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The effect of third-party funding of plaintiffs on settlement

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Abstract

In this paper we use a signaling model to analyze the effect of (endogenously-determined) third-party non-recourse loans to plaintiffs on settlement bargaining when a plaintiff has private information about the value of her suit. We show that an optimal loan (i.e., one that maximizes the joint expected payoff to the litigation funder and the plaintiff) induces full settlement. Furthermore, in contrast with the more standard (no-loan) settlement bargaining models, there is no revelation of information created by the bargaining process: all plaintiff types (where the plaintiff's type is her level of harm) make the same demand and, since no types go to trial, private information is not revealed. Implementation of the loan may entail a very high interest rate; we show that a high (enough) rate is necessary if one wants to obtain full settlement for all types of plaintiffs even when there is asymmetric information. We also find that plaintiffs' lawyers benefit from such financing, as it reduces their costs by eliminating the need to take the case to trial due to bargaining breakdown. We further show that regulation of such loans, in the form of caps on the interest charged, may result in settlement failure or elimination of the litigation-funding industry itself.

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1. Introduction

Since the late twentieth century the financing of lawsuits, wherein third parties provide direct financial support to plaintiffs, has developed into an emerging industry in the U.S. (and worldwide[1]) with a potentially-substantial effect on the efficiency of the legal system. Such financial support (which we will refer to as a loan) has an unusual nature: these loans (typically) involve non-recourse transfers from the third-party lender to the plaintiff-borrower, meaning that repayment occurs only if the plaintiff is successful (either in settlement negotiations or, if such negotiations fail, at trial), and then only up to the plaintiff's recovery, net of lawyer fees (which are generally contingent fees; that is, a percentage of the plaintiff's received transfer from the defendant). Focusing on the non-recourse aspect of the transaction, some courts and commentators have bemoaned such loans, arguing that they will necessarily lead to increased failure of settlement negotiations and interference in the attorney-client relationship.[2]

In this paper we use a signaling model to analyze the effect of such third-party loans to plaintiffs on settlement bargaining when a plaintiff has private information about the value of her suit. In theory, a "standard" loan (one that must be repaid, independent of the success of the borrower's undertaking) should have no effect on settlement bargaining between a plaintiff and a defendant. As will be shown in this paper, the effect of a non-recourse loan on settlement is substantial, but not as usually surmised: an <u>optimal</u> loan (i.e., one that maximizes the joint expected payoff to the litigation funder and the plaintiff) induces <u>full</u> settlement. In other words, the prevailing third-party funding mechanism, the non-recourse loan, can eliminate the usual inefficiencies associated with asymmetric information. This is a remarkable result, inasmuch as settlement bargaining under asymmetric information generally results in some degree of bargaining breakdown, leading to trial of the suit.[3] Furthermore, in contrast with the more standard (no-loan) settlement bargaining models, there is no revelation of information created by the bargaining process: all plaintiff types (where the plaintiff's type is her level of harm) make the same demand and, since no types go to trial, private information is not revealed. Of course, since there are no trials in equilibrium, there is no efficiency loss as trial costs are avoided.

This occurs because an optimal non-recourse loan has the effect of making the plaintiff's expected net recovery from trial <u>independent of her true type</u>. In the "standard" case of no loan (or a traditional loan that must be repaid), it is variation in this "outside option" to settlement that allows a plaintiff to reveal her damages through her settlement demand. A plaintiff with higher damages is willing to make a higher settlement demand and face a higher likelihood of rejection by the defendant as long as her expected net recovery from trial is also higher. But if her expected net recovery from trial does not vary with her type, then no revelation is possible and pooling is the

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[1] For discussions of litigation funding outside the U.S., see Abrams and Chen (forthcoming), Barker (forthcoming), Chen (2012), and Hodges (2010).

[2] For example, the U.S. Chamber Institute for Legal Reform has opined (2012, p. 1) that "Third-party investments in litigation represent a clear and present danger to impartial and efficient administration of civil justice in the United States." The Chamber also asserts that such mechanisms will encourage "abusive litigation," a topic we do not address in this paper.

[3] For a recent survey of the settlement literature see Daughety and Reinganum (2012).

equilibrium outcome; this will happen with a non-recourse loan if the loan is structured optimally. It also turns out that it is essential that the funder not buy the plaintiff's case, though he can purchase the right to the stream of settlement or trial payments. If he were to purchase the control rights over decisions about settlement as well, then the bargaining problem would resemble one wherein there is no loan, and costly signaling (a positive likelihood of trial and wasted resources) would occur.

This analysis also leads to other policy implications. First, the optimal loan is implemented via a cash advance to the plaintiff and a repayment amount that is sufficient to direct all receipts from settlement or trial to the litigation funder; this may entail a very high interest rate. While there may be important reasons to be concerned about consumers facing high interest rates, we show that a high (enough) rate is necessary if one wants to obtain full settlement for all types of plaintiffs even when there is asymmetric information. Furthermore, the interest rate in our model functions to maximize the joint value of the loan, does not reflect a risk premium (since all agents are taken to be risk neutral), and the high rate is (weakly) preferred by plaintiffs.

Second, we find that plaintiffs' lawyers benefit from such financing, as it eliminates the need to take the case to trial due to bargaining breakdown; they do not face court costs or the risk of losing at trial. Depending upon the extent of such consumer lending, and the degree of competitiveness of the market for legal services, this may result in a reduction in contingent fees. Third, we find that regulation of such loans via caps on the interest rate charged may lead to settlement failure or to elimination of the loan industry itself.

1.1 Background and Related Literature

Historically in common law countries (at least since the late thirteenth century), support of litigation by third parties was banned as "maintenance," as it was viewed as encouraging weak legal claims to be pursued.[4] Currently (and very recently), most U.S. jurisdictions allow such third-party financing of plaintiffs' cases, as it is viewed as enhancing access to courts by plaintiffs who may be wealth-constrained.[5]

According to Garber (2010) and Molot (2010), there are three primary forms of litigation funding in the US. These are: 1) consumer legal funding, wherein a third party provides a non-recourse loan directly to a plaintiff (the focus of this paper);[6] 2) loans to plaintiffs' law firms,

[4] As Bentham (1787) explains, third-party support – in conjunction with the buying of a case, which was also banned – sometimes featured physical intimidation of the Court: "A mischief, in those times it seems too common, ..., that a man would buy a weak claim, in hopes that power might convert it into a strong one, and that the sword of a baron, stalking into court with a rabble of retainers at his heels, might strike terror into the eyes of a judge upon the bench." (Bowring, ed., Vol. 3, 1843).

[5] In the same letter as indicated above, Bentham went on to assert that the prohibition of third-party involvement in cases was (at his writing) unneeded, since judges no longer were so readily intimidated: "At present, what cares an English judge for the swords of one hundred barons?" (Bowring, ed., Vol. 3, 1843).

[6] Avraham and Wickelgren (2011) consider consumer lending, employing a contract similar to that which we use; their paper will be discussed in more detail below. On the legal issues involved in consumer legal funding, see Rodak (2006).

wherein a funder provides an ordinary secured loan to a law firm that has a portfolio of cases; and 3) investments in commercial claims, wherein a funder provides an up-front payment in exchange for a share of the eventual recovery.[7]

Garber (p. 9-10) summarizes consumer legal funding as follows (where ALF denotes "alternative litigation financing").

> "... ALF companies provide money to consumers (individuals) with pending legal – typically, personal-injury – claims. To be eligible for such funding, it appears that a consumer must have an attorney who has agreed to represent him or her in pursuing the claim. And, since almost all of the underlying lawsuits involve personal-injury claims, it is likely that almost all consumers receiving this form of litigation funding are being represented on a contingency-fee basis. ... Crucially for both legal and analytic reasons, these contracts are typically *non-recourse loans*, meaning that consumers are obligated to pay their ALF suppliers the *minimum* of (1) the amount specified in the contract (given the time of payment) and (2) the consumers' proceeds from the underlying lawsuit. Thus, by contract, a consumer is obligated to pay his or her ALF company no more than what he or she receives as proceeds from the underlying lawsuit, and any excess amount specified in the contract is forgiven."

Our formal model is consistent with the description provided by Garber (2010) for consumer legal lending.[8] Relevant players include a plaintiff, a plaintiff's attorney who is being compensated via a contingent fee, a lender offering a non-recourse loan directly to the plaintiff, and a defendant. Our focus is not on access or the credibility of trial following bargaining breakdown (contingent fees already ensure this), but on how such a loan affects the plaintiff's (and defendant's) incentive to settle when she has private information about her damages. As indicated earlier, in our model, the plaintiff may (effectively) sell the rights to the monetary award but she never relinquishes control over the suit; in particular, she continues to make decisions about settlement bargaining and trial.

There are at least two important reasons why consumer legal funding might be value-creating. The litigation funder has access to capital markets at a lower interest rate than the plaintiff,

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[7] Deffains and Desrieux (2011), Hylton (2011), and Kirstein and Rickman (2004) examine this kind of funding contract. They provide analyses of settlement, but Hylton and Kirstein and Rickman use an inconsistent-priors model wherein the plaintiff and defendant have different estimates of the plaintiff's likelihood of prevailing (though neither party has any private information). Deffains and Desrieux first consider bargaining under complete information and later include nuisance suits. Although the lawyer and the funder know whether the suit has merit, the defendant makes the settlement offer so that information transmission (e.g., through the lawyer's or funder's share, or a plaintiff settlement demand) is suppressed. See Steinitz (2012) for a discussion of the legal aspects of this kind of funding contract.

[8] To our knowledge, Avraham and Wickelgren (2011) is the only other paper that examines consumer legal funding. In their model, the relevant players are a plaintiff, a litigation funder, and a judge. The funder observes a private signal about the case value, while the plaintiff has private information about her need for funds. The terms of the loan reveal the funder's private information, so the authors ask whether the funding contract should be admissible as evidence in court (as the judge may draw an inference from it about the case value). They find that making the contract admissible induces the funder to lower the interest rate, which benefits plaintiffs. Settlement is not considered.

which can allow the plaintiff (and therefore the funder) to gain from a form of intertemporal "arbitrage." While the use of contingent-fee compensation for the plaintiff's attorney provides the plaintiff with access to the legal system, the harmed plaintiff is also likely to have immediate and unusual costs due to covering possible harm-generated expenses, such as medical, psychological, and specialized living expenses; financing these via normal loans is likely to be impossible. Furthermore, the non-recourse nature of the loan shifts risk from the (arguably more risk-averse) plaintiff to the (arguably less risk-averse) litigation funder. We abstract from these rationales by assuming risk neutrality and equal discount rates in order to focus on the effect of litigation funding on settlement negotiations (we do return to the possible difference in discount rates later in the analysis).

One concern that is expressed in the legal literature is that consumer legal funding may result in fewer settlements. Rodak (p. 522) summarizes this argument as follows:

> "A rational plaintiff will not settle for any amount offered by the defendant that is less than the aggregate of the principal amount advanced to her and the current interest accrued, which is often immense due to the staggering rates charged by many litigation finance companies. This artificially inflated minimum acceptable offer and the nonrecourse character of the arrangement will lead the rational plaintiff to reject otherwise reasonable settlement offers, since, if she loses at trial, she will owe nothing. In this way, litigation finance gives plaintiffs disincentives to settle and instead encourages disputes to progress to trial."

We will see that, in a signaling model, the hypothesized effect of a lower likelihood of settlement can occur for some loan contracts, but it does not occur for the equilibrium loan contract (which is jointly optimal for the funder and the plaintiff). The equilibrium loan contract extracts the defendant's full willingness-to-pay and induces all suits to settle, whereas only a fraction of suits would settle absent funding.[9] This occurs because the equilibrium non-recourse loan contract induces all plaintiff types to "pool" and demand the average damages (plus the defendant's trial costs), which the defendant accepts. If there were no funding (or for funding levels below the jointly-optimal level), then equilibrium[10] would involve different plaintiff types making different ("revealing") demands, with the defendant rejecting higher demands (thus, leading to trials) with a higher probability. This channel through which consumer legal funding ensures settlement by removing the plaintiff's incentive to "signal" her type has not been recognized previously, either in

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[9] When there is either full information, or symmetric imperfect information, about A then a contract between P and LF cannot improve their joint recovery from the defendant as he is fully extracted and all suits settle. It might still be optimal for P to obtain litigation funding if P and LF have different discount rates (or if P is risk averse), but the strategic value of litigation funding in suppressing costly signaling is absent.

