Technical Appendix for:

**The Effect of Third-Party Funding of Plaintiffs on Settlement**

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See the main paper for a description of the notation, payoffs, and game form used therein. In this Technical Appendix, we provide the derivation of all results pertaining to the signaling model of settlement bargaining. We also provide an analysis of the effect of interest-rate regulation on litigation funding. Finally, we provide an analysis of two different versions of screening models.

**Signaling Analysis of Period 2 Settlement Bargaining**

As indicated in the text, it is credible for every P type to go to trial following a rejected settlement demand, even if that type anticipates a zero net return from trial (as P's litigations costs fall on PA). P can be strictly incentivized to go to trial following a rejected settlement demand via a provision in the contract with LF that gives P a small side payment whenever P either settles or goes to trial, but P does not receive this payment if she fails to go to trial following a rejected settlement demand. This does not disturb P's preferences between settlement and trial, but renders suboptimal a decision to drop the case. Since the required side payment is vanishingly small, we ignore it. If, moreover, P suffers a small cost of going to trial that is not covered by PA, then the contract with LF will also include an agreement that LF will compensate P for this cost; LF wants to ensure that P will go to trial rather than drop the case (as this is LF's only way to obtain a payoff and P's litigation costs fall on PA, not LF). For simplicity, we also ignore the possibility that P may have costs of pursuing trial.

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 $s^C(A)$ 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 $s^C(A)$. 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 $s^C(A)$ 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.[1] 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:

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

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:

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

The condition for D to be indifferent is that $S = \lambda A + c_D$; that is, the plaintiff's equilibrium demand

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[1] 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 (QJE 1987) for a definition of D1 and a discussion of equilibrium refinements more generally. Reinganum and Wilde (1986) actually uses the refinement "universal divinity" (see Banks and Sobel, Econometrica 1987) but the refinement D1 is more straightforward to implement and selects the same equilibrium in this type of model.

must be her complete-information demand, $s^C(A)$. 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 $\underline{S} \equiv s^F(\underline{A}) = \lambda\underline{A} + c_D$.[2] This results in the equilibrium probability of rejection function for Case (a), conditional on $z < z^X$, as given by equation (2) in the main text. Alternatively, one can write the probability of rejection faced by any given type, A, as:

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

For repayment amounts $z \in [z^X, \underline{z})$, all P types prefer trial to settlement at $s^C(A)$ 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

[2] 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.

a demand that would provoke rejection by D, since $\max\{0, (1 - \alpha)E(s^C(A) \mid A \in [A_1, A_2]) - z\} \leq \max\{0, (1 - \alpha)s^C(A_2) - z\} < \lambda[(1 - \alpha)A_2 - z]$. 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 $s^C(A)$, 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 $s^C(A)$ accepted), she can easily guarantee a trial by making an "extreme" demand of $S > \overline{S} = s^C(\overline{A})$. 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 $S < s^C(\underline{A})$, since this is strictly less than what he would pay against any type of P at trial. Demands in $(s^C(\underline{A}), s^C(\overline{A})]$ are also rejected by D, based on the belief that any such demand is coming from type $\underline{A}$.[3] 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

[3] 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 $S \in (s^C(\underline{A}), s^C(\overline{A})]$, 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 $s^C(\underline{A})$ can be accepted with any probability in [0, 1].

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 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.[4] Let $s^P(A) \equiv E\{s^C(a) \mid a \in [\underline{A}, A]\}$; 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 $\lambda[(1 - \alpha)A - z] > \max\{0, [(1 - \alpha)s^C(A) - z]\}$. 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 $s^P(A_0^T(z))$, where $s^P(A) \equiv (\lambda(\underline{A} + A)/2) + c_D$; 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 $(1 - \alpha)s^P(A_0^T(z)) - z \leq (1 - \alpha)s^C(A_0^T(z)) - z < 0$ (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

[4] 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.

extreme demands[5]).

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, at the time of contracting, 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.[6] 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 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.

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[5] 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 $(s^P(A_0^T(z)), \overline{S}]$.

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

Therefore, for Case (a) we augment the contract between LF and P to include the following provision: *If* $z \geq \underline{z}$*, then P will play according to the equilibrium wherein types in* $[\underline{A}, A_0^T(z)]$ *demand* $s^P(A_0^T(z))$. Notice that this provision only applies when (in the 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 provision, 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 provision. Call this equilibrium E*; for Case (a), the only equilibrium demands are $s^P(A_0^T(z))$ and an(y) extreme demand $S > s^C(\overline{A})$. As indicated in the text, P can be strictly incentivized to play E* by including a small side payment from LF to P if (1) P makes any equilibrium demand from E* that is accepted; or (2) P makes an equilibrium demand from E* that is rejected but, upon trial, is verified to be that P-type's equilibrium demand from E*. This makes P types in $[\underline{A}, A_0^T(z)]$ strictly prefer $s^P(A_0^T(z))$ to any lower pooled demand or to provoking trial by making an extreme demand (both of these deviations result in loss of the side payment and a zero net payoff from either settlement or trial), while it does not disturb the higher types' preferences over equilibrium demands from E*, since types in $(A_0^T(z), \overline{A}]$ cannot gain by deviating from their (equilibrium) extreme demand to the pooled demand (they would make only the side payment at the pooled demand and they already make a positive net payoff at trial plus the side payment by making their equilibrium demand). Finally, since every type loses the same amount (the side payment) by deviating to an out-of-equilibrium demand in $(s^P(A_0^T(z)), s^C(\overline{A})]$ there is no reason for D to hold different out-of-equilibrium beliefs upon observing such a demand when such an incentive is in place. The required side payment is vanishingly small, so we will let it go to zero.

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 provision 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 $\Pi(z) = E\{(1 - \alpha)s^C(A)(1 - p(s^C(A); z)) + p(s^C(A); z)(1 - \alpha)\lambda A\}$, where $p(s^C(A); z)$ 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 complete-information demand $s^C(A) = \lambda A + c_D$ 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 (2) 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 complete-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 $s^P(A_0^T(z)) = (\lambda(\underline{A} + A_0^T(z))/2) + c_D$ 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 for Case (b), $\hat{z} < z^X$. The marginal type in the pool, $A_0^T(z)$, would prefer settling at her complete-information demand $s^C(A_0^T(z)) = \lambda A_0^T(z) + c_D$, 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 $(1 - p_0(z))[(1 - \alpha)s^C(A_0^T(z)) - z] = [(1 - \alpha)s^P(A_0^T(z)) - z]$. Substituting for $s^C(A_0^T(z))$ 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 complete-information demands, $s^C(A)$, 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 $\lim_{\varepsilon \to 0} p(s^C(A_0^T(z)) + \varepsilon; z) = p_0(z)$. The overall rejection function for $z \in [\underline{z}, \hat{z})$ is then given by equation (3) in the main text.

Out-of-equilibrium demands $S \in (s^P(A_0^T(z)), s^C(A_0^T(z))]$ 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 $s^C(A_0^T(z))$. 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 $s^C(A_0^T(z))$ 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 $s^C(A_0^T(z))$ were accepted with probability $1 - p_0(z)$, this type would prefer to demand $s^C(A)$ and to be accepted with probability $p(s^C(A); z))$, since the demand $s^C(A)$ uniquely maximizes type A's payoff. In order to induce a type $A \in (A_0^T(z), \overline{A}]$ to demand $s^C(A_0^T(z))$, 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 $s^C(A_0^T(z))$ 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:

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

Recall that $\lim_{z \to \hat{z}} (1 - p_0(z)) = 0$. Therefore, $\lim_{z \to \hat{z}} p(s^C(A); z) = 1$ 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, 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 $s^C(A)$, 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 $s^C(A)$), 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 $s^C(A)$ to trial, they would demand $s^C(A)$ (in case D were to err and accept rather than reject this demand).

