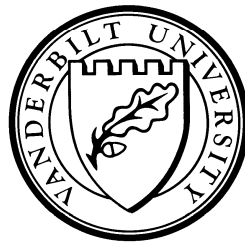# SEARCH, BARGAINING, AND AGENCY IN THE MARKET FOR LEGAL SERVICES*

by

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ABSTRACT

We show that, in the context of the market for a professional service, adverse selection problems can sufficiently exacerbate moral hazard considerations so that even though all agents are risk neutral, welfare can be reduced by allowing the agent to "buy the firm" from the principal. In particular, we model the game between an informed seller of a service (a lawyer) and an uninformed buyer of that service (a potential client) over the choice of compensation for the lawyer to take a case to trial, when there is post-contracting investment by the lawyer (effort at trial) that involves moral hazard. Clients incur a one-time search cost to contact a lawyer, which parametrically influences the market power of the lawyer when he makes a demand of the client for compensation for his service. The client uses the demand to decide whether to contract with the lawyer or to visit a second lawyer so as to seek a second option, which incurs a second search cost. Seeking a second option shifts the bargaining power to the client because she can induce the lawyers to bid for the right to represent her. We allow for endogenously-determined contingent fees alone (that is, the lawyer covers all costs and obtains a percentage of any amount won at trial) or endogenously-determined contingent fees and transfers; in this latter analysis, lawyers could buy the client's case.

Under asymmetric information with only a contingent fee (the "no-transfer" case), in equilibrium the first lawyer visited demands a higher contingent fee for lower-valued cases, signaling the case's value to the client. If a transfer is also allowed, then in equilibrium the higher contingent fee (and transfer from the lawyer to the client) is obtained by the more valuable case, with only the highest-value case resulting in the lawyer buying the entire case (100% contingent fee with a transfer); again, in equilibrium, the value of the case is signaled. In both settings the client uses an equilibrium strategy that involves seeking a second option a fraction of the time, which induces separation. In equilibrium the presence of asymmetric information does not affect the client's expected payoff, but it does reduce the lawyer's expected payoff and it does increase moral-hazard-induced inefficiency on the part of the lawyer in the post-contracting investment. We also show that welfare under the no-transfer compensation scheme may increase with an increase in search costs, and shifting from a no-transfer to an unrestricted-transfer scheme can result in a reduction in expected social efficiency, as the adverse selection effect exacerbates, rather than ameliorates, the moral hazard problem.

1. Introduction

A classic concern in the theory of asymmetrically-informed trade is the purchase of a good by a less-informed buyer from a more-informed seller, especially when the buyer relies upon the expertise of the seller to provide information about the value of the good in the exchange. We consider this problem in the context of a lawsuit: the hiring of a lawyer (the seller of a service) by a client who has been harmed, but who is comparatively ignorant about the value of a potential lawsuit. Complicating the adverse selection issue is that the lawyer will, after contracting based on his superior information about the value of the suit, decide the level of non-verifiable effort to take in pursuing the case at trial. Thus, the value to the buyer and the seller is contingent upon a post-contracting investment choice by the seller, leading to moral hazard. Surprisingly, we find that adverse selection effects can sufficiently exacerbate the moral hazard problem so that , at least in some circumstances, allowing the lawyer to acquire the case from the client (the usual intuition for resolving moral hazard problems, drawn from the principal-agent literature) actually lowers, rather than raises, expected welfare in comparison to prohibiting such arrangements.

This issue is of more than purely theoretical concern. Trade in tort claims is currently illegal in most jurisdictions, but this is changing. For some years most jurisdictions in the U.S. have allowed lawyers to take a fractional share of any winnings in a tort lawsuit (a "contingent fee" which in the U.S. tends to be one-third), based on the lawyer's commitment to cover the costs; historically (reaching back over many centuries of common law) lawyers cannot purchase a case outright by making a payment to the client. In some countries (e.g., Australia, the U.K. and, increasingly, the U.S.), third parties may engage in "litigation funding" wherein the funding party advances money to a plaintiff (or to a law firm) in exchange for a claim on the eventual recovery (these are usually in the form of non-recourse loans, with no need for the recipient to repay should she lose her case). Theoretically, there would appear to be efficiency gains from transferring a claim to an informed expert, as moral hazard problems associated with motivating appropriate effort by the lawyer could be resolved. However, there is also reason for concern if the party purchasing the claim has market power and/or private information regarding its value, both of which seem plausible in regard to tort

claims.[1] Thus, the basic policy issue concerns the relaxation of constraints on transferring the ownership of a legal claim, particularly when the expertise about the value of the claim lies with the acquiring party: there is the very real potential that an informed lawyer with some market power could defraud an uninformed client in such a transaction.

Despite this often-voiced concern, previous analytical models that consider the determination of contingent fees (with or without transfers between the client and the lawyer or other third party) assume that the market for legal services is perfectly competitive (see the literature review for specific examples). As a consequence, lawyers try to attract clients by offering compensation structures that will appeal to the clients, rather than trying to fleece the clients. While we certainly believe that competition for clients plays an important role, we provide a model below in which active search by the client is necessary in order to bring this competition about. We use the magnitude of the client's search cost as an index of the extent of lawyers' market power.

We also consider the possibility that lawyers have private information about the value of the client's case. Upon conferring with the client, we assume that the lawyer learns the expected value of the case (the actual realized value will be determined at trial), but this information cannot be conveyed to the client in a credible manner. Rather, the lawyer quotes a compensation demand which consists of a contingent fee and (possibly) a transfer (we will consider both the prevailing situation in which the lawyer cannot make a transfer payment to the client and an unrestricted situation in which the lawyer can make a positive transfer payment to the client or demand a flat fee from the client). The client observes this demand, draws any possible inferences from it regarding the value of her case, and decides whether to accept the lawyer's demand or to seek a second option by paying the search cost again. If the client seeks a second option, the second lawyer will also learn the expected value of her case (and it is assumed to be the same because it is an attribute of the case and both lawyers are experts in evaluating the case). However, having consulted two lawyers, we

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[1] Similar considerations can operate in the context of antitrust and intellectual property claims.

assume that the client can induce the lawyers to "bid" for her case. That is, having sought two options, the client can induce the lawyers to compete, but she has to consult both of them (expending the search cost twice) to induce this shift in bargaining power. Notice that the role of a second option here is to shift bargaining power rather than provide new information.

We find that, in equilibrium, the contingent fee alone – or in concert with a transfer – can serve as a signal to the client about the expected value of the case. Although the lawyer always prefers a higher contingent fee (and lower transfer payment to the client, when permitted) if this would be accepted, the client responds to less favorable compensation demands with a higher probability of a second search. This restrains the lawyer's temptation to extract surplus from the client to quite a substantial degree. We find that the client's equilibrium payoff is quite simply-expressed and depends on the search cost in a very direct and intuitive way; indeed, the client makes the same payoff as she would make under full information. However, as is often the case in signaling models, the party with the private information – here, the lawyer – makes lower expected profits under private information than under full information.

When transfers are not possible (for example, because the client is financially-constrained and the lawyer is prohibited from paying the client), the equilibrium contingent fee quoted by the first lawyer visited is decreasing in the expected case value.[2] Although the equilibrium contingent-fee demand is the same as under full information, it is now rejected with positive probability in favor of a second search (which leads to competition). This leads to lower expected profits for lawyers.

On the other hand, when the lawyer can buy part or all of the case from the client, then the equilibrium contingent fee is an increasing function of the expected case value (as is the transfer paid to the client) because lawyers who know that the value of the case is lower choose to distort their compensation demands away from their full-information optima. This is because lawyers with higher-value cases have an incentive to masquerade as ones with lower-value cases, so demands suggesting that the case is low-valued

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[2] This is consistent with recent empirical evidence in class action settlements; see Eisenberg and Miller (2010).

are met with a higher probability of rejection by the client (so as to induce separation). Thus, in this case, both the client and the lawyer-type with a low-value case engage in behavior that discourages mimicry by the lawyer-type with the high-value case.

Since the contingent fee also motivates the lawyer's subsequent effort in the case, this has implications for how efficiently the case is ultimately pursued (where the measure of efficiency here involves only the joint payoff of the client and her lawyer). When no transfers are allowed, a lawyer who knows the case is of lower value reveals this through choosing a higher contingent fee (it is higher than the client would ideally prefer, but the same as the lawyer would demand under full information). Due to the presence of asymmetric information, client search is increased, leading to lower contingent fees in a fraction of the cases. Thus, in this case private information results in lower lawyer effort (on average). Interestingly, when transfers (from lawyer to client) are also allowed, then a lawyer who knows the case is of lower value reveals this through choosing a lower (rather than higher) contingent fee; in this case, private information results in downward-distorted contingent fees which result in lower lawyer effort than would occur under full information. Search for a second option in this setting, however, results in an outcome wherein the case is sold outright and thus efficient effort is taken by the lawyer who represents the client in equilibrium. Thus, the two alternative approaches generate substantially different pricing of legal services and potentially different results with respect to amelioration of moral hazard on the part of the lawyer.

We find that, regardless of whether the value of the client's case is common knowledge or private information for the lawyer, and regardless of whether transfers are allowed, the client's equilibrium payoff is lower when lawyers have more market power (that is, when the client's cost of seeking a second option is higher). The effect of an increase in the client's search cost on overall welfare depends on whether transfers are allowed (but, for the most part, not on whether the value of the case is common knowledge or private information for the lawyer). When transfers are allowed, welfare is always decreasing in the level of search costs, but when transfers are not allowed, then an increase in search costs increases overall welfare, at least

when search cost is sufficiently small. The latter, seemingly perverse, finding is due to the fact that higher

search costs lead to higher contingent fees which lead to more efficient conduct of the case at trial. We

further ask whether welfare is always improved by allowing transfers. While this is clearly true when the

value of the case is common knowledge, we show by example that when the lawyer has private information

about the value of the case, then allowing transfers can lower *ex ante* expected welfare.

Plan of the Paper

In Section 2 we describe some of the related literature, including the previous work on search which

forms the basis of our model and the previous work on the determination of the equilibrium compensation

structure for lawyers. In Section 3 we provide the primary notation and describe the continuation game in

which a lawyer who has contracted for a case chooses his effort level at trial. Section 4 provides the full-

information analysis for the cases wherein: 1) lawyers may only be compensated via a contingent fee; and

2) lawyers may demand a combination of a contingent fee and an endogenously-determined transfer. Section

5 revisits the two alternatives from Section 4, now allowing for asymmetric information as to the value of the

case. Section 6 provides a discussion of two welfare effects: 1) the effect of changes in the search costs; 2)

the effect on welfare of changing from the no-transfer case to one wherein unrestricted transfers are allowed,

thereby allowing lawyers to buy a client's case . Section 7 provides a discussion of the results and possible

extensions. An Appendix provides details of the analysis discussed in the text; a separate Technical Appendix

provides additional analysis of the contingent-fee-only model and an application of an equilibrium refinement

in the model wherein transfers are permitted.

2. Related Literature

Our model of the client-lawyer bargaining process involves history-dependent search, in which

bargaining power switches endogenously as a consequence of the searching agent's behavior. This concept

was pioneered by Daughety (1993) and was applied to the problem of a consumer searching for the lowest

price at which to acquire an item when multiple firms have private information about their common (constant) marginal cost of production.[3] The potential for search constrains the ability of the first firm to profit at the consumer's expense, even when the consumer does not search a second time. In particular, the model involves a widespread inability to commit: the consumer cannot commit to search a specific number of times (she must decide on the spot whether or not to search again, after drawing any possible inferences from the first firm's price quote), nor can the firm commit to a price; it is free to revise its price quote to undercut any rival bidder for the consumer's sale. We maintain this inability to commit in our model of lawyers being induced to bid for cases or for the more limited "right to represent" a client.

Macey and Miller (1991) argue that auctions should be used to determine the attorney for large-scale small-value class actions, with the best alternative (assuming a competitive market) being to sell the entire case to the highest bidder; Shukaitis (1987) makes a similar argument for personal injury claims. Macey and Miller also discuss the merits of lawyers bidding, in terms of contingent fees alone, to obtain the right to represent a client.[4]

Some of the previous related analytical literature has focused on the determination of the contingent fee, assuming no transfers between lawyer and client, under conditions of full information between the client and the lawyer.[5] One standard result is that competition by lawyers for clients will not lead to extremely low contingent fees since clients also recognize that the contingent fee incentivizes the lawyer's effort when effort

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[3] This search model also appears in Daughety and Reinganum (1991, 1992), which endogenize the use of retail policies such as the probability of a stock-out and the notion of recall (i.e., durable price quotes), respectively.