[10] We consider only equilibria that survive the equilibrium refinement D1 (Cho and Kreps, 1987). While pooling equilibria typically exist alongside revealing equilibria, the unique refined equilibrium when there is no litigation funding is a fully-revealing equilibrium.

the legal or economics literature.[11]

Finally, there is a large literature examining how other contracts can affect settlement negotiation. On the plaintiff's side, Bebchuk and Guzman (1996) consider contingent-fee versus hourly compensation; Choi (2003) and Leshem (2009) further consider delegation of settlement authority to the lawyer. On the defendant's side, Spier and Sykes (1998) consider debt (versus equity) financing by a firm; Spier (2003a, 2003b) and Daughety and Reinganum (2004) consider the use of most-favored-nation clauses; Daughety and Reinganum (1999, 2002) consider the use of confidentiality agreements; and Meurer (1992) and Sykes (1994) consider liability insurance contracts that delegate bargaining authority to the insurer. Our model is different from each of these in various ways; we do not consider delegation of the bargaining authority, or the use of debt (versus equity) financing by the defendant, and we do not have multiple litigants on either side.

1.2 Plan of the Paper

In Section 2 we provide the details of the model's assumptions as well as the sequence of actions being taken by the plaintiff, the plaintiff's lawyer, the third-party lender, and the defendant. We also use the parameters of the model to define the three cases of interest (a subdivision of the parameter space reflecting the defendant's cost and likelihood of being found liable) and the payoffs to the agents. Section 3 provides a more-detailed discussion – in the context of the most representative case – of the specific (asymmetric information) bargaining game between the plaintiff and the defendant used in the model (a signaling model, which we argue reflects the institutional structure of the legal system). Section 4 considers the implications of imposing caps on the interest rate that the litigation funder may charge. Section 5 provides a discussion of the results of our analysis and some directions for potential extensions. The Appendix contains the supporting analytical detail for the three cases while (for completeness) a Technical Appendix[12] provides the details for a screening model of the bargaining game between the plaintiff and the defendant.

2. Modeling Preliminaries

We model the problem as a two-period (five-stage) game among four agents: the plaintiff (P), the plaintiff's attorney (PA), a litigation-funder (LF) who may lend funds to P, and the defendant (D). Let the actual award at trial be denoted A, where A is uniformly distributed for A

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[11] Aghion and Hermalin (1990) show that exogenous restrictions on the form of contracts that effectively prohibit separation (by limiting or mandating certain terms that – if subject to choice – might reveal private information) can be welfare-enhancing. In our model, the terms of the non-recourse loan contract between the plaintiff and litigation funder are endogenous, and the contract does not prohibit costly signaling; rather, it removes the incentive for the plaintiff to engage in costly signaling, thus enhancing welfare.

[12] Available at http://www.vanderbilt.edu/econ/faculty/Daughety/DR-LitFundingTechApp.pdf.

$\in [\underline{A}, \overline{A}]$, with $\overline{A} > \underline{A} > 0$.[13] There is (initially) symmetric uncertainty among all agents regarding A when P, PA, and LF engage in contracting but later (see stage 3 below), as a result of preliminary trial preparation, P and PA will (jointly) privately observe the realized value of A prior to settlement bargaining with D. Preliminary trial preparation results in a cost, denoted as c_S; this is a cost that PA incurs even if settlement occurs (for simplicity, we ignore any costs that D experiences arising from settlement, as they do not affect the analysis), and includes the cost of preparing and filing the complaint by P that (among other things) specifies the demand for damages made by P. The incremental cost of trial for PA is denoted as c_P and the incremental cost of trial for D is denoted as c_D; all costs are common knowledge. The probability that P wins at trial, also common knowledge, is denoted as $\lambda \in (0, 1)$.

The model involves two periods. In the first period, P engages a lawyer (PA) and then negotiates a loan contract with a litigation funder (LF). We follow the general perception that the plaintiff is wealth-constrained, and that her contract with PA involves a contingent-fee arrangement wherein PA bears the costs c_S and c_P (if there is a trial) and receives a share, denoted as $\alpha \in (0, 1)$, of either the settlement or award at trial. Payment to PA takes priority over repaying the loan to LF; that is, an award of A at trial yields the amount $(1 - \alpha)A$ to P, out of which she then makes a loan repayment; LF knows this, and PA's share α, when he offers a loan to P. The critical aspect of this loan is that it is a <u>non-recourse</u> loan; it is secured only by the plaintiff's recovery (after paying her lawyer). We assume that P's discount factor for future income and LF's cost of capital are the same, and denoted as i ($0 < i < 1$), and that this, too, is common knowledge.[14]

More precisely our game involves the following timing:

<u>Period 1</u> (which consists of three stages):

1. P contracts with PA using the (exogenously specified) contingent-fee rate α.[15] PA verifies that P has a "real" suit (not a nuisance suit) and documents the fact that the award is uniformly distributed on the support $[\underline{A}, \overline{A}]$.

2. P provides verifiable documentation on the distribution and support of the award, and on PA's contingent-fee rate, to LF. LF offers a non-recourse loan (r, B), which gives P the amount B immediately and requires a repayment in Period 2 of $z \equiv (1 + r)B$ if P nets (after

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[13] We have assumed that A is uniformly distributed so as to simplify computations in the equilibria that involve some pooling. More generally, the qualitative properties of the model are robust to more general distributional assumptions, as long as the density is everywhere-positive on the support $[\underline{A}, \overline{A}]$.

[14] We return in a later section of the paper to allow P to discount the future more heavily than LF. In particular, higher discounting by P reinforces our results.

[15] A contingent fee contract specifies that: 1) only if the suit is successful (i.e., a settlement occurs, or if the suit is won at trial) does the attorney get paid, and then he only receives the fraction α of the amount that P obtains; and 2) PA covers all costs. For an analysis of the endogenous determination of α allowing for search and bargaining, see Daughety and Reinganum (forthcoming).

payment to PA) more than this amount in either settlement or at trial. If P rejects the loan, then she will still proceed with her suit due to the contingent-fee arrangement with PA, and LF obtains zero.

3. PA expends the preliminary cost c_S, which reflects costs incurred because of preparation for settlement negotiation as well as filing costs. In the course of preparing the suit, P and PA jointly learn the true value of A; that is, the true value of A is now P's private information and is therefore P's type. PA files a complaint against D and specifies the damages P is seeking.

Period 2 (which consists of two stages):

4. Settlement negotiation occurs (we provide more detail below); as implied earlier, it is assumed that (before settlement negotiations begin) D learns the distribution and support of the award A, as well as the prevailing contingent-fee rate α, and the prevailing loan terms (r, B). If settlement bargaining is successful, then transfers occur among the parties as specified by the contracts in the following order: 1) pursuant to the settlement contract, D makes a transfer to P of the settlement amount, denoted as S; 2) pursuant to the contract between P and PA, P pays the contingent fee of αS; and 3) pursuant to any existing contract between P and LF, P makes any warranted transfer to LF. Thus, if there is a loan contract, P pays LF the amount $\min\{z, (1 - \alpha)S\}$ if P settles for an amount S.

5. If settlement fails then trial occurs; PA incurs cost c_P and D incurs cost c_D. The court learns P's true type and determines whether P has won or lost; P wins with probability $\lambda \in (0, 1)$. If P wins at trial then D transfers A to P, and the set of contracts are fulfilled as follows: 1) P pays PA the amount αA; and 2) if there is a contract between P and LF, P pays LF the amount $\min\{z, (1 - \alpha)A\}$. Finally, if P loses at trial, then P pays zero to PA and zero to LF.

Intuitively, the foregoing assumes that P and PA have a preliminary meeting (stage 1), at which PA learns and documents the distribution of A. Then P is referred to LF (stage 2) and they conclude a contract, based only on the distribution of A. Next, PA prepares a complaint that specifies a settlement demand of D (stage 3); this process is time-consuming. During this time period, P and PA inevitably learn more information about P's type; for instance, if P is receiving ongoing treatment for injuries, the extent of the harm she has suffered will become clearer to her and PA. For simplicity, we summarize this as P and PA learning P's true type, A.

Notice that in stage 2 above, the bargaining between P and LF over the loan occurs under conditions of symmetric (but imperfect) information, since it is not until stage 3 that PA expends c_S and P and PA jointly learn P's true type (A). This sequence of activities is consistent with our understanding that litigation funding is obtained early in the process and that consumer legal funding providers do not get very involved in the details of the suit. Garber (2010, p. 25) suggests that "the amount that an ALF supplier in this industry segment would be willing to spend on due diligence for any application is fairly small" and they are more likely to simply rely on the assessment and reputation of the plaintiff's attorney.[16] Moreover, to the extent that a litigation funder's ultimate goal is to construct a portfolio of suits that can be securitized (e.g., sold to potential investors), the litigation funder does not want to have private information relative to these potential investors, as this may make it harder to sell them shares in its portfolio.

Since bargaining between P and D (in stage 4) involves private information, and since the complaint filed by PA for P in stage 3 includes a specific demand for damages, we model the (one-sided) incomplete information bargaining problem in stage 4 as a signaling game wherein P makes a take-it-or-leave-it demand of D (that is, an ultimatum game wherein the informed P moves first by making a demand of amount S – via the complaint – and the uninformed D chooses to accept or reject the demand).[17] Moreover, since P has a contingent-fee contract with PA, and may have a non-recourse loan from LF, going to trial generates no direct cost for P. Therefore, P's threat to go to trial if D rejects her settlement demand is always credible.

In the sections to follow we have organized the analysis in terms of the parameters $\underline{A}$, $\overline{A}$, λ, and c_D, and we employ the following mutually exclusive and exhaustive partition of this parameter space.

Case (a). $c_D \leq (1 - \lambda)\underline{A}$;

Case (b). $(1 - \lambda)\underline{A} < c_D \leq (1 - \lambda)\overline{A}$;

Case (c). $(1 - \lambda)\overline{A} < c_D$.

In the next Section we focus the discussion around Case (b), as we view this case as the most representative since it allows for the greatest variety of possible outcomes; towards the end of the Section we provide a brief discussion of special aspects of the analysis in Cases (a) and (c). The Appendix provides detail for all three cases.

3. Settlement Bargaining and Optimal Funding

Working backwards, we first analyze Period 2 and then find the optimal non-recourse loan (r, B), which implies a repayment amount $z = (1 + r)B$, in Period 2. Recall that P only repays LF out of her winnings at trial or her settlement (i.e., the loan is a non-recourse loan), and P retains the authority to make the settlement demand (via PA's filed complaint) and to decide whether or not to proceed to trial. Thus, if D <u>accepts</u> a settlement demand of S then payoffs are as follows:

- P (of every type) receives $\max\{0, (1 - \alpha)S - z\}$;
- PA receives $\alpha S - c_S$;
- LF receives $\min\{z, (1 - \alpha)S\}$;

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[16] "The fact that lawyers have accepted the cases on a contingency-fee basis would likely be viewed by funders as a positive signal about the quality of the underlying lawsuits—but this will not help them discriminate among the many applicants for which this is true." (Garber, 2010, p. 25).

[17] For completeness we discuss a screening model, wherein D makes a take-it-or-leave-it offer to P, in the Technical Appendix; a summary of the results is reported in Section 3.5.

and

- D pays S.

If D <u>rejects</u> the demand S, then it is credible for P to proceed to trial since PA (not P) bears the trial costs. In this case, expected payoffs (for a given value of A) are as follows:

- P (of type A) receives the amount $\max\{0, \lambda[(1 - \alpha)A - z]\}$;
- PA receives $\alpha\lambda A - c_S - c_P$;
- LF receives $\min\{z, \lambda(1 - \alpha)A\}$;

and

- D pays $\lambda A + c_D$.

If the trial award A were common knowledge, then a P of type A owing z would be able to demand her full-information settlement demand, $s^F(A) \equiv \lambda A + c_D$, which D would accept in equilibrium.[18] Neglecting the non-recourse aspect of the loan, a P of type A prefers to settle at $s^F(A)$ rather than going to trial as long as $(1 - \alpha)(\lambda A + c_D) - z \geq \lambda[(1 - \alpha)A - z]$; that is, as long as $z \leq z^X \equiv (1 - \alpha)c_D/(1 - \lambda)$. Therefore, when $z > z^X$, a P of type A prefers to go to trial rather than settle at her full-information demand. This preference for trial is due to the non-recourse nature of the loan and would not arise if P had to repay the amount z regardless of the outcome of her suit. Notice also that when the loan repayment amount is small enough ($z < \underline{z} \equiv (1 - \alpha)\underline{A}$), then every type of P makes a positive expected net payoff from trial, while if the repayment amount is high enough ($z > \overline{z} \equiv (1 - \alpha)\overline{A}$), then no type of P makes a positive expected net payoff from trial.