Since types in $[\underline{A}, A_0^T(z)]$ net zero both in settlement (at the pooled demand $s^P(A_0^T(z))$) and at trial, there are other (refined) equilibria wherein they settle for less or needlessly provoke trial. Thus, for Case (b) we augment the contract between LF and P to include the following provision: *If $z \geq \hat{z}$, then P will play according to the equilibrium wherein types in $[\underline{A}, A_0^T(z)]$ demand $s^P(A_0^T(z))$.* Notice that this provision only applies when (in the 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 provision, 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 provision. Call this equilibrium E*; for Case (b), the only equilibrium demands are $s^P(A_0^T(z))$ and $(s^C(A_0^T(z), s^C(\overline{A})]$. As indicated in the text, P can be strictly incentivized to play E* by including a small side payment from LF to P if (1) P makes any equilibrium demand from E* that is accepted; or (2) P makes an equilibrium demand from E* that is rejected but, upon trial, is verified to be that P-type's equilibrium demand from E*. This makes P types in $[\underline{A}, A_0^T(z)]$ strictly prefer $s^P(A_0^T(z))$ to any lower pooled demand or to provoking trial by making any other equilibrium demand or an extreme demand (both of these deviations result in trial and a loss of the side payment), while it does not disturb the higher types' preferences over equilibrium demands from E*, since types in $(A_0^T(z), \overline{A}]$ cannot gain by deviating from their (equilibrium) revealing demands to the pooled demand (they would make only the side payment at the pooled demand and they already make a positive net payoff at trial plus the side payment by making their equilibrium demand). Finally, since every type loses the same amount (the side payment) by deviating to an out-of-equilibrium demand in $(s^P(A_0^T(z)), s^C(A_0^T(z))]$ there is no reason for D to hold different out-of-equilibrium beliefs upon observing such a demand when such an incentive is in place. The required side payment is vanishingly small, so we will let it go to zero.

We now consider repayment amounts $z \in [z^X, \overline{z})$. 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 $A \in (A_0^T(z), \overline{A}]$ 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 provision described above and making the pooled demand $s^P(A_0^T(z))$, and types $A \in (A_0^T(z), \overline{A}]$ making extreme demands so as to ensure trial. Finally, for repayment amounts $z \geq \overline{z}$, every P type expects 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.

The following Figure illustrates the above analysis by displaying the equilibrium settlement demands and rejection functions for Case (b) as z is varied from zero to $\overline{z}$.

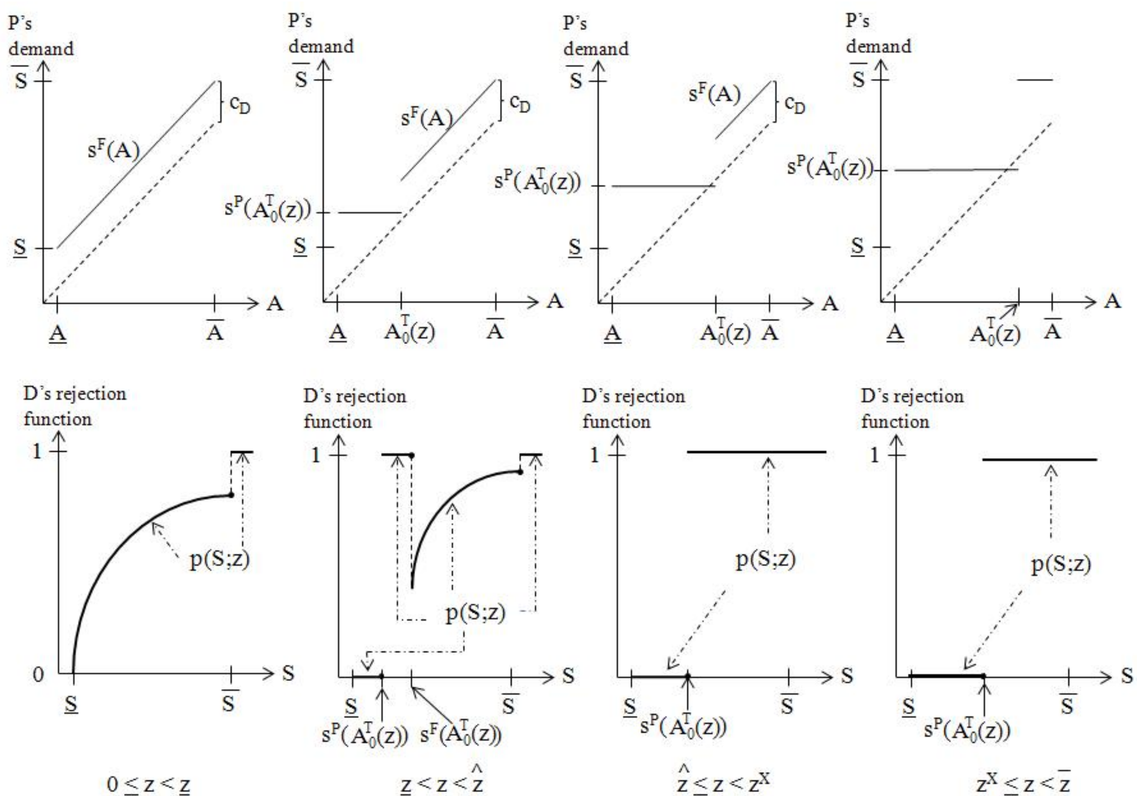


**Figure 2: Equilibrium Demand and Rejection Functions for Varying Levels of z**

*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 $\Pi(z) = E\{(1 - \alpha)s^C(A)(1 - p(s^C(A); z)) + p(s^C(A); z)(1 - \alpha)\lambda A\}$, where $p(s^C(A); z)$ 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 $\Pi(z) = (1 - \alpha)s^P(A_0^T(z))(A_0^T(z) - \underline{A})/(\overline{A} - \underline{A}) + E\{(1 - \alpha)s^C(A)(1 - p(s^C(A); z)) + p(s^C(A); z)(1 - \alpha)\lambda A \mid A \in (A_0^T(z), \overline{A}]\}(\overline{A} - A_0^T(z))/(\overline{A} - \underline{A})$, where $p(s^C(A); z)$ is now 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 $s^P(A_0^T(z))$; $(1 - \alpha)s^P(A_0^T(z))$ is insufficient to repay in full, so this amount is simply turned over to LF. On the other hand, P types in $(A_0^T(z), \overline{A}]$ 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.

*Analysis of Settlement Negotiations for Case (c)*

In Case (c) (wherein $\overline{A} < c_D/(1 - \lambda)$), the critical values of z are ordered as follows: $\underline{z} < \overline{z} < z^X$. Since $\overline{z} < z^X$, 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 $s^C(A) = \lambda A + c_D$ to trial and all P types expect a net positive payoff from trial. The equilibrium settlement demand is $s^C(A)$, and the probability of rejection as a function of S (respectively, A) is given by equation (2) in the main text (respectively, equation (A.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 $s^C(A)$, 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 $s^C(A)$, 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.

As before, this is not the unique refined equilibrium, because P could equally well settle for less or needlessly provoke trial. Thus, for Case (c), we again augment the contract between LF and P to include the following provision: *If $z \geq \hat{z}$, then P will play according to the equilibrium wherein types in $[\underline{A}, A_0^T(z)]$ demand $s^P(A_0^T(z))$.* Exactly as argued in Case (b) above, P can be strictly incentivized to play this equilibrium by means of a judicously-applied vanishingly small side payment.