[4] For example, in *In re Oracle Securities Litigation*, Judge Vaughn R. Walker allocated the role of lead counsel based on bids that specified qualifications and a contingent fee structure. In *In re Auction Houses Antitrust Litigation*, Judge Lewis A. Kaplan allocated the role of lead counsel based on bids that specified qualifications and an amount (contingent on recovery) that would go directly to the class members, with the excess recovery over and above that amount being split between the attorneys (25%) and the class (75%).

[5] Polinsky and Rubinfeld (2003) propose a decentralized scheme with a zero-profit "administrator" acting to coordinate (under full information) the demand and supply of legal services in a manner which would achieve efficient effort choice by lawyers.

is non-contractible[6] (see, e.g., Hay 1996 and 1997; see also Santore and Viard, 2001, who argue that constraints on lawyers making transfers to clients act to preserve lawyers' rents). Using a specific functional form, Hay (1996) finds that the competitively-determined contingent fee is a decreasing function of the anticipated award.

There are two previous papers that consider both a contingent fee and a transfer between a potential plaintiff and her lawyer, under conditions of asymmetric information.[7] Dana and Spier (1993) assume that lawyers compete for clients by offering contracts prior to the receipt of any private information. However, it is common knowledge that the lawyer will subsequently receive private information about the likelihood that the plaintiff will win the case and the expected award contingent on winning. They find that a contract consisting of a contingent fee and a transfer can induce the lawyer to make the jointly-optimal decision about whether to drop the case. They also characterize the (second-best) optimal contingent fee when the transfer is constrained to be zero.

Rubinfeld and Scotchmer (1993) consider a model in which a client is assumed to be better-informed than lawyers about the expected award (which may be High or Low). Their model is a competitive screening one: uninformed lawyers offer a menu of contracts (which involve both a contingent fee and a transfer) to the informed client. They find that the equilibrium contingent fee is 1 (that is, the lawyer purchases the entire case) when the expected award is Low. However, in order to sort the client types, a client who claims to have a high-value case cannot receive the same favorable treatment; rather, the contingent fee for high-value cases is (typically) less than 1.

Our model differs from all of the aforementioned models of the fee structure by departing from the

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[6] The judge addressed this concern (see *In re Oracle*, 136 F.R.D. 639, at 641) in awarding the role of lead counsel. McKee, Santore, and Shelton (2007) examine an experimental market for lawyers' services and find that client-subjects reject contingent fee bids that are "too low" and that equilibrium bids are quite close to their predicted values. They also find that lawyer-subjects invest higher effort when the contingent fee is higher (as predicted by the model).

[7] Fong and Xu (2011) consider the compensation structure for defendant's lawyers, finding support for the generally-observed use of flat fees for such representation.

assumption of perfect competition on the part of the lawyers. We allow bargaining power to shift endogenously between the lawyer and the client as a consequence of client search. Unlike Dana and Spier (1993), in our model the contract is not determined *ex ante* of the receipt of private information; rather, the plaintiff's lawyer has private information about the value of the case when he makes a compensation demand, resulting in the potential for information transmission. Also, in our model it is not the pursue/drop decision that is of interest but rather the lawyer's subsequent choice of effort given the compensation structure.

Our model differs from Rubinfeld and Scotchmer (1993) in that we assume it is the lawyer (rather than the client) who has private information about the value of the case and we provide a signaling (rather than a screening) model.[8] The use of a transfer is crucial in a screening model since all lawyer types prefer higher contingent fees so the contingent fee alone cannot sort them. In our model, the contingent fee alone can signal the expected value of the case, because of the client's endogenous search decision.[9] This search decision can serve as the second "instrument" in the absence of a transfer payment, since a higher contingent-fee demand results in a higher probability of a second search. It is therefore interesting to observe that, when transfers are also permitted, both a contingent fee and a transfer (as well as the client's search decision) are used in equilibrium. That is, both the contingent fee component and the transfer component differ for the high- and low-value cases. Moreover, the likelihood of a second search is also different, since the lawyer's demand associated with the high-value case is accepted for sure while the one associated with the low-value

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[8] Our results are the opposite of theirs when both a contingent fee and a transfer are possible: the equilibrium contingent fee is 1 for the high-value case, while low-value cases are not purchased in full. In our model, the lawyer would like the client to believe that the case value is low (so he can make a low transfer). Consequently, a client can trust the lawyer's suggestion that the case value is high (provided this is accompanied by a high transfer payment) but must react with skepticism when the lawyer suggests that the case value is low (skepticism results in a positive probability that the client will search again). This difference in results is due to the alternative allocation of private information, not due to the screening versus signaling game form.

[9] Rubinfeld and Scotchmer (1993) also consider a screening model in which lawyers have private information about their abilities, while all other case attributes are common knowledge. Although client search is discussed, only extreme versions of it are considered. When search costs are zero, the client offers a single contract that is unacceptable to a low-quality lawyer, and she searches until a (high-quality) lawyer accepts the contract (Cotton and Santore, 2010, conduct an experimental test of this model and find that clients do sort lawyers as predicted). On the other hand, when search costs are prohibitive, the client offers a non-degenerate menu of contracts that sorts lawyer types.

case is followed by a positive probability of a second search. Thus, the client provides incentives to deter mimicry by the lawyer with a high-value case by searching with a positive probability following the demand associated with a low-value case, while the lawyer with a low-value case provides incentives by specifying a contingent fee less than 1 (which is the full-information optimal value). This is less attractive for a lawyer with a high-value case to mimic (as compared to a contingent fee of 1), and allows the client to engage in a second search with a lower probability than would otherwise be required.

Since the client cannot observe the expected value of her case directly (either before or after trial), nor can she observe the lawyer's effort, she cannot verify even *ex post* whether the lawyer's implicit claim about the expected value, or his effort, were appropriate. Thus, the lawyer's opinion about the case value is a credence good (see Dulleck and Kerschbamer, 2006, for a recent survey). These models typically assume two possible levels of a problem and two possible treatments. We will briefly mention just a few of these contributions that seem most closely-related; however, to the best of our knowledge, none of these employ all of the features of our model (although some of these features are present in some of the models): costly search, bargaining under incomplete information, and contracting with moral hazard using contingent fees and (potentially) transfers.

Emons (2000) provides a model in which a client may have a more-developed, or less-developed case; a more-developed case has a higher likelihood of success at trial. Additional effort by the lawyer will convert a less-developed case into a more-developed case; effort is observable, but whether or not it is needed is private information for the lawyer. Emons finds conditions such that contingent fees cannot induce the lawyer to develop the less-developed cases even though it would be efficient to do so. On the other hand, hourly fees (equal to their hourly costs) can induce lawyers to exert effort efficiently. Our model differs from that of Emons in that we assume effort is a continuous strategy choice that is not verifiable; that lawyers have some market power but are not monopolists; that the compensation scheme involves a contingent fee and (potentially) a transfer; and that the lawyer's choice of contingent fee level can signal his private information.

Fong (2005) provides a model wherein a monopoly provider commits to a pair of prices, one for a minor treatment and one for a serious treatment. When approached by a client, the provider learns the client's problem and recommends a treatment. In equilibrium, the client always accepts the recommendation of minor treatment and rejects the recommendation of serious treatment with a probability that deters the provider from recommending it fraudulently. Thus, the provider's recommendation reveals his private information; nevertheless, the outcome is inefficient because some clients with serious problems do not obtain treatment.

Wolinsky (1993, 1995) models the search for second options as a means of disciplining experts, who commit to prices before observing the severity of the client's problem. He characterizes equilibria in which experts fraudulently recommend the serious treatment with positive probability and the client searches with positive probability after the first "serious" recommendation (thus, both parties employ mixed strategies).[10] The client deals sequentially with each expert. Firms are competitive in Wolinsky (1993), and Wolinsky (1995) is a sequential screening model since uninformed clients make offers to informed experts.

Our model differs from those of Fong and of Wolinsky in that the lawyer cannot pre-commit to a fee schedule; since he chooses his fee after he privately learns the expected value of the client's case, his choice reveals his private information. In addition, we allow the client to visit a second lawyer (unlike Fong), and to (potentially) bring the two into competition for her case (unlike Wolinsky). Finally, in our model the lawyer who obtains the case also subsequently chooses his effort level based on a contingent fee and (potentially) a transfer.

Pesendorfer and Wolinsky (2003) provide a model wherein a client requires an expert to diagnose and treat his problem. The client samples experts sequentially; after she accepts a contract offered by the expert, the expert can exert non-verifiable effort (at a cost) and provide the correct diagnosis (fraudulent diagnosis is not allowed) or exert no effort and provide a random (and almost-surely incorrect) diagnosis.

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[10] Wolinsky's (1993) main focus is another equilibrium in which some experts choose to specialize in the minor treatment and others maintain the ability to provide either treatment. By first visiting an expert in the minor problem and then – only if declined service – visiting a provider who can treat the serious problem, the consumer can learn the nature of her problem. However, there is some inefficiency due to the fact that some consumers search twice.

In equilibrium, the treatment price contains a "quality-guaranteeing" premium that is sufficient to induce some (but insufficient) effort on the part of the expert. Again, this model is very different from ours. Our expert learns the expected value of the case for sure; his compensation demand reveals his private information; and his post-contracting effort is a continuous strategy choice that is motivated by a contingent fee and (potentially) a transfer.

3. Model Setup

A harmed client has decided to sue for damages. Let A be the expected award at trial for the case,[11] where $A \in [\underline{A}, \bar{A}]$, with $0 < \underline{A} < \bar{A} < \infty$; we assume that A is distributed on $[\underline{A}, \bar{A}]$ following a cumulative distribution H(A) with density h(A) > 0 everywhere on $[\underline{A}, \bar{A}]$. Initially we analyze the problem under full information, wherein we assume that A is common knowledge to both the client and all lawyers that the client visits. Later (under incomplete information) the value of A will be known by the lawyers but not by the client. All other attributes of the model will be common knowledge between the client and the lawyer(s), though the effort of any lawyer who ends up taking the case will not be verifiable. Formally, our analysis under incomplete information will be of an adverse selection problem with a moral hazard problem as the continuation game.

When a client visits a lawyer, the client incurs a cost s > 0, which represents the cost of locating a qualified lawyer, foregoing other uses of the client's time, and documenting and expressing the details of the case (which might impose a disutility on the client as well as a monetary expense); moreover this cost might also reflect a "consultation fee" that is demanded by the lawyer for them to spend their time listening to the case.[12] This search cost is an important friction, providing the lawyer with some degree of monopoly (or

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[11] In the continuation game, the lawyer who contracts with the client chooses trial effort based on the expected award; any realized award (which is observable) cannot reveal the lawyer's effort, thereby allowing for moral hazard.

[12] In general we would assume that, since lawyers in this model are homogeneous, the consultation fee is the same across all lawyers, reflecting competition among lawyers for clients to seek them and thus it is something that lawyers would use to cover the cost of their time spent in the consultation process, independent of whether they take the

hold-up) power;[13] the higher the search cost the less willing the client will be to seek a second option, and thus the greater the monopoly power of the first lawyer visited. The search cost (expended by the client for each new lawyer that the client visits) is only applicable to visiting a lawyer for the first time: returning to a previously-visited lawyer is costless while a visit to another new lawyer will again cost s.[14]

Should a lawyer take the case, his effort at trial is denoted as $x \geq 0$ and his likelihood of winning at trial (given effort level x) is denoted as $p(x)$; we do not consider the possibility of settlement bargaining in the model. We make the following assumptions about the twice continuously differentiable function $p(x)$.

Assumption 1. $p'(x) > 0$ and $p''(x) < 0$ for $x \geq 0$; $p(0) = 0$, $\lim_{x \to \infty} p(x) = 1$. Moreover, assume that $\lim_{x \to 0} p'(x) = \infty$ and $\lim_{x \to \infty} p'(x) = 0$.

The foregoing assumption means that the probability of winning at trial is increasing (but at a decreasing rate) in effort, and that at zero effort this probability is zero. The portions of the assumption that are addressing limits of the function or its derivative simply guarantee that the function acts like a probability ($p(x) < 1$ for all possible values of x) and that it will always be optimal to put in some effort, but that optimal effort will be finite in level.

All qualified lawyers are homogeneous in terms of talent and costs of operation; let $w > 0$ be a lawyer's cost of a unit of effort expended, so that the lawyer's effort costs are wx. Finally, after hearing the details of a case, a lawyer announces a compensation pair (α, F) that he demands for taking the case, where α is the contingent fee (the fraction of the award from trial obtained by the lawyer if the lawyer wins) and F is a transfer between the lawyer and the client. We assume that $0 \leq \alpha \leq 1$ and that F can be positive, zero, or

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case or not; therefore this revenue is a wash from the perspective of the lawyer, as it just covers costs.

[13] A possible solution to the hold-up problem would be for lawyers to pay clients to come to them. However, this would present an arbitrage opportunity to individuals who have not been harmed (and who have negligible search costs, since they have no disutility associated with documenting or discussing a harm). Thus, this cannot be an equilibrium strategy for a lawyer to employ.