We first provide a diagram (Figure 1) depicting the (refined) equilibria for Period 2, for an arbitrary value of λ, in the space defined by the level of D's court cost and the size of the loan offered by LF; that is, in (c_D, z) space. We next sketch the supporting analysis for Case (b), wherein $(1 - \lambda)\underline{A} < c_D \leq (1 - \lambda)\overline{A}$; the details of the analysis (along with the analysis of the other cases) are provided in the Appendix. Finally, we consider the Period 1 problem of determining the optimal loan, (r, B), in Case (b); again, supporting detail for all of the cases is in the Appendix.

In some portions of the (c_D, z) space there are multiple (refined) equilibria, and P is indifferent between two (or more) such equilibria, whereas LF is not indifferent among these. To handle this, we assume that contracts between LF and P always include the following proviso:[19]

If there are multiple (refined) equilibria in the settlement negotiation stage (stage 4) and if P is indifferent among them, then P plays according to the equilibrium that LF most prefers (as of the date the contract was concluded).

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[18] Because the demand extracts D's maximum willingness-to-pay, D would be indifferent between accepting and rejecting the demand. However, if D rejected this demand with positive probability, then P could cut it infinitesimally and obtain D's acceptance for sure. Thus, D must accept this demand for sure to be consistent with equilibrium play.

[19] As will become clear, PA will never object to this proviso in the contract between P and LF.

3.1 Results from the Period 2 Analysis of the Signaling Game

Figure 1 illustrates how the (c_D, z) space is partitioned by the different (refined) equilibria for all three cases that partition the parameter space. First, note the dashed line labeled z^X demarcating where P strictly prefers trial to settlement at her full-information demand, $s^F(A)$. To the left of this line, some or all types of P make demands that force the suit to trial.

For repayment amounts $z < \min \{\underline{z}, z^X\}$, including the case of no loan (z = 0), all P types prefer settlement at the full-information demand $s^F(A) = \lambda A + c_D$ to trial and all P types expect a net positive payoff from trial. Since the trial payoff increases with the type, A, it is possible to have a fully-separating equilibrium wherein higher demands are rejected with a higher probability; higher

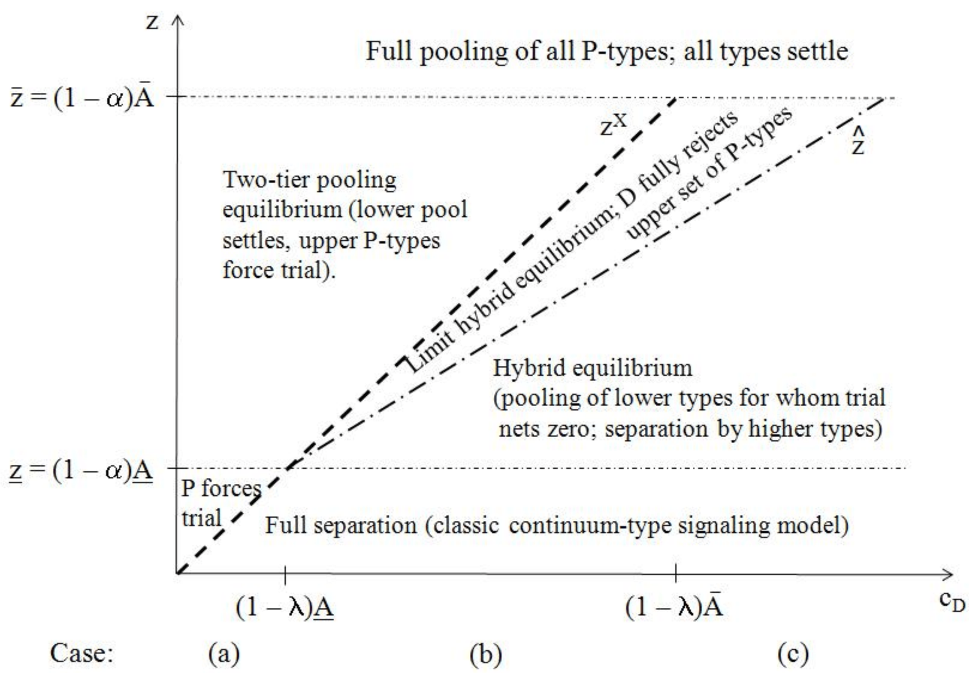


Figure 1: (Refined) PBE when P makes Demand

types are willing to make higher demands and risk a higher probability of rejection because their expected payoff at trial is higher. As shown in the Appendix, when $z \leq \min \{\underline{z}, z^X\}$ then the equilibrium is analogous to that derived in Reinganum and Wilde (1986): a P of type A makes herfull-information demand, $s^F(A) = \lambda A + c_D$, and D rejects an arbitrary demand S with probability p(S; z):

$$p(S; z) = \begin{cases} 0 \text{ for } S < \underline{S} \\ 1 - \exp\{-(S - \underline{S})/w(z)\} \text{ for } S \in [\underline{S}, \overline{S}] \\ 1 \text{ for } S > \overline{S}, \end{cases} \quad (1)$$

where $w(z) = c_D(1 - z/z^X)$, $\overline{S} \equiv s^F(\overline{A})$, and $\underline{S} \equiv s^F(\underline{A})$.[20] It is straightforward to show that the equilibrium probability of rejection is increasing in S for fixed z and increasing in z for fixed S. Moreover, the lowest equilibrium demand, $\underline{S}$, is never rejected and the highest equilibrium demand, $\overline{S}$, is rejected with positive (but fractional) probability. Here, all types are revealed via their demands. Furthermore, $p(s^F(A); z)$, the equilibrium rejection function for D as a function of P's equilibrium demand, is also increasing in z for fixed A.

For the rest of this derivation we focus on Case (b) and we augment Figure 1 with Figure 2 below. Figure 2 illustrates equilibrium strategies for P (demands) and D (probability of rejection) for a fixed arbitrary value of c_D in Case (b). The left-most panel of Figure 2 illustrates the equilibrium strategies discussed above when $0 \leq z < \underline{z}$; P's equilibrium demand strategy is illustrated on the top portion of the panel, while D's equilibrium rejection function is illustrated below it.

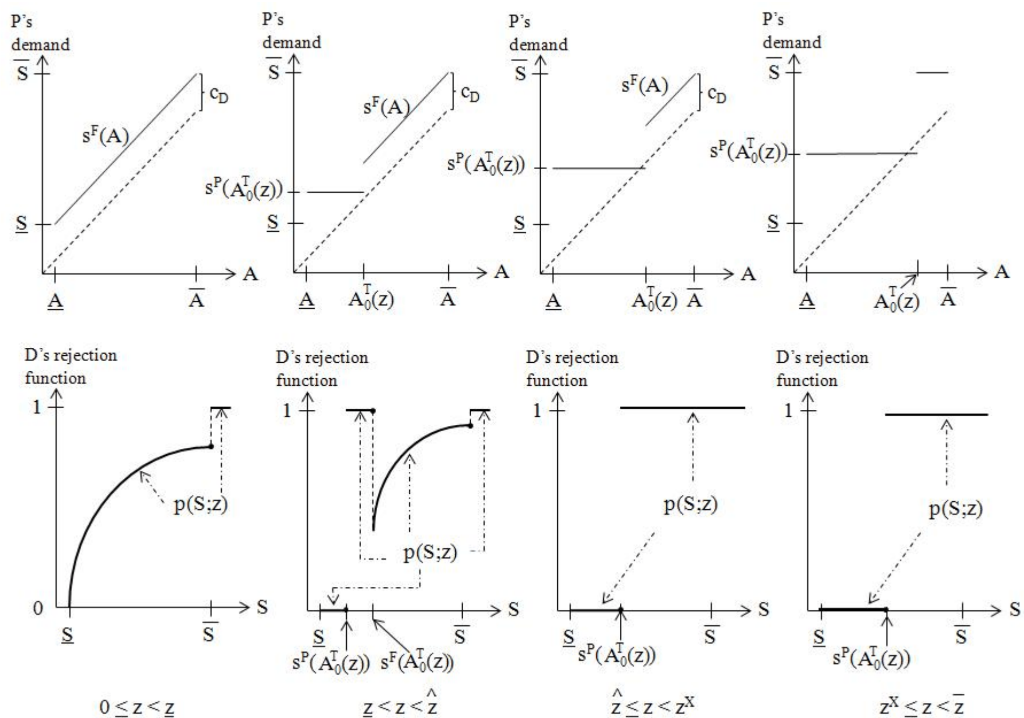


Figure 2: Equilibrium Demand and Rejection Functions for Varying Levels of z

The next three panels illustrate the strategies for P and D when $z > \underline{z}$; we start by considering the second vertical panel of Figure 2. When $z > \underline{z}$, then for some types of P, the expected payoff from trial, $\max\{0, \lambda[(1 - \alpha)A - z]\}$, is zero due to the non-recourse property of the loan from LF; clearly, this is for those types with lower values of A. Let $A_0^T(z)$ denote the plaintiff type who just expects to break even at trial when the repayment amount is z; thus, $A_0^T(z) = z/(1 - \alpha) > \underline{A}$ for $z > \underline{z}$,

[20] In the Appendix, Cases (a), (b), and (c) are shown to employ the same function when $z \leq \min\{\underline{z}, z^X\}$.

while $A_0^T(\underline{z}) = \underline{A}$. Since all $A \in [\underline{A}, A_0^T(z)]$ have the same expected net trial payoff of zero, the plaintiff's payoff function does not vary with her type on this interval; every type in this interval expects to make $(1 - p(S))\max\{0, [(1 - \alpha)S - z]\}$ if she demands the amount S, where p(S) is an arbitrary rejection probability for D. There need not be a unique maximizer of this expression, but there is no reason for the types in the set $[\underline{A}, A_0^T(z)]$ to make different demands, so we assume they make the same demand. Let the pooled demand by types in $[\underline{A}, A_0^T(z)]$ be $s^P(A_0^T(z)) \equiv E\{s^F(A) \mid A \in [\underline{A}, A_0^T(z)]\}$; then, under the uniform distribution, $s^P(A_0^T(z)) = (\lambda(\underline{A} + A_0^T(z))/2) + c_D$. If D believes that the demand $s^P(A_0^T(z))$ is made by all P types in $[\underline{A}, A_0^T(z)]$, then D accepts this demand with probability 1.

On the other hand, the plaintiff's payoff does vary with type for plaintiff types $A \in (A_0^T(z), \overline{A}]$ because they expect a net positive payoff of $\lambda[(1 - \alpha)A - z]$ at trial; moreover, these types prefer settlement at their full-information demand to trial, since $z < z^X$. This means that an equilibrium wherein types in this upper set reveal A via their demands can be found, but there must be an upward jump in D's rejection function between the pooling demand $s^P(A_0^T(z))$ and the lowest possible demand for the revealing set $(A_0^T(z), \overline{A}]$, so that members of the pool will not try to mimic a member of this upper (revealing) set of types. Furthermore, if this jump is such that the resulting probability of rejection for this lowest possible revealing type is less than one, then D's rejection function (much like that described earlier for $z \leq \underline{z}$) will be increasing over the interval of demands arising from the set $(A_0^T(z), \overline{A}]$; that is, the interval $(s^F(A_0^T(z)), \overline{S}]$.

