Contracts in the Shadow of the Law: Optimal Litigation Strategies within Organizations

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Abstract

A principal can bring litigation against an agent for overstating the realized production costs. A lawsuit functions much like an audit; the principal's ability to bring suit against the agent can reduce the information rent and increase production efficiency by penalizing the agent for false reports. The benefit from higher awards will depend on the ability of the principal to commit to a litigation strategy comprised of a frequency of and expenditure in litigation. While higher awards increase the agent's expected punishment for shirking, they also encourage excessive litigation expenditures by both parties ex post. When the principal can pre-commit to a probability of bringing suit, for large stakes in trial, the principal reduces the probability to maintain a constant expected punishment. Alternatively, if the principal were able to commit ex ante to a probability and intensity of litigation, even when stakes are large, the principal would litigate with certainty but reduce litigation intensity below what is ex post rational.

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1 Introduction

Many of the discussions of optimal contract design assume that placing penalties on those who violate the contract is costless. However, many contractual obligations require that the court system be used to penalize those who do not perform adequately. In a sense, litigation is a way to audit the performance of those parties, and like the audit process, is costly and often imperfect in judgment. While a significant amount research explores the function of audits,[1] little has been done to study the effects of litigation on optimal contract design. Like an audit, the principal can choose use litigation to reduce the cost of providing incentives to perform. But as we show, litigation has some key features which distinguish it from typical audit procedures.

One difference is that the costs of litigation are variable and will depend on the intensity in which the party pleads their case. For example, litigants expend resources to make their case on evidence, expert testimonies, and lawyers. For this reason, we refer to litigation as an 'active audit' in which both the principal and the agent must make expenditures to win. This is in contrast to the 'passive audit' typical in the literature where it is just the principal who pays the costs of auditing.

Furthermore, the expenditures of a party do not necessarily lead to a more accurate verdict, but rather serve to increase the chance of that party winning the case. This active audit process thus leads to an "arms race" in which the expenditures of one party counteract the expenditures of the other, and ultimately both parties are encouraged to over-invest in litigation. Excessive expenditures in suit can weaken the intended deterrence effects of litigation.

This paper examines a fundamental tradeoff between the costs of litigation and the incentives it provides for the agent to perform in the original task. Specifically, we consider the principal's choice of "litigation strategy", a combination of the frequency and expenditure in litigation. As we show, the principal's ability to commit to various aspects of a litigation strategy has profound effects on how the size of the awards from litigation will affect the effectiveness and cost of litigation.

The principal's strategy for filing suits and expenditures in trial will ultimately relate to the design of the initial contract. To see this, we devise a model of litigation that begins with the implementation of the initial task,

[1] Examples of contracting with audits include Baron & Besanko (1984), Demski & Sappington (1987), and Khalil (1997).

i.e. contract design, and ends with litigation. Thus, our model is very similar to those of asymmetric information with auditing. We demonstrate the effects of the size of litigation awards and the principal's ability to commit to litigation on the incentives to file and spend in trial as well as the reliance of the initial task on litigation. The optimal contract will mitigate between incentives for excessive litigation expenses and the deterrence effects of potential litigation. Unlike the audits, however, the costs of litigation are ultimately dependent on the size of the award.

This model also diverges from most audit literature in which the agent is a passive player, meaning in the audit process, she is not obligated to provide effort. In reality, audits may require the compliance or assistance of the agent. For example, when audited by the IRS, a taxpayer is obligated to present items such as receipts to the auditor. Such evidence is costly and ultimately will affect the outcome of the audit. Similarly, the accuracy of the audit may be influenced by the principal as well, who may choose how much time to employ the auditor for, or how much to spend on the auditing procedure. Ex post, the incentive to invest in a more accurate auditor does not always align with the incentives ex ante. For example, if the principal believes the agent has not shirked, he may prefer to invest in a less accurate audit in order to increase the chance of a mistake.

We consider a potential plaintiff (the principal) who enters a contractual agreement with a potential defendant (the agent).[2] The plaintiff can bring suit in cases when low outcomes from the project are observed. For example, should the shareholders or owner of a corporation observe poor stock performance, a suit may be filed against the manager for failure to adequately manage the firm or violation of fiduciary obligations. The actual behavior of the manager is not observed, but can only be inferred from the stock performance or other productivity indicators. It is through the litigation procedure that negligence (i.e. a misreport) is identified.

As is typical in the adverse-selection literature, the agent has incentive to overstate the realized production costs to earn a positive rent from the principal. To prevent this, the principal has three means of mitigating this incentive: providing rent, distorting output, or utilizing litigation. The costs and outcome from litigation will depend in part on the action by the agent which in turn is determined by the contract designed by the principal. Both parties are able to influence the outcome of trial through expending costly "litigation effort" to promote their cases. The magnitude of these costs will depend on the underlying action of the agent and the principal's belief as

[2]We reserve the male gender pronoun for the principal and the female for the agent.

to whether the agent has complied or violated the terms of the contract. One important result that comes from this analysis is that the size of the stake - the award/penalty that results from the plaintiff winning trial - will proportionally affect the costs parties expend in litigation. Simply put, the greater the stake, the more effort both parties put forth and hence the greater litigation costs. [3]

Litigation deters shirking because the shirking agent has a greater cost of litigation effort and ultimately bears a greater cost when the principal brings suit. The amount of deterrence, and therefore the principal's payoff increases with the size of the stake, however, so do the costs of litigation. If the principal can not pre-commit to a level of litigation expenditure when bringing suit, the costs of litigation - comprised of the principal's and the compliant agent's litigation expenditures - increase proportionally with the stake.

The principal's benefit from litigation while increasing with the stake, does not increase linearly. Greater stakes enable the principal to reduce information rent and ultimately regain efficiency in production. However, the principal's payoff increases at a diminishing rate as efficiency is regained. For large enough stakes, the marginal cost of a higher stake will exceed the marginal benefit. If a credible commitment is possible, the principal will lower the probability of suit such that the expected stake remains unchanged, and the benefit and cost from the larger stake is entirely absorbed by the lower probability of suit.

As is often the case, the principal may not be able to pre-commit to such a reduction in the probability of suit. In this case, for a large stake the number of suits is excessive. Too many suits are filed due to the principal's ex post incentive to capture an award from trial, despite his belief that the agent has not shirked.

But a complete understanding of optimal litigation must also consider the optimal intensity of suit. To illustrate, we consider if the principal can pre-commit to a litigation effort as well as a probability of suit. For any given stake, a greater level of deterrence can be achieved at the same cost by increasing the stake while lowering the principal's litigation effort. This is because the shirking agent's payoff is less sensitive to the effort of the principal than a compliant agent. Furthermore, the principal will file suit with certainty, even when the stake is large.