Finally, for repayment amounts $z \geq \overline{z}$, every plaintiff type expects to net zero at trial and in settlement, so (respecting the provision above) 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 $s^C(A)$, and the probability of rejection as a function of S (respectively, A) is given by equation (3) 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 $\Pi(z) = E\{(1 - \alpha)s^C(A)(1 - p(s^C(A); z)) + p(s^C(A); z)(1 - \alpha)\lambda A\}$, where $p(s^C(A); z)$ 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 $\Pi(z) = (1 - \alpha)s^P(A_0^T(z))(A_0^T(z) - \underline{A})/(\overline{A} - \underline{A}) + E\{(1 - \alpha)s^C(A)(1 - p(s^C(A); z)) + p(s^C(A); z)(1 - \alpha)\lambda A \mid A \in (A_0^T(z), \overline{A}]\}(\overline{A} - A_0^T(z))/(\overline{A} - \underline{A})$, where $p(s^C(A); z)$ 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 $z = \bar{z}$, where all types pool and settle at $s^P(\overline{A})$. Thus, any $z \geq \bar{z}$ 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 $\hat{z} > \bar{z}$) is that, while D is fully-extracted and no trials occur as soon as z reaches $\bar{z}$, 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 $\Pi(\bar{z}) = (1 - \alpha)s^P(\overline{A}) = (1 - \alpha)(\lambda(\underline{A} + \overline{A})/2) + c_D)$, 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.

The following figure illustrates the second-period joint payoff for the three cases.

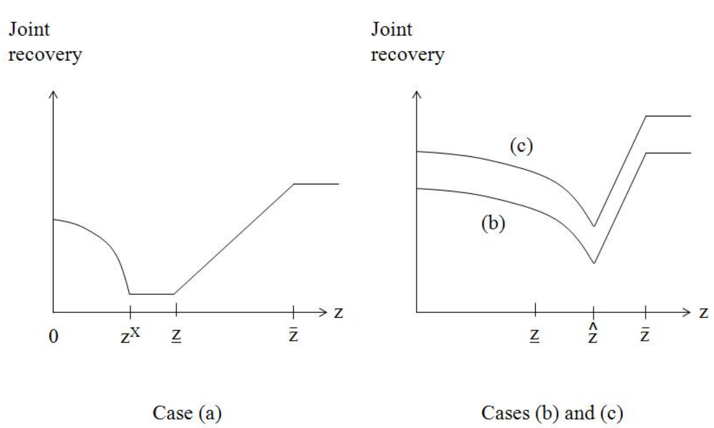


**Figure 3: Joint Recovery for P and LF**

**Analysis of the Optimal Loan in Period 1**

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, any given amount received by P in Period 2 would have a higher discounted value to LF than to P. Therefore, an optimal loan would give P a lump sum in Period 1, leaving all of the receipts in Period 2 to LF. 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 will involve P turning over all receipts from settlement or trial to LF.[7]

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 expected (stand alone) value of her suit.[8] This expected value is found by observing that the equilibrium (when $z = 0$) involves a P of type A making her complete-information demand $s^C(A)$ and D rejecting it with probability $p(s^C(A); 0)$. From the position of being in Period 1, wherein P's

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[7] 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.

[8] 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 to result in $z^{max} > \overline{z}$, so for convenience of exposition we assume that P always desires a loan contract with no residual receipts in Period 2.

type is not known by either LF or P, the Period 2 expected value without a loan is simply:

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

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

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

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 $(B, z^{max})$ be no less than $\pi^P(0)/(1 + i)$, P's discounted value of proceeding with the lawsuit without the loan. 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, 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 $\Pi(\overline{z})/(1 + i) - B$. At the other extreme, if the litigation funding market is highly competitive, then funders will bid away all of the surplus so $B = \Pi(\overline{z})/(1 + i)$. Regardless of the surplus division, the optimal repayment amount is $\overline{z}$. Since the imputed interest rate is given by $(1 + r)B = \overline{z}$, this rate would be $r = [(1 + i)\overline{z} - \pi^P(0)]/\pi^P(0) > i$ if $B = \pi^P(0)/(1 + i)$, and $r = [(1 + i)\overline{z} - \Pi(\overline{z})]/\Pi(\overline{z}) > i$ if $B = \Pi(\overline{z})/(1 + i)$. Note that the imputed interest rate is lower when the litigation funding market is more competitive; nevertheless, the imputed interest rate always exceeds LF's cost of funds.

**Regulating the Litigation Funding Market via Rate Caps**

If one simply calculated an imputed interest rate r* via the equation $B(1 + r^*) = z^{max}$, then $r^* = [(1 + i)z^{max} - \pi^P(0)]/\pi^P(0) > i$. Since r* could be quite high (and, in practice, there is concern about how high such imputed interest rates are in suits involving litigation funding), 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 some types of P, and LF, will both accrue some payments in Period 2; however, they will also sometimes lose at trial.

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,[9] 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 (in Period 2 dollars) 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 $r^* = [(1 + i)\overline{z} - \pi^P(0)]/\pi^P(0)$, and $B^* = \pi^P(0)/(1 + i)$, as found above.

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 $\gamma^R$ be constructed accordingly from $r^R$ (note that, by construction, lower values of $r^R$ induce higher values of $\gamma^R$). Now the litigation funder's problem is to choose z (since $\gamma^R$ is given) that solves:

$\max_z \pi^{LF}(z) - \gamma^R z$

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

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 as $z^R$. We want to know when the response to regulation continues to involve full settlement (by LF choosing $z^R = \overline{z}$).

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 $\gamma^R$. 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 $\gamma^R$ 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 $\gamma^R$ to violate the above inequality will induce repayment levels below $\overline{z}$ (thereby inducing some settlement failure) or withdrawal of LF from the market.

**Screening Analysis of Period 2 Settlement Bargaining when D is Privately Informed About λ**

Thus far we have assumed that P has private information about her damages (and thus her anticipated award, A) during settlement negotiations; since P makes the settlement demand, this results in a signaling game. However, another plausible game form would entail D having private information about $\lambda$, his likelihood of being found liable at trial. Assuming that P still makes the settlement demand, this would result in a screening game. Here we consider this alternative game form, under the assumption that now A is common knowledge and exceeds $c_D$, while $\lambda$ is distributed uniformly on [0, 1], and is observed privately by D prior to settlement negotiations.

We first characterize the screening equilibrium in the settlement negotiation subgame, for arbitrary values of the repayment amount, z. P's payoff from settlement at the amount S is $\max\{0, (1 - \alpha)S - z\}$, whereas her payoff from trial against a D of type $\lambda$ is $\max\{0, \lambda[(1 - \alpha)A - z]\}$. Since a D of type $\lambda$ will accept a demand of S if and only if $S \leq \lambda A + c_D$, P's payoff can be written as a function of the marginal type that P induces to settle, denoted as $\lambda^m$ (the corresponding settlement demand, $S^m = \lambda^m A + c_D$, is accepted by all D-types above $\lambda^m$):

$$\max\{0, (1 - \alpha)(\lambda^m A + c_D) - z\}(1 - \lambda^m) + \int \max\{0, \lambda[(1 - \alpha)A - z]\}d\lambda,$$

where the integral is over $[0, \lambda^m]$.

Notice that the integrand, $\max\{0, \lambda[(1 - \alpha)A - z]\}$, is positive for all $\lambda$ if $z < (1 - \alpha)A$ and zero for all $\lambda$ if $z \geq (1 - \alpha)A$. In addition, the expression $\max\{0, (1 - \alpha)(\lambda^m A + c_D) - z\}$ is certainly zero for any $z \geq (1 - \alpha)(A + c_D)$. This yields three parameter regimes of interest. We will proceed by choosing $\lambda^m$ to maximize P's payoff within each of the two regimes involving $z < (1 - \alpha)(A + c_D)$, under the additional hypothesis that the first expression in P's payoff is positive; that is, that $(1 - \alpha)(\lambda^m A + c_D) - z > 0$. We will then verify that this latter hypothesis is satisfied at the optimal value, denoted as $\lambda^*(z)$. For $z \geq (1 - \alpha)(A + c_D)$, P expects a net payoff of zero from both settlement and trial, and is thus indifferent among all values of $\lambda^m$.