[14] One might think that the search cost at the second lawyer might be lower, as the client might become more efficient in expressing the details of the case. It will become clear that s can be different for first and second searches without affecting the results; the necessary modifications should be obvious.

negative. Thus, for example, a demand (1, F) with F positive would be a demand by the lawyer to buy the case from the client at price F; a demand (.5, F) with F negative would be a demand to represent the client wherein the client pays $|F|$ and the lawyer receives $|F|$ as a transfer payment as well as receiving half of any award that is won at trial; a demand of (.333, 0) would be the demand that the lawyer receives one-third of the award and no flat fee is paid or received by the lawyer.

The Effort-Level Continuation Game and the Overall Game

We first describe the effort-level continuation game which is common to all the analyses to come. Assume a lawyer and a client have agreed to a contract that specifies a contingent fee and a transfer (which might be zero); assume that the lawyer's effort x is not contractible. For any given value of A and any demand (α, F), the lawyer's payoff (ignoring the transfer F) that both the client and the lawyer anticipate from the lawyer's pursuit of the case is denoted $\Pi^L(\alpha, A)$. After agreeing to a contract, the plaintiff's lawyer chooses x to maximize $\alpha A p(x) - wx$; given the assumptions made on $p(x)$, this agency analysis is analogous to a standard problem in the classical theory of the firm. Under Assumption 1, there is a unique maximizer, denoted $x^L(\alpha, A)$, at which $\alpha A p'(x) - w = 0$ and $\alpha A p''(x) < 0$. As long as $\alpha > 0$, $x^L(\alpha, A) > 0$; however, should $\alpha = 0$, then $x^L(0, A) = 0$. Let $p^L(\alpha, A) \equiv p(x^L(\alpha, A))$ and let $p_1^L(\alpha, A) \equiv p'(x^L(\alpha, A))x_1^L$ be the partial derivative of p^L with respect to α. Similarly, let $p_2^L(\alpha, A) \equiv p'(x^L(\alpha, A))x_2^L$ be the partial derivative of p^L with respect to A. It is straightforward to see that p_1^L, p_2^L, x_1^L, and x_2^L are all positive for $\alpha > 0$. Thus, $\Pi^L(\alpha, A) \equiv \alpha A p^L(\alpha, A) - wx^L(\alpha, A)$; under the maintained assumptions, $\Pi^L(\alpha, A)$, Π_1^L, Π_2^L, and Π_{12}^L are all strictly positive for all $\alpha > 0$. The lawyer's total profit, should he obtain the right to represent the client under a contract specifying (α^*, F^*), is $\Pi^L(\alpha^*, A) - F^*$.

Sequence of Moves in the Overall Game

Given the understanding of the foregoing continuation game, we now specify the overall game to proceed as follows:

1) The client, C, visits lawyer 1 (L1), to discuss the case, at a cost of s; L1 learns A;
2) L1 makes a demand of C of (α_1, F_1);

3) If C accepts L1's demand, then they contract at this demand and the game moves to the effort-level continuation phase discussed earlier.

4) If C rejects L1's demand, then she expends a search cost s in visiting and discussing the case with lawyer 2 (L2); L2 learns A and (α_1, F_1);

5) L2 makes a demand of C of (α_2, F_2);

6) Having visited two lawyers, C may now choose either demand or costlessly auction the right of representation to L1 and L2 using a first-price sealed-bid format, with the winner making the equilibrium demand (α^*, F^*). C chooses the best bid (based on her beliefs) and selects each lawyer with equal probability should they bid the same demand; the effort-level continuation game discussed earlier follows.

In this game, the lawyers cannot pre-commit to their compensation demands in order to avoid bidding for the right to represent the client, while the client cannot pre-commit to her search policy. Thus, the game involves the endogenously-chosen possibility of the transfer of bargaining power from the lawyers to the client if the client (initially the less-powerful player) is willing to incur the added search cost of consulting a second lawyer. This allows us to incorporate different levels of market power on the part of lawyers in the analysis.

In the sections that follow we consider the preceding game when there is full information (A is known by clients and lawyers) and when there is incomplete information (A is private information known only by the lawyers). Throughout we maintain the assumption that C can prove to L2 that she has visited another lawyer previously, and she can document the demand made by L1; thus, C cannot mislead an L1 into thinking he is an L2 (because he can demand proof, which she cannot provide if he really is L1). The client does not have an incentive to mislead an L2 into thinking that he is an L1, since she does not expect the lawyers to have different information about her case.

4. Full-Information Analysis

We start by considering the full-information game, wherein the client also knows the value of A (the expected value of the case at trial) and wants to contract with a lawyer so as to maximize her (the client's) expected return from the contract. Let $\Pi^C(\alpha, A) = (1 - \alpha)Ap^L(\alpha, A)$ be the client's payoff from trial when the lawyer chooses his effort in the previously-described continuation game based on his demand (α, F) with expected award value A; the client's payoff (ignoring search costs) is $\Pi^C(\alpha, A) + F$ and the lawyer's overall

payoff is $\Pi^L(\alpha, A)$ - F. Note that, clearly, the combined payoff is maximized at α equal to 1 (and, moreover, $\Pi_1^L(1, A) + \Pi_1^C(1, A) = 0$; see the Appendix).

4.1 Full-Information Equilibrium when F = 0

We first consider the problem wherein F is restricted to be zero; only a contingent fee is allowed. Notice that $\Pi^C(0, A) = 0 = \Pi^C(1, A)$; the first equality follows from the fact that the lawyer puts in no effort if $\alpha = 0$ while the client gets no share of the award if $\alpha = 1$. This motivates the following assumption to ensure a unique interior solution.[15]

> **Assumption 2**. $\Pi^C(\alpha, A)$ is increasing, and then decreasing, in α for every A. Moreover, for each value of A, assume that: 1) $\Pi^C(\alpha, A)$ is twice differentiable and 2) $\Pi_{11}^C = -2Ap_1^L + (1 - \alpha)Ap_{11}^L < 0$ at the peak.

Thus, there exists a unique value of $\alpha \in (0, 1)$, denoted $\alpha^C(A)$, that is most-preferred by the client (i.e., that maximizes $\Pi^C(\alpha, A)$). It is defined by the first-order condition:

$$\Pi_1^C(\alpha, A) = -Ap^L(\alpha, A) + (1 - \alpha)Ap_1^L(\alpha, A) = 0.$$

The only source of conflict between the client and the lawyer concerning the setting of α would occur in the range of $\alpha \geq \alpha^C(A)$, since if $\alpha < \alpha^C(A)$, both parties would find it mutually beneficial to increase the value of α: the lawyer always would desire a higher value of α and the client knows that a value of $\alpha < \alpha^C(A)$ will elicit too little effort on the part of the lawyer.[16] Thus, in what follows, we will focus on properties of payoff functions and best response functions wherein $\alpha \geq \alpha^C(A)$.

Differentiating $\Pi_1^C(\alpha, A)$ and collecting terms provides the result that $d\alpha^C(A)/dA = -\Pi_{12}^C / \Pi_{11}^C$, where both expressions on the right-hand-side are evaluated at $(\alpha^C(A), A)$. Since $\Pi_{11}^C(\alpha^C(A), A) < 0$, then $\text{sgn}\{d\alpha^C(A)/dA\} = \text{sgn}\{\Pi_{12}^C(\alpha^C(A), A)\}$. We make the following assumption.

> **Assumption 3**. $\Pi_{12}^C(\alpha, A) < 0$ for $\alpha > \alpha^C(A)$, and $\Pi_{12}^C(\alpha, A) \leq 0$ for $\alpha = \alpha^C(A)$.

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[15] In sequential-move games, where the early-chosen strategy affects payoffs both directly and indirectly through its effect on subsequently-chosen strategies of other players, it is often necessary to impose more regularity assumptions on payoff functions than would be required in simultaneous-move games.

[16] A similar point is made by, for example, Hay (1996) and Santore and Viard (2001).

We have made this assumption because we are unable to prove this property for $\Pi^C_{12}(\alpha, A)$ for general $p(\bullet)$ functions (see footnote 10). However, we have considered three fairly classic cases of $p(\bullet)$: 1) $p(x) = \lambda x^\theta$, where $0 < \theta < 1$ and $\lambda > 0$; 2) $p(x) = x/(x+1)$; and 3) $p(x) = 1 - \exp(-\lambda x)$, where $\lambda > 0$. In all three cases, $\Pi^C(\alpha, A)$ satisfies Assumptions 2 and 3.[17] Thus, under Assumption 3, $d\alpha^C(A)/dA \leq 0$. Notice that the since the lawyer's incentives to work on the case are strengthened by an increase in either α or A, then Assumption 3 implies that as A increases, the client finds it optimal to reduce (or leave unchanged) the contingent fee α; thus (at the client's optimum) the lawyer will get a lower share of the higher award A.

When a client visits a (first) lawyer, denoted as L1, and describes her case, this visit costs the client a one-time amount of s. Since $F = 0$, L1 offers to represent the client for a contingent fee alone, which may depend on the expected award, A, and which we denote by $\alpha^L(A)$ and derive below. The client can either accept this offer or leave and visit a second lawyer (L2, again at a one-time cost of s). As indicated in the sixth step of the overall game, a client who has visited two lawyers can induce them to "bid" for the client's case. Thus, after visiting two lawyers, the winning bid (should the client initiate an auction) will be the contingent fee that maximizes the client's payoff; that is, $\alpha^C(A)$. Since L2 can anticipate the outcome of the auction (in which he will bid $\alpha^C(A)$ and win with probability $1/2$), he will prefer to simply offer $\alpha_2 = \alpha^C(A)$ if he expects that the client will accept this demand (and the client would be willing to accept it, since this is the anticipated winning bid in the auction). Thus, there two possible outcomes following the second search, one in which the auction is conducted and one in which C simply accepts L2's demand of $\alpha_2 = \alpha^C(A)$. In the complete-information model and in the model wherein transfers are permitted, it doesn't really matter which of these equilibria is chosen; in the model with asymmetric information wherein only contingent fees can be used, it does matter to a limited extent; this is discussed in more detail in the relevant section below. For concreteness, we will proceed under the assumption that L2 demands $\alpha_2 = \alpha^C(A)$ and C accepts.

Thus, the client's overall payoff is $\Pi^C(\alpha^C(A), A) - 2s$ if she visits two lawyers, and is $\Pi^C(\alpha^L(A), A) -$

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[17] The conditions in Assumption 1 are not all necessary. Each of the aforementioned functional-form examples violates one or more inessential aspects of Assumption 1 without invalidating their use.

s if she accepts the first lawyer's offer. In order to ensure that all types will enter the market for legal services when only contingent fees can be used, we maintain the following assumption, which is an implicit restriction on $\underline{A}$ in relation to the search cost s and the parameters of the problem.[18] Note that, since $\Pi^C(\alpha^C(A), A)$ is increasing in A, we need only concern ourselves with the lowest-value case for all cases to be worth the client's choice to seek representation.

Assumption 4. $\Pi^C(\alpha^C(\underline{A}), \underline{A}) - 2s \geq 0$.

Comparing the client's payoffs from visiting one versus two lawyers implies that, in order to maximize his payoff, the first lawyer should charge the contingent fee $\alpha^L(A)$ such that:

$$\Pi^C(\alpha^L(A), A) = \Pi^C(\alpha^C(A), A) - s. \tag{1}$$

Any $\alpha^L(A)$ yielding a lower client surplus would be rejected (the client would visit a second lawyer and then, along the equilibrium path, she would accept L2's demand of $\alpha^C(A)$), while any demand yielding a higher client surplus would be accepted by C but would result in lower profit for L1. In equilibrium the client, though indifferent, accepts the demand defined implicitly by equation (1).

Since $\Pi^C(\alpha, A)$ is first increasing, and then decreasing, in α and reaches its maximum at $\alpha^C(A)$, equation (1) will have two solutions, one on either side of the function's peak. As indicated earlier, since $\Pi^L(\alpha, A)$ is increasing in α, it follows that $\alpha^L(A)$ will be the <u>larger</u> solution to equation (1); thus, if s > 0, then $\alpha^L(A) > \alpha^C(A)$ for all $A \in [\underline{A}, \bar{A}]$. Moreover, since Assumption 4 implies that $\Pi^C(\alpha^C(A), A) - s > 0 = \Pi^C(1, A)$ for all $A \in [\underline{A}, \bar{A}]$, it follows that $\alpha^L(A) < 1$ for all $A \in [\underline{A}, \bar{A}]$.