[3]Similar models of rent-seeking in litigation include Farmer & Pecorino (1999), Hirshleifer & Osborne (2001), and Bernardo et al. (2000).[4] The litigation process is a specific form of a rent-seeking game. Skaperdas (1996) discusses some general properties of these types of contests.

There is a great deal of discussion regarding limiting awards in order to curb the large costs of litigation. This analysis argues that caps on litigation *expenses* are a more effective measure at reducing court costs while maintaining the enforcement from potential suits. While excessively large awards induce large litigation expenses, a policy which directly limits these expenditures while maintaining large awards will provide a greater deterrence without increasing costs. To see this, consider the deterrence from a set award without a cap on expenditures. Reducing allowable expenditures will lower the cost of litigation, but also reduce the deterrence. Simultaneously increasing awards will enable the previous level of deterrence to be achieved at a lower cost through limits in expenditures. Thus, we show that the principal can benefit from larger awards so long as he is able to concurrently reduce litigation expenditures accordingly.

The remainder of the paper is presented as follows. The next section surveys some of the literature relating to litigation and contract design. Section **??** presents the describes the basic model including the production and litigation stages. Section **??** solves for the optimal contract with commitment to filing suit, but not effort in litigation, and shows how relaxes commitment brings about excessive filing of suits. Section **??** presents the optimal contract with commitment to a complete litigation strategy and how the results imply excessive litigation expenditures. In section **??** we conclude.

1.1 Related Literature

This research lends to the discussion on the effectiveness of litigation in enforcement of contracts. Much debate surrounds the effectiveness of litigation in preventing security fraud, and abuse scandals are commonplace in the news. Arguments abound as to whether the penalties from litigation are sufficient to deter violations, or whether the awards are excessive and create a "race to the courthouse" (Perino, 2003). This latter concern has in part motivated changes to securities class action legislation such as the Private Securities Litigation Reform Act of 1995 (PSLRA), which in part was an attempt to reduce so-called frivolous class action suits. This model is in part an attempt to provide a more complete framework for analysis of such claims.

Litigation in a principal-agent framework is similarly described by Bernardo et al. (2000). Their study shows how increasing biases in the litigation process to favor the plaintiff may in fact result in the defendant winning more cases. This is because of the effect the bias has on the defendant's action in the underlying task, and ultimately the plaintiff's belief and action in litigation. We relax the assumption that the plaintiff (i.e. principal) pays a fixed wage to the defendant for participating in the contract, and as a result the principal does not require litigation to induce compliance. Rather, litigation serves to reduce the information rent the agent enjoys.

Gutierrez (2003) and Sarath (1991) study how litigation insurance and limited liability provisions can mitigate ex post incentives to sue by shareholders against directors. Both assume that the principal is unable to precommit to a litigation strategy. Gutierrez in particular argues that these "protective measures" are chosen by the shareholders to induce the desired level of litigation ex post by acting as a decoupling device between what the director pays from litigation and what the shareholders receive. Our description of the litigation process is made more sophisticated by accounting for the intensity in which litigants push their case. This dimension makes endogenous both the cost and accuracy of litigation. Instead of assuming an exogenous wealth constraint, we show that the size of the penalty is constrained for a different reason: the greater cost of litigation expenses makes a larger penalty costly to impose. Thus, we find that when the penalty is made large, the principal will in fact lower the chance of suit such that the expected penalty to the agent remains constant. None of the studies account for the possibility that the principal may commit to a litigation strategy prior to executing the contract.

Garcia et al. (2003) incorporates the possibility of litigation into an adverse selection model. Instead of litigation punishing the agent for failure to perform, the agent brings litigation in order to receive additional compensation for the task. Because the agent does not realize his costs until after signing the contract, the first best occurs when litigation does not occur, and therefore, the principal benefits from commitment to high litigation expenditures because it deters the filing of suits ex post. Because litigation serves a different function in our model, we find that the principal benefits from commitment to *low* litigation expenditures. Without commitment, the principal tends to over-invest in litigation rather than in their model in which the principal under-invests.

In most of the audit literature, the principal is restricted to choosing the frequency, but not the intensity with which the audit is conducted. A recent exception is Kessler (2004) who considers the principal's choice of both frequency and accuracy. In this setting, the principal always favors accuracy over frequency if the agent's transfer can be made contingent on the occurrence of an audit. Our result is quite different: if the principal is able to commit to a litigation frequency and intensity, he will litigate with certainty but reduce the intensity as the stake increases. One reason for the difference here is that the principal's intensity in litigation does not imply a greater accuracy. Rather, intensity increases the likelihood that the stake is recovered by the principal ex post. This leads to a greater cost for both compliant and shirking agents alike.

Khalil (1997) considers the role of commitment in optimal contract design as pertaining to audits.[5] In that model, the principal cannot commit to a probability of an audit, but unlike in our paper, the principal will audit only if he believes the agent has shirked with a sufficiently high probability. This is because audits are accurate so that the ex post payoff from an audit for the principal is below the cost. The resulting audit equilibrium will have the principal and the agent randomizing their audit and compliance strategies, respectively. Our result shows that fewer audits/suits occur only if the principal is unable to commit to a litigation effort. When effort is also committed in the contract, the principal will reduce litigation effort rather than reduce the frequency of suits. Furthermore, without commitment to a frequency of suit, the principal's payoff does not necessarily increase with the stake, as larger stakes eventually drive the marginal cost of litigation above the marginal benefit.

2 The Model

2.1 Production

A firm is owned by a single, risk-neutral principal. The principal employs a risk-neutral agent to manage production in the firm. The output of the firm, q, is verifiable and valued by the principal according to a strictly concave function, $V(q)$ satisfying the Inada conditions.

The agent is endowed with private information as to her marginal cost of production. We suppose that a (constant) marginal cost parameter, θ, can take one of two values, $\theta \in \{\theta_L, \theta_H\}$, $\theta_L < \theta_H$. Thus, the agent bears a total cost from production of θq. The principal does not observe the agent's cost parameter, but his prior belief that $\mathbb{P}(\theta_H) = p$ is common knowledge.

After the agent learns her marginal cost, the principal offers the agent a take-it-or-leave-it contract specifying a menu of outputs and transfers from which to choose, $\{q_i, t_i\}_{i=H,L}$. The agent can comply with the contract by producing q_i and receive a transfer t_i when marginal cost θ_i is realized, or violate the contract by producing $q_{j\neq i}$ and receive transfer $t_{j\neq i}$. Production of output q_i indicates an announcement by the agent that the marginal cost

[5]See also Khalil and Lawarrée (2000).

is θ_i.

