prefers \( q = \hat{\lambda} \) to \( q = 1-l \). To see this, first note that since \( \hat{\lambda} \geq 1-u \), the firm weakly prefers producing \( q = \hat{\lambda} \) to \( q = 1-u \) (and this preference is strict whenever \( \hat{\lambda} > 1-u \)).

Next, we verify that producing \( 1-u \) is preferred to producing \( 1-l \). To see this, note that:

\[
\Pi(1-u) = (1-u) - \frac{1}{2}(1-u)^2 = \frac{1}{2}(1-u)(1+u)
\]

whilst:

\[
\Pi(1-l) = (1-l) - \frac{1}{2}(1-u)^2 - \frac{u+l}{2}(1-l) = \frac{1}{2}(1-l)(1-u) < \frac{1}{2}(1+u)(1-u)
\]

since \( 0 < l \leq u < 1 \). Hence \( q = \hat{\lambda} \) is strictly preferred to any \( q \geq 1-u \). Moreover, by construction, \( q_A \) is strictly preferred to any other \( q \in (\hat{\lambda}, 1-l) \). Hence, the firm’s choice is between \( q = \hat{\lambda} \) and \( q = q_A \). Let \( \lambda^* \) be defined by:

\[
\lambda^* = \min_{\lambda \geq 1-u} \left\{ \lambda - \frac{1}{2} \lambda^2 \geq \Pi(q_A) \right\}
\]

\( \lambda^* \) is the quantity that the firm would need to produce if it were certain to not be fined, that would achieve the same net-profit as producing \( q_A \) (where it may be fined). Clearly, \( q_A \) is preferred to \( \hat{\lambda} \) if \( \hat{\lambda} < \lambda^* \), and vice versa.

We can verify that \( q_A > 1-u \) provided that \( u-l > 1-u \). If \( q_A > 1-u \), then \( \Pi(q_A) > \Pi(1-u) \) and so \( \lambda^* > 1-u \). Else set \( \lambda^* = 1-u \).

Finally, suppose \( \hat{\lambda} \geq 1-l \). Then \( (\hat{\lambda}, 1-u) = \emptyset \), and so the ambiguous region is empty; \( q_A \) is infeasible. By the above arguments, the firm must choose \( \hat{\lambda} \).

**Case 2** When court costs are 0 then there is not difference between the de-facto and de-jure threshold. Thus, either the firm chooses \( q = \lambda \) or \( q = q_A \). The marginal profit in the
ambiguous region is,
\[(1 - q) - \frac{(1 - q)q}{u - l}.
\]
This expression is positive at \(q = 1 - u\) if and only if \((u - l) > 1 - u\). Hence, if this condition is satisfied, then \(q^*(l, u) = q_A\), otherwise, \(q^*(l, u) = 1 - u\). ■

**Proof of Proposition 3.** First recall that given \((l, u)\) at the beginning of some period, a firm chooses the safe output if,
\[u - l < 1 - u,
\]
otherwise, it chooses the risky output. If the firm is not held liable after choosing \(q_1\), then \(u_2 = 1 - q_1\). Thus, the period 2 firm chooses the safe output if (6) is satisfied at \(l = l_1 = l_2\) and \(u_2 = 1 - q_1\), which is equivalent to,
\[q_1 < \frac{1 - l_1}{2}.
\]
Instead, if the firm is not held liable after choosing \(q_1\) in period 1, the \(u_2 = u_1\), and \(l_2 = 1 - q_1\). Thus, the period 2 firm chooses the safe output if,
\[q_1 < 2(1 - u_1).
\]
Thus, if
\[\frac{1 - l_1}{2} < 2(1 - u_1),
\]
which is implied by Assumption 1, there are three cases to consider. We study each in case separately.

**Case i** if \(q_1 < \frac{1 - l_1}{2}\), then if it is held liable in the first period, then the second period firm chooses the safe output, whereas if it is not held liable in the first period, the second period firm chooses the risky output. For this case the \(IR\) constraint (3) simplifies to,
\[
V(\text{NotSettle}) = \frac{u_1^2 - (1 - q_1)^2}{2(u_1 - l_1)} q_1 \geq \frac{u_1 - (1 - q_1)}{u_1 - l_1} \left[ -\frac{u_1 + (1 - q_1)(1 - u_1)}{2} + \frac{(1 - q_1) - l}{u_1 - l_1} \left[ -\frac{(1 - q_A^*)^2 - l^2}{(1 - q_1) - l} q_A^* \right] \right]
\]
\[
\iff \frac{u_1^2 - (1 - q_1)^2}{2(u_1 - l_1)} [q_1 - (1 - u_1)] - \frac{(1 - q_A^*)^2 - l^2}{2(u_1 - l_1)} q_A^* \geq 0,
\]
(7)

Where \(q_A^* = q_A(l, 1 - q_1) < 1 - l\).
Case ii If \( q_1 \in (\frac{1-l_1}{2}, 2(1-u_1)) \), the second period firm always chooses the safe output and the plaintiff’s IR constraint is,

\[
\frac{u_1^2 - (1 - q_1)^2}{2(u_1 - l_1)} q_1 \geq \text{prob}(\theta \geq 1 - q_1) \left( \frac{l_2 + u_1}{2} q_2(l_2, u_1) \right) + \text{prob}(\theta < 1 - q_1) \left( \frac{l_1 + u_2}{2} q_2(l_1, u_2) \right)
\]