In the Appendix we show that $d\alpha^L(A)/dA < 0$; that is, the equilibrium contingent fee under full information is a decreasing function of the award A. The functions $\alpha^C(A)$ and $\alpha^L(A)$ are illustrated in Figure 1. Here we have assumed that $\alpha^C(A)$ is everywhere declining (as will be seen in an example, below, it may be constant). A lawyer who anticipates a higher award is willing (because of the client's credible threat to seek a second option) to represent the client for a lower contingent fee. These results are summarized below.

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[18] In the next sub-section we modify this assumption to account for allowing transfers; we discuss the effect of relaxing these assumptions in Section 6.

Proposition 1. Under full information, Assumptions 1 - 4, and the restriction that F is zero, the first lawyer visited will demand the contingent fee rate $\alpha^L(A)$ to represent the client; $\alpha^L(A) \in (\alpha^C(A), 1)$, where $\alpha^L(A)$ satisfies equation (1). The client will accept this demand: there is no second search in equilibrium. Furthermore, $d\alpha^L(A)/dA < 0$ for all $A \in [\underline{A}, \bar{A}]$. For any given value of A, in equilibrium the client's payoff is $\Pi^C(\alpha^L(A), A) - s = \Pi^C(\alpha^C(A), A) - 2s$, while the lawyer's payoff is $\Pi^L(\alpha^L(A), A)$. Finally, since $\alpha^L(A) < 1$, the lawyer exerts an inefficient level of effort in the continuation game.
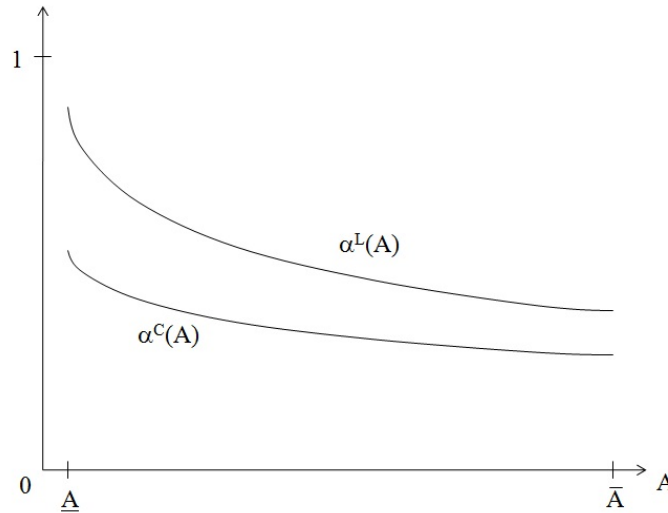

Figure 1: Equilibrium Contingent Fee Rates when F = 0

An example

As an example of the results of the full-information analysis, assume that $p(x) = \lambda x^\theta$, where $0 < \theta < 1$ and $\lambda > 0$. This function satisfies Assumption 1, except that a further parameter restriction is needed to guarantee that $p^L(\alpha, A) \leq 1$ for all α and A: $\bar{A} \leq (w/\theta)(\lambda^{-1/\theta})$. Then the lawyer's continuation payoff (that is, his payoff assuming the subgame-perfect choice of effort) is $\Pi^L(\alpha, A) = (w(1 - \theta)/\theta)(\alpha A\lambda\theta/w)^{1/(1 - \theta)}$ while the client's payoff is $\Pi^C(\alpha, A) = (1 - \alpha)A\lambda(\alpha A\lambda\theta/w)^{\theta/(1 - \theta)}$. In the Appendix we verify that this example satisfies Assumptions 2 and 3 and show that the client's most-preferred value of α is $\alpha^C(A) = \theta$ for all $A \in [\underline{A}, \bar{A}]$. Thus, the client always wants the lawyer to have the contingent fee $\alpha = \theta$, independent of the value of A; that is, $d\alpha^C(A)/dA = 0$.

Under full information, if the client obtains two options, then the lawyers will compete for her case.

In this event, the equilibrium "bid" is the one the client most-prefers; that is, $\alpha^C(A) = \theta$ for all $A \in [\underline{A}, \bar{A}]$. So the client's continuation value after obtaining two options is given by $\Pi^C(\alpha^C(A), A) = \Pi^C(\theta, A)$. The first lawyer consulted is therefore able to charge $\alpha = \alpha^L(A)$ such that $\Pi^C(\alpha^L(A), A) = \Pi^C(\theta, A) - s$. Although this equation could be solved explicitly for $\alpha^L(A)$, this does not yield much insight. However, we do know that the example satisfies Assumptions 2 and 3, and therefore $d\alpha^L(A)/dA < 0$: in equilibrium, higher-value cases (that is, cases with higher values of A) are contracted at lower contingent fees.

4.2 Full-Information Equilibrium when F is Unconstrained

Returning to the more general model, we now turn to the full-information game wherein F is not constrained to be 0. Thus, demands by lawyers to represent a client are of the form (α, F). In step 6 of the game, the client has expended a second search cost and obtained a second option. Then, after searching a second time and initiating the auction, she would obtain a payoff of $\Pi^C(\alpha^*, A) + F^*$, where $(\alpha^*, F^*) = (1, \Pi^L(1, A))$. This holds since (in the auction) both lawyers would choose to bid the maximum amount to the client, which is obtained by first maximizing the profit from the case (i.e., setting $\alpha^* = 1$), and then offering the entire amount to the client (that is, setting $\Pi^L(1, A) - F^* = 0$). If the auction is held, then each lawyer bids the full profit from the case and obtains the right to the case with probability ½; this is the familiar result from principal-agent theory (when both parties are risk neutral and there is moral hazard) that the principal should sell the firm to the agent, even though (as discussed earlier) the client in our analysis is not a principal: she cannot commit to a contract *ex ante* to the bargaining/search process. As in the contingent-fee-only case, L2 could simply make the demand $(1, \Pi^L(1, A))$, which the client would be willing to accept. This demand leaves L2 with no profit, as does the auction, so there is no difference in the equilibrium payoffs to any player between these two continuation games following two searches.

Thus, if the client were to expend s and get a second option, she would obtain (ignoring search costs) $F^* = \Pi^L(1, A)$. Therefore, upon visiting L1, this lawyer quotes an offer of (α_1, F_1) such that the client is just willing to accept it rather than visit L2. Such an offer must satisfy a version of equation (1) above, now

modified to reflect the presence of transfers:

$$\Pi^C(\alpha_1, A) + F_1 = \Pi^C(1, A) + F^* - s. \tag{2}$$

L1 chooses (α_1, F_1) to maximize $\Pi^L(\alpha_1, A) - F_1$ subject to equation (2). Substituting from equation (2) yields

that L1 chooses α_1 to maximize $\Pi^L(\alpha_1, A) + \Pi^C(\alpha_1, A) - \Pi^C(1, A) - F^* + s$. Since $F^* = \Pi^L(1, A)$, only the first

two terms are a function of α_1, and the maximum is obtained at $\alpha_1 = 1$. Thus, the solution is that $(\alpha_1, F_1) =$

$(1, \Pi^L(1, A) - s)$, so that $\Pi^C(\alpha_1, A) + F_1 = 0 + \Pi^L(1, A) - s$. That is, after paying the cost s to visit L1, the client

obtains (ignoring the first search cost) $\Pi^L(1, A) - s$ and L1 obtains s. The following proposition provides the

details for this case and obtains under a weakening of Assumption 4:

Assumption 4'. $\Pi^L(1, \underline{A}) - 2s \geq 0$.

This weakening of Assumption 4 reflects the fact that lawyers may now bid the contingent fee to 1 and

redistribute all their profits to the client.

> **Proposition 2.** Under full information, Assumptions 1 and 4', and allowing (α, F) to be chosen by
> the lawyer, the equilibrium demand made by the first lawyer visited satisfies equation (2)
> and is $(1, \Pi^L(1, A) - s)$; there is no second search in equilibrium. In equilibrium, the client's
> overall payoff is $\Pi^L(1, A) - 2s$ and the first lawyer visited obtains s. Finally, the lawyer who
> obtains the case exerts the efficient level of effort.

5. Asymmetric-Information Analysis

We now consider the problem when the lawyer is more informed about the value of the case (the

expected award, A), than is the client. In particular, we assume that when the client visits a lawyer and

describes her case, the lawyer learns (receives a private signal of) the case's expected value A. The client

knows only the prior distribution of A, denoted H(A), with density $h(A) > 0$ on $[\underline{A}, \bar{A}]$. When the lawyer

demands (α, F) to represent the client, the client infers that $A = B(\alpha, F)$; that is, the function $B(\bullet,\bullet)$ represents

the client's beliefs about A. Because we focus on a separating equilibrium, we assume that the beliefs

associate a single value of A with any given demand (α, F).[19]

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[19] Standard refinements, such as the one we will use below (D1), typically select the Pareto optimal separating
equilibrium when there are multiple (and possibly pooling) equilibria; see Cho and Kreps (1987).

As before, we first consider the traditional contract, with demands of the form $(\alpha, 0)$; in this case, we take beliefs to be $B(\alpha)$, suppressing the $F = 0$ term. As indicated earlier, there are two possible types of equilibrium after the client has searched twice, one in which the client actually conducts the auction and one in which L2 makes a demand that the client accepts. In the text we will provide the details of the model assuming the second type of equilibrium, while the details of the model assuming the first type of equilibrium are provided in a separate Technical Appendix. While the client's equilibrium probability of search is somewhat different under these two alternatives, the lawyer's (L1's) separating equilibrium demand function is the same. Subsequently, we consider what would happen if lawyers could make demands for their services of the form (α, F) with F not restricted to be zero.

5.1 Asymmetric-Information Equilibrium when $F = 0$

Here all the demand and bidding activity focuses on the contingent fee α. Given the results from the full-information analysis, there is an incentive for L1 to make a high demand so as to suggest to the client that A is low (even if it is not); if the client were to blindly accept this, then L1 would be able to inflate his revenue over what it would have been in the full-information setting. Thus, the model reflects the policy concern that the expert might mislead the lay person into accepting a poorer deal than she would have been able to strike if she had been fully informed. Of course, in the separating equilibrium the client does not accept the lawyer's demand blindly, and in the separating equilibrium the true expected value A is revealed.

In this scenario, the client visits a first lawyer, informs him that he is L1, and discloses the details of her case. Having been offered the contingent fee α by L1, the client believes that the expected value of her case is $B(\alpha)$. If she consults a second lawyer and again discloses the details of her case, we assume that she can demonstrate to him that he is L2, and that L1 demanded α. Thus, L2 also knows that the client believes that the expected value of her case is $B(\alpha)$. We assume that the client engages in no further updating of beliefs so that, regardless of what L2 demands, she continues to believe that her case has expected value

$B(\alpha)$.[20] If L2 demands anything except $\alpha^C(B(\alpha))$, then C will initiate the auction and the lawyers will both

bid $\alpha^C(B(\alpha))$ because that is what they think will most appeal to C; however, if L2 demands $\alpha^C(B(\alpha))$, then

the client is willing to forego the auction and accept L2's demand. Note that, for the power-function model

used in Section 3, $\alpha^C(A) = \theta$ for all values of A, so C most prefers $\alpha = \theta$ <u>independent of her beliefs</u>.

The client expects that, if she searches again, she will obtain a payoff of $\Pi^C(\alpha^C(B(\alpha)), B(\alpha))$ - s. Her

expected payoff if she rejects the demand α with probability r (and searches again) is:

$$(1 - r)\Pi^C(\alpha, B(\alpha)) + r[\Pi^C(\alpha^C(B(\alpha)), B(\alpha)) - s].$$

The client will accept the demand by L1 of α if $\Pi^C(\alpha, B(\alpha)) > \Pi^C(\alpha^C(B(\alpha)), B(\alpha))$ - s and reject the demand

α if $\Pi^C(\alpha, B(\alpha)) < \Pi^C(\alpha^C(B(\alpha)), B(\alpha))$ - s. She will be indifferent between accepting and rejecting the demand

α if $\Pi^C(\alpha, B(\alpha)) = \Pi^C(\alpha^C(B(\alpha)), B(\alpha)) + s$; in this event she will be willing to randomize between the

strategies of accepting the demand of α and rejecting it in favor of seeking a second option. Randomizing

is the means by which she can induce the types of lawyers to reveal themselves (that is, for the first lawyer's

demand to reveal the expected value of the case).

From L1's point of view, the client will be using a rejection strategy that depends on the contingent

fee he quotes: $r(\alpha)$. Anticipating that L2 will demand $\alpha^C(B(\alpha))$ and the client will accept this demand, L1

will only obtain C's case if she does not reject his demand in favor of a second search. Thus, L1's payoff

from this interaction with C is simply $(1 - r(\alpha))\Pi^L(\alpha, A)$; although this lawyer will also obtain some cases for

which he is L2, his contingent fee in those cases will be $\alpha^C(B(\alpha'))$, where α' is the demand made by some

other lawyer, whose client did not accept it.