For $z < (1 - \alpha)A$, P chooses $\lambda^m$ to maximize:

$$[(1 - \alpha)(\lambda^m A + c_D) - z](1 - \lambda^m) + \int \lambda[(1 - \alpha)A - z]d\lambda,$$

where the integral is over $[0, \lambda^m]$. This expression is strictly concave in $\lambda^m$; differentiating and collecting terms implies that $\lambda^*(z) = [(1 - \alpha)(A - c_D) + z]/[(1 - \alpha)A + z]$. This marginal type is clearly in (0, 1); moreover, it is straightforward to verify that $(1 - \alpha)(\lambda^*(z)A + c_D) - z > 0$ for all $z < (1 - \alpha)A$.

For $z \geq (1 - \alpha)A$, the integrand (reflecting P's net payoff from trial) is zero for all $\lambda$. Thus, P chooses $\lambda^m$ to maximize:

$$[(1 - \alpha)(\lambda^m A + c_D) - z](1 - \lambda^m).$$

Again, this expression is strictly concave in $\lambda^m$; differentiating and collecting terms implies that $\lambda^*(z) = [(1 - \alpha)(A - c_D) + z]/[2(1 - \alpha)A]$. This marginal type is clearly positive and $\lambda^*(z) < 1$ as long as $z < (1 - \alpha)(A + c_D)$. Moreover, it is straightforward to verify that $(1 - \alpha)(\lambda^*(z)A + c_D) - z > 0$ for all $z < (1 - \alpha)(A + c_D)$.

Combining these results, we find that the optimal marginal type $\lambda^*(z)$ is continuous and increasing for z in $[0, (1 - \alpha)(A + c_D))$, with a "kink" at $z = (1 - \alpha)A$. In the limit, as z goes to $(1 - \alpha)(A + c_D)$, the marginal type $\lambda^*(z)$ goes to 1; this implies that the equilibrium settlement demand goes to $(1 - \alpha)(A + c_D)$, which is rejected with probability 1 (this demand would just net P zero even if it were accepted). Thus, for repayment amounts z in $(0, (1 - \alpha)(A + c_D))$, the effect of a higher repayment amount is to increase the likelihood of trial. However, for $z \geq (1 - \alpha)(A + c_D)$, P is completely indifferent regarding her settlement demand, as she expects to net zero from both settlement and trial; that is, $\lambda^*(z)$ is the entire set [0, 1].

The optimal repayment amount z will maximize the combined receipts of P and LF in Period 2, anticipating that P will make a settlement demand of $S^*(z) = \lambda^*(z)A + c_D$. Since LF receives $\min\{z, (1 - \alpha)S^*(z)\}$ in the event of settlement at $S^*(z)$ and $\min\{\lambda z, \lambda(1 - \alpha)A\}$ in the event of trial against a D of type $\lambda$, the combined payoffs of P and LF are $(1 - \alpha)S^*(z)$ in the event of settlement at $S^*(z)$ and $\lambda(1 - \alpha)A$ in the event of trial against a D of type $\lambda$. Thus, the jointly optimal repayment amount maximizes:

$$(1 - \alpha)(\lambda^*(z)A + c_D)(1 - \lambda^*(z)) + \int \lambda[(1 - \alpha)A]\}d\lambda,$$

where the integral is over $[0, \lambda^*(z)]$. Notice that z does not appear except through the marginal type $\lambda^*(z)$ that P will be induced to choose. Thus, the marginal type that maximizes P and LF's joint payoff is $\lambda^*(0)$. That is, P and LF cannot use consumer legal funding to extract more from D; absent other motivations, P and LF will not find consumer legal funding beneficial.[10] However, if (for instance) P discounts the future more heavily than does LF, they can still benefit from consumer legal funding as they can use it to funnel P's discounted stand-alone value to her in Period 1, with LF receiving all of the proceeds of the settlement or trial in Period 2. To implement this outcome, it is necessary to use a high repayment amount of $z \geq (1 - \alpha)(A + c_D)$, since P is then willing to make the demand associated with the marginal type $\lambda^*(0)$. The analog of the contract provision under signaling is now: *If $z \geq (1 - \alpha)(A + c_D)$, then P will play according to the equilibrium wherein P demands $\lambda^*(0)A + c_D$.*[11] Notice that now consumer legal funding leaves the extent of settlement and D's type-specific payoffs unchanged.

**Screening Analysis of Period 2 Settlement Bargaining when P Has Private Information About A and D makes the Settlement Offer**

We now consider a screening version of settlement negotiations wherein P is informed about her anticipated award but D makes the settlement offer, S, to the informed P, who chooses whether

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[10] Indeed, it can be shown that the joint payoff to P and LF in Period 2 is decreasing in z until the threshold $z = (1 - \alpha)(A + c_D)$ is reached.

[11] For such high levels of z, P is indifferent among all demands, but LF can incentivized P to choose this one by offering P a small side payment if and only if P demands $S = \lambda^*(0)A + c_D$.

to accept or reject D's offer. Note that this is arguably not a plausible scenario, as P is arguably able to make the first move by making a settlement demand when she files suit. We include this game form because some readers may find it of interest.

Since trial costs are paid by PA and any loan from LF is non-recourse, it is always a credible threat for P to go to trial after having rejected D's offer. As in the signaling model above, there will be parameter configurations and loan repayment values that will leave P with a net payoff of zero in settlement and at trial. This raises the possibility that D could offer S = 0 and P could, in principle, accept this offer when she would also net zero at trial. This is clearly to the detriment of LF, so we also assume that LF includes the following provision in her loan contract with P. *If the settlement offer does not permit P to pay off her loan in full (that is, if $(1 - \alpha)S - z < 0$), then P should reject the settlement offer and go to trial*. P is willing to accede to this request since she either receives a positive net payoff at trial (in which case she strictly prefers to reject any settlement offer that does not allow her to pay off her loan), or she receives a zero net payoff at trial (in which case she is indifferent and therefore willing to reject the offer). The role of this provision is to make P a tougher bargainer, since it is now D who can push P to her concession limit.

The same three parameter configurations, Cases (a), (b), and (c), continue to be relevant, as do the cutoff values for the repayment amount, $\underline{z} = (1 - \alpha)\underline{A}$; $\overline{z} = (1 - \alpha)\overline{A}$; $z^X \equiv (1 - \alpha)c_D/(1 - \lambda)$; and $\hat{z} = (1 - \alpha)[\lambda\underline{A} + 2c_D]/(2 - \lambda)$. Finally, we will also maintain the following parameter restriction, which guarantees that it is not optimal for D to settle with all P types in the benchmark case of z = 0.

**PR1.** $\lambda(\overline{A} - \underline{A}) > c_D$.

*Analysis of Settlement Negotiations for Case (a)*

In Case (a) (wherein $\underline{A} \geq c_D/(1 - \lambda)$), the critical values of z are ordered as follows: $z^X \leq \hat{z} \leq \underline{z} < \overline{z}$. Note that all inequalities are strict if $\underline{A} > c_D/(1 - \lambda)$, while $z^X = \hat{z} = \underline{z}$ if $\underline{A} = c_D/(1 - \lambda)$. For repayment amounts $z \in [0, z^X)$, all types expect a positive net payoff at trial. Thus, to induce a P of type A to settle, D must offer an S such that: $(1 - \alpha)S - z \geq \lambda[(1 - \alpha)A - z] > 0$. Solving for the lowest value of S that is acceptable to type A yields $S(A) = \lambda A + (1 - \lambda)z/(1 - \alpha) = \lambda A + c_D(z/z^X)$. Although she is indifferent between accepting this offer and rejecting it and going to trial, in equilibrium type A accepts this offer.[12]

Thus, we can formulate D's expected cost function in terms of the marginal type, denoted $A^m$, with whom D settles; all lower types also settle, while all higher types go to trial. D chooses $A^m$ to minimize his expected costs (employing the uniform distribution):

$$[\lambda A^m + c_D(z/z^X)](A^m - \underline{A})/(\overline{A} - \underline{A}) + \int[\lambda A + c_D]dA/(\overline{A} - \underline{A}), \qquad (A.6)$$

where the integral is over $[A^m, \overline{A}]$.