There exists a level of repayment, $\hat{z} < z^X$, where the pooled types of P just net zero from settlement; that is, $\hat{z}$ is the value of z which solves $(1 - \alpha)s^P(A_0^T(z)) - z = 0$. At this value of z, the jump in the rejection function just brings the overall rejection probability for D on the revealing types to be 1; the line labeled as "$\hat{z}$" is indicated in Figure 1. Thus, as we move in Figure 1 up from $z = \underline{z}$, the pool of types $[\underline{A}, A_0^T(z)]$ increases in measure, the related pooling demand (which D accepts with probability 1), $s^P(A_0^T(z))$, increases (since the upper end of the pool is increasing), the set of revealing types $(A_0^T(z), \overline{A}]$ is shrinking from below, and the rejection function over these types is rising towards 1, converging to 1 just as z converges to $\hat{z}$. There are still some types who reveal themselves by making their full-information demands, but these demands are rejected with probability one. Specifically, and as shown in more detail in the Appendix, D's overall equilibrium rejection function for $z \in [\underline{z}, \hat{z})$ is given by:

$$p(S; z) = \begin{cases} 0 \ \text{ for } S \leq s^P(A_0^T(z)) \\ 1 \ \text{ for } S \in (s^P(A_0^T(z)), s^F(A_0^T(z))] \\ 1 - (1 - p_0(z))\exp\{-(S - s^F(A_0^T(z)))/w(z)\} \ \text{ for } S \in (s^F(A_0^T(z)), \overline{S}] \\ 1 \text{ for } S > \overline{S}, \end{cases} \tag{2}$$

where the multiplier $1 - p_0(z)$ can be shown to be $[(2 - \lambda)/2(1 - \lambda)][(\hat{z} - z)/(z^X - z)]$; the function $(1 - p_0(z))$ converges to 0 as z converges to $\hat{z}$ and converges to 1 as z converges to $\underline{z}$ (i.e., the image in the lower portion of this panel of Figure 2 converges back to the image in the lower portion of the left-most panel in the Figure). Note that out-of-equilibrium demands $S \in (s^P(A_0^T(z)), s^F(A_0^T(z))]$ are rejected based on the belief that such a demand is coming (uniformly) from the set of pooled types rather than from a type in $(A_0^T(z), \overline{A}]$.

When z exceeds $\hat{z}$, but is less than z^X, a (limit) hybrid equilibrium obtains wherein the pooled types make the demand $s^P(A_0^T(z))$ and the higher types make their full-information demands, but now D rejects the demands above $s^P(A_0^T(z))$ with probability 1; this is illustrated in the third vertical panel of Figure 2. When z continues to rise above z^X, this type of hybrid equilibrium persists, but now it is the high types of P that force trial – by making an extreme demand – rather than trying to settle at their full-information demands. We refer to this type of hybrid equilibrium as a "two-tiered pooling equilibrium," as both sub-intervals of the type space are pooling, and this is illustrated in the fourth vertical panel in Figure 2. As z increases above z^X the pooling set continues to increase in measure until $z = \overline{z}$, whence all types pool and demand $s^P(A_0^T(\overline{z})) = s^P(\overline{A}) = (\lambda(\underline{A} + \overline{A})/2) + c_D$. At this point all types of P are settling with D; thus, no types go to trial and any loan by LF of $\overline{z}$ (or more) would induce full settlement. Because $\overline{z} > \hat{z}$, every plaintiff type expects to net zero at trial and in settlement, so (respecting the proviso in the loan contract indicated earlier) all types settle at the pooling demand $s^P(\overline{A})$, and turn the proceeds over to LF.

3.2 Discussion of Case (a) and Case (c) Results

The results for Cases (a) and (c) differ from that of Case (b) as follows. In Case (a), as can be seen from Figure 1, when $z \leq z^X$ (which in Case (a) is less than or equal to $\underline{z}$), all types make a positive (type-dependent) return from both trial and from making their full information settlement demand. Thus, the analysis is exactly the same as in Case (b) for $z \leq \underline{z}$, with equilibrium demand and rejection functions as displayed by the left-most panel in Figure 2. When $z^X < z < \overline{z}$, then all types can do better by forcing trial than by settling, so all types will force trial by making an extreme demand that D will reject for sure. Finally, when $z \geq \underline{z}$, types in $[\underline{A}, A_0^T(z)]$ net zero from trial, so they pool and demand $s^P(A_0^T(z))$, while types in $(A_0^T(z), \overline{A}]$ still prefer trial to settlement, so they make extreme demands so as to drive D to trial; this is similar to the right-most panel in Figure 2.

The bargaining analysis for Case (c) yields similar results to Case (b), though there is no portion of the parameter space associated with P forcing suits to trial (that is, all relevant values of z lie on or to the right of the line in Figure 1 labeled as "z^X," so P always prefers settlement at her full-information demand to forcing the suit to trial). As discussed in the Appendix, when $c_D \leq \overline{A} - \lambda(\underline{A} + \overline{A})/2$, then $\hat{z}$ is less than or equal to $\overline{z}$, so that the analysis of the bargaining game looks very similar to that done for Case (b).

When $c_D > \overline{A} - \lambda(\underline{A} + \overline{A})/2$, then the line labeled "$\hat{z}$" exceeds that labeled "$\overline{z}$" (this portion of the $\hat{z}$-line is not illustrated in Figure1). In this sub-case the plaintiff nets a positive payoff from settlement even when all types are in the pool (i.e., when $z = \overline{z}$). Only when z reaches $z^0 \equiv (1 - \alpha)[(\lambda(\underline{A} + \overline{A})/2) + c_D] > \overline{z}$ does every plaintiff type net zero both at trial and in settlement. Finally, for repayment amounts $z \geq z^0$, all types $A \in [\underline{A}, \overline{A}]$ expect to net zero at trial and in settlement, so (respecting the proviso) all types settle at the pooling demand $s^P(\overline{A})$, and turn the proceeds over to LF.

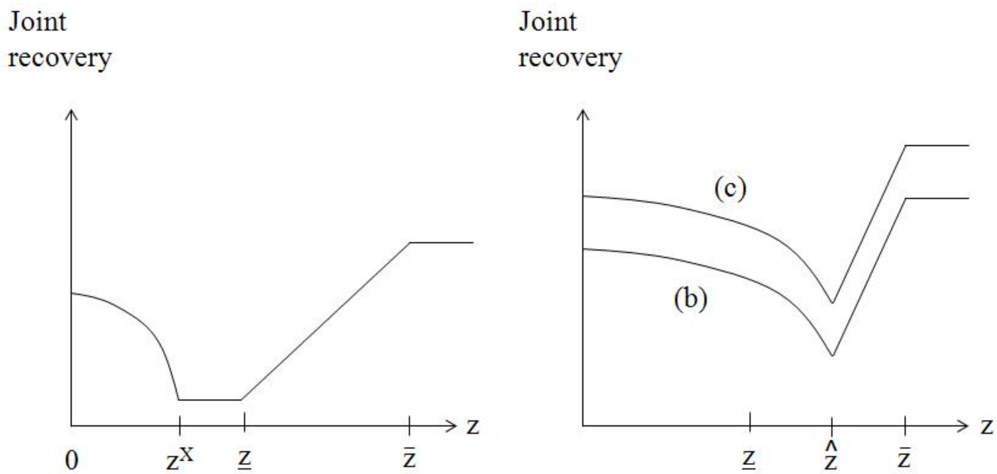
A complementary perspective of the three Cases can be gained by fixing the amount z and letting D's cost of trial increase; reconsidering Figures 1 and 2, we find that the equilibrium likelihood of settlement is non-decreasing. To see this, consider what happens for any arbitrary z strictly between $\underline{z}$ and $\overline{z}$ as c_D increases. Initially, as seen in Figure 1 for Case (a), all types in $[\underline{A}, A_0^T(z)]$ pool and settle with probability 1 at $s^P(A_0^T(z))$, while higher types force trial, so for this entire range of c_D (up to when we cross the z^X-line from the left) the only settlement is with the lower set of types. Furthermore, as c_D increases beyond this value, z will be between $\hat{z}$ and z^X, where pooled types will settle and those types who are revealing will be rejected with probability 1; thus, again there is only settlement by those lower types that pool, though now it is D who is forcing trial. Note that because z is fixed, the set of types who settle does not change from $[\underline{A}, A_0^T(z)]$, though the pooling demand increases as c_D increases. Eventually c_D is large enough to place the point of interest in the portion of Case (b) to the right of the $\hat{z}$-line, so that the same types pool as before, but now types in the revealing set (those in $(A_0^T(z), \overline{A}]$) are rejected with probability less than 1 (that is, in equilibrium some of these types sometimes settle). Moreover, one can show that as c_D increases further, the equilibrium rejection probability, $p(s^F(A); z)$, falls for each type in the revealing set, so settlement is increasingly likely.

One further observation across the three Cases: observe that if LF and P were to conclude a contract wherein $z < \overline{z}$, then for any such z and any value of c_D, the equilibrium will involve some settlement failure. This could imply that litigation funding actually reduced the likelihood of settlement (in comparison with $z = 0$), but as we shall next see, such a contract would not be part of an equilibrium for the overall game.

3.3 Results from the Period 2 Analysis for Joint P-LF Recovery

In Figure 3 we illustrate the joint recovery (that is the joint Period 2 subgame value) for P and LF for all three cases. More precisely, if $\pi^j(z)$, j = P, LF, are the individual payoffs (in Period 2 terms) for P and LF, respectively, as a function of z, then Figure 3 illustrates the joint payoff $\Pi(z) = \pi^P(z) + \pi^{LF}(z)$ for all relevant values of the contracted repayment z. Note that $\pi^{LF}(0) = 0$, so that $\Pi(0) = \pi^P(0)$. In the left-hand portion of Figure 3 we illustrate the joint recovery for Case (a), allowing for z to vary from 0 to $\overline{z}$ and beyond. The left-most point on the function is when $z = 0$ and is what P could obtain without LF that is, P's "no-loan" or "satnd alone" value of her suit). As can be seen, the joint recovery is initially decreasing in z (from 0 to z^X), then is constant between z^X and $\underline{z}$ (as all P-types force trial), then increases linearly in z between $\underline{z}$ and $\overline{z}$, and then finally remains constant thereafter (as all P-types settle). In the right-hand panel of the Figure we have illustrated the same functions for Cases (b) and (c). Both functions start higher on the vertical axis (since c_D is higher in Case (b) and yet higher in Case (c)), fall as z increases until $z = \hat{z}$, and then rise linearly until $z = \overline{z}$, again becoming constant for yet larger values of z. In all three cases, for all z

$\geq \overline{z}$, $\Pi(z) = (1 - \alpha)[\lambda(\overline{A} + \underline{A})/2 + c_D]$; that is, D is fully extracted via settlement, and pays the full expected value of the suit plus his court costs.



Case (a)

Cases (b) and (c)

Figure 3: Joint Recovery for P and LF

3.4 Results from the Period 1 Analysis of the Equilibrium Loan

We have earlier assumed that LF and P have the same discount rate. However, if P's discount rate differs from that of LF, it is likely that it would be higher than LF's (due to LF's superior access to credit markets). Thus, for any given amount received by P in Period 2, she would prefer to receive its discounted value in Period 1. Therefore, P would prefer a lump sum in Period 1, leaving all of the receipts in Period 2 to LF, and LF also prefers this loan structure. Recall that any $z \geq \overline{z}$ maximizes $\Pi(z)$, but for very high c_D (i.e., $c_D > \overline{A} - \lambda(\underline{A} + \overline{A})/2$), P still receives a positive net payoff from settlement in Period 2 if $z < z^0$, so such a Period 2 payoff would reduce the lump sum P receives in Period 1. To avoid this, the optimal loan contract will set the repayment amount as $z^{max} \equiv \max\{\overline{z}, z^0\}$; using the definitions of $\overline{z}$ and z^0, then $z^{max} = (1 - \alpha)\max\{\overline{A}, \lambda(\overline{A} + \underline{A})/2 + c_D\}$. Thus, the optimal loan contract will always induce full settlement and involve P turning over all receipts from settlement or trial to LF.[21]

In Period 1, LF's offer to P must satisfy P's individual rationality constraint: P is no worse off (in expectation) by taking the loan than by foregoing the loan and obtaining the discounted

[21] Although the optimal litigation funding contract can be viewed as giving the plaintiff "full insurance" since she receives an upfront payment and the litigation funder becomes the residual claimant of the settlement or award, the plaintiff is not risk averse and so the traditional motive for insurance is absent.

expected (stand alone) value of her suit.[22] This expected value is found by observing that the equilibrium (when $z = 0$) involves a P of type A making her full-information demand $s^F(A)$ and D rejecting it with probability $p(s^F(A); 0)$. From the position of being in Period 1, wherein P's type is not known by either LF or P, the Period 2 expected value without a loan is simply:

$$\pi^P(0) = [(1 - \alpha)/(\overline{A} - \underline{A})]\int[s^F(A)(1 - p(s^F(A); 0)) + \lambda Ap(s^F(A); 0)]dA,$$

where this integral is evaluated over $[\underline{A}, \overline{A}]$. This expression simplifies to:

$$\pi^P(0) = (1 - \alpha)[\lambda(\overline{A} + \underline{A})/2 + c_D] - [(1 - \alpha)c_D/(\overline{A} - \underline{A})]\int p(s^F(A); 0)dA.$$

Notice that the first term on the right-hand-side of $\pi^P(0)$ is the total value of the settlement if $z = z^{max}$, $\Pi(z^{max})$, so we can see that using the optimal loan generates a greater joint value to P and LF with the loan than without it, if the loan is set to create a repayment of z^{max}.