We are interested in a separating equilibrium, which consists of a rejection function $r(\alpha)$ that

maximizes C's expected payoff, given her beliefs $B(\alpha)$, and a demand function that maximizes L1's expected

payoff, given the rejection function employed by C. As will be shown below, the demand function will again

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[20] This assumption gives L1 even more influence, which seems appropriate since our goal is to investigate how the client's search behavior can restrain L1's ability to use market power and private information to extract rent from the client. To our knowledge, there is no game-theoretic literature that addresses the sequential acquisition of knowledge from the type of interested parties modeled in this paper.

be $\alpha^L(A)$. Finally, C's beliefs must be correct in equilibrium; that is, $B(\alpha^L(A)) = A$ for all $A \in [\underline{A}, \bar{A}]$. Note that the rejection function and beliefs must be defined for all $\alpha \in [0, 1]$, not just for equilibrium values of α.

In a separating equilibrium the following observations must hold. First, there will be a smallest and a largest contingent fee, denoted by $\underline{\alpha}$ and $\bar{\alpha}$, respectively. Second, the function $r(\alpha)$ must be increasing on $(\underline{\alpha}, \bar{\alpha})$; that is, the client must reject higher contingent fee offers with a higher probability since to do otherwise would invite mimicry and pooling. Third, since $r(\alpha)$ must be increasing on $(\underline{\alpha}, \bar{\alpha})$, it must be interior (i.e., $r(\alpha) \in (0, 1)$) on $(\underline{\alpha}, \bar{\alpha})$.

Fourth, this last point implies that the client must be made indifferent about searching again. Indifference implies that α must satisfy $\Pi^C(\alpha, B(\alpha)) = \Pi^C(\alpha^C(B(\alpha)), B(\alpha)) - s$. That is, there is a function $\alpha^0(A)$, such that $\Pi^C(\alpha^0(A), B(\alpha^0(A))) = \Pi^C(\alpha^C(B(\alpha^0(A))), B(\alpha^0(A)))) - s$. Consistency of beliefs requires that $B(\alpha^0(A)) = A$, so that the indifference requirement is that:

$$\Pi^C(\alpha^0(A), A) = \Pi^C(\alpha^C(A), A) - s,$$

but this means that $\alpha^0(A)$ is identically equal to $\alpha^L(A)$. In other words, the full-information contingent-fee demand function, $\alpha^L(A)$, is also the separating equilibrium contingent-fee demand function. Since $\alpha^L(A)$ is downward-sloping, it provides the implied values of $\underline{\alpha}$ and $\bar{\alpha}$: $\underline{\alpha} = \alpha^L(\bar{A})$ and $\bar{\alpha} = \alpha^L(\underline{A})$. Fifth, the function $r(\alpha)$ must be continuous on $[\underline{\alpha}, \bar{\alpha})$, and continuous from the left at $\bar{\alpha}$. To see this, suppose to the contrary that there is a jump at some α in this interval; note that any jump must be upward since $r(\alpha)$ is increasing. But then type $A = (\alpha^L)^{-1}(\alpha)$ would prefer to cut his demand infinitesimally to gain a discrete reduction in the probability of rejection, which contradicts the fact that $\alpha^L(A)$ is the equilibrium contingent-fee offer function. Note that upward jumps to the right of $\bar{\alpha}$ are not ruled out and will, indeed, be part of the equilibrium. Finally, regardless of out-of-equilibrium beliefs, $r(\alpha) = 0$ for $\alpha^C(\bar{A}) \leq \alpha < \underline{\alpha}$ and $r(\alpha) = 1$ for $\alpha > \bar{\alpha}$. Since $r(\alpha)$ is continuous at $\underline{\alpha}$, it follows that $r(\underline{\alpha}) = 0$; this provides a boundary condition for the equilibrium rejection function.

Differentiating L1's payoff with respect to α yields the following first-order condition:

$$-r'(\alpha)\Pi^L(\alpha, A) + (1 - r(\alpha))\Pi^L_1(\alpha, A) = 0.$$

Substituting $A = B(\alpha)$ yields the differential equation $-r'(\alpha)\Pi^L(\alpha, B(\alpha)) + (1 - r(\alpha))\Pi^L_1(\alpha, B(\alpha)) = 0$. The solution through the boundary condition $r(\underline{\alpha}) = 0$ is:

$$r(\alpha) = 1 - \exp\left\{-\int [\Pi^L_1(t, B(t))/\Pi^L(t, B(t))]dt\right\}, \text{ where the integral is over } [\underline{\alpha}, \alpha]. \tag{3}$$

This rejection function, along with the demand function $\alpha^L(A)$, provides a <u>candidate</u> for a separating equilibrium; it remains to verify that each of these components is a best response to the other. The following condition is sufficient to ensure that $\alpha^L(A)$ is the unique best response to $r(\alpha)$ as specified in equation (3); see the Appendix for the details of the verification.

Assumption 5. $\Pi^L_1(\alpha, A)/\Pi^L(\alpha, A)$ is strictly decreasing in A for fixed α.

Again, due to the complexity of the continuation game involving effort choice by the lawyer, we cannot prove that Assumption 5 will hold for arbitrary $p(x)$ functions; however, it does hold for our previously-mentioned examples $p(x) = x/(1 + x)$ and $p(x) = 1 - e^{-\lambda x}$, for $\lambda > 0$. Moreover, while this ratio is constant in A for the power-function example $p(x) = \lambda x^\theta$, where $0 < \theta < 1$ and $\lambda > 0$, it is straightforward to show that $(\alpha^L(A), r(\alpha) = 1 - (\underline{\alpha}/\alpha)^{1/(1 - \theta)})$ is the unique separating equilibrium outcome (in which C accepts L2's offer rather than initiating the auction).

To summarize, L1's demand function in the asymmetric-information setting (with $F = 0$) is the same as in the corresponding full-information setting; the difference between the two analyses is that in the asymmetric-information setting the client employs a mixed strategy to provide incentives for types to separate. This means that, in equilibrium, a client seeks a second option a fraction of the time that she obtains a first option. Therefore, while the client's payoff is the same as under full information, the lawyer's payoff is actually lower. All of this is more formally stated for the general probability function satisfying Assumption 1 in the following proposition.

Proposition 3. Under Assumptions 1-5, incomplete information, and the restriction that F is zero,

the first lawyer visited will demand the contingent fee rate $\alpha^L(A)$ to represent the client; $\alpha^L(A) \in (\alpha^C(A), 1)$, where $\alpha^L(A)$ satisfies equation (1). In equilibrium, the client will accept this demand with probability $1 - r(\alpha^L(A))$, where $r(\alpha)$ is defined in equation (3); thus, there is a second search with probability $r(\alpha^L(A))$. Since r is increasing in α and α^L is decreasing in A, then the equilibrium likelihood of rejection is decreasing in A. For a given A, in equilibrium the client's overall payoff is the same as under full information, $\Pi^C(\alpha^C(A), A)$ - 2s, while L1's payoff is $(1 - r(\alpha^L(A)))\Pi^L(\alpha^L(A), A)$, which is less than was obtained under full information. As was true in the full-information model, since $\alpha^L(A) < 1$, the lawyer exerts an inefficient level of effort in the continuation game; L1 exerts $x^L(\alpha^L(A), A)$ in effort while L2 exerts $x^L(\alpha^C(A), A) < x^L(\alpha^L(A), A)$ in effort. Thus, the lawyer exerts (on average) yet less effort under asymmetric information than under full information.

As indicated in the Introduction, we find that the client is no worse off than under full information, while the lawyer is worse off due to the need to deal with the distortion introduced by revelation under incomplete information. In this case, the distortion shows up in the increased use by the client of search, not in the actual demands made. Of course, one important difference (as observed above) is that the distribution of contracts in the market for lawyers now involves two points for the same expected case-value A: a fraction $(1 - r(\alpha^L(A)))$ of the contracts will be at a contingent fee of $\alpha^L(A)$, while the rest will be at $\alpha^C(A)$.

5.2 Asymmetric-Information Equilibrium when F is Unconstrained

We now consider the more general problem when the lawyers can make demands of the client in terms of an (α, F) pair. Unfortunately, the solution to the general continuous-type problem generates a pair of equations defining the equilibrium rejection function that we have, thus far, been unable to fully solve. In order to get a basic intuition for the problem and its likely characteristics, we provide a two-type analysis; more precisely, we provide some of the basic intuition in the continuum-type setting (when that provides a better perspective), but resort to the two-type model in order to demonstrate the effect of incomplete information on the equilibrium of the game.[21] We will also briefly report results for a three-type analysis which relies upon the earlier power-function model of the probability of a win at trial; this should provide some further intuition.

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[21] For a previous analysis of one-dimensional private information being signaled with two instruments, see Milgrom and Roberts (1986), who consider a monopolist using price and advertising expenditure as signals of product quality (which can be either high or low). Also, see Lutz (1989) for a model that uses warranties and prices to signal quality to consumers.

Thus, formally, we assume that the client's case can take on two possible values, $\underline{A} > 0$ and $\bar{A} > \underline{A}$; we later describe the relationship between the two possible case types and the search cost, s. Let $B(\alpha_1, F_1)$ be the client's belief if the first lawyer visited demands (α_1, F_1); such a demand would yield a perceived payoff to the client (ignoring her initial search cost) of $\Pi^C(\alpha_1, B(\alpha_1, F_1)) + F_1$. After expending a second search cost s and visiting a second lawyer, the client expects that she can fully extract the profit from the case. This is because if the client initiates the auction she can use the decision rule of simply accepting the highest transfer bid (and accepting each lawyer with probability ½ if the proposed transfers are equal). The two lawyers will bid up the contingent fee to 1 in order to maximize the amount of available profit and then offer that entire profit as a transfer. Thus, the client expects that visiting the second lawyer and initiating the auction to represent her will net $\Pi^L(1, B(\alpha_1, F_1)) - s$. Alternatively, L2 could simply demand $(1, \Pi^L(1, B(\alpha_1, F_1)))$ and the client could accept it. Notice that L2 makes zero under this demand and he also makes zero if the auction is initiated; moreover, the payoffs of L1 and C are also unaffected, so it does not matter which continuation equilibrium we use (the one in which the auction is conducted or the one in which L2 makes a pre-emptive offer).

First, we turn to characterizing the beliefs. As in the full-information F-unrestricted analysis, the first lawyer visited will make a demand that makes the client indifferent between accepting the demand and seeking a second option. For any value of the case, A, that indifference is captured by the equation:

$$\Pi^C(\alpha, A) + F = \Pi^L(1, A) - s.$$

Thus, the client's indifference curve for values of α and F and for any believed value of A (denoted as U(A)) is defined as:

$$U(A) = \{(\alpha, F) \mid F = \Pi^L(1, A) - s - \Pi^C(\alpha, A)\}.$$

Alternatively put, U(A) provides the values of α and F that induce a belief that the case value is A. Let $\varphi(\alpha, A) \equiv \Pi^L(1, A) - s - \Pi^C(\alpha, A)$, so that $(\alpha, \varphi(\alpha, A)) \in U(A)$. Two indifference curves for arbitrary levels of A (A' and A'', with $\underline{A} \leq A' < A'' \leq \bar{A}$), are illustrated in Figure 2. While the indifference curves are illustrated
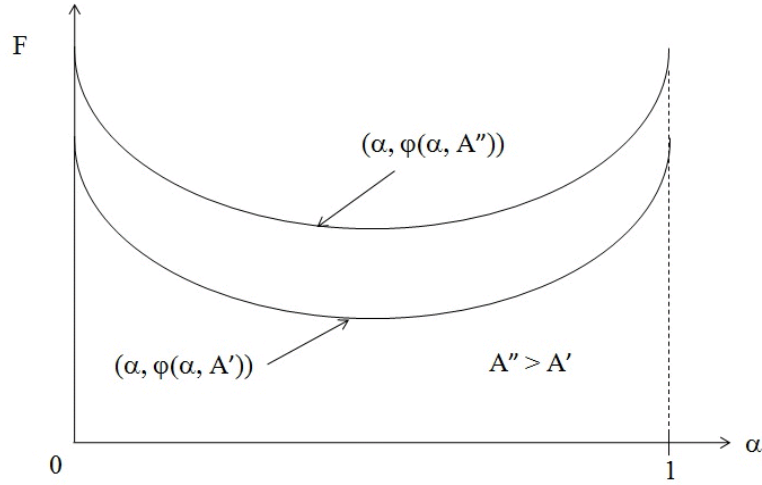
Figure 2: Examples of Client Indifference Curves

as being convex, symmetric, and parallel shifts of one-another, this is not a necessary property. However, the same F-value occurs when $\alpha = 0$ or $\alpha = 1$, and the function first decreases, reaching a minimum at $\alpha^C(A)$, and then increases thereafter.