The first derivative of this expression is $H(A^m) \equiv [\lambda(A^m - \underline{A}) + c_D((z/z^X) - 1)]/(\overline{A} - \underline{A})$. Since $H'(A^m) > 0$, the optimal marginal type will be determined by the first-order condition. This expression is clearly negative when evaluated at $A^m = \underline{A}$, which implies that it is not optimal for D to go to trial against all $A \in [\underline{A}, \overline{A}]$. Under PR1, this expression is positive when evaluated at $A^m = \overline{A}$. Thus, the unique optimal marginal type when the loan repayment value is z, denoted $A^{m*}(z)$, is $A^{m*}(z) = \underline{A} + (c_D/\lambda)(1 - z/z^X)$, and the corresponding optimal settlement offer is $S(A^{m*}(z)) = \lambda\underline{A} + c_D$. Notice that

[12] If type A was expected to reject this offer with positive probability, then D could offer ε more to guarantee A's sure acceptance. But this ε can be vanishingly small so, in the limit as ε goes to zero, D accepts this offer with probability one.

the optimal settlement offer does not vary with z, while the optimal marginal type decreases as z increases. Recall that the offer required to induce type A to settle, $S(A) = \lambda A + c_D(z/z^X)$, is increasing in z. Thus, as the loan repayment amount increases, every type A requires a higher settlement offer to induce her to settle; as a consequence, D chooses to settle with fewer P types.[13]

Notice that $\lim_{z \to z^X} A^{m*}(z) = \underline{A}$; that is, in the limit D prefers to go to trial against all P types, rather than settling with any of them. This pattern persists for all $z \in [z^X, \underline{z})$. To see this, note that the analysis above still applies (since all P types still anticipate a positive payoff at trial), but the first derivative of D's expected cost (which he is minimizing) is now positive at $A^m = \underline{A}$, indicating that D does not want to settle with any P types. Basically, when $z > z^X$, trial is such an attractive option for P that the required offer to induce a P of type A to settle, $S(A) = \lambda A + c_D(z/z^X)$, exceeds what D would expect to pay at trial against this type. Thus, D's optimal offer is anything that induces all P types to reject (e.g., S = 0).

For repayment amounts $z \in [\underline{z}, \overline{z}]$, P types in $[\underline{A}, A_0^T(z)]$ expect a net payoff of zero at trial, where $A_0^T(z) = z/(1 - \alpha)$ is the type that is just able to repay the loan in full upon winning at trial. Types in $(A_0^T(z), \overline{A}]$ continue to expect a positive net payoff at trial. Given the provision specified in the contract between LF and P (that is, do not accept an offer that would not allow full repayment), in order to induce types in $[\underline{A}, A_0^T(z)]$ to settle, D must offer at least $S = z/(1 - \alpha)$. Thus, D has three choices: (1) offer $S < z/(1 - \alpha)$ and go to trial against all P types; (2) offer $S = z/(1 - \alpha)$ and settle with

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[13] If PR1 does not hold, then it could be optimal for D to settle with all P types for some values of z. The optimal marginal type is now given by $A^{m*}(z) = \min\{\overline{A}, \underline{A} + (c_D/\lambda)(1 - z/z^X)\}$, and the corresponding optimal settlement offer is $S(A^{m*}(z)) = \lambda A^{m*}(z) + c_D(z/z^X)$. Note that this is increasing in z as long as $A^{m*}(z) = \overline{A}$; that is, as long as $z \leq [(1 - \alpha)[c_D - \lambda(\overline{A} - \underline{A})]/(1 - \lambda) \equiv z^{\#}$, which is less than $z^X$.

types in $[\underline{A}, A_0^T(z)]$ but go to trial against types in $(A_0^T(z), \overline{A}]$ (since these types anticipate a positive net payoff at trial and a zero net payoff from the offer $S = z/(1 - \alpha)$); or (3) offer $S(A^m) = \lambda A^m + c_D(z/z^X)$ for some marginal type $A^m > A_0^T(z)$ that is just indifferent between settlement and trial, and settle with types in $[\underline{A}, A^m]$ but go to trial against types in $(A^m, \overline{A}]$.

The second and third choices above can be combined into the following constrained problem. D chooses $A^m \geq A_0^T(z)$ to minimize (employing the uniform distribution):

$$[\lambda A^m + c_D(z/z^X)](A^m - \underline{A})/(\overline{A} - \underline{A}) + \int[\lambda A + c_D]dA/(\overline{A} - \underline{A}), \tag{A.7}$$

where the integral is over $[A^m, \overline{A}]$. Again the first derivative of this expression is $H(A^m) = [\lambda(A^m - \underline{A}) + c_D((z/z^X) - 1)]/(\overline{A} - \underline{A})$. Note that $H(A_0^T(z)) \geq 0$ if and only if $\lambda(z/(1 - \alpha)) - \underline{A}) + c_D((z/z^X) - 1) = (z/(1 - \alpha)) - (\lambda\underline{A} + c_D) \geq 0$. Since $z \geq \underline{z}$, and $\underline{z} = \underline{A}/(1 - \alpha)$, we have $z/(1 - \alpha) \geq \underline{z}/(1 - \alpha) = \underline{A} \geq \lambda\underline{A} + c_D$ for Case (a). Thus, D would not want to choose a marginal type above $A_0^T(z)$; it is either optimal to settle only with the types in $[\underline{A}, A_0^T(z)]$, or to go to trial against all P types.

In either case, D will go to trial against P types in $(A_0^T(z), \overline{A}]$, so the relevant comparison is D's expected payment against those types in $[\underline{A}, A_0^T(z)]$. If D goes to trial against these types, he expects to pay $\int[\lambda A + c_D]dA/(\overline{A} - \underline{A})$, where the integral is over $[\underline{A}, A_0^T(z)]$. If D settles with these types for $S = z/(1 - \alpha)$, he expects to pay $[z/(1 - \alpha)](A_0^T(z) - \underline{A})/(\overline{A} - \underline{A})$. It is straightforward to show that going to trial against these types is preferred to settling with them as long as $z \geq (1 - \alpha)[\lambda\underline{A} + 2c_D]/(2 - \lambda) = \hat{z}$. But this is true for Case (a) and $z \in [\underline{z}, \overline{z}]$. Thus, for these repayment amounts (or any higher value of z), D makes a settlement offer that no P type will accept, so settlement negotiations fail and all P types go to trial.

*Joint Recovery for P and LF for Case (a)*

For repayment amounts $z \in [0, z^X)$, every P type is able to repay LF in full upon settling at $S(A^{m}*(z)) = \lambda \underline{A} + c_D$ or upon winning at trial. The combined receipts of P and LF, denoted as $\Pi(z)$, are given by:

$\Pi(z) = (1 - \alpha)[\lambda \underline{A} + c_D](A^{m}*(z) - \underline{A})/(\overline{A} - \underline{A}) + \int (1 - \alpha)\lambda A dA/(\overline{A} - \underline{A})$, where the integral is over $[A^{m}*(z), \overline{A}]$, and where $A^{m}*(z) = \underline{A} + (c_D/\lambda)(1 - z/z^X)$. For all repayment amounts $z \geq z^X$, the equilibrium in the screening game involves all P types going to trial. The combined receipts of P and LF are $\Pi(z) = (1 - \alpha)\lambda(\overline{A} + \underline{A})/2$.