After observing output and providing the agent with the corresponding transfer, the principal chooses whether to file a legal suit against the agent on the grounds that the agent did not comply with the contract. Assume that litigation may only be filed when the agent *overstates* her true cost of production, and therefore the principal can file suit if and only if the agent produces q_H. We are restricting suits to occur only when the principal realizes damages from the agent *overstating* the true production costs.[6] After the principal files suit, the case proceeds to trial.[7]

2.2 The Trial Process

Litigation is a contest in which both parties provide *litigation efforts* to promote their case thereby increasing their chance of winning suit. These efforts represent lawyers' fees, expert witness testimony, evidence production, or any other means the litigants promote there case. We are not interested in precisely how the litigants choose what to provide in court, but rather on the overall effort they choose to make. The principal, who is the plaintiff in the suit, provides a level of litigation effort denoted by l_P, at a constant marginal and average cost which is normalized to 1. Similarly, the agent, who is now the defendant, provides a level of litigation effort given by l_A^i, $i = H, L$.

The cost the defendant bears from litigation effort will depend on the merit of the case. We assume that an agent who has misreported her cost in the previous stage will bear a greater cost of providing litigation effort than an agent who has complied with the contract. The high-cost agent when brought to trial has complied with the contract and bears a marginal and average cost of litigation effort of 1. If the agent is a low-cost type and has therefore misreported will bear an effort cost of $\mu > 1$. [8] This captures the

[6]If the agent were to misreport costs as low, then it is reasonable to assume that the principal is made better off by the false report. In order to file suit, the principal must realize a loss attributed to the agents report.
This assumption is not relevant when the principal can commit to bringing suit, for the optimal filing strategy would never result in litigation when the agent reports high cost.

[7]We are abandoning the possibility of settlement to emphasize the enforcement effects of litigation. Despite this assumption, the expected outcome of trial will determine the settlement possibilities for the parties. Shavell (2004) discusses of how the litigants' beliefs of trial outcomes influence the likelihood of settlement.

[8]Alternatively, we can suppose that the cost of evidence is identical for both types of defendant, but "false" evidence is less persuasive to the judge or jury. This would have the same formulation.

fact that false evidence or testimony is more costly to present than truthful evidence.

The effect of litigation effort on the verdict of the trial is described by a *litigation success function* given by:

$$\sigma(l_P, l_A^i) = \frac{l_P}{l_P + l_A^i}, i = H, L, \tag{1}$$

where $\sigma(\cdot)$ is the probability that the plaintiff wins the suit.[9] This particular success function has the property that the effort of a party positively influences the probability that he or she wins the suit at a diminishing rate.[10] The court is not a strategic player in this game, meaning the court only uses the function above to come to a verdict. The court's success function is common knowledge.

This particular form of litigation can also be interpreted as an audit in which parties can influence the outcome of the audit through costly effort. For example, a manager wishing not to get caught stealing funds may expend resources to hide certain files from the auditors. Similarly, the auditors can expend more effort to fabricate or dig deeper for evidence which might convict the manager of fraud. The cost of these activities will depend on whether the manager has in fact committed fraud.[11]

The probability that the principal files suit is given by λ. When in trial, both the principal and agent (i.e. plaintiff and defendant) simultaneously choose litigation efforts. If the plaintiff wins the trial, he is paid an award by the defendant. This award/penalty is called the *stake* of the suit and denoted by S, $S > 0$. Alternatively, if the defendant wins the suit, no penalty is mandated by the court, the principal must pay the contracted transfer to the agent, and both parties still must pay the cost of their litigation efforts. The size of the stake is fixed. The stake and success function are common knowledge.

[9] In the case where $l_P = l_A^i = 0$, we will assume that $\sigma = 1/2$, however, this does not affect the results.

[10] This is a common form of a litigation success function, also found in Bernardo et al. (2000) and Farmer & Pecorino (1999). This is a specific form of a contest success function (see Skaperdas (1996)).

[11] In conjunction with this interpretation, we can suppose that the cost of influencing the audit outcome is equal for both an innocent or fraudulent manager, but the degree to which this affects the outcome differs. This is mathematically equivalent to formulation given.

2.3 Timing

The timing is as follows:

- The agent learns cost of production.
- The principal offers contract.
- The agent chooses quantity of output to produce.
- Output q_i is observed and t_i is paid.
- If q_H is produced, the principal can file suit.[12]
- If a suit is filed, the litigants simultaneously provide litigation efforts.
- Outcome of trial realized. If principal wins trial the agent pays S to principal. Otherwise, no transfer occurs.

2.4 The Litigation Stage

In equilibrium, agent chooses litigation effort to minimize her expected cost from suit. The principal too will choose the optimal litigation effort given his belief of whether the agent has misreported or not. Denote α as the principal's posterior belief that the agent is type θ_L given the agent has announced θ_H. In any reasonable equilibrium, (e.g. sequential equilibrium), this belief must be consistent with the action of the agent, and is therefore common knowledge prior to giving litigation effort.

The principal's objective function in trial is:

$$\max_{l_P} S\alpha \left[\frac{l_P}{l_P + l_A^H}\right] + S(1-\alpha)\left[\frac{l_P}{l_P + l_A^L}\right] - l_P.$$

The low-cost agent who provides a false report in the previous stage, has an objective function:

$$\min_{l_A^L} S\frac{l_P}{l_P + l_A^L} + \mu l_A^L, \tag{2}$$

[12]Many studies of litigation incorporate a cost to filing suit by the plaintiff. This could include any research conducted, forms filed, or billed lawyers' hours. We assume the cost of filing is zero for this analysis. While a large cost of filing suit is likely to lead to a mixed strategy equilibrium in production choice and filing choice (Khalil, 1997), this is left for further research.

and for the high-cost agent:

$$\min_{l_A^H} S\frac{l_P}{l_P + l_A^H} + l_A^H. \tag{3}$$

These objective functions yield the following interior solutions for the agent:

$$l_A^H = \sqrt{Sl_P} - l_P \tag{4}$$

$$l_A^L = \sqrt{\frac{Sl_P}{\mu}} - l_P. \tag{5}$$

The principal and high-cost agent will put forth a strictly positive level of litigation effort, regardless of the principal's belief. However, the low-cost agent will provide a strictly positive effort in litigation if and only if $l_P < S/\mu$. To see this, note that the principal's litigation effort will never exceed S. Above S, the principal makes a loss from litigation and is better not providing any effort. This implies that the high-cost agent always chooses effort according to the interior solution (**??**). The following lemma describes the expected outcome from the litigation stage:

Lemma 1 *In the litigation stage, if $\mu > \mu^* \equiv [(1+p)/p]^2$, for any given $\alpha \geq p$, the litigation game has a unique equilibrium given by:*

$$l_A^L = 0,\ l_A^H = S\frac{\alpha}{(1+\alpha)^2}, \textit{ and } l_P = S\frac{\alpha^2}{(1+\alpha)^2}.$$

See the appendix for a detailed proof.