Returning to the incomplete-information analysis, in a separating equilibrium beliefs should be consistent; that is, if the expected value of the case is A then the associated equilibrium (α, F) pairs should yield the belief $B(\alpha, F) = A$ when $F = \varphi(\alpha, A)$. More precisely, if $\alpha^*(A)$ is part of an equilibrium demand $(\alpha^*(A), \varphi(\alpha^*(A), A))$, then in equilibrium beliefs are consistent if:

$$B(\alpha^*(A), \varphi(\alpha^*(A), A)) = A \text{ for all A.}$$

We make the following general assumption, and then provide the two-type application of it.

Assumption 6: $\varphi(\alpha, A)$ is increasing in A for all $\alpha \in [0, 1]$. Equivalently, $\Pi^L(1, A) - \Pi^C(\alpha, A)$ is increasing in A for all $\alpha \in [0, 1]$.

The economic intuition behind this assumption is as follows. For any value of A, $\Pi^L(1, A)$ is the value of the maximum joint (full information) payoff to the lawyer and client, since the transfer F nets out and the resulting joint payoff, $\Pi^L(\alpha, A) + \Pi^C(\alpha, A)$, is maximized when $\alpha = 1$. In general, then: $\Pi^L(1, A) - \Pi^C(\alpha, A)$ > 0 for all α. Assumption 6 asserts that this difference is increasing in A. Referring again to Figure 2, this implies that $U(A') \cap U(A'') = \emptyset$ if $A' \neq A''$; that is, the client's indifference curves never cross. This

assumption is easily verified to hold for the three specific p(x) functions introduced in subsection 4.1.

Figure 2 also illustrates the two indifference curves for the two-type model, by letting $A'' = \bar{A}$ and A' = $\underline{A}$, and can be used to understand the two-type separating equilibrium. Since $\bar{A}$ would prefer to be taken to be $\underline{A}$, C should be skeptical about demands between the $U(\bar{A})$ and $U(\underline{A})$ loci. Specifically, C's beliefs are that $B(\alpha, F) = \bar{A}$ for all (α, F) such that $F > \varphi(\alpha, \underline{A})$ and $B(\alpha, F) = \underline{A}$ otherwise. In other words, the client is not persuaded that $A = \underline{A}$ unless L1's demand is on or below $U(\underline{A})$. In a separating equilibrium, along the top curve (that for $\bar{A}$), the client's best response is to accept the demand (α_1, F_1) from the first lawyer with probability one. One of the points on this curve is the separating equilibrium first-visit demand made by the lawyer of type $\bar{A}$. Of course, any (α, F) above this curve would also be accepted with certainty by the client, as it would provide her with a yet higher payoff, but any such point would reduce L1's profits. The lawyer with a case of type $\underline{A}$ will choose a point from the lower curve but, as we will see, all points along that curve will be met with an appropriate probability of rejection by the client so as to deter mimicry by the higher type. Demands in the region between the curves will be rejected with probability one (based on the belief that they are coming from the type $\bar{A}$) while points below the lowest curve will also be rejected with probability one (independent of the client's beliefs).

Formally, the incentive compatibility conditions for the two types, denoted as $IC(\bar{A})$ and $IC(\underline{A})$, require that each type of lawyer is at least as well off by making a demand along its associated U-curve, rather than the best choice it can make along the other type's curve that induces an alternative belief by the client, when the client rejects a demand of (α, F) with probability $r(\alpha, F)$:

$IC(\bar{A})$: $\max_{(\alpha, F) \in U(\bar{A})} (1 - r(\alpha, F))(\Pi^L(\alpha, \bar{A}) - F) \geq (1 - r(\alpha, F))(\Pi^L(\alpha, \bar{A}) - F)$ $\quad\quad \forall (\alpha, F) \in U(\underline{A})$;

$IC(\underline{A})$: $\max_{(\alpha, F) \in U(\underline{A})} (1 - r(\alpha, F))(\Pi^L(\alpha, \underline{A}) - F) \geq (1 - r(\alpha, F))(\Pi^L(\alpha, \underline{A}) - F)$ $\quad\quad \forall (\alpha, F) \in U(\bar{A})$.

In a separating equilibrium, when $A = \bar{A}$, then $r(\alpha, \varphi(\alpha, \bar{A})) = 0$; since $\bar{A}$ is the "weakest" type which no other type wishes to mimic, a demand that is consistent with type $\bar{A}$ can be accepted for sure. Thus, the left-hand-side of $IC(\bar{A})$ reduces to finding α that (after substituting in for $\varphi(\alpha, \bar{A})$) maximizes $\Pi^L(\alpha, \bar{A}) - \Pi^L(1,$

$\bar{A}) + s + \Pi^C(\alpha, \bar{A})$. This maximum occurs at $\bar{\alpha} = 1$, so that the high type demands $(\bar{\alpha}, \varphi(\bar{\alpha}, \bar{A})) = (1, \Pi^L(1, \bar{A}) - s)$, yielding a profit to L1 of s. Thus, IC($\bar{A}$) simplifies to:

$$s \geq (1 - r(\alpha, \varphi(\alpha, \underline{A})))(\Pi^L(\alpha, \bar{A}) - \varphi(\alpha, \underline{A})) \quad \forall \, \alpha \in [0, 1].$$

That is, the problem is to keep the weak type ($\bar{A}$) from mimicking the strong type ($\underline{A}$); this is accomplished by rejecting demands along U($\underline{A}$) with sufficient frequency (r($\alpha, \varphi(\alpha, \underline{A})$)) so as to make mimicry unprofitable for the weak type. Notice that not all α-values on U($\underline{A}$) require a positive probability of rejection, but this is required for $\alpha = 1$.

In a similar manner, IC($\underline{A}$) can be re-expressed as:

$$\max_\alpha (1 - r(\alpha, \varphi(\alpha, \underline{A})))(\Pi^L(\alpha, \underline{A}) - \Pi^L(1, \underline{A}) + s + \Pi^C(\alpha, \underline{A}))$$

$$\geq \Pi^L(\alpha, \underline{A}) - \Pi^L(1, \bar{A}) + s + \Pi^C(\alpha, \bar{A}) \quad \forall \alpha \in [0, 1].$$

We next show that in a separating equilibrium, IC($\underline{A}$) is slack as long as s is not too large. To see this, let $\hat{\alpha}$ maximize $\Pi^L(\alpha, \underline{A}) - \Pi^L(1, \bar{A}) + s + \Pi^C(\alpha, \bar{A})$ for fixed s. Notice that $\hat{\alpha} < 1$ since were $\hat{\alpha}$ equal to one we would need to have $\Pi_1^L(1, \underline{A}) + \Pi_1^C(1, \bar{A}) = 0$, but since $\Pi_1^C(1, \bar{A}) = - \Pi_1^L(1, \bar{A})$ and $\Pi_1^L(1, \bar{A}) > \Pi_1^L(1, \underline{A})$, it cannot be that $\hat{\alpha} = 1$. Thus, $\hat{\alpha} < 1$; moreover, $\hat{\alpha}$ is independent of s, so let

$$\hat{s} \equiv \Pi^L(1, \bar{A}) - (\Pi^L(\hat{\alpha}, \underline{A}) + \Pi^C(\hat{\alpha}, \bar{A})).$$

Then the right-hand-side of IC($\underline{A}$) is non-positive for all $s < \hat{s}$. As long as r($\alpha, \varphi(\alpha, \underline{A})$) is less than 1, the left-hand-side of IC($\underline{A}$) can always be made to be positive by an appropriate choice of α, so that the incentive constraint IC($\underline{A}$) is always slack. Moreover, from Assumption 6 it is straight-forward to show that $d\hat{s}/d\bar{A} > 0$ and that $d\hat{s}/d\underline{A} < 0$, so that an increase in $\bar{A} - \underline{A}$ allows an increase in the upper bound on the allowable values of s such that we are guaranteed that IC($\underline{A}$) is always slack. Thus, the economic intuition is that when search costs are not too large the strong type does not have an incentive to mimic the weak type. The assumption that $s < \hat{s}$ is overly strong but expositionally convenient.

Combining these two results provides a set of possible rejection functions for the client, each of which (with the beliefs as specified earlier) supports a separating equilibrium. Figure 3 illustrates this set of
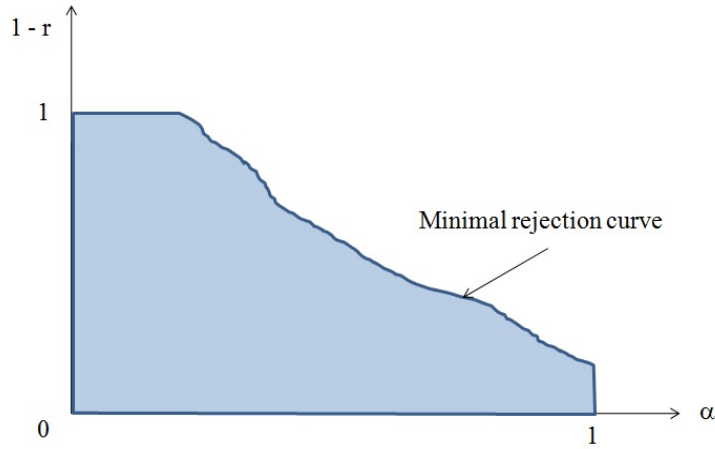
Figure 3: Alternative Equilibrium Rejection Probabilities

functions (expressed in terms of the probability of acceptance, 1 - r). Note that any selection (that is, a function selected so that its graph is entirely in the region of interest) will satisfy the IC constraints, but the function represented by the upper boundary of the set will provide the one that yields separation with the least amount of rejection (search). This selected rejection function is most-preferred by the $\underline{A}$-type lawyer; both the client and the $\bar{A}$-type lawyer are indifferent, making this selection the unique Pareto optimal rejection function.[22] It is found by taking IC($\bar{A}$) to be an equality which, upon solving, yields:

$$(1 - r(\alpha, \varphi(\alpha, \underline{A})) = s/(\Pi^L(\alpha, \bar{A}) - \varphi(\alpha, \underline{A}))$$

$$= s/(\Pi^L(\alpha, \bar{A}) - \Pi^L(1, \underline{A}) + s + \Pi^C(\alpha, \underline{A})). \tag{3}$$

Using this on the left-hand-side of IC($\underline{A}$) and solving the optimization problem thereby provides the $\underline{A}$-type's demand ($\underline{\alpha}^*$, $\varphi(\underline{\alpha}^*, \underline{A})$). Thus, type $\underline{A}$ can be viewed as choosing α so as to solve:

$$\text{maximize}_\alpha \ s[\Pi^L(\alpha, \underline{A}) - \Pi^L(1, \underline{A}) + s + \Pi^C(\alpha, \underline{A})]/[\Pi^L(\alpha, \bar{A}) - \Pi^L(1, \underline{A}) + s + \Pi^C(\alpha, \underline{A})].$$

As shown in the Appendix, $\underline{\alpha}^*$ is less than 1, so that the $\underline{A}$-type lawyer demands a contingent fee less than 1 and offers an up-front payment of $\varphi(\underline{\alpha}^*, \underline{A}) = \Pi^L(1, \underline{A}) - \Pi^C(\underline{\alpha}^*, \underline{A}) - s < \Pi^L(1, \underline{A}) - s = \varphi(1, \underline{A})$. That is, the $\underline{A}$-type lawyer demands a compensation package (α_1, F_1) both of whose elements are less than what

---

[22] The equilibrium strategies using this selected rejection function provide the unique separating equilibrium outcome that survives refinement using D1 (see Cho and Kreps, 1987). This is discussed in the Technical Appendix.

obtains in the full-information equilibrium. We note that (as can be seen in Figure 3) it is possible that $\underline{\alpha}$ is

such that $1 - r = 1$ (though it cannot be to the left of this kink[23]).

To make more headway, let us re-consider the power-function probability model[24] discussed in the

earlier $F = 0$ analysis. Assuming that $\underline{\alpha}^*$ is to the right of the kink noted above, it can be shown that $\underline{\alpha}^* = (1 -$

$s/[(1 - \theta)z\underline{A}^{1/(1 - \theta)}])^{(1 - \theta)/\theta}$, where $z = \lambda^{1/(1 - \theta)}(\theta/w)^{\theta/(1 - \theta)}$ (see the Appendix), and that $\underline{\alpha}^*$ is increasing in $\underline{A}$ and

decreasing in w. Thus, if the least valuable case increases in value, then the first lawyer visited will propose

taking a larger share, while if (instead) the cost of a lawyer's time increases, he will propose a lower share.

As will be discussed in more detail below for the general two-type case, an increase in s reduces $\underline{\alpha}^*$.

Proposition 4 summarizes the equilibrium for the full (α, F), two-type case with a probability model

which satisfies Assumptions 1 and 4'.