The function $\Pi(z)$ is decreasing for $z \in [0, z^X)$, since $\Pi'(z) = (1 - \alpha)[\lambda \underline{A} + c_D - \lambda A^{m}*(z)]A^{m}*'(z) < 0$ because the term in brackets is positive and $A^{m}*'(z) < 0$, and it is constant thereafter. Thus, the optimal repayment amount is $z = 0$, which corresponds to <u>no loan</u>.[14]

*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: $\underline{z} < \hat{z} < z^X \leq \overline{z}$ (the final inequality is strict except when $c_D/(1 - \lambda) = \overline{A}$, at which point $z^X = \overline{z}$). For repayment amounts $z \in [0, \underline{z})$, all types expect a positive net payoff at trial. Thus, the analysis

[14] If PR1 does not hold, then $\Pi(z) = (1 - \alpha)[\lambda \overline{A} + c_D(z/z^X)]$ for $z \in [0, z^{\#}]$, where D settles with all P types. It is then described as above for $z > z^{\#}$. Thus, $\Pi(z)$ is initially increasing linearly in z; then it decreases as described above for $z \in (z^{\#}, z^X)$; and remains constant for $z \geq z^X$. The optimal repayment amount in this parameter configuration is $z = z^{\#}$.

proceeds exactly as in Case (a) (there, for repayment amounts $z \in [0, z^X)$). That is, to induce a P of type A to settle, D must offer an $S \geq S(A) = \lambda A + (1 - \lambda)z/(1 - \alpha) = \lambda A + c_D(z/z^X)$. D's expected cost function in terms of the marginal type, $A^m$, with whom D settles, is still given by equation (A.6), with the first derivative equal to $H(A^m) = [\lambda(A^m - \underline{A}) + c_D((z/z^X) - 1)]/(\overline{A} - \underline{A})$. Under PR1, $H(\overline{A}) > 0$ so D will never want to settle with all P types. Since $z < \underline{z} < z^X$, we have $H(\underline{A}) < 0$, so the optimal marginal type is interior at $A^{m}*(z) = \underline{A} + (c_D/\lambda)(1 - z/z^X)$, with the corresponding optimal settlement offer $S(A^{m}*(z)) = \lambda\underline{A} + c_D$. Under PR1, there is some screening in equilibrium since types in $[\underline{A}, A^{m}*(z)]$ settle and types in $[A^{m}*(z), \overline{A}]$ go to trial.

For repayment amounts $z \in [\underline{z}, \hat{z})$, P types in $[\underline{A}, A_0^T(z)]$ expect a net payoff of zero at trial, where $A_0^T(z) = z/(1 - \alpha)$ is the type that is just able to repay the loan in full upon winning at trial. Types in $(A_0^T(z), \overline{A}]$ continue to expect a positive net payoff at trial. This case proceeds as in Case (a) (there, for repayment amounts $z \in [\underline{z}, \overline{z}]$). Given the provision specified in the contract between LF and P (that is, do not accept an offer that would not allow full repayment), in order to induce types in $[\underline{A}, A_0^T(z)]$ to settle, D must offer at least $S = z/(1 - \alpha)$. Thus, D has three choices: (1) offer $S < z/(1 - \alpha)$ and go to trial against all P types; (2) offer $S = A_0^T(z) = z/(1 - \alpha)$ and settle with types in $[\underline{A}, A_0^T(z)]$ but go to trial against types in $(A_0^T(z), \overline{A}]$ (since these types anticipate a positive net payoff at trial and a zero net payoff from the offer $S = z/(1 - \alpha)$); or (3) offer $S(A^m) = \lambda A^m + c_D(z/z^X)$ for some marginal type $A^m > A_0^T(z)$ that is just indifferent between settlement and trial, and settle with types in $[\underline{A}, A^m]$ but go to trial against types in $(A^m, \overline{A}]$.

Again, the second and third choices above can be combined into the constrained problem given in equation (A.7) above. The first derivative of D's expected cost is $H(A^m) = [\lambda(A^m - \underline{A}) + c_D((z/z^X) - 1)]/(\overline{A} - \underline{A})$. Note that $H(A_0^T(z)) \geq 0$ if and only if $\lambda(z/(1 - \alpha)) - \underline{A}) + c_D((z/z^X) - 1) = (z/(1 - \alpha)) - (\lambda\underline{A} + c_D) \geq 0$. That is, $H(A_0^T(z)) \geq 0$ if and only if $z \geq \tilde{z} \equiv (1 - \alpha)(\lambda\underline{A} + c_D)$. It is straightforward to show that $\tilde{z} < \hat{z}$ for Cases (b) and (c) (under PR1). Thus, the interval $[\underline{z}, \hat{z})$ is divided into two subsets: (1) the subset $[\underline{z}, \tilde{z})$, for which there is an interior solution to D's constrained problem, so that D wants to settle with P types in $[\underline{A}, A^{m*}(z)]$, where $A^{m*}(z) = \underline{A} + (c_D/\lambda)(1 - z/z^X) > A_0^T(z)$; and (2) the subset $[\tilde{z}, \hat{z})$, for which the solution to D's constrained problem is at the boundary; that is, where $A^m = A_0^T(z)$.[15]

The expected cost at the solution to D's constrained problem must still be compared to the expected cost of going to trial against all P types. When the constraint $A^m \geq A_0^T(z)$ is not binding, then D's optimal settlement offer is $S(A^{m*}(z)) = \lambda\underline{A} + c_D$, which results in settlement with types in $[\underline{A}, A^{m*}(z)]$. When the constraint does bind (that is, for $z \equiv (\tilde{z}, \hat{z})$), then in either case, D will go to trial against P types in $(A_0^T(z), \overline{A}]$, so the relevant comparison is D's expected payment against types in $[\underline{A}, A_0^T(z)]$. If D goes to trial against these types, he expects to pay $\int[\lambda A + c_D]dA/(\overline{A} - \underline{A})$, where the integral is over $[\underline{A}, A_0^T(z)]$. If D settles with these types for $S = z/(1 - \alpha)$, he expects to pay $[z/(1 - \alpha)](A_0^T(z) - \underline{A})/(\overline{A} - \underline{A})$. It is straightforward to show that settling with these types is preferred to going to trial against them if and only if $z \leq (1 - \alpha)[\lambda\underline{A} + 2c_D]/(2 - \lambda) = \hat{z}$. But this is true for the

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[15] If PR1 does not hold, then again it could be optimal for D to settle with all P types for some values of z. The optimal marginal type is now given by $A^{m*}(z) = \min\{\overline{A}, \underline{A} + (c_D/\lambda)(1 - z/z^X)\}$, and the corresponding optimal settlement offer is $S(A^{m*}(z)) = \lambda A^{m*}(z) + c_D(z/z^X)$. Note that this is increasing in z as long as $A^{m*}(z) = \overline{A}$; that is, as long as $z \leq z^{\#}$ (which may exceed $\underline{z}$, but is less than $\tilde{z}$ in Case (b)).

repayment amounts at issue; that is, for $z \in (\tilde{z}, \hat{z})$. Thus, for all $z \in [\underline{z}, \hat{z})$, D engages in some screening of the P types; for lower values of z, D's optimal offer is an interior (unconstrained) solution, but as z rises, eventually the constraint becomes binding. Note that for $z = \hat{z}$, D is indifferent between settling with P types in $[\underline{A}, A_0^T(\hat{z})]$ and going to trial against all P types; in what follows, we will assume that D settles with these P types.

For repayment amounts $z \in (\hat{z}, \overline{z}]$, the previous analysis continues to apply and the constraint $A^m \geq A_0^T(z)$ continues to bind, so D either settles with types in $[\underline{A}, A_0^T(z)]$ or goes to trial against all P types. Since $z > \hat{z}$, D now strictly prefers to go to trial against all P types, rather than making a settlement offer that would induce all types in $[\underline{A}, A_0^T(z)]$ to settle.