The lemma shows that if the cost differential of litigation effort between a shirking agent and compliant agent is sufficiently large, the shirking agent's will put forth zero effort in litigation, regardless of the principal's posterior belief. Because $\alpha \geq p$, the principal will anticipate a portion of the agents who claim to be high cost are truthful. A truthful agent mounts a stronger defense in litigation because of the lower cost of effort. Therefore, principal fights harder the greater probability he assigns to the agent being truthful. When $\mu > \mu^*$, even in the extreme case where $\alpha = p$ (i.e. the agent always reports costs are high), the effort of the principal is sufficient to drive the shirking agent's litigation effort to zero.

We will assume that $\mu > \mu^*$ for the remainder of the paper. Following the lemma, the principal's net payoff from litigation is:

$$\Gamma_P(\alpha) = S\left[\frac{\alpha^3}{(1+\alpha)^2} + 1 - \alpha\right],$$

while the high-cost agent's *loss* from litigation is:

$$\Gamma_A^H(\alpha) = S\left[\frac{\alpha(2+\alpha)}{(1+\alpha)^2}\right].$$

Finally, the low-cost agent bears a total cost of S.

The principal's payoff is strictly decreasing in α. Intuitively, the greater probability the principal assigns to the agent complying, the prosecution of the agent will be less effective. The principal puts forth more effort as α increases. The higher effort cost coupled with the greater proportion of high-cost agents lowers the principal's expected payoff. Similarly, the high-cost agent anticipates a greater effort by the principal as α increases, which causes her to increase her own effort as well. While her probability of winning is unchanged, she puts forth more litigation effort, increasing her total cost of litigation.

2.5 The Contracting Stage

The principal will design the contract while accounting for the expected cost and penalties resulting from litigation and the ex post optimal probability of filing. We will consider only the pure-strategy equilibrium contract, in which case the principal will induce the agent to report the true state and comply with certainty. The appendix provides the sufficient conditions for this assumption to be true. The principal's problem is to choose $q_L, q_H, t_L, t_H, l_P, l_A^H, l_A^L$, and λ to:

$$\max p\left[V(q_H) - t_H + \lambda\left(\sigma(l_A, l_A^H)S - l_P\right)\right] + (1-p)\left[V(q_L) - t_L\right]$$

subject to

$$t_H - \theta_H q_H - \lambda\left(\sigma(l_P, l_A^H) + l_A^H\right) \geq 0 \tag{6}$$

$$t_L - \theta_L q_L \geq 0 \tag{7}$$

$$t_L - \theta_L q_L \geq t_H - \theta_L q_H - \lambda\left(\sigma(l_P, l_A^L) + \mu l_A^L\right) \tag{8}$$

$$l_P \in \arg\max_{\hat{l}_P}\left\{\sigma(\hat{l}_P, l_A^H)S - \hat{l}_P\right\} \tag{9}$$

$$l_A^H \in \arg\max_{\hat{l}_A^H}\left\{\sigma(l_P, \hat{l}_A^H)S + \hat{l}_A^H\right\} \tag{10}$$

$$l_A^L \in \arg\max_{\hat{l}_A^L}\left\{\sigma(l_P, \hat{l}_A^L)S + \mu\hat{l}_A^L\right\} \tag{11}$$

$$\lambda \in \arg\max\left\{\lambda\left(\sigma(l_P, l_A^H)S - l_P\right)\right\} \tag{12}$$

The first three constraints are the standard participation and incentive compatibility constraints. The agent's reservation utility is normalized to zero. (**??**) assures the high-cost agent will accept the contract given the probability and cost of litigation. Because the principal can bring suit if and only if the agent reports θ_H, there is no cost from litigation appearing in the low-cost agent's participation constraint, (**??**). The incentive compatibility constraint, (**??**), includes the cost of litigation if the low-cost agent reports θ_H. The last four constraints assure that the choice of litigation effort for the principal, high-cost agent, and low-cost agent, and the principal's filing probability are sequentially rational, respectively. Notice that the principal's belief when litigation occurs is that the agent's report is accurate.

Constraints (**??**) and (**??**) capture the principal's inability to commit to litigation effort and probability of filing, respectively. In the sections that follow, we will consider commitment to both effort and probability of suit ("full commmitment") and commitment to probability only ("partial commitment"). Depending on the level of commitment, these two constraints may be relaxed from the problem. We begin in the next section by considering the partial commitment case.

3 The Optimal Contract with Commitment to a Probability of Filing Suit

Consider the case where the principal can commit to a probability of filing suit in the contract. The principal will choose an optimal probability of filing suit by accounting for the expected outcome of litigation computed above (see Lemma **??**). The "partial commitment" regime, or $\mathscr{P}^{\mathcal{PC}}$, assumes that the principal can commit to a probability of suit, but not a litigation effort. We use this to analyze how the principal chooses the optimal filing strategy.

Working backwards, we replace the litigation effort constraints, (**??**), (**??**), and (**??**), with the expected payoffs from the litigation stage. In equilibrium the agent provides a truthful report. The principal's belief after observing q_H must be consistent with the agent's action and therefore $\alpha = 1$. From the results in Section **??**, the principal's net payoff from litigation is $S/4$ and the high and low cost agent's are $-3S/4$ and $-S$, respectively. The principal's problem is rewritten:

$$\max p\left[V(q_H) - t_H + \lambda S/4\right] + (1-p)\left[V(q_L) - t_L\right]$$

subject to

$$t_H - \theta_H q_H - \lambda 3S/4 \geq 0 \qquad (\text{IR}_H^{PC})$$

$$t_L - \theta_L q_L \geq 0 \qquad (\text{IR}_L^{PC})$$

$$t_L - \theta_L q_L \geq t_H - \theta_L q_H - \lambda S \qquad (\text{IC}_L^{PC})$$

The tradeoff from litigation is apparent in the problem above. When litigation occurs, the principal must bear his own litigation effort cost, l_P, as well as that of the high-cost agent. This is because t_H must compensate the agent for expected litigation costs as well as production costs. While the transfer of the stake provides the principal with no net gain or loss ex ante, the litigation efforts represent a cost to the principal of $\lambda S/2$, which is the sum of the agent and principal's effort costs in litigation.[13] The benefit from litigation appears in (IC_L^{PC}) where the principal can reduce the agent's rent and increase production efficiency. This is possible because litigation is more costly for the shirking agent.