> **Proposition 4.** In the two-type case, with $\bar{A} > \underline{A}$ and $s < \hat{s}$, a separating equilibrium which employs
> the Pareto-optimal rejection function is as follows:
>
> a) If $A = \bar{A}$, then the first lawyer visited demands $(\alpha_1, F_1) = (1, \Pi^L(1, \bar{A}) - s)$ and the client
> accepts with certainty. In equilibrium C's overall payoff is $\Pi^L(1, \bar{A}) - 2s$ while the L1's
> payoff is s, and L2's payoff is zero. Since L1 buys the case from C, L1's effort is efficient.
>
> b) If $A = \underline{A}$, then the first lawyer visited demands $(\alpha_1, F_1) = (\underline{\alpha}^*, \varphi(\underline{\alpha}^*, \underline{A}))$ with $\underline{\alpha}^* < 1$ and
> $\varphi(\underline{\alpha}^*, \underline{A})$ as specified earlier, and the client rejects such a demand with probability
> $r(\underline{\alpha}^*, \varphi(\underline{\alpha}^*, \underline{A}))$. If the demand is rejected, the second lawyer is visited (at an additional
> search cost s), resulting in the equilibrium demand $(1, \Pi^L(1, \underline{A}))$, which the client accepts.
> In equilibrium the client's overall payoff is $\Pi^L(1, \underline{A}) - 2s$, L1's payoff is $(1 - r(\underline{\alpha}^*, \varphi(\underline{\alpha}^*,$
> $\underline{A})))(\Pi^L(\underline{\alpha}^*, \underline{A}) + \Pi^C(\underline{\alpha}^*, \underline{A}) - \Pi^L(1, \underline{A}) + s)$ and L2's payoff is again zero. Since L1 does not
> buy the case, he exerts too little effort.
>
> c) Beliefs that support this equilibrium are: $B(\alpha, F) = \bar{A}$ for all (α, F) such that $F > \varphi(\alpha, \underline{A})$
> and $B(\alpha, F) = \underline{A}$ otherwise.
>
> d) The client's rejection function is $r(\alpha, F) = 0$ if $F \geq \varphi(\alpha, \bar{A})$; $r(\alpha, \varphi(\alpha, \underline{A}))$ as given in
> equation (3) for $F = \varphi(\alpha, \underline{A})$; and is equal to one otherwise.

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[23] It cannot be an equilibrium for $\underline{\alpha}^*$ to be in the interior of the horizontal segment in Figure 3, since then it could be increased with no change in the client's response (or the $\bar{A}$-type lawyer's demand). This would increase $\underline{A}$'s payoff, contradicting the hypothesized optimality of $\underline{\alpha}^*$.

[24] This example can be extended to more (discrete) types following the same procedure (that is, assuming that higher types have an incentive to mimic lower types, but lower types do not have an incentive to mimic higher types). In the equilibrium, the contingent fee is monotonically increasing in A, reaching $\alpha = 1$ only for the highest type, $\bar{A}$.

The following comparative statics hold if $\underline{\alpha}^*$ is to the right of the kink discussed above; that is, if $r(\underline{\alpha}^*, \varphi(\underline{\alpha}^*, \underline{A})) < 1$ on the boundary of the set shown in Figure 3. It is straightforward to show that $d\underline{\alpha}^*/ds < 0$: an increase in the client's search cost means that the equilibrium contingent fee for an $\underline{A}$-type lawyer _falls_. This reflects both a direct and an indirect effect. The direct effect is that an increase in s makes a second search less attractive to C, but a lower likelihood of search increases the incentive for an $\bar{A}$-type lawyer to mimic the $\underline{A}$-type. The indirect effect is that the $\underline{A}$-type lawyer lowers his contingent fee, reducing the incentive for mimicry, thereby allowing the client to reduce her rejection rate for the resulting $\underline{A}$-type demand; that is, $dr(\underline{\alpha}^*, \varphi(\underline{\alpha}^*, \underline{A}))/ds < 0$.

6. Welfare Implications

There are two aspects of the model that have important effects on welfare, where welfare is the sum of the payoffs for C, L1, and L2. These aspects reflect the presence of (limited) monopoly on the part of lawyers (captured in the model via the search cost, s) and the presence of asymmetries in information between the lawyers and the client. We consider these in turn, as both aspects produce unexpected results: 1) when F is restricted to be zero then increases in s may _improve_ welfare; and 2) shifting from a no-transfer system to an unrestricted transfer system may _reduce_ welfare. We will see that these results, while seemingly counterintuitive, are quite reasonable.

6.1 The Effect of Changes in the Search Cost on Welfare

In this section we hold the regime (F = 0 or F unrestricted) fixed and ask what happens when the search cost, s, changes. Asymmetric information has no effect on the direction of the impact of changes in s on welfare. To keep comparisons clear, we let W_j^i denote welfare under full or asymmetric information (i = FI or AI, respectively) and under F = 0 or F unrestricted (j = 0 or u, where u means "unrestricted"); thus, for example, social welfare in the F-unrestricted, full-information case would be denoted as W_u^{FI}. While these welfare measures are a function of A, we suppress this dependence for ease of exposition.

First, consider W_0^{FI}. Clearly, an increase in s reduces C's payoff in equilibrium, since it is $\Pi^C(\alpha^C(A),$ A) - 2s (see Proposition 1). However, notice that increasing s increases $\alpha^L(A)$, resulting in greater effort in the trial subgame, reducing the moral hazard problem in the contingent-fee-only scheme. Thus, there is a tradeoff here. Since $W_0^{FI} = \Pi^L(\alpha^L(A), A) + \Pi^C(\alpha^C(A), A) - 2s$, then it is straightforward to show that:

$$dW_0^{FI}/ds \gtrless 0 \text{ as } \Pi_1^L(\alpha^L(A), A)(\partial\alpha^L(A)/\partial s) \gtrless 2.$$

Both terms on the left are positive, for the reasons discussed earlier, so the issue is the magnitude of their product. In particular, $\partial\alpha^L(A)/\partial s = -1/\Pi_1^C(\alpha^L(A), A)$. As s becomes small, $\Pi_1^C(\alpha^L(A), A)$ becomes arbitrarily close to $\Pi_1^C(\alpha^C(A), A)$, which is zero by definition of $\alpha^C(A)$, so that $\partial\alpha^L(A)/\partial s$ becomes arbitrarily large. Thus, when s is "small" then $\Pi_1^L(\alpha^L(A), A)(\partial\alpha^L(A)/\partial s) > 2$, while if s is sufficiently large, then it can be shown that $\Pi_1^L(\alpha^L(A), A)(\partial\alpha^L(A)/\partial s) < 2$.[25] This means that when s is small, an increase in s improves welfare. This occurs because while C is hurt directly via an increase in s, the increased subgame efficiency from increasing $\alpha^L(A)$ overcomes this social loss and raises the payoffs from the subgame to both C and L1. However, since $\alpha^L(A) < 1$, the benefit via the subgame is diminishing, while the harm to C is linear in s.

Social welfare in the F = 0 case when there is asymmetric information is given by:

$$W_0^{AI} = W_0^{FI} - r^*(\alpha^L(A))(\Pi^L(\alpha^L(A), A) - \Pi^L(\alpha^C(A), A)).$$

The added complication is that one needs to find the effect of s on the second term above, which includes both the direct effect of s on r* as well as the indirect effect via $\alpha^L(A)$. This latter effect continues to dominate for small values of s and, while more tedious, a qualitative result similar to the full-information result emerges: when s is sufficiently small, an increase in s improves welfare W_0^{AI}. Again, the tradeoff is the direct impact of an increase of s on C (which is negative) versus the impact of s on the continuation game after contracting (which is positive and large for small s).

The full-information, F-unrestricted case is very easy. From Proposition 2, $W_u^{FI} = s + \Pi^L(1, A) - 2s$,

---

[25]   Note that the turning point, where the effect shifts from being welfare-enhancing to welfare-diminishing depends upon the details of the subgame. Thus, whether such a critical s value is ruled out by Assumption 4 (that two searches by C is credible) depends upon the probability model (p(x)) employed. If such a critical value of s does not satisfy Assumption 4, then welfare is always increasing in s for the relevant range of search cost.

so that it is immediate that $dW_u^{FI}/ds < 0$ for all s. This is because, under full information, the subgame always involves the efficient level of effort, so while lawyer L1 obtains s (L2 is never visited by this C), C's payoff declines at twice the rate that L1's increases.

Finally, in the computation of dW_u^{AI}/ds, the calculations are more tedious than in the full-information case, but the result is the same: $dW_u^{AI}/ds < 0$. To see this, first observe that when $A = \bar{A}$, as discussed in Proposition 4, this is the same as the full-information case. The complication arises in the $\underline{A}$-case, as now search occurs in equilibrium. However, L2's payoff is zero, so the expected social welfare value, W_u^{AI} can be written as:

$$W_u^{AI} = (\Pi^L(1, \underline{A}) - 2s) + \{(1 - r(\underline{\alpha}^*, \varphi(\underline{\alpha}^*, \underline{A})))(\Pi^L(\underline{\alpha}^*, \underline{A}) - \Pi^L(1, \underline{A}) + s + \Pi^C(\underline{\alpha}^*, \underline{A}))\}.$$

Recall that $\underline{\alpha}^*$ was found by maximizing the term in braces above with respect to α (see equation (3) above and the discussion following it). It is routine to show that while this term is increasing in s, that rate is less than 2, which is the rate at which the first term above decreases: the effect on W_u^{AI} is preponderantly via the direct loss to C's payoff, so once again $dW_u^{AI}/ds < 0$ for all s.

6.2 The Effect of Changes in the Compensation Scheme on Welfare

The effect of changing from the no-transfer to the unrestricted-transfer regime, while straightforward for the full-information case, is more complex for the asymmetric-information case. It is obvious that (using equation (1)):

$$W_0^{FI} = \Pi^L(\alpha^L(A), A) + \Pi^C(\alpha^C(A), A) - 2s$$

$$= \Pi^L(\alpha^L(A), A) + \Pi^C(\alpha^L(A), A) - s$$

$$< W_u^{FI} = \Pi^L(1, A) - s,$$

since $\alpha^L(A) < 1$ for all A, making $\Pi^L(\alpha^L(A), A) + \Pi^C(\alpha^L(A), A)$ always less than $\Pi^L(1, A)$.

When we turn to the asymmetric information case, since the F-unrestricted analysis is currently for two types, one must re-do the analysis of the $F = 0$ case[26] and then compare it with the F-unrestricted analysis.

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[26] This must be done since the correct answer to the two-type case when $F = 0$ is not found by simply evaluating the continuum-type case at the two types.

Again, as discussed in Proposition 4, when $A = \bar{A}$, the comparison is the same as in the full information case: $W_0^{AI} < W_u^{AI}$ for $A = \bar{A}$.

However, the comparison when $A = \underline{A}$ is much more complicated, so for this discussion we have numerically analyzed the power-function model from earlier $(p(x) = \lambda x^\theta)$, with the following parameter assumptions: 1) $\lambda = w = 1$; 2) $\theta = \frac{1}{2}$; 3) $\bar{A} = 2$; 4) $\underline{A} = 1$. The numerical results for this example show that when s is sufficiently small then $W_0^{AI} < W_u^{AI}$ but that for s sufficiently large (but still satisfying the credibility requirement[27] of Assumption 4) then $W_0^{AI} > W_u^{AI}$. This occurs because as s grows, it becomes more costly for C to search, and C optimally reduces the rejection probability in both compensations schemes. To maintain separation in the F-unrestricted scheme, the low-type of L1 must <u>reduce</u> α^* (and the associated equilibrium transfer $\varphi(\alpha^*, \underline{A})$) leading to reduced subgame efficiency when C does not reject the demand. On the other hand, in the no-transfer scheme, an increase in s allows L1 to demand a higher contingent fee, leading to greater subgame efficiency when C does not reject the demand.

Thus, if the initial distribution of types puts enough weight on the low type of A, and search costs are sufficiently high (but still allow credibility for C's use of search), then the expected welfare from the no-transfer policy will be greater than that from the unrestricted-transfer policy: the intuition we get from the principal-agent model does not carry over to the correct prediction for a portion of the parameter space when there is adverse selection during the contracting activity as well as moral hazard in the continuation game.

<u>6.3 Summary of Welfare Effects</u>

Proposition 5 summarizes our welfare results discussed above.

Proposition 5.

> 1) Under full information and under asymmetric information, increases in the search cost s are always welfare-reducing when F is unrestricted, but may be welfare-enhancing when F is restricted to be zero. In the no-transfer case, if search costs are high enough (but still satisfy the search credibility condition (1)), then increases in search costs will be welfare-reducing.

---

[27] Assumption 4 is employed instead of Assumption 4', since the latter assumption (which was for the unrestricted transfer case) is weaker and we are comparing the two regimes.