Thus, in present value terms, P requires that the amount B in the loan (r, B) be no less than $\pi^P(0)/(1 + i)$, P's discounted value of proceding with the lawsuit without the loan. This in turn implies that to generate the repayment amount z^{max}, the interest rate r must satisfy $(1 + r)B = z^{max}$. This means that the overall expected value for P and LF to bargain over in Period 1 is $\Pi(z^{max})/(1 + i)$, with P's individual rationality constraint being $B \geq \pi^P(0)/(1 + i)$ and LF's individual rationality constraint requiring a nonnegative payoff. Therefore, for example, if LF can make a take-it-or-leave-it offer to P, it would be $B^* = \pi^P(0)/(1 + i)$, and LF's discounted value of the contract would be $\Pi(z^{max})/(1 + i) - B^*$.[23] This means that the interest rate in the loan contract would be set as $r^* = [(1 + i)z^{max} - \pi^P(0)]/\pi^P(0) > I$.

3.5 Discussion of Alternative Period 2 Bargaining as Screening

We have assumed that the plaintiff makes the settlement demand; this seems consistent with the fact that she can specify the damages she is seeking when she files suit. Nevertheless, we have also analyzed a screening version of this model wherein the uninformed defendant makes a settlement offer to the informed plaintiff. The details of this analysis can be found in the Technical Appendix, but we briefly summarize those results here. We assume that $c_D < \lambda(\overline{A} - \underline{A})$ so that the defendant screens the P types (rather than settling with all P types) in the base case of no loan.[24]

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[22] If P does discount future receipts at $1/(1 + i)$, as LF does, then P would be willing to accept a lower upfront payment in conjunction with a positive future flow as long as $z \geq \overline{z}$, so as to ensure full settlement. This is only important when c_D is high enough resulting in $z^{max} > \overline{z}$, so for convenience of exposition we assume that P always desires a loan contract with no residual receipts in the future.

[23] Alternatively, the Nash Bargaining Solution might be employed to pick a point on the bargaining frontier, and thereby divide the surplus $\Pi(z^{max})/(1 + i) - (B^* + 0)$ between P and LF, increasing P's upfront loan B at the expense of LF's discounted return from the residual that would become available to LF from the settlement in Period 2.

[24] There is also a proviso in the contract between P and LF: *P agrees not to accept a settlement that is insufficient to repay her loan.* This serves to make P a tougher bargainer; otherwise, if her repayment amount z resulted in a zero net payoff at trial, she would be willing to accept an offer of S = 0 from D, and this would be a very bad outcome for LF (and for PA, as well). P is happy to accept the proviso because if she anticipates a positive net payoff at trial then she strictly

That is, D chooses a marginal type and makes a settlement offer that is just sufficient to induce this type to settle; of course, all lower types also accept this offer.

We find that in Case (a), a non-recourse loan always lowers the joint expected recovery of P and LF. The non-recourse aspect of the loan means that the settlement required to induce any given plaintiff type to settle is higher; as a consequence, the defendant chooses a lower marginal type (that is, he chooses to settle with fewer plaintiff types). For sufficiently large z, the defendant makes a very low offer and goes to trial with all P types; this can be optimal for D because c_D is very low in Case (a). In Cases (b) and (c), small values of the repayment amount z have the same effect of reducing settlement and the joint recovery of P and LF, but larger repayment amounts become feasible as c_D grows (because D is less willing to go to trial when his court costs are high). There are parameter combinations in Cases (b) and (c) wherein P and LF can increase their joint recovery relative to the no-loan benchmark. Finally, in the sub-case of Case (c) wherein $c_D > \overline{A} - \lambda(\underline{A} + \overline{A})/2$, P and LF can use the repayment amount $z = z^0 = (1 - \alpha)(\lambda(\underline{A} + \overline{A})/2) + c_D)$ to extract an offer of $S = (\lambda(\underline{A} + \overline{A})/2) + c_D)$ from D, which is his maximum expected willingness to pay. All P types accept this demand and, after paying PA's contingent fee, P turns the rest of the settlement, z^0, over to LF, as it is just sufficient to repay her loan.

This analysis of the screening game suggests that, while P could forego her option to make the settlement demand (that is, she could wait to be screened), she is better off taking advantage of having the first move, as this permits her to make use of a non-recourse loan from LF that will allow her to extract via settlement the full amount that D would be willing to pay, regardless of the magnitude of c_D.

4. Regulating the Litigation Funding Market via Rate Caps

Since the interest rate in the optimal loan contract between P and LF, r*, can be quite high, we now explore the effect of imposing a maximum allowed value of r (a "rate cap"). To simplify the exposition, we again focus on Case (b) and we assume that LF has all the bargaining power in stage 2 (subject to P's individual rationality constraint, which will be specified below). When the parties are completely free to determine the terms of the contract, then it is optimal for LF to maximize the recovery from the defendant by setting $z = \overline{z}$, and to provide P with her stand-alone value B* in Period 1. However, when the interest rate is constrained to be, say, $r^R < r^*$, then LF must give P more than her stand-alone value B* if LF continues to choose $z = \overline{z}$ so as to maximize the joint recovery (if $\overline{z} = (1 + r^*)B^*$, then $\overline{z} = (1 + r^R)B^R$ requires $B^R > B^*$). Thus, a regulated funder may, or may not, want to ensure full settlement. If full settlement is not achieved, then both some types of P, and LF, will accrue some payments in Period 2.

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prefers trial to a settlement that is insufficient to repay her loan (she would have a net payoff of zero in settlement), whereas if she expects a zero net payoff at trial then she is indifferent between these two alternatives.

In what follows, we will only consider values of z in $(\hat{z}, \overline{z}]$; this is because the joint payoff when $0 < z \leq \hat{z}$ is dominated by the stand-alone value of P's suit, so LF would never choose such a value of z. Furthermore, $\pi^{LF}(z) = \Pi(\overline{z})$ for all $z \geq \overline{z}$, so there is no need to consider higher values of z. On the domain $(\hat{z}, \overline{z}]$ the payoffs $\pi^{LF}(z)$ and $\pi^{P}(z)$ can be shown to be as follows:

$$\pi^{LF}(z) = (1 - \alpha)s^{P}(A_0^T(z))[(A_0^T(z) - \underline{A})/(\overline{A} - \underline{A})] + \lambda z\,[(\overline{A} - A_0^T(z))/(\overline{A} - \underline{A})],$$

and

$$\pi^{P}(z) = \lambda((1 - \alpha)(\overline{A} + A_0^T(z))/2 - z)[(\overline{A} - A_0^T(z))/(\overline{A} - \underline{A})].$$

The payoff for LF, expressed in terms of z and B, and in Period 2 dollars,[25] is $\pi^{LF}(z) - (1 + i)B$; this is because LF expects to receive the revenue $\pi^{LF}(z)$ and to repay the principal plus interest on whatever cash payment (B) he advanced to P in Period 1. The payoff for P, again expressed in terms of z and B , and in Period 2 dollars, is $\pi^{P}(z) + (1 + i)B$; P's individual rationality constraint is that this amount must be no less than her stand-alone suit value of $\pi^{P}(0)$.

Let $\gamma \equiv [(1 + i)/(1 + r)]$, and recall that $z = (1 + r)B$. Then we can express LF's optimization problem as follows:

$$\max_{(z,\gamma)} \pi^{LF}(z) - \gamma z$$
subject to: 1) $\pi^{P}(z) + \gamma z \geq \pi^{P}(0)$; and 2) $z \leq \overline{z}$,

where the first inequality is P's individual rationality constraint. LF's payoff is maximized when the first constraint is tight, which means that (upon substituting the constraint into the objective function), LF's objective is to maximize $\Pi(z) - \pi^{P}(0)$, yielding the solution $(\overline{z}, \gamma^*)$, where $\gamma^* = [(1 + i)/(1 + r^*)]$ or, equivalently, that $(r^*, B^*) = ([(1 + i)\overline{z} - \pi^{P}(0)]/\pi^{P}(0), \pi^{P}(0)/(1 + i))$, as found in Section 3.4.

Now we consider the regulated-LF problem. Let us assume that a regulatory authority sets a maximum allowable rate, denoted as r^R (where $r^R < r^*$), and let γ^R be constructed accordingly from r^R (note that, by construction, lower values of r^R induce higher values of γ^R). Now the litigation funder's problem is to choose z (since γ^R is given) that solves:

$$\max_{z} \pi^{LF}(z) - \gamma^R z$$
subject to: 1) $\pi^{P}(z) + \gamma^R z \geq \pi^{P}(0)$; and 2) $z \leq \overline{z}$.

Let us denote the solution to the regulated-funder problem be denoted as z^R. We want to know when the response to regulation continues to involve full settlement (by choosing $z^R = \overline{z}$).

[25] Again, we are simplifying the exposition by assuming that P and LF use the same discount factors.

Notice two important implications of this optimization problem. First, if $\pi^{LF}(z^R) - \gamma^R z^R < 0$, then the lender should withdraw from the market, as his maximal possible profit is negative This condition means that for the lender to be willing to make the settlement-ensuring loan, his average profits must be at least as large as γ^R. Second, as mentioned above, P's individual rationality constraint is slack at $\overline{z}$, since $r^R < r^*$ implies directly that $\gamma^R > \gamma^*$. Thus, if profits are non-negative for LF when $z^R = \overline{z}$, then it must be that $d\pi^{LF}(z)/dz - \gamma^R \geq 0$ if $z^R = \overline{z}$. In other words, for the non-recourse loan to induce full settlement, which requires that $z^R = \overline{z}$, then γ^R must be no greater than LF's marginal profit at $\overline{z}$. To summarize, a regulated funder will only be willing to make a non-recourse loan that will induce full settlement if:

$$\gamma^R \leq \min\{\pi^{LF}(\overline{z})/\overline{z}, \pi^{LF\prime}(\overline{z})\},$$

where $\pi^{LF\prime}(\overline{z})$, LF's marginal profit, is $d\pi^{LF}(z)/dz$ at $z = \overline{z}$. Rate caps that are low enough to cause γ^R to violate the above inequality will induce repayment levels below $\overline{z}$ (thereby inducing some settlement failure) or withdrawal of LF from the market.

5. Discussion and Conclusions

Given that P's filed complaint against D can act as a strategic move by making P a first-mover in the bargaining game (thereby leading us to analyze this as a signaling game), we find that an optimal loan induces every P type to demand $s^P(\overline{A})$, and D should accept this rather than reject it and go to trial. Notice that, since P is fully extracted by the optimal interest rate in the loan contract, even if D could make a counteroffer (a move which is outside of the current analysis), P can credibly resist any counteroffer that D might make: it is credible for P to go to trial (and net zero) if D were to make a counteroffer that is less than $s^P(\overline{A})$.

As was indicated above, the interest rate in the loan, r, exceeds the interest rate faced by LF in obtaining capital, i, possibly by quite a bit.[26] This may have important negative ramifications beyond our analysis, but in our analysis the interest rate r is simply there to facilitate the implementation of the loan in a manner which provides the greatest Period 1 upfront transfer to P that she can negotiate with LF (see footnotes 22 and 23). Essentially, LF then gets title to all the proceeds of the suit in exchange for the upfront payment to P. As mentioned in the Introduction, it is essential that LF not buy the case, since then the bargaining will be between LF and D and, since LF would then learn P's type through case preparation, settlement will be subject to the usual bargaining failure associated with asymmetric information negotiation, and as can be seen from Figure 3, this would reduce the total value of the suit to LF (it would become $\pi^P(0)$).

With respect to the defendant, it is also worth noting that increasing settlement does not undermine incentives for D to take care, since with an optimal loan D will be fully extracted. That

[26] See the earlier quote from Rodak (2006) in the Introduction.

is, litigation funding need not affect D's incentives for care-taking. Finally, the plaintiff's attorney (PA) benefits from the use of an optimal loan. PA is paid on a contingent-fee basis, which means he bears both the cost of preparing the case, c_S, and the cost of going to trial, c_P. Since, in equilibrium, there are no trials, then PA never incurs the cost c_P and does not risk losing at trial.