The principal may or may not use litigation. On one hand, litigation is more costly for the low-cost agent who misreports, reducing the agent's incentive to misreport. On the other hand, litigation is costly for the principal directly through litigation effort, and indirectly through the truthful agent's litigation effort. The principal will benefit from incorporating a strictly positive probability of suit only if there is a sufficiently large probability that the agent's costs are high. The formal analysis, reserved for the appendix, shows that this result is independent of the size of the stake. That is, if p is sufficiently large, the principal will optimally choose a contract without litigation ($\lambda = 0$) regardless of the size of the stake. The following lemma offers this result:

Lemma 2 *When the probability of a high-cost agent is large (i.e. $p > 1/3$), the principal never files suit (i.e. $\lambda = 0$), regardless of the size of the litigation stake.*

When p is large, the cost of litigation exceeds the benefit. The benefit from suit is at most $S/4$ whereby the principal is able to reduce t_L. This occurs with probability $1-p$. The cost, which is the sum of litigation efforts of the principal and high-cost agent is $S/2$ which is borne with probability p. The expected cost will exceed the benefit when:

$$(1-p)S/4 > pS/2$$

[13] Note that the principal ultimately must bear the cost of the agent's effort cost through the participation constraint.

or $p > 1/3$.

If and only if p is small will the principal choose a strictly positive probability of filing suit. When the stake is small, the principal finds that litigation with certainty ($\lambda = 1$) is optimal. The output levels remain at the second-best (no litigation) levels, but the presence of suits enables the principal to reduce the rent of the low-cost agent.

However, even as the size of the stake gets increasingly large, the contract does not achieve the first best. For $S > \overline{S}$, where $\overline{S}$ is defined below, the principal will choose a probability of suit to maintain a constant level of deterrence, $\lambda S = \overline{S}$. That is, larger stakes are offset exactly by a reduced probability of suit, and even in the limit as the stake approaches infinity, inefficient production remains.

The intuition behind the resulting *constant expected punishment* is that the higher stakes are accompanied by proportionally greater litigation effort costs. Ultimately, these costs are borne by the principal when making the contract through the participation constraints. The marginal benefit from a greater punishment is strictly diminishing, and therefore, the optimal expected punishment reaches an internal optimum.

The following proposition formalizes the results:

Proposition 1 *Suppose the principal can commit to a probability of bringing suit in the contract and $1/5 < p < 1/3$. The optimal contract is as follows:*

- *For small litigation stakes, the principal files suit with certainty when the agent announces costs are high ($\lambda = 1$). The optimal outputs are such that:*

$$V'(q_L) = \theta_L \text{ and } V'(q_H) = \theta_H + \Delta\theta \frac{1-p}{p}$$

The high-cost agent receives zero rent while the low-cost agent earns a rent of

$$\Delta\theta q_H - S/4.$$

- *For intermediate litigation stakes, the principal files suit with certainty, neither type of agent earns rent, and the optimal outputs are characterized by:*

$$V'(q_L) = \theta_L \text{ and } q_H = \frac{S}{4\Delta\theta}.$$

- *For large litigation stakes, neither type of agent earns rent and the optimal outputs are described by:*

$$V'(q_L) = \theta_L \text{ and } V'(q_H) = \theta_H + 2\Delta\theta$$

The principal chooses a probability of suit such that:

$$\lambda S = 4\Delta\theta q_H \equiv \overline{S}.$$

Proof in Appendix.

The above proposition restricts the analysis to $p > 1/5$. This assures that the agent will play a pure strategy in equilibrium. [14]

For small stakes, the principal uses litigation to reduce the rent to the agent. This is clearly seen by the (IC_L^{PC}) constraint. The threat of litigation reduces the payoff from misreporting by precisely the difference in litigation costs for a high-cost agent ($3S/4$) and a low-cost agent (S). The difference of the two is the decrease in the low-cost agent's rent resulting from litigation. In the intermediate region, the principal increases q_H to regain efficiency.

The last bullet is worth noting, for when the stake is large, the principal will reduce the probability of filing suit so that the expected punishment does not exceed the stated threshold. Thus, increasing the stake in this region will be matched by a proportional reduction in the probability of suit. A clear way to understand this is to see how litigation compares to an audit. The cost of an audit is typically independent of the size of the stake.[15] Therefore, as the stake increases, the principal will use the auditor to progressively increase q_H to the efficient level. With litigation, there is a second effect from larger stakes of higher litigation efforts. This cost is ultimately borne by the principal and amounts to $S/2$; it increases proportionally with the stake. Eventually, for stakes large enough, this effect dominates the benefit from increasing output. The principal counteracts the larger stakes through reducing the probability of suit.[16]

[14] While $p \leq 1/5$ does not necessarily imply the agent chooses a mixed strategy, for our analysis, we wish to focus on the pure strategy equilibrium contract for which $p > 1/5$ is sufficient. From Lemma **??**, the effort of the principal and high-cost agent increase in α. Therefore, if the principal induces misreports with a strictly positive probability, according to the definition of equilibrium, α must decrease according to Bayes' Rule. As a result, the principal's cost of litigation decreases. The principal faces a tradeoff between the costs of litigation - particularly the litigation effort of the high-cost agent and himself - and inducing the agent to comply with the contract.

[15] Kofman and Lawarrée (1993) derive the interesting result that in the presence of corruption, larger stakes will in fact increase the costs the principal must bear from auditing. Therefore, a similar result to Proposition 1 of "constant punishment" may arise when employing corruptible auditors.

[16] This result will continue to hold in the presence of a fixed filing cost as well. However,

3.1 Without Commitment to File Suit

The principal will expect a strictly positive net payoff from filing suit for any given belief he may have regarding the truthfulness of the agent's report. This means that without prior commit to a filing probability, λ, the principal will file suit with certainty.

From the results above, this has no consequence when the stake is small or in the intermediate range. The optimal filing strategy with commitment is for $\lambda = 1$, which satisfies sequential rationality without commitment. However, when S is large, the principal can no longer reduce the probability of suit. As we will see, there are two consequences of this lack of commitment. First, the principal continues to file suit, even when the additional cost exceeds the additional benefit from deterrence. Second, for stakes large enough, the contracted outputs reach the first best.