*Joint Recovery for P and LF for Case (b)*

By construction, any P type that settles repays her loan in full (according to the provision in the contract between LF and P, no P type will settle for an amount that does not allow her to pay off her loan in full). For repayment amounts $z \in [0, \underline{z})$ and $z \in [\underline{z}, \tilde{z})$, all P types in $[\underline{A}, A^{m*}(z)]$ settle (and repay their loan in full), and all P types in $(A^{m*}(z), \overline{A}]$ go to trial (and repay their loans in full upon winning). The combined receipts of P and LF, denoted as $\Pi(z)$, are given by:

$\Pi(z) = (1 - \alpha)[\lambda\underline{A} + c_D](A^{m*}(z) - \underline{A})/(\overline{A} - \underline{A}) + \int(1 - \alpha)\lambda A dA/(\overline{A} - \underline{A})$, where the integral is over $[A^{m*}(z), \overline{A}]$, and where $A^{m*}(z) = \underline{A} + (c_D/\lambda)(1 - z/z^X)$.

For repayment amounts $z \in [\tilde{z}, \hat{z}]$, all P types in $[\underline{A}, A_0^T(z)]$ settle (and repay their loan in full), and all P types in $(A_0^T(z), \overline{A}]$ go to trial (and repay their loans in full upon winning). The combined receipts of P and LF are given by:

$\Pi(z) = (1 - \alpha)[A_0^T(z)](A_0^T(z) - \underline{A})/(\overline{A} - \underline{A}) + \int(1 - \alpha)\lambda A dA/(\overline{A} - \underline{A})$, where the integral is over $[A_0^T(z)), \overline{A}]$, and where $A_0^T(z) = z/(1 - \alpha)$.

Finally, for repayment amounts $z \in (\hat{z}, \overline{z}]$ (or for even larger z), D would rather go to trial against all P types rather than try to induce some of them to settle. Thus, the combined receipts of P and LF are $\Pi(z) = (1 - \alpha)(\lambda(\underline{A} + \overline{A})/2)$.

The function $\Pi(z)$ is decreasing for $z \in [0, \tilde{z})$, since $\text{sgn}\{\Pi'(z)\} = \text{sgn}\{[\lambda\underline{A} + c_D - \lambda A^{m*}(z)]A^{m*\prime}(z)\} < 0$ because the term in brackets is positive and $A^{m*\prime}(z) < 0$. However, for $z \in [\tilde{z}, \hat{z}]$, the function $\Pi(z)$ is <u>increasing</u>, since $\text{sgn}\{\Pi'(z)\} = \text{sgn}\{[(2 - \lambda)A_0^T(z) - \underline{A}]A_0^{T\prime}(z)\} > 0$ because the term in brackets is positive and $A_0^{T\prime}(z)\} > 0$. Finally, for $z > \hat{z}$, $\Pi(z)$ is constant at $(1 - \alpha)(\lambda(\underline{A} + \overline{A})/2)$. Recall that at $z = \hat{z}$, D is indifferent between settling with $[A, A_0^T(\hat{z})]$ and going to trial against all P types. However, P and LF (jointly) strictly prefer the outcome involving some settlement; that is, $\Pi(z)$ takes a <u>downward</u> jump when z exceeds $\hat{z}$. It is also straightforward to prove that $\Pi(0) > (1 - \alpha)(\lambda(\underline{A} + \overline{A})/2)$. Consequently, the loan repayment amount that maximizes the joint payoff to P and LF is <u>either</u> $z = 0$ (that is, no loan) or $z = \hat{z}$.[16]

*Analysis of Settlement Negotiations for Case (c)*

In Case (c) (wherein $\overline{A} < c_D/(1 - \lambda)$), the critical values of z are ordered as follows: $\underline{z} < \tilde{z} < \overline{z}$

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[16] If PR1 does not hold, then $\Pi(z) = (1 - \alpha)[\lambda\overline{A} + c_D(z/z^X)]$ for $z \in [0, z^\#]$, where D settles with all P types. It is then described as above for $z > z^\#$. Thus, $\Pi(z)$ is initially increasing linearly in z; then it decreases as described above for $z \in (z^\#, \tilde{z})$; then it increases for $z \in [\tilde{z}, \hat{z}]$; and it jumps down and remains constant for $z > \hat{z}$. The optimal repayment amount in this parameter configuration is either $z = z^\#$ or $z = \hat{z}$, depending on the values of $\Pi(z)$ at these two repayment amounts.

$< z^X$, where PR1 implies the inequality $\tilde{z} < \overline{z}$. Just as in the signaling model, Case (c) is usefully divided into two sub-cases by the same threshold value of $c_D$: $\hat{z}$ (<, =, >) $\overline{z}$ as $c_D$ (<, = >) $\overline{A} - \lambda(\underline{A} + \overline{A})/2$. We will distinguish between these two sub-cases as needed; some results apply across both sub-cases.

For repayment amounts $z \in [0, \underline{z})$, all types expect a positive net payoff at trial. Thus, the analysis proceeds exactly as in Case (b) for this same range. That is, the optimal marginal type is interior at $A^{m*}(z) = \underline{A} + (c_D/\lambda)(1 - z/z^X)$, with the corresponding optimal settlement offer $S(A^{m*}(z)) = \lambda\underline{A} + c_D$. Under PR1, there is some screening in equilibrium since types in $[\underline{A}, A^{m*}(z)]$ settle and types in $[A^{m*}(z), \overline{A}]$ go to trial.

Now consider the sub-case wherein $c_D < \overline{A} - \lambda(\underline{A} + \overline{A})/2$, and therefore $\hat{z} < \overline{z}$. Then for repayment amounts $z \in [\underline{z}, \hat{z})$, the analysis proceeds exactly as in Case (b) for this range. That is, for the subset $[\underline{z}, \tilde{z})$, there is an interior solution to D's constrained problem,[17] so that D wants to settle with P types in $[\underline{A}, A^{m*}(z)]$, where $A^{m*}(z) = \underline{A} + (c_D/\lambda)(1 - z/z^X) > A_0^T(z)$; and for the subset $[\tilde{z}, \hat{z})$, the solution to D's constrained problem is at the boundary, $A_0^T(z)$, and D prefers to settle at this offer rather than going to trial against all P types. Again, for $z = \hat{z}$, D is indifferent between settling with P types in $[\underline{A}, A_0^T(\hat{z})]$ and going to trial against all P types; in what follows, we will assume that D settles with these P types. For repayment amounts $z \in (\hat{z}, \overline{z}]$, the previous analysis continues to apply and the constraint $A^m \geq A_0^T(z)$ continues to bind, so D either settles with types in $[\underline{A}, A_0^T(z)]$ or goes

[17] See footnote 10 for the characterization of the optimal marginal type when PR1 does not hold; for this sub-case of Case (c), it is still true that $z^\# < \tilde{z}$.

to trial against all P types. Since $z > \hat{z}$, D now strictly prefers to go to trial against all P types, rather than making a settlement offer that would induce all types in $[\underline{A}, A_0^T(z)]$ to settle.

Now consider what happens when $c_D = \overline{A} - \lambda(\underline{A} + \overline{A})/2$, and therefore $\hat{z} = \overline{z} = z^0 = (1 - \alpha)[(\lambda(\underline{A} + \overline{A})/2) + c_D]$. The entire analysis is the same as above for repayment amounts $z \in [0, \overline{z})$. For the repayment amount $\hat{z} = \overline{z}$, the constrained marginal type is $A_0^T(\hat{z}) = A_0^T(\overline{z}) = \overline{A}$. To induce settlement with P types in $[\underline{A}, \overline{A}]$, D must offer $S = (1 - \alpha)\overline{A}$, and D is just willing to do this rather than offering less and going to trial against all P types because $\overline{A} = (\lambda(\underline{A} + \overline{A})/2) + c_D$ for this threshold value of $c_D$. Notice that the offer $S = (1 - \alpha)\overline{A}$ is also equal to $S = z^0 = (1 - \alpha)[\ (\lambda(\underline{A} + \overline{A})/2) + c_D]$ at this threshold value of $c_D$; that is, D is fully-extracted. Thus, for any $z > z^0$ D will offer $S = 0$ so as to provoke trial with all P types.