Finally, recall that we have taken the contingent-fee rate α as exogenous. If the market for lawyers is perfectly competitive then the expected revenue from the contracted contingent-fee rate should just cover expected costs. To the degree that litigation funding leads to settlement, then this rate should fall since lawyers with clients with third-party support do not incur the total cost of preparation for settlement bargaining (c_S) plus the expected cost of trial (that is, c_P times the probability of trial); they only incur c_S. Whether this would substantially affect those firms (that primarily have such clients) is unclear, and worth considering.

Furthermore, while the use of a contingent-fee contract with her attorney affords the plaintiff improved access to the courts, the use of a non-recourse loan from a litigation funder has a yet further affect on access. Because the suit always settles when the plaintiff has a non-recourse loan contract with a litigation funder, as indicated above, the plaintiff's attorney never risks losing at trial and never pays c_P. As a consequence, at a given contingent fee PA will be willing to take cases with higher c_S, lower λ, or lower stakes, thus improving plaintiff access to the legal system. Alternatively, the contingent fee α for a given case will be lower than if there were no loan contract in place. If the litigation funder is a monopolist, then the surplus generated to the plaintiff through a lower contingent fee will accrue to the litigation funder. However, as entry into the litigation funding industry occurs, the plaintiff will have more alternatives and her bargaining power should improve, allowing her to capture more of this surplus. Moreover, entry into the litigation funding industry will involve lenders competing for clients by offering higher values of B and lower values of r, while maintaining $B(1 + r) = z^{max}$ to ensure efficient settlement.

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Appendix on Signaling Analysis of Period 2 Settlement Bargaining

There are several critical values of z that will be important in the analysis, and we repeat their definitions here for convenience. Neglecting the non-recourse aspect of the loan, a P of type A prefers to settle at $s^F(A)$ rather than going to trial as long as $z \le z^X \equiv (1 - \alpha)c_D/(1 - \lambda)$; when $z > z^X$, a P of type A prefers to go to trial rather than settle at $s^F(A)$. Let $\underline{z} \equiv (1 - \alpha)\underline{A}$ and $\overline{z} \equiv (1 - \alpha)\overline{A}$; for $z < \underline{z}$, every type of P makes a positive expected net payoff from trial, whereas for $z > \overline{z}$, no type of P makes a positive expected net payoff from trial.

Analysis of Settlement Negotiations for Case (a)

In Case (a) (wherein $\underline{A} \ge c_D/(1 - \lambda)$), the critical values of z are ordered as follows: $z^X \le \underline{z} < \overline{z}$. For repayment amounts $z < z^X$, all P types prefer settlement at $s^F(A)$ to trial and all P types expect a net positive payoff from trial. Since the trial payoff increases with the type, A, it is possible to have a fully-revealing equilibrium wherein higher demands are rejected with a higher probability; higher types are willing to make higher demands and risk a higher probability of rejection because their expected payoff at trial is higher.[27] Let p(S) denote the probability with which D rejects the demand S. Then P's payoff if she is type A and demands S is:

$$(1 - p(S))[(1 - \alpha)S - z] + p(S)\lambda[(1 - \alpha)A - z]. \tag{A.1}$$

The optimal settlement demand must (1) maximize the expression in equation (A.1); and (2) make D indifferent so that he is willing to randomize. The first-order condition is:

$$- p'(S)[(1 - \alpha)S - z - \lambda(1 - \alpha)A + \lambda z] + (1 - p(S))(1 - \alpha) = 0. \tag{A.2}$$

The condition for D to be indifferent is that $S = \lambda A + c_D$; that is, the plaintiff's equilibrium demand must be her full-information demand, $s^F(A)$. Alternatively put, when P demands S, D believes that the plaintiff is of type $A = b^*(S) \equiv (S - c_D)/\lambda$. Substituting this into equation (A.2) and simplifying yields the following ordinary differential equation for the unknown function p(S):

$$- p'(S)w(z) + (1 - p(S)) = 0, \tag{A.3}$$

where $w(z) \equiv c_D - z(1 - \lambda)/(1 - \alpha) > 0$ for $z < z^X$. The boundary condition for the p(S) function is that $p(\underline{S}) = 0$, where $\underline{S} \equiv s^F(\underline{A}) = \lambda\underline{A} + c_D$.[28] This results in the equilibrium probability of rejection function for Case (a), conditional on $z < z^X$, as given by equation (1) in the main text. Alternatively, one can write the probability of rejection faced by any given type, A, as:

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[27] The interested reader is referred to Reinganum and Wilde (1986) for details on deriving the fully-revealing equilibrium for this type of model. In that paper, it is shown that this is also the unique equilibrium satisfying the equilibrium refinement D1 (see Cho and Kreps, 1987, for a discussion of equilibrium refinements).

[28] D would accept for sure any demand less than $\underline{S}$, since this is less than he expects to pay against any type at trial. If he were to reject $\underline{S}$ with positive probability, then P could cut the demand infinitesimally and guarantee acceptance. Thus, to be consistent with equilibrium play, the demand $\underline{S}$ must be accepted for sure.

$$p(s^F(A); z) = 1 - \exp\{ - \lambda(A - \underline{A})/w(z)\} \quad \text{for } A \in [\underline{A}, \overline{A}]. \tag{A.4}$$

For repayment amounts $z \in [z^X, \underline{z})$, all P types prefer trial to settlement at $s^F(A)$ and all P types expect a net positive payoff from trial. In this case, there cannot be an equilibrium involving settlement; every plaintiff type A will make a demand that is sure to be rejected so as to obtain the payoff $\lambda[(1 - \alpha)A - z]$. To see this, suppose that there was an equilibrium in which some plaintiff of type A was revealed and in which D accepted P's demand with positive probability. The most this plaintiff could demand is $s^F(A) = \lambda A + c_D$, and the most she could obtain in settlement is $\max\{0, (1 - \alpha)(\lambda A + c_D) - z\}$, while she obtains $\lambda[(1 - \alpha)A - z] > \max\{0, (1 - \alpha)(\lambda A + c_D) - z\}$ at trial. Thus, any type A that is revealed in equilibrium would deviate from her putative revealing equilibrium settlement demand in order to provoke a trial. If a collection of types $[A_1, A_2]$ were (conjectured) to pool at a common demand S, then the highest value of S that D would accept is $E(s^F(A) \mid A \in [A_1, A_2])$. But if this demand was accepted with positive probability, then type A_2 would deviate to a demand that would provoke rejection by D, since $\max\{0, (1 - \alpha)E(s^F(A) \mid A \in [A_1, A_2]) - z\} \leq \max\{0, (1 - \alpha)s^F(A_2) - z\} < \lambda[(1 - \alpha)A_2 - z]$. Thus, there cannot be an equilibrium in which either a revealing or a pooling demand is accepted by D with positive probability; the only possible equilibria involve all plaintiff types going to trial.

The equilibrium demand function for P is not unique in this case. For instance, every type A could make her revealing demand $s^F(A)$, but then these demands must all be rejected with probability 1 by D. This is consistent with D holding the revealing equilibrium beliefs $b^*(S) = (S - c_D)/\lambda)$), and represents the natural extension of the limiting case as z approaches z^X from below. However, since P's goal is to end up at trial (and she would actually prefer trial to having $s^F(A)$ accepted), she can easily guarantee a trial by making an "extreme" demand of $S > \overline{S} = s^F(\overline{A})$. D will reject an extreme demand (regardless of beliefs), as this is more than he would pay against any type of P at trial. Of course, D must still accept for sure any demand $S < s^F(\underline{A})$, since this is strictly less than what he would pay against any type of P at trial. Demands in $(s^F(\underline{A}), s^F(\overline{A})]$ are also rejected by D, based on the belief that any such demand is coming from type $\underline{A}$.[29] For ease of exposition, we will select the equilibrium demand function wherein every type of P chooses an extreme demand for repayment amounts $z \in [z^X, \underline{z})$.

For repayment amounts $z \in [\underline{z}, \overline{z})$, sufficiently high plaintiff types expect a positive payoff from trial, while lower types expect a "negative" payoff, though this is translated into a payoff of zero due to the non-recourse nature of the loan. Let $A_0^T(z)$ denote the plaintiff type who just expects to break even at trial when the repayment amount is z; thus, $A_0^T(z) = z/(1 - \alpha) > \underline{A}$ for $z > \underline{z}$, while $A_0^T(\underline{z}) = \underline{A}$ Since all $A \in [\underline{A}, A_0^T(z)]$ have the same expected net trial payoff of zero, P's payoff does

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[29] The equilibrium (trial) payoff for P is increasing in type. Some types (e.g., $\overline{A}$) would never be willing to deviate to a demand $S \in (s^F(\underline{A}), s^F(\overline{A})]$, but others would if it was accepted with a sufficiently high probability. Since type $\underline{A}$ would be willing to deviate to such a demand for the lowest probability of acceptance, the refinement D1 requires that such demands be attributed to $\underline{A}$. Thus, this equilibrium survives refinement using D1. The out-of-equilibrium demand $s^F(\underline{A})$ can be accepted with any probability in [0, 1].

not vary with her type on this interval; every type in this interval expects to make $(1 - p(S))\max\{0, [(1 - \alpha)S - z]\}$ if she demands the amount S. We assume that all of these plaintiff types make the same pooling demand.[30] Let $s^P(A) \equiv E\{s^F(a) \mid a \in [\underline{A}, A]\}$; then, under the uniform distribution, $s^P(A) = (\lambda(\underline{A} + A)/2) + c_D$. If D holds the belief that the demand $s^P(A_0^T(z))$ is made by all P types in $[\underline{A}, A_0^T(z)]$, then D will accept this (and any lower) demand with probability 1.

On the other hand, P's payoff does vary with type for types $A \in (A_0^T(z), \overline{A}]$, since it has the form $(1 - p(S))\max\{0, [(1 - \alpha)S - z]\} + p(S)\lambda[(1 - \alpha)A - z]$, with $\lambda[(1 - \alpha)A - z] > \max\{0, [(1 - \alpha)s^F(A) - z]\}$. By the same argument as above, there cannot be an equilibrium involving settlement for any type $A \in (A_0^T(z), \overline{A}]$; these types will make extreme demands so as to ensure trial.

Thus, the equilibrium has the following form: A plaintiff of type $A \in (A_0^T(z), \overline{A}]$ makes an extreme demand and goes to trial. Plaintiff types in the interval $[\underline{A}, A_0^T(z)]$ make the pooling demand $s^P(A_0^T(z))$; this demand is accepted by D with probability 1. Notice that this settlement yields an equilibrium payoff of zero for P (under the non-recourse aspect of the loan), because $(1 - \alpha)s^P(A_0^T(z)) - z \leq (1 - \alpha)s^F(A_0^T(z)) - z < 0$ (since $z > z^X$). Any demand in the interval $(s^P(A_0^T(z)), \overline{S}]$ is rejected with probability 1, based on the belief that it comes from the set of pooled types, $[\underline{A}, A_0^T(z)]$, rather than from a higher type (as higher types are expected to make extreme demands[31]).

Since the plaintiffs that make the pooled settlement demand $s^P(A_0^T(z))$ obtain a net payoff of zero both in settlement and at trial, they really don't care about the outcome and could just as well make extreme demands (or a lower pooled demand). Thus, for the same rejection rule on the part of D (that is, accept any demand at or below $s^P(A_0^T(z))$, and reject any higher demands), there is another equilibrium wherein plaintiff types in $[\underline{A}, A_0^T(z)]$ choose extreme demands. However, both LF and PA prefer the outcome in which these types settle at $s^P(A_0^T(z))$ to the outcome in which these types go to trial.[32] To see this, note that PA receives $\alpha s^P(A_0^T(z)) = \alpha[(\lambda(\underline{A} + A_0^T(z))/2) + c_D]$ from each member of the set of types $[\underline{A}, A_0^T(z)]$ if they settle at the pooled demand $s^P(A_0^T(z))$, whereas PA receives (an average of) $E\{\alpha\lambda A \mid A \in [\underline{A}, A_0^T(z)]\} = \alpha[\lambda(\underline{A} + A_0^T(z))/2]$ from members of this set if they all go to trial (in addition, PA will pay c_P for these cases). The former expression is clearly

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[30] The expression $(1 - p(S))\max\{0, [(1 - \alpha)S - z]\}$ is not guaranteed to have a unique maximum, but there is no reason for types in $[\underline{A}, A_0^T(z)]$ to make different demands; hence, we assume that they make the same demand.