Case iii If \( q_1 > 2(1-u_1) \), then when the firm is held liable in the first period, the second period firm chooses the risky output. Whereas if the firm is not held liable the second period firm chooses the safe output. In this case, the IR is,

\[
\frac{u_1^2 - (1 - q_1)^2}{2(u_1 - l_1)} q_1 \geq \text{prob}(\theta > 1 - q_1) q_2 \left( \frac{(1 - q_2)^2 - (1 - q_1)^2}{2(u_1 - (1 - q_1))} \right) + \text{prob}(\theta < 1 - q_1)(1 - u_2) \left( \frac{1 - q_1 + l_1}{2} q_2(u_1, 1 - q_1) \right)
\]

In all three cases, at \( q_1 = 1 - u_1 \) the constraints are violated because the left hand side is 0, but the right hand side strictly positive. Hence, by continuity the plaintiff’s threat is not credible for some positive neighborhood near \( 1 - u \), and there exists a \( \lambda_D > \lambda = 1 - u \) such that going to court is not a credible threat if \( q_1 < \lambda_D \). It should be noted that \( \lambda \) may be greater than \( 1 - l \). In this case going to court would not be credible for any value in the ambiguous region.

**Proof of Proposition 4.**

This proof utilizes the three cases from the proof of the previous proposition assuming that,

\[
\frac{1 - l_1}{2} < 2(1-u_1),
\]

Case 1: \( q_1 < \frac{1-l_1}{2} \) In this case, if the first period firm is found liable, the period 2 firm chooses the safe output, while if the first period firm is found not liable, the period 2 firm chooses the risky output. Hence, the payoff from not-settling is:

\[
V(NotSettle) = \frac{u^2 - (1 - q_1)^2}{2(u - l)} q_1 + \frac{u - (1 - q_1)}{u - l} \left[ \frac{-u + (1 - q_1)}{2} (1 - u) \right] + \frac{1 - q_1 - l}{u - l} \left[ \frac{(1 - q_A^*)^2 - l^2}{(1 - q_1) - l} q_A^* \right]
\]

\[
= \frac{u^2 - (1 - q_1)^2}{2(u - l)} [q_1 - (1 - u)] - \frac{(1 - q_A^*)^2 - l^2}{2(u - l)} q_A^*, \tag{9}
\]
which is identical to the payoff in the IR constraining of case i in the proof of proposition 3.

By contrast, the payoff from settling is in all three cases is:

\[ V(\text{Settle}) = S_1 - \frac{(1 - q_A(l, u))^2 - l^2}{2(u - l)} q_A(l, u) \]

Let \( S' = S_1 - \frac{u^2 - (1 - q_1)^2}{2(u - l)} q_1 \) be the difference between the settlement received and the settlement that would be received in a static game. The plaintiff will accept any \( S' \) satisfying:

\[ S' \geq - \frac{u^2 - (1 - q_1)^2}{2(u - l)} (1 - u) - \frac{(1 - q_A)^2 - l^2}{2(u - l)} q_A + \frac{(1 - q_A(l, u))^2 - l^2}{2(u - l)} q_A(l, u) = \hat{S}(l, u, q_1) \]

Next, notice that \( \hat{S}(l, u, 1 - u) = 0 \) and verify that \( \hat{S}(l, u, q_1) \) is decreasing in \( q_1 \), given the assumed parametric restrictions. Then \( \hat{S} \leq 0 \). Hence, the plaintiff will accept offers that are less generous than the equilibrium static offer.

Similarly, for Case (ii) and (iii), the payoff from not settling is,

\[ \frac{u^2 - (1 - q_1)^2}{2(u - l)} q_1 - \left[ \text{prob}(\theta \geq 1 - q_A) \left( \frac{l_2 + u_1}{2} q_2(l_2, u_1) \right) + \text{prob}(\theta < 1 - q_A) \left( \frac{l_1 + u_2}{2} q_2(l_1, u_2) \right) \right] \]

and

\[ \frac{u_1^2 - (1 - q_1)^2}{2(u_1 - l_1)} q_1 - \left[ \text{prob}(\theta < q_1)(1 - u_2) \left( \frac{1 - q_1 - l_1}{2} \right) q_2(u_1, 1 - q_1) \right] \]

respectively. In each case the payoff is strictly less than \( \frac{u^2 - (1 - q_1)^2}{2(u - l)} q_1 \) which is the settlement offer in the static game (note that the term inside the square brackets is positive in both cases). This term represents the cost to the plaintiff from clarifying the law.

This observation yields two conclusions. First, recall that in the static game, when there are no costs, the plaintiff only weakly prefers settlement to trial. In contrast, due to the costs from clarifying the law, the plaintiff strictly prefers settlement. Second, due to these costs the plaintiff’s position is weakened in the (first period) settlement bargaining game, and she will accept less generous offers than in the static game.

\[ \blacksquare \]
References