Finally, consider what happens when $c_D > \overline{A} - \lambda(\underline{A} + \overline{A})/2$; in this case, the expression $\hat{z}$ exceeds both $\overline{z}$ and $z^0$ (so $\hat{z}$ becomes irrelevant). The entire analysis is the same as above for repayment amounts $z \in [0, \overline{z})$.[18] For repayment amounts $z \in [\overline{z}, z^0]$, D prefers to offer $S = z/(1 - \alpha)$, which is accepted by all P types, rather than offering less and going to trial against all P types (for $z = z^0$, D is indifferent, and we assume that he settles at $S = z^0/(1 - \alpha)$). For repayment amounts $z > z^0$, D prefers trial to any settlement that would be acceptable to the plaintiff (i.e., that would allow

[18] See footnote 10 for the characterization of the optimal marginal type when PR1 does not hold; for this sub-case of Case (c), it is still true that $z^\# < \tilde{z} < \overline{z}$ as long as $c_D < \overline{A} - \lambda\underline{A}$. When $c_D = \overline{A} - \lambda\underline{A}$, then $z^\# = \tilde{z} = \overline{z}$. For all larger values of $c_D$, D will settle with all P types <u>for all</u> $z \leq z^0$.

her to pay off her loan in full), so he makes a low offer to provoke rejection by all P types.

*Joint Recovery for P and LF for Case (c)*

We now determine the optimal contract between LF and P for Case (c). By construction, any P type that settles repays her loan in full (according to the provision in the contract between LF and P, no P type will settle for an amount that does not allow her to pay off her loan in full). For repayment amounts $z \in [0, \underline{z})$ <u>and</u> $z \in [\underline{z}, \tilde{z})$, all P types in $[\underline{A}, A^{m}*(z)]$ settle (and repay their loan in full), and all P types in $(A^{m}*(z), \overline{A}]$ go to trial (and repay their loans in full upon winning). The combined receipts of P and LF, denoted as $\Pi(z)$, are given by:

$$\Pi(z) = (1 - \alpha)[\lambda\underline{A} + c_D](A^{m}*(z) - \underline{A})/(\overline{A} - \underline{A}) + \int(1 - \alpha)\lambda A dA/(\overline{A} - \underline{A}),$$

where the integral is over $[A^{m}*(z), \overline{A}]$, and where $A^{m}*(z) = \underline{A} + (c_D/\lambda)(1 - z/z^X)$.

Consider the sub-case wherein $c_D < \overline{A} - \lambda(\underline{A} + \overline{A})/2$ (and therefore $\hat{z} < \overline{z}$). For repayment amounts $z \in [\tilde{z}, \hat{z}]$, all P types in $[\underline{A}, A_0^T(z)]$ settle (and repay their loan in full), and all P types in $(A_0^T(z), \overline{A}]$ go to trial (and repay their loans in full upon winning). The combined receipts of P and LF are given by:

$$\Pi(z) = (1 - \alpha)[A_0^T(z)](A_0^T(z) - \underline{A})/(\overline{A} - \underline{A}) + \int(1 - \alpha)\lambda A dA/(\overline{A} - \underline{A}),$$

where the integral is over $[A_0^T(z)), \overline{A}]$, and where $A_0^T(z) = z/(1 - \alpha)$. For repayment amounts $z \in (\hat{z}, \overline{z}]$ (or for even larger z), D would rather go to trial against all P types rather than try to induce some of them to settle. Thus, the combined receipts of P and LF are given by $\Pi(z) = (1 - \alpha)(\lambda( \underline{A} + \overline{A})/2)$.

Now consider the sub-case wherein $c_D \geq \overline{A} - \lambda(\underline{A} + \overline{A})/2$ (and therefore $\hat{z} \geq z^0 \geq \overline{z}$, with strict inequalities except at $c_D = \overline{A} - \lambda(\underline{A} + \overline{A})/2$). For repayment amounts $z \in [\tilde{z}, \overline{z}]$, all P types in $[\underline{A}, A_0^T(z)]$ settle (and repay their loan in full), and all P types in $(A_0^T(z), \overline{A}]$ go to trial (and repay their loans in full upon winning). The combined receipts of P and LF are given by:

$$\Pi(z) = (1 - \alpha)[A_0^T(z)](A_0^T(z) - \underline{A})/(\overline{A} - \underline{A}) + \int(1 - \alpha)\lambda A dA/(\overline{A} - \underline{A}),$$

where the integral is over $[A_0^T(z)), \overline{A}]$, and where $A_0^T(z) = z/(1 - \alpha)$.

For repayment amounts $z \in (\overline{z}, z^0]$, D settles at $S = z/(1 - \alpha)$ with all P types, so the combined receipts of P and LF are $\Pi(z) = z$. Any repayment amounts in excess of $z^0$ result in trial, so the combined receipts of P and LF are given by $\Pi(z) = (1 - \alpha)(\lambda(\underline{A} + \overline{A})/2)$.

For the parameter sub-case wherein $c_D < \overline{A} - \lambda(\underline{A} + \overline{A})/2$ (and therefore $\hat{z} < \overline{z}$), the function $\Pi(z)$ behaves the same as in Case (b). In particular, it is decreasing for $z \in [0, \tilde{z})$;[19] then it is increasing for $z \in [\tilde{z}, \hat{z}]$ (that is, once D's offer becomes constrained); finally, it jumps down when z exceeds $\hat{z}$ and remains constant thereafter at $\Pi(z) = (1 - \alpha)(\lambda(\underline{A} + \overline{A})/2)$. As in Case (b), the loan repayment amount that maximizes the joint payoff to P and LF is <u>either</u> $z = 0$ (that is, no loan) or $z = \hat{z}$.

For the parameter sub-case wherein $c_D \geq \overline{A} - \lambda(\underline{A} + \overline{A})/2$ (and therefore $\hat{z} \geq \overline{z}$), the function

[19] If PR1 does not hold, then $\Pi(z)$ is as described in footnote 11 for this sub-case of Case (c). The optimal repayment amount in this parameter configuration is either $z = z^{\#}$ or $z = \hat{z}$, depending on the values of $\Pi(z)$ at these two repayment amounts.

$\Pi(z)$ behaves the same as in the other sub-case for $z \in [0, \bar{z})$. In particular, it is decreasing for $z \in [0, \tilde{z})$; then it is increasing for $z \in [\tilde{z}, \bar{z})$ (that is, once D's offer becomes constrained). However, now it continues to increase over the range $[\bar{z}, z^0]$, and jumps downward to remain constant at $(1 - \alpha)(\lambda(\underline{A} + \bar{A})/2)$ for $z > z^0$. In this case, since the loan repayment amount $z^0$ fully-extracts D, it is clear that this value maximizes the joint payoff to P and LF.[20] Moreover, this repayment value results in settlement with all P types, who pay off their loans in full. Thus, for this sub-case of Case (c), the optimal use of litigation funding increases the settlement rate and maintains the same level of deterrence as would trial (since D is fully-extracted).

[20] If PR1 does not hold, then $\Pi(z)$ is as described in footnote 11 for this sub-case of Case (c) as long as $c_D < \bar{A} - \lambda\underline{A}$. However, $\Pi(z)$ now continues to increase up to $z = z^0$, which is clearly the optimal repayment amount in this parameter configuration, as it fully-extracts D. When $c_D = \bar{A} - \lambda\underline{A}$, then $z^\# = \tilde{z} = \bar{z}$ and the decreasing portion of $\Pi(z)$ for $z \in (z^\#, \tilde{z})$ vanishes. Therefore, for all $c_D \geq \bar{A} - \lambda\underline{A}$, the function $\Pi(z)$ simply increases linearly in z until $z = z^0$, and thereafter it jumps downward. Again, the optimal repayment amount in this parameter configuration is $z = z^0$.