[31] Somewhat less harsh beliefs will also support rejection of these demands. For instance, consider the demand $\overline{S}$; D would only be willing to accept this demand if he believed that P was of type $\overline{A}$. But type $\overline{A}$ prefers her trial outcome of $\lambda[(1 - \alpha)\overline{A} - z]$ to settlement at her full-information demand $\overline{S}$. So D's beliefs must assign full probability to types strictly less than $\overline{A}$ (but this probability need not be concentrated on the pool), which implies that D would reject this demand. A similar argument can be made for all demands in the interval $(s^P(A_0^T(z)), \overline{S}]$.

[32] There are also equilibria wherein this set of types settle for a lower common demand than $s^P(A_0^T(z))$. Again, LF clearly prefers (as does PA) that P settle for the highest common demand, $s^P(A_0^T(z))$.

larger than the latter expression. Since P types in $[\underline{A}, A_0^T(z)]$ do not make enough either in settlement or at trial to repay their loans in full, they simply turn over their receipts to LF. Thus, LF expects to make $(1 - \alpha)s^P(A_0^T(z)) = (1 - \alpha)[(\lambda(\underline{A} + A_0^T(z))/2) + c_D]$ from each member of this set of types if they settle, whereas LF expects to receive (an average of) $E\{(1 - \alpha)\lambda A \mid A \in [\underline{A}, A_0^T(z)]\} = (1 - \alpha)[\lambda(\underline{A} + A_0^T(z))/2]$ from members of this set if they all go to trial. Again, the former expression is clearly greater than the latter.

Therefore, we augment the contract between LF and P to include the following proviso: *If there are multiple (refined) equilibria in the settlement negotiation stage (stage 4) and if P is indifferent among them, then P plays according to the equilibrium that LF most prefers (as of the date the contract was concluded)*. This proviso will only come into play if P has learned that her type is in $[\underline{A}, A_0^T(z)]$ (so that she will net zero from trial), and if P would also net zero at the settlement demand $s^P(A_0^T(z))$. In this case, the proviso would lead P to make the settlement demand $s^P(A_0^T(z))$. Notice that this proviso only applies when (in a refined equilibrium) P would net zero both from trial and from the pooled settlement $s^P(A_0^T(z))$; if P has non-trivial preferences then she chooses the settlement demand she most prefers. Thus, P is not hurt by acceding to this proviso, and it is beneficial to LF; moreover, although PA is not a party to this contract, he also benefits from P's compliance with this proviso.

Finally, for repayment amounts $z \geq \overline{z}$, every P type expects a zero net payoff from trial, so all types pool at the demand $s^P(\overline{A})$, which D accepts with probability 1. But all types net a payoff of zero from settlement as well, since $\max\{0, (1 - \alpha)s^P(\overline{A}) - z\} \leq \max\{0, (1 - \alpha)s^F(\overline{A}) - z\} = 0$ (since $z > \overline{z}$). Invoking the proviso described above, the equilibrium for $z \geq \overline{z}$ involves all P types demanding $s^P(\overline{A})$, which is accepted by D. All lower demands are also accepted, while all higher demands are rejected under the belief that a higher demand comes from all members of the pool according to the uniform distribution (recall that all members of the pool have the same preferences over settlement demands, independent of their true types, so there is no reason to believe that an out-of-equilibrium demand is coming from a distribution different from the prior).

Joint Recovery for P and LF for Case (a)

For repayment amounts $z < z^X$, every P type is able to repay LF in full upon settling or upon winning at trial. The combined receipts of P and LF are $\Pi(z) = E\{(1 - \alpha)s^F(A)(1 - p(s^F(A); z)) + p(s^F(A); z)(1 - \alpha)\lambda A\}$, where $p(s^F(A); z)$ is given in equation (A.4). For repayment amounts $z \in [z^X, \underline{z})$, all P types go to trial and repay in full upon winning. The combined receipts of P and LF are $\Pi(z) = E\{(1 - \alpha)\lambda A\}$. For repayment amounts $z \in [\underline{z}, \overline{z})$, P types in $[\underline{A}, A_0^T(z)]$ settle at $s^P(A_0^T(z))$. The amount $(1 - \alpha)s^P(A_0^T(z))$ is not enough to repay the loan, so this amount is simply turned over to LF. On the other hand, P types in $(A_0^T(z), \overline{A}]$ go to trial and are able to repay LF upon winning at trial. The combined receipts of P and LF are $\Pi(z) = (1 - \alpha)s^P(A_0^T(z))(A_0^T(z) - \underline{A})/(\overline{A} - \underline{A}) + E\{(1 - \alpha)\lambda A \mid A \in (A_0^T(z), \overline{A}]\}(\overline{A} - A_0^T(z))/(\overline{A} - \underline{A})$. Finally, for repayment amounts $z \geq \overline{z}$, every P type settles at $s^P(\overline{A})$; since $(1 - \alpha)s^P(\overline{A})$ is not enough to repay the loan, this amount is simply turned over to LF. The combined receipts of P and LF are now $\Pi(z) = (1 - \alpha)s^P(\overline{A}) = (1 - \alpha)(\lambda(\underline{A} + \overline{A})/2) + c_D)$.

The function $\Pi(z)$ is decreasing and concave in z for $z < z^X$ (since the probability of rejection increases with z, and settlement yields a higher payoff than trial). It is flat at its minimum value for $z \in [z^X, \underline{z})$. Thereafter, $\Pi(z)$ increases linearly until z reaches $\overline{z}$, and it remains flat at this value for higher z. Thus, any $z \geq \overline{z}$ maximizes the combined receipts of P and LF.

Analysis of Settlement Negotiations for Case (b)

In Case (b) (wherein $\underline{A} < c_D/(1 - \lambda) \leq \overline{A}$), the critical values of z are ordered as follows: $\underline{z} < z^X \leq \overline{z}$ (the latter inequality is strict except at $c_D/(1 - \lambda) = \overline{A}$, where $z^X = \overline{z}$). For repayment amounts $z < \underline{z}$, all P types prefer settlement at the full-information demand $s^F(A) = \lambda A + c_D$ to trial and all P types expect a net positive payoff from trial. Since the trial payoff increases with the type, A, it is possible to have a fully-revealing equilibrium wherein each type makes her full-information demand and the equilibrium probability of rejection as a function of S (respectively, A) is given by equation (1) in the main text (respectively, equation (A.4) above).

For repayment amounts $z \in [\underline{z}, z^X)$, sufficiently high P types expect a positive payoff from trial, while lower types expect a "negative" payoff, though this is translated into a payoff of zero due to the non-recourse nature of the loan. As before, let $A_0^T(z)$ denote the P type who just expects to break even at trial when the repayment amount is z; that is, $A_0^T(z) = z/(1 - \alpha)$. Since all $A \in [\underline{A}, A_0^T(z)]$ have the same expected net trial payoff of zero, P's payoff function does not vary with her type on this interval; every type expects to make $(1 - p(S))\max\{0, [(1 - \alpha)S - z]\}$ if she demands the amount S. Again, we assume that all of these plaintiff types make the same pooling demand, $s^P(A_0^T(z))$. The defendant will accept this pooling demand (and any lower one) with probability 1.

On the other hand, P's payoff <u>does</u> vary with type for $A \in (A_0^T(z), \overline{A}]$, since it has the form $(1 - p(S))\max\{0, [(1 - \alpha)S - z]\} + p(S)\lambda[(1 - \alpha)A - z]$, with $\lambda[(1 - \alpha)A - z] > 0$. However, since $z < z^X$, these types all prefer to settle at their full-information demands rather than go to trial. We therefore ask whether these types can be induced to make revealing demands and enjoy some probability of settlement as part of the overall equilibrium.

First, we note that the pooled settlement demand $s^P(A_0^T(z))$ results in a positive net payoff for P in settlement whenever $(1 - \alpha)[(\lambda(\underline{A} + A_0^T(z))/2) + c_D] - z > 0$; that is, whenever $z < \hat{z} \equiv (1 - \alpha)[\lambda\underline{A} + 2c_D]/(2 - \lambda)$. Note that in Case (b), $\hat{z} < z^X$. The marginal type in the pool, $A_0^T(z)$, would prefer settling at her full-information demand $s^F(A_0^T(z))$ to settling at the pooled demand. On the other hand, she would prefer settling at the pooled demand to going to trial, where her net payoff is zero. Thus, the marginal type can be made indifferent between remaining in the pool and deviating to her (revealing) full-information demand if the latter demand is met with a probability of rejection, denoted as $p_0(z)$, such that $(1 - p_0(z))[(1 - \alpha)s^F(A_0^T(z)) - z] = [(1 - \alpha)s^P(A_0^T(z)) - z]$. Substituting for $s^F(A_0^T(z))$ and $s^P(A_0^T(z))$ in terms of $A_0^T(z)$, and using $A_0^T(z) = z/(1 - \alpha)$ and simplifying yields $(1 - p_0(z)) = [(1 - \alpha)(\lambda\underline{A} + 2c_D) - (2 - \lambda)z]/2[(1 - \alpha)c_D - (1 - \lambda)z]$. The denominator is $2(1 - \lambda)(z^X - z) > 0$, since $z \in [\underline{z}, z^X)$, while the numerator is $(2 - \lambda)(\hat{z} - z)$. The expression $1 - p_0(z)$ equals 1 at $z = \underline{z}$;

for $\underline{z} < z < \hat{z}$, the expression $1 - p_0(z)$ is positive but decreasing, and $\lim_{z \to \hat{z}} (1 - p_0(z)) = 0$.

Thus, in what follows, we first consider the sub-case $z \in [\underline{z}, \hat{z})$; we will then go on to the sub-case $z \in [\hat{z}, z^X)$. The analysis immediately above implies that, for $z \in [\underline{z}, \hat{z})$, there can be a hybrid equilibrium wherein types in $[\underline{A}, A_0^T(z)]$ pool at $s^P(A_0^T(z))$ while types in $(A_0^T(z), \overline{A}]$ make their full-information demands, $s^F(A)$, and are rejected with positive probability. The derivation of the probability of rejection function proceeds exactly as above in Case (a). In particular, equations (A.1)-(A.3) continue to apply, and only the boundary condition is different. The new boundary condition is that $\lim_{\varepsilon \to 0} p(s^F(A_0^T(z)) + \varepsilon; z) = p_0(z)$. The overall rejection function for $z \in [\underline{z}, \hat{z})$ is then given by equation (2) in the main text.

Out-of-equilibrium demands $S \in (s^P(A_0^T(z)), s^F(A_0^T(z))]$ are rejected based on the belief that such a demand is coming (uniformly) from the set of pooled types rather than from a type in $(A_0^T(z), \overline{A}]$. These beliefs are implied by the D1 refinement. As an illustration, consider the out-of-equilibrium demand $s^F(A_0^T(z))$. All types in $[\underline{A}, A_0^T(z)]$ are indifferent between settling at the pooled demand $s^P(A_0^T(z))$ and making the demand $s^F(A_0^T(z))$ and being accepted with probability $1 - p_0(z)$. Now consider a type $A \in (A_0^T(z), \overline{A}]$. Even if the demand $s^F(A_0^T(z))$ were accepted with probability $1 - p_0(z)$, this type would prefer to demand $s^F(A)$ and to be accepted with probability $p(s^F(A); z))$, since the demand $s^F(A)$ uniquely maximizes type A's payoff. In order to induce a type $A \in (A_0^T(z), \overline{A}]$ to demand $s^F(A_0^T(z))$, this demand would have to be accepted with probability strictly greater than $1 - p_0(z)$. Thus, all types in $[\underline{A}, A_0^T(z)]$ are willing to deviate to $s^F(A_0^T(z))$ for a lower minimum probability of acceptance than any type in $(A_0^T(z), \overline{A}]$. D1 then implies that this out-of-equilibrium demand should be attributed to the set $[\underline{A}, A_0^T(z)]$.

The equilibrium probability of rejection as a function of type is given by $p(s^P(A_0^T(z)); z) = 0$ for $A \in [\underline{A}, A_0^T(z)]$, and:

$$p(s^F(A); z) = 1 - (1 - p_0(z))\exp\{ - \lambda(A - A_0^T(z))/w(z)\} \quad \text{for } A \in (A_0^T(z), \overline{A}]. \tag{A.5}$$

Recall that $\lim_{z \to \hat{z}} (1 - p_0(z)) = 0$. Therefore, $\lim_{z \to \hat{z}} p(s^F(A); z) = 1$ for all $A \in (A_0^T(z), \overline{A}]$. That is, in the limit as z approaches $\hat{z}$, those types that make revealing demands are rejected for sure.