Proposition 2 *Suppose the principal cannot commit to a probability of suit,* λ.

- *The principal always brings suit after observing* q_H.
- *If the stake is small,* $S \leq \overline{S}$*, the optimal contract without commitment is the same as the optimal contract when the principal can commit to a probability of filing suit.*
- *If the stake is large, the contracted outputs are at first-best levels and the agent earns no rent.*

The first and second points are clear. The principal expects a positive payoff from filing suit (ex post) and therefore always files. Because the optimal probability of suit when S is small is to always file, the restriction that the principal's filing choice be sequentially rational has no bite.

With large stakes, litigation is excessive. Despite reaching the first best and zero rent, the principal is better with commitment to limit his probability of filing suit. Recall that with probability p, the agent has high costs, and therefore the principal files suit. The expected net cost of litigation is

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there is an additional benefit from reducing the probability of suit, namely, the filing fee. The principal reduces the probability of litigation for stakes below $\overline{S}$ and only in the limit as $S \to \infty$, does the output achieve

$$V'(q_H) = \theta_H + 2\Delta\theta.$$

which is strictly less than the first best.

$pS/2$. The principal is in fact better lowering the probability of suits and distorting output rather than paying such high litigation costs.

The result above provides a clear argument for limiting awards from trial. Large stakes encourage excessive filing of suits. The reason is illustrated by our rent-seeking model of litigation. Higher stakes increase the cost of litigation potentially beyond the marginal benefit from increased deterrence. Because the principal is the sole beneficiary of greater efficiency, and the marginal cost of litigation exceeds this marginal benefit from higher awards, the overall surplus generated by such a contract decreases in the face of large stakes. Providing limited liability provisions (LLPs) are one way of correcting this lack of commitment to a frequency of suit, particularly when the stake is in excess of $\overline{S}$. While this will bring about lower production efficiency, reduction in the net cost of litigation is greater. LLPs enable the principal to limit his own litigation effort as well as the agent's.

4 Commitment to Litigation Effort and Probability

Proposition 1 illustrated the result that production inefficiency persists, even when the stakes of litigation are large. One reason for this is that the principal increases his own litigation effort as the stake is increased as well as the agent. As a result, larger stakes induced greater litigation costs. However, when the principal can commit to a litigation effort ex ante (i.e. in the contract itself), as the stake increases the principal can increase deterrence at a lower cost by providing a level of litigation effort below that which is sequentially rational..

Before looking at the contract stage, we determine the principal's anticipated outcome from the litigation stage for a given l_P.

4.1 Litigation when the Principal Moves First

Suppose the principal can commit to a level of litigation effort, l_P, prior to the agent's choice of her own litigation effort. If the agent has misreported information, and hence is low-cost, then her objective function when choosing l_A^L is given by (**??**). Her optimal litigation effort will depend on the principal's choice and is given by:

$$\hat{l}_A^L(l_P) = \begin{cases} \sqrt{\frac{Sl_P}{\mu}} - l_P & \text{for } l_P < S/\mu \\ 0 & \text{for } l_P \geq S/\mu \end{cases} \tag{13}$$

This solution shows that the principal, when committing to a large amount of litigation, can in fact push the agent to accept the penalty. The resulting expected payoff to the low-cost agent is:

$$\Gamma_A^L = \begin{cases} 2\sqrt{\mu S l_P} - \mu l_P & \text{for } l_P < S/\mu \\ S & \text{for } l_P \geq S/\mu \end{cases} \tag{14}$$

Similarly, a high-cost agent, whose marginal cost of litigation is 1 has the following best-response to the principal's level of litigation:

$$\hat{l}_A^H(l_P) = \begin{cases} \sqrt{S l_P} - l_P & \text{for } l_P < S \\ 0 & \text{for } l_P \geq S \end{cases} \tag{15}$$

When the principal litigates with effort $l_P = S$, in order to attain just a 50% chance of not paying the stake S, the agent would have to provide S in litigation expenses. Clearly, the agent is better off in this case by just accepting the penalty. The payoff to the high-cost agent is then:

$$\Gamma_A^H = \begin{cases} 2\sqrt{S l_P} - l_P & \text{for } l_P < S \\ S & \text{for } l_P \geq S \end{cases} \tag{16}$$

The agent's payoff functions above show that expected loss the agent bears in litigation is (weakly) greater when the agent is low-cost and therefore has misreported her type. Furthermore, this loss is strictly greater for the low-cost agent when the principal commits to a level of litigation strictly less than S. It is this feature of litigation that allows the principal to utilize litigation to extract information rents from the low-cost agent.

4.2 The Contract Stage

The principal will never choose $l_P \geq S$. When $l_P \geq S$, both the lying agent (θ_L) and the honest agent (θ_H) put forth zero litigation effort and therefore bear the same expected burden from being sued.

The principal's problem, $\mathscr{P}^{\mathcal{FC}}$, is to choose $q_L, q_H, t_L, t_H, \lambda$, and l_P to:

$$\max p\left(V(q_H) - t_H + \lambda(\sqrt{S l_P} - l_P)\right) + (1-p)\left(V(q_L) - t_L\right) \tag{17}$$

subject to

$$t_H - \theta_H q_H - \lambda(2\sqrt{S l_P} - l_P) \geq 0 \tag{IR$_H^{FC}$}$$

$$t_L - \theta_L q_L \geq 0 \tag{IR$_L^{FC}$}$$

$$t_L - \theta_L q_L \geq t_H - \theta_L q_H - \lambda\Gamma_A^L(l_P) \tag{IC$_L^{FC}$}$$

$$\lambda \leq 1 \tag{MP}$$

$$l_P < S \tag{ML1}$$

Recall that $\Gamma_A^L(l_P)$, the low-cost agent's expected cost from trial, reaches a maximum of S when $l_P = S/\mu$. Any increase in the principal's litigation effort above S/μ will increase the cost of litigation borne by the honest θ_H-type while not increasing the cost to the misreporting type. We therefore can assume that $l_P \leq S/\mu$. Presenting the constraints to take into account this fact:

$$t_L - \theta_L q_L \geq t_H - \theta_L q_H - \lambda(2\sqrt{\mu S l_P} - \mu l_P) \qquad (\text{IC}_L^{FC})$$

$$l_P \leq S/\mu \qquad (\text{ML2})$$

Proposition 3 *If litigation is optimal (i.e. $l_P\lambda > 0$), the principal always files suit when the agent announces costs are high, and chooses a strictly smaller litigation effort than when commitment is not possible.*

The proposition shows that with the ability to commit to litigation effort, the principal in fact chooses a weaker litigation strategy than what is ex post rational. While a tough strategy will create a greater cost on the agent for shirking, it has a direct cost of a high cost of the principal's litigation effort. Indirectly, it increases the effort of the compliant agent in litigation. Therefore, the principal benefits from restricting himself to a weak litigation strategy in order to curb the compliant agent's litigation effort.