We now consider the sub-case $z \in [\hat{z}, z^X)$. The types $A \in [\underline{A}, A_0^T(z)]$ that make the pooled demand $s^P(A_0^T(z))$ net zero in settlement and at trial (so the proviso applies), while the types $A \in (A_0^T(z), \overline{A}]$ make positive net payoffs at trial. These latter types would prefer to settle at $s^F(A)$, where they would net an even higher positive payoff, but if D were to accept any such demand – say, S – with positive probability (e.g., based on the beliefs obtained by inverting $s^F(A)$), then all $A \in [\underline{A}, A_0^T(z)]$ would defect from the pooled demand $s^P(A_0^T(z))$ (which nets a zero payoff) to S (which nets a positive payoff). Thus, all demands above $s^P(A_0^T(z))$ are rejected for sure, while all demands at or below $s^P(A_0^T(z))$ are accepted for sure. Again, the equilibrium demands for $A \in (A_0^T(z), \overline{A}]$ are not uniquely-specified, but since they prefer settlement at $s^F(A)$ to trial, they would demand $s^F(A)$ (in case D were to err and accept rather than reject this demand).

We now consider repayment amounts $z \in [z^X, \bar{z})$. Recall that (neglecting the non-recourse aspect of the loan) when $z > z^X$, all P types prefer to go to trial rather than settle at their full-information demands (when $z = z^X$, all types are indifferent between these two alternatives). Types $A \in [\underline{A}, A_0^T(z)]$ net zero at trial and in settlement at the pooled demand $s^P(A_0^T(z))$, while types $A \in (A_0^T(z), \bar{A}]$ have a positive net payoff at trial (and prefer this even to settling at $s^F(A)$). Thus, the equilibrium now involves types $A \in [\underline{A}, A_0^T(z)]$ respecting the proviso and making the pooled demand $s^P(A_0^T(z))$, and types $A \in (A_0^T(z), \bar{A}]$ making extreme demands so as to ensure trial. Finally, for repayment amounts $z \geq \bar{z}$, every P type expects to net zero at trial and in settlement, so all types settle at the pooling demand $s^P(\bar{A})$, and P simply turns over the settlement to LF.

Joint Recovery for P and LF in Case (b)

For repayment amounts $z < \underline{z}$ (including the case of no loan, $z = 0$), there is a fully-revealing equilibrium and every P type is able to repay LF in full upon settling or upon winning at trial. The combined receipts of P and LF are $\Pi(z) = E\{(1 - \alpha)s^F(A)(1 - p(s^F(A); z)) + p(s^F(A); z)(1 - \alpha)\lambda A\}$, where $p(s^F(A); z)$ is given in equation (A.4). For repayment amounts $z \in [\underline{z}, \hat{z})$, the pooled settlement allows P to repay in full; moreover, the types that make revealing demands can also repay in full either upon settlement or upon winning at trial. The combined receipts of P and LF are $\Pi(z) = (1 - \alpha)s^P(A_0^T(z))(A_0^T(z) - \underline{A})/(\bar{A} - \underline{A}) + E\{(1 - \alpha)s^F(A)(1 - p(s^F(A); z)) + p(s^F(A); z)(1 - \alpha)\lambda A \mid A \in (A_0^T(z), \bar{A}]\}(\bar{A} - A_0^T(z))/(\bar{A} - \underline{A})$, where $p(s^F(A); z)$ is now given in equation (A.5). For repayment amounts $z \in [\hat{z}, \bar{z})$, P types in $[\underline{A}, A_0^T(z)]$ settle at $s^P(A_0^T(z))$; $(1 - \alpha)s^P(A_0^T(z))$ is insufficient to repay in full, so this amount is simply turned over to LF. On the other hand, P types in $(A_0^T(z), \bar{A}]$ go to trial and are able to repay LF upon winning at trial. The combined receipts of P and LF are $\Pi(z) = (1 - \alpha)s^P(A_0^T(z))(A_0^T(z) - \underline{A})/(\bar{A} - \underline{A}) + E\{(1 - \alpha)\lambda A \mid A \in (A_0^T(z), \bar{A}]\}(\bar{A} - A_0^T(z))/(\bar{A} - \underline{A})$. Finally, for repayment amounts $z \geq \bar{z}$, every P type settles at $s^P(\bar{A})$; since $(1 - \alpha)s^P(\bar{A})$ is not enough to repay the loan, this amount is simply turned over to LF. The combined receipts of P and LF are $\Pi(z) = (1 - \alpha)s^P(\bar{A}) = (1 - \alpha)(\lambda(\underline{A} + \bar{A})/2) + c_D)$.

The function $\Pi(z)$ is decreasing and concave in z until $z = \hat{z}$; thereafter it increases linearly in z and reaches a maximum at $z = \bar{z}$, where all types pool and settle at $s^P(\bar{A})$. Thus, any $z \geq \bar{z}$ maximizes the combined receipts of P and LF.

Analysis of Settlement Negotiations for Case (c)

In Case (c) (wherein $\bar{A} < c_D/(1 - \lambda)$), the critical values of z are ordered as follows: $\underline{z} < \bar{z} < z^X$. Since $\bar{z} < z^X$, neglecting the non-recourse aspect of the loan, every type of P prefers to settle at $s^F(A)$ rather than going to trial. The critical value z^X is now unimportant, but the critical value $\hat{z}$

$= (1 - \alpha)[\lambda\underline{A} + 2c_D]/(2 - \lambda)$ retains its significance. Case (c) is usefully divided into two sub-cases. For $c_D \leq \overline{A} - \lambda(\underline{A} + \overline{A})/2$, it follows that $\hat{z} \leq \overline{z}$. On the other hand, for $c_D > \overline{A} - \lambda(\underline{A} + \overline{A})/2$, it follows that $\hat{z} > \overline{z}$. We will distinguish between these two sub-cases as needed.

For repayment amounts $z < \underline{z}$, there is no need to distinguish sub-cases. All P types prefer settlement at $s^F(A) = \lambda A + c_D$ to trial and all P types expect a net positive payoff from trial. The equilibrium settlement demand is $s^F(A)$, and the probability of rejection as a function of S (respectively, A) is given by equation (1) in the main text (respectively, equation (A.4)).

Sub-case wherein $c_D \leq \overline{A} - \lambda(\underline{A} + \overline{A})/2$. For this parameter configuration, $\hat{z} \leq \overline{z}$. The equilibrium in this case is the same as in Case (b) for repayment amounts $z \in [\underline{z}, \hat{z})$. All types $A \in [\underline{A}, A_0^T(z)]$ make the pooling demand $s^P(A_0^T(z))$, which D accepts. The pooled types make a positive net payoff in settlement. Types $A \in (A_0^T(z), \overline{A}]$ demand $s^F(A)$, and the probability of rejection as a function of S (respectively, A) is given by equation (2) in the main text (respectively, equation (A.5)). As before, in the limit as z approaches $\hat{z}$, those types demanding $s^F(A)$ are rejected for sure.

For repayment amounts $z \in [\hat{z}, \overline{z})$, the equilibrium is again the same as in Case (b) for $z > \hat{z}$. The types $A \in [\underline{A}, A_0^T(z)]$ make the pooled demand $s^P(A_0^T(z))$, which is accepted; they net zero in settlement and at trial). The types $A \in (A_0^T(z), \overline{A}]$ make positive net payoffs at trial (but would make even higher net payoffs if they could settle at $s^F(A)$). These types demand $s^F(A)$, but are rejected with probability 1 (this is necessary to deter mimicry by the pooled types). Thus, all demands above $s^P(A_0^T(z))$ are rejected for sure, while all demands at or below $s^P(A_0^T(z))$ are accepted for sure.

Finally, for repayment amounts $z \geq \overline{z}$, every plaintiff type expects to net zero at trial and in settlement, so (respecting the proviso) all types settle at the pooling demand $s^P(\overline{A})$. This also results in a net payoff of zero to the plaintiff, so she simply turns over the settlement amount to LF.

Sub-case wherein $c_D > \overline{A} - \lambda(\underline{A} + \overline{A})/2$. In this case, $\hat{z} > \overline{z}$. Thus, for repayment amounts $z \in [\underline{z}, \overline{z}]$, all types $A \in [\underline{A}, A_0^T(z)]$ make the pooling demand $s^P(A_0^T(z))$, which D accepts. Types $A \in (A_0^T(z), \overline{A}]$ demand $s^F(A)$, and the probability of rejection as a function of S (respectively, A) is given by equation (2) in the main text (respectively, equation (A.5)). However, in this sub-case P still nets a positive payoff from settlement even when all types are in the pool (i.e., when $z = \overline{z}$). Only when z reaches $z^0 \equiv (1 - \alpha)[(\lambda(\underline{A} + \overline{A})/2) + c_D] > \overline{z}$ does every P type net zero both at trial and in settlement. For repayment amounts $z \geq z^0$, all types expect to net zero at trial and in settlement, so all types settle at the pooling demand $s^P(\overline{A})$, and P simply turns over the settlement to LF.

Joint Recovery for P and LF in Case (c)

For repayment amounts $z < \underline{z}$, there is a fully-revealing equilibrium and every P type is able to repay LF in full upon settling or upon winning at trial. The combined receipts of P and LF are

$\Pi(z) = E\{(1 - \alpha)s^F(A)(1 - p(s^F(A); z)) + p(s^F(A); z)(1 - \alpha)\lambda A\}$, where $p(s^F(A); z)$ is given in equation (A.4). For the sub-case wherein $c_D \leq \overline{A} - \lambda(\underline{A} + \overline{A})/2$, the combined payoffs are computed exactly as in Case (b). For repayment amounts $z \in [\underline{z}, \hat{z})$, the pooled settlement allows P to repay in full; moreover, the types that make revealing demands can also repay in full either upon settlement or upon winning at trial. The combined receipts of P and LF are $\Pi(z) = (1 - \alpha)s^P(A_0^T(z))(A_0^T(z) - \underline{A})/(\overline{A} - \underline{A}) + E\{(1 - \alpha)s^F(A)(1 - p(s^F(A); z)) + p(s^F(A); z)(1 - \alpha)\lambda A \mid A \in (A_0^T(z), \overline{A}]\}(\overline{A} - A_0^T(z))/(\overline{A} - \underline{A})$, where $p(s^F(A); z)$ is given in equation (A.5). For repayment amounts $z \in [\hat{z}, \overline{z})$, P types in $[\underline{A}, A_0^T(z)]$ settle at $s^P(A_0^T(z))$; since $(1 - \alpha)s^P(A_0^T(z))$ is insufficient to repay in full, this amount is simply turned over to LF. On the other hand, P types in $(A_0^T(z), \overline{A}]$ go to trial and are able to repay LF upon winning at trial. The combined receipts of P and LF are $\Pi(z) = (1 - \alpha)s^P(A_0^T(z))(A_0^T(z) - \underline{A})/(\overline{A} - \underline{A}) + E\{(1 - \alpha)\lambda A \mid A \in (A_0^T(z), \overline{A}]\}(\overline{A} - A_0^T(z))/(\overline{A} - \underline{A})$. Finally, for repayment amounts $z \geq \overline{z}$, every P type settles at $s^P(\overline{A})$; since $(1 - \alpha)s^P(\overline{A})$ is not enough to repay the loan, this amount is simply turned over to LF. The combined receipts of P and LF are $\Pi(z) = (1 - \alpha)s^P(\overline{A}) = (1 - \alpha)(\lambda(\underline{A} + \overline{A})/2) + c_D)$.

The function $\Pi(z)$ is decreasing and concave in z until $z = \hat{z}$; thereafter it increases linearly in z and reaches a maximum at $z = \overline{z}$, where all types pool and settle at $s^P(\overline{A})$. Thus, any $z \geq \overline{z}$ maximizes the combined receipts of P and LF.

The only additional twist that arises in the sub-case wherein $c_D > \overline{A} - \lambda(\underline{A} + \overline{A})/2$ (and thus, wherein $\hat{z} > \overline{z}$) is that, while D is fully-extracted and no trials occur as soon as z reaches $\overline{z}$, the plaintiff still receives a positive net payoff in settlement. This is inefficient for P and LF if P discounts this second-period payoff more than does LF. Although P and LF cannot increase the total pie to be shared beyond $\Pi(\overline{z}) = (1 - \alpha)s^P(\overline{A}) = (1 - \alpha)(\lambda(\underline{A} + \overline{A})/2) + c_D)$, they can shift the incidence between themselves: by raising z to z^0, P and LF can reduce P's net payoff in settlement to zero, with all of the settlement proceeds going to LF.