We also see that the principal will never choose a random filing probability ($0 < \lambda < 1$). To see this, suppose that the principal were playing a random strategy. The cost of litigation is the sum of the efforts for the principal and the high-cost agent, which occurs with probability λp, the probability of suit and high cost. From Equation (**??**), this net cost is simply $\lambda\sqrt{Sl_P}$. Alternatively, the principal can increase the probability of suit to 1 and reduce his effort in litigation to $l'_P = \lambda^2 l_P$, which will result in the same expected cost. From Equation (**??**), the expected deterrence on the low-cost agent is now greater. Therefore, the principal's optimal filing strategy will result in $\lambda = 1$.

5 Conclusion

We have shown how various levels of commitment to litigation influence the design of the optimal contract. Both the principal and the agent can influence the outcome of litigation by providing efforts to promote their case. As a result, the rent-seeking nature of trials promote large expenditures to be made, beyond the level which promotes the optimal deterrence for the principal. When possible, the principal will commit to a level of litigation effort strictly less than what is ex post rational. This reduction is preferred to simply reducing the probability of suit.

6 Proof of Lemma ??

If the principal's posterior belief is:

$$\alpha \geq \frac{1}{\sqrt{\mu}-1},$$

the low-cost agent will put forth no effort in litigation ($l_A^L = 0$) and

$$l_P = S\left[\frac{\alpha}{1+\alpha}\right]^2$$
$$l_A^H = S\frac{\alpha}{(1+\alpha)^2}.$$

Alternatively, if the principal's belief is:

$$\alpha < \frac{1}{\sqrt{\mu}-1},$$

the principal will put forth effort

$$l_P = S\left[R(\alpha)\right]^2$$

where

$$R(\alpha) \equiv \frac{\alpha + (1-\alpha)\sqrt{\mu}}{1+\alpha+(1-\alpha)\mu}.$$

R is increasing in α. Given the principal's belief, the low-cost and high-cost agents will provide strictly positive litigation efforts:

$$l_A^L = SR(\alpha)\left(\frac{1}{\sqrt{\mu}} - R(\alpha)\right)$$
$$l_A^H = SR(\alpha)\left(1-R(\alpha)\right).$$

This equilibrium exists only if $\alpha \leq 1/(\sqrt{\mu}-1)$, which contradicts the assumption that $\mu > \mu^*$.

7 Proof of Proposition ??

We first prove the results restricting the principal to a contract that induces truthful revelation. Then, we show that this restriction is without loss of generality for $p > 1/5$. For reference, the *no litigation contract* is the optimal contract in the absence of litigation (e.g. litigation not allowed). This contract has been thoroughly explored, so we do not spend any time discussing the results.[17]

Constraint (IR_H^{PC}) will bind or the principal will lower t_H. Also, (IC_L^{PC}) will bind or the principal can reduce λ. Furthermore, if $\lambda = 0$, the program is identical to the no-litigation problem and (IC_L^{PC}) will bind. This simplifies the principal's problem to:

$$\max p\left[V(q_H) - \theta_H q_H - \lambda S/2\right] + (1-p)\left[V(q_L) - \theta_L q_L - \Delta\theta q_H + \lambda S/4\right]$$

subject to

$$\Delta\theta q_H - \lambda S/4 \geq 0 \qquad (\text{IR}_L'^{PC})$$

The Lagrangian is:

$$\begin{aligned}\mathscr{L} = \quad & p\left[V(q_H) - \theta_H q_H - \lambda S/2\right] + (1-p)\left[V(q_L) - \theta_L q_L - \Delta\theta q_H + \lambda S/4\right] \\ & + \gamma_1\left(\Delta\theta q_H - \lambda S/4\right) + \gamma_2\left(1 - \lambda\right)\end{aligned}$$

The first-order conditions are:

$$p\left[V'(q_H) - \theta_H\right] - \Delta\theta(1-p) + \gamma_1\Delta\theta = 0 \qquad (18)$$

$$-(S/2)p + (1-p)(S/4) - \gamma_1(S/4) - \gamma_2 \leq 0 \qquad (19)$$

$$\lambda\left[-(S/2)p + (1-p)(S/4) - \gamma_1(S/4) - \gamma_2\right] = 0 \qquad (20)$$

First, suppose $p > 1/3$. From (**??**), $\lambda = 0$. Also, if $p = 1/3$, then $\lambda = 0$ if and only if $\gamma_1 = 0$. But the principal is indifferent to filing suit (ex ante) and it is without loss of generality to assume $\lambda = 0$.

For any p, if $\lambda = 0$, the optimal contract is the no-litigation contract, with outputs denoted by $\left\{q_H^{BM}, q_L^{BM}\right\}$, where:

$$V'(q_L^{BM}) = \theta_L \text{ and } V'(q_H^{BM}) = \theta_H + \Delta\theta\frac{1-p}{p}.$$

Thus, when $p > 1/3$, the optimal contract is the no-litigation contract.

[17] See Baron & Myerson (1982).

Now, assume $p < 1/3$. If $\gamma_1 = 0$, then from (**??**), $\gamma_2 > 0$ and $\lambda = 1$. Then, $q_H = q_H^{BM}$. From (IR'$_L^{PC}$), $\gamma_1 = 0$ only if:

$$S \leq q_H^{BM} 4\Delta\theta \equiv S_1.$$

Otherwise, if $S > S_1$, a contradiction occurs and $\gamma_1 > 0$.

Suppose $S > S_1$ and $\gamma_2 > 0$. Then $\lambda = 1$ and

$$q_H = \frac{S}{4\Delta\theta}.$$

Also, $1 - 3p > \gamma_1$ and

$$V'(q_H) > \theta_H + 2\Delta\theta.$$

This holds only if $S < S_2$ where S_2 is defined by:

$$V'\left(\frac{S_2}{2\Delta\theta}\right) = \theta_H + 2\Delta\theta.$$

Otherwise, for $S \geq S_2$, a contradiction results and it must be that $\gamma_2 = 0$. Then, the optimal q_H is where:

$$V'(q_H) = \theta_H + 2\Delta\theta.$$

The optimal probability of suit is:

$$\lambda = \frac{4\Delta\theta q_H}{S}$$

which implies that λS does not vary with S for all $S \geq S_2$.

Finally, we show that $S_1 < S_2$. Suppose $S_2 < S_1$. Then:

$$V'\left(\frac{S_1}{2\Delta\theta}\right) < \theta_H + 2\Delta\theta$$

which implies

$$V'\left(q_H^{BM}\right) < \theta_H + 2\Delta\theta.$$

But this contradicts $p > 1/3$.

The final item is to show that the pure strategy equilibrium contract is optimal. Conceivably, the principal can induce a strictly positive probability that the low-cost agent shirks, which will alter the principal's posterior, α. A smaller α results in a reduction in the cost of litigation per suit because the principal reduces his own litigation effort as does the high-cost agent. We do not discuss this possibility, but rather assume the parameters are such that this does not occur as an optimum.

To show that the restriction that $p > 1/5$ is sufficient, we start with the principal's problem when the probability of shirking, π is a choice parameter for the principal.

$$\max(p + (1-p)\pi)\left[V(q_H) - t_H + \lambda\Gamma^P(\alpha)\right] + (1 - p - (1-p)\pi)\left[V(q_L) - t_L\right]$$

subject to

$$t_H - \theta_H q_H - \lambda\Gamma_H^A(\alpha) \geq 0 \qquad (\text{IR}_H^{\mathcal{S}})$$

$$(1-\pi)(t_L - \theta_L q_L) + (1-\pi)(t_L - \theta_L q_H - \lambda S) \geq 0 \qquad (\text{IR}_L^{\mathcal{S}})$$

$$\pi \in \arg\max_{\overline{\pi}} \{1 - \overline{\pi})(t_L - \theta_L q_L) + (1 - \overline{\pi})(t_H - \theta_L q_H - \lambda S)\} \qquad (\text{IC}_L^{\mathcal{S}})$$

The expected litigation payoffs, depend on the principal's updated posterior belief. From Bayes' rule, the principal's belief that the agent has reported truthfully is given by:

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

To see that the revelation principle will hold, notice that when $0 < \pi < 1$, then $p < \alpha < 1$. It is equivalent, therefore, for the principal to choose α instead of π, respecting the sequential equilibrium definition of posterior beliefs. If the agent plays a mixed strategy, then $(\text{IC}_L^{\mathcal{S}})$ can be replaced by the first-order condition:

$$t_L - \theta_L q_L = t_H - \theta_L q_H - \lambda S.$$

It follows from the lagrangian that for $p > 1/5$:

$$\left.\frac{\partial \mathscr{L}}{\partial \alpha}\right|_{\alpha=1} < 0,$$

where $\mathscr{L}$ is the Lagrangian function. Thus, $p > 1/5$ is a sufficient condition for the revelation principle to hold.

8 Proof of Proposition ??

The principal's problem is given by $\mathscr{P}^{\mathcal{FC}}$.

It must be that (IR_H^{FC}) binds or the principal can profitably reduce t_H.

The Lagrangian is:

$$\begin{aligned}\mathscr{L} =& p\left[V(q_H) - \theta_H q_H - \lambda\sqrt{Sl_p}\right] + (1-p)\left[V(q_L) - t_L\right] \\ &+ \gamma_1\left(t_L - \theta_L q_L\right) \\ &+ \gamma_2\left(t_L - \theta_L q_L - \Delta\theta q_H + \lambda\left[2\sqrt{Sl_P}\left(\sqrt{\mu}-1\right) - (\mu-1)l_P\right]\right) \\ &+ \gamma_3\left(S/\mu - l_P\right) + \gamma_4(1-\mu)\end{aligned}$$

The first-order conditions are:

$$\frac{\partial\mathscr{L}}{\partial\lambda} = -p\sqrt{Sl_P} + \gamma_2\left[2\sqrt{Sl_P}\left(\sqrt{\mu}-1\right) - (\mu-1)l_P\right] - \gamma_4 \leq 0; \frac{\partial\mathscr{L}}{\partial\lambda}\lambda = 0 \tag{21}$$

$$\frac{\partial\mathscr{L}}{\partial l_P} = -p\lambda\frac{1}{2}\sqrt{\frac{S}{l_P}} + \lambda\gamma_2\left[\sqrt{\frac{S}{l_P}}\left(\sqrt{\mu}-1\right) - (\mu-1)\right] - \gamma_3 \leq 0; \frac{\partial\mathscr{L}}{\partial l_P}l_P = 0 \tag{22}$$

$$\frac{\partial\mathscr{L}}{\partial q_H} = p\left(V'(q_H) - \theta_H\right) - \gamma_2\Delta\theta = 0 \tag{23}$$

$$\frac{\partial\mathscr{L}}{\partial q_L} = -(1-p) + \gamma_1 + \gamma_2 = 0 \tag{24}$$

$$\frac{\partial\mathscr{L}}{\partial t_L} = (1-p)V'(q_L) - \gamma_1\theta_L - \gamma_2\theta_L \tag{25}$$

Equations (**??**) and (**??**) show that the low-cost agent is assigned the first-best output, i.e.

$$V'(q_L) = \theta_L.$$

If $\gamma_2 = 0$, from (**??**):

$$-p\lambda\frac{1}{2}\sqrt{\frac{S}{l_P}} = \gamma_3$$

which implies that $\gamma_3 = 0$ and $\lambda = 0$. But then, the optimal contract is the no-litigation contract from before and $\gamma_2 > 0$. This contradiction shows that in equilibrium $\gamma_2 > 0$.

If $\gamma_3 > 0$, then $l_P = S/\mu$. Then, from (**??**), we get a contradiction so $\gamma_3 = 0$.

There are two possible cases: $\gamma_1 = 0$ or $\gamma_1 > 0$.

If $\gamma_1 = 0$, from (**??**) and (**??**):

$$q_H = q_H^{BM}.$$

If $\lambda > 0$, from (**??**) and (**??**) we get $\gamma_4 > 0$ and so $\lambda = 1$.

The optimal litigation effort is determined by (**??**) and is increasing in S. From ($\text{IR}_L^{\mathcal{FC}}$), this equilibrium requires:

$$\Delta\theta q_H^{BM} > \frac{S}{\mu - 1}\left[\sqrt{\mu} - \frac{2-p}{2-2p}\right]\left[\sqrt{\mu} - \frac{2-p}{2-2p} - 2\right]$$

which requires S sufficiently small.

Therefore, for large S, $\gamma_1 > 0$ and the low-cost agent earns zero rent.