2) Under full information, unrestricted transfers are always socially preferred. When the lawyers have private information about the value of the case, then this may not hold: if the prior probability of the low type is sufficiency high, then when search costs are high enough a very simple counter-example shows that there can be greater inefficiency under unrestricted transfers than under restricted transfers.

These results paint an interesting picture. First, under the no-transfer scheme, search costs (while directly harming consumers) provide an indirect benefit to all parties: they improve the efficiency of the subgame. That is, some monopoly power helps redress the subgame moral hazard problem, and the fact that the search cost is exogenous acts as a device to bring about this reduction in social inefficiency in a manner that is not fully bargained away.

Second, the presence of asymmetric information complicates the policy question of shifting to an unrestricted-transfer scheme: it may reduce rather than enhance welfare. The problem here is the need for some of the agents (C and the low-type L1) to engage in wasteful distortion in order to induce separation.

7. Conclusions and Extensions

Three conclusions/implications can be drawn from the foregoing analysis. First, informational asymmetry appears to be less of a problem for clients than market power. It is the cost of search, which reflects market power on the part of the lawyers, that reduces the payoff to the client, not asymmetry of information. In the case of the traditional compensation scheme (no transfers), the lawyer's demands followed the same schedule under full as under asymmetric information; the inflation of the first lawyer's demand was fully attributable to the search cost. Furthermore, in the traditional setting, we found that reducing search costs may actually reduce welfare, as it reduces the incentives for effort in the trial subgame. On the other hand, when transfers were allowed, welfare is higher when search costs are reduced.

Second, allowing lawyers to make (α, F) demands under incomplete information about the value of the case will not result in the first lawyer demanding to buy the case except at the highest possible award $\bar{A}$. We draw this conclusion by observing that initial demands will generally involve an equilibrium value of α

which is less than one. This was shown in the two-type case for a general probability function, and this appears to extend to cases involving more (discrete) types; that is, $\alpha = 1$ only for the highest type. Since for all types except the highest type the client will search with positive probability, such search nets the client the best possible payoff (modulo having to search) of $\Pi^L(1, A)$. Of course, when the first lawyer offers to buy the case, it only occurs for the highest type and involves the maximum transfer to the client of $F = \Pi^L(1, \bar{A})$ - s. This further implies that the claim (often made in the law and economics literature) that allowing lawyers the option to buy a client's case necessarily will lead to the elimination of moral hazard over-estimates this effect. As we have shown, the presence of asymmetric information leads to this being (possibly) the comparatively rare outcome as it would only occur for cases that have the highest expected value or cases wherein clients "shop" a second time. More significantly, we found that the interplay of the lawyers' monopoly power and private information can result in lower welfare in the unrestricted-transfer equilibrium than in the corresponding no-transfer equilibrium (when search costs are high).

A third pair of implications concern some issues we have not addressed, but which (at least qualitatively) seem to be reflected in our equilibrium. It is possible that the informational asymmetry is two-sided: perhaps clients know relevant information. In this case, we should expect that wary lawyers will have less reason to buy the case outright, leading to further downward-pressure on the contingent-fee rates, which is qualitatively similar to our current result. It is also possible that lawyers might need the involvement of clients in the trial to come, but that comes automatically in our asymmetric-information analysis of the (α, F) case since, in contrast with the full-information version, α will generally be less than one in the equilibrium, meaning that clients continue to have a stake in the future of the case (unless they search for a second option, in which case they will be bought-out). Furthermore, as Shukaitis (1987, page 340) has observed, buy-out of a client reducing her incentive to provide needed future cooperation with the lawyer is probably not as critical as one might initially believe, as this can be dealt with through an appropriate contract so either way this particular concern seems to fade into the background.

Extensions

One important extension would be to allow for a third party, the "litigation-funder," as briefly mentioned in the Introduction. Such third-party activity appears to be growing and the presence of litigation-funders has raised concerns with legislators and with practicing attorneys (see Beisner, et. al., 2009, a brief discussion written by three attorneys with a major law firm – Skadden – whose title suggests their perspective: "Selling Lawsuits, Buying Trouble"). There is no reason to expect that such third parties will have preferences that are consistent with those of either the client or the attorney, and the added conflict of incentives is likely to further influence the equilibrium pricing of legal services as well as the efficiency of the lawyer's effort choice.

Alternatively, one could incorporate a model of the defense lawyer as a strategic agent who will also exert effort at trial, thereby augmenting the model of the continuation game to allow for effort on the part of both competing lawyers. Defense lawyers are unlikely to be compensated via a contingent fee, but whatever is the form of their compensation (e.g., per unit of effort), this will affect the incentives for the plaintiff's lawyer to demand an (α, F) combination of the plaintiff.

A further extension is to allow for settlement bargaining activity as an alternative to trial as part of the continuation game after contracting. Hay (1997) has shown (for $F = 0$ and under full information) why contracting can lead to differential contingent fees for settlement versus trial activity by the lawyer. Adding a settlement phase to the continuation game can affect the information revelation process, possibly influencing the contracting problem as well as the incentives for the lawyer in his effort choice.

Finally, it would be valuable to relax our assumption that clients' expected payoffs are sufficiently high that they will always want to enter the market for legal services and that search will always be a credible threat. Under these maintained assumptions, we found that constraining the transfer F to zero, so that the lawyers can only bid using the contingent fee, has the negative effect of reducing the lawyer's subsequent effort on the case. On the other hand, lawyers' profits are not dissipated greatly since the client herself does

not want the contingent fee to be too low. When the transfer F is unconstrained, then the contingent fees tend

to be high (and thus the lawyers tend to put in substantial effort) but the profits are bid away to the client; at

most, the lawyer makes the amount of the search cost, s, on a case. Thus, it would appear that in our model

lawyers would be better off if search costs were higher and if only contingent fees were allowed; indeed,

Santore and Viard (2001) make this latter point (in a model with no search costs), noting that allowing

transfers from lawyers to clients intensifies competition among lawyers and dissipates profits. However, this

does not account for the possibility that higher search costs, or the use of contingent fees only, also reduce

the *ex ante* expected value of entering the legal process for clients. It is quite possible that sufficiently high

search costs and/or the use of contingent fees only would deter some clients from entering the market for legal

services, while these clients would find it profitable to enter this market if they were able to capture more of

the value of their case through transfer payments from the lawyers. A full characterization of the results with

arbitrary search costs (for which fully-separating equilibria may fail to exist) would be of value to understand

the implication of allowing unrestricted (α, F)-pricing of legal services.

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Appendix

Proof that α = 1 maximizes joint payoffs and that the derivative of joint profits is zero when α = 1

By definition, $\Pi^L(\alpha, A) + \Pi^C(\alpha, A) = Ap(x^L(\alpha, A)) - wx^L(\alpha, A)$, where $x^L(\alpha, A)$ maximizes $\alpha Ap(x) - wx$. This latter problem is well-defined for all $\alpha \geq 0$, not only for $\alpha \leq 1$, and thus both $x^L(\alpha, A)$ and $\Pi^L(\alpha, A) + \Pi^C(\alpha, A)$ are also well-defined for all $\alpha \geq 0$. Differentiating yields:

$$\Pi_1^L(\alpha, A) + \Pi_1^C(\alpha, A) = [Ap'(x^L(\alpha, A)) - w]x_1^L(\alpha, A).$$

Since $x_1^L(\alpha, A) > 0$, the sign of the left-hand-side is the same as the sign of $[Ap'(x^L(\alpha, A)) - w]$. By definition, $\alpha Ap'(x^L(\alpha, A)) - w = 0$, so $[Ap'(x^L(\alpha, A)) - w] > 0$ for $\alpha < 1$ and $[Ap'(x^L(\alpha, A)) - w] = 0$ for $\alpha = 1$. Finally, $[Ap'(x^L(\alpha, A)) - w] < 0$ for $\alpha > 1$. Thus, $\alpha = 1$ provides an unconstrained maximum of the combined payoffs, at which the first derivative of the combined payoffs is zero.

Proof that $\alpha^L(A)$ is decreasing in A

To see how $\alpha^L(A)$ depends on A, use equation (1) to define $g(\alpha, A) \equiv \Pi^C(\alpha, A) - \Pi^C(\alpha^C(A), A) + s$. Then $g(\alpha^C(A), A) = s > 0$ and $g(\alpha^L(A), A) = 0$. Differentiating this latter expression and collecting terms implies that $d\alpha^L(A)/dA = -g_2/g_1$, where both expressions on the right-hand-side are evaluated at $(\alpha^L(A), A)$. Notice that $g_1(\alpha^L(A), A) = \Pi_1^C(\alpha^L(A), A) < 0$ since $\Pi^C(\alpha, A)$ is decreasing for $\alpha > \alpha^C(A)$. Moreover, $g_2(\alpha^L(A), A) = \Pi_2^C(\alpha^L(A), A) - \Pi_2^C(\alpha^C(A), A)$; this difference has the same sign as $\Pi_{12}^C(\alpha^L(A), A)$ because $\alpha^L(A) > \alpha^C(A)$. Recall from Assumption 3 that $\Pi_{12}^C(\alpha, A) < 0$ for all $\alpha > \alpha^C(A)$. Combining these sign results implies that $d\alpha^L(A)/dA < 0$.

Verification that $(\alpha^L(A), r(\alpha))$ as defined in equations (1) and (3) provide the unique separating equilibrium outcome (when C accepts L2's offer)

We have to demonstrate that L1's and C's strategies are best replies to each other (when both anticipate that C will accept an offer of $\alpha^L(B(\alpha))$ from L2 rather than initiating the auction); moreover, we have to prove that $\alpha^L(A)$ is L1's unique optimum against $r(\alpha)$. If C expects L1 to play the strategy $\alpha^L(A)$, then C's beliefs will be $B(\alpha) = (\alpha^L)^{-1}(\alpha)$ and C will be indifferent between accepting and searching again. Therefore she is willing to randomize according to $r(\alpha)$ and thus $r(\alpha)$ is a best reply to $\alpha^L(A)$. If C observes an out-of-equilibrium $\alpha > \bar{\alpha}$, then she will reject this demand for sure (regardless of her beliefs). If C observes an out-of-equilibrium $\alpha < \underline{\alpha}$, she will accept it if $\alpha \geq \alpha^C(B(\alpha))$ and she will reject it otherwise.

Now suppose that C is expected to play the strategy $r(\alpha)$, where the function $B(\alpha) = (\alpha^L)^{-1}(\alpha)$; we will show that it is a unique best reply for L1 to play according to $\alpha^L(A)$. For future use, it is worth noting that equation (3) implies that $r(\alpha) \in [0, 1)$ for all $\alpha \in [\underline{\alpha}, \bar{\alpha}]$ and that $r'(\alpha) = (1 - r(\alpha))[\Pi_1^L(\alpha, B(\alpha))/\Pi^L(\alpha, B(\alpha))]$.

Recall that L1's payoff is $(1 - r(\alpha))\Pi^L(\alpha, A)$. First, we argue that any α outside the interval $[\underline{\alpha}, \bar{\alpha}]$ is strictly dominated by one inside the interval. Any $\alpha > \bar{\alpha}$ is rejected for sure and is thus strictly dominated by the demand $\alpha = \bar{\alpha}$ which is accepted with positive probability. Any demand $\alpha < \underline{\alpha}$ – whether it is accepted or rejected – is strictly dominated by the demand $\alpha = \underline{\alpha}$, which is accepted for sure. Next, notice that the first-order condition is given by:

$$-r'(\alpha)\Pi^L(\alpha, A) + (1 - r(\alpha))\Pi_1^L(\alpha, A)$$
$$= (1 - r(\alpha))\left\{\Pi_1^L(\alpha, A) - \Pi^L(\alpha, A)[\Pi_1^L(\alpha, B(\alpha))/\Pi^L(\alpha, B(\alpha))]\right\} = 0.$$

Since $1 - r(\alpha) > 0$, any stationary point equates the bracketed term to zero. Assumption 5 (which says

that the term in brackets is strictly decreasing in B) implies that there is a unique stationary point, at which $B(\alpha) = A$ or, equivalently, $\alpha = \alpha^L(A)$. The second-order condition for a maximum holds at the stationary point if and only if:

$$d\left\{\Pi_1^L(\alpha, A) - \Pi^L(\alpha, A)[\Pi_1^L(\alpha, B(\alpha))/\Pi^L(\alpha, B(\alpha))]\right\}/d\alpha < 0 \text{ at } B(\alpha) = A.$$

Differentiating and collecting terms implies that the inequality above holds if and only if:

$$- B'(\alpha)\partial[\Pi_1^L(\alpha, B(\alpha))/\Pi^L(\alpha, B(\alpha))]/\partial B < 0 \text{ at } B(\alpha) = A.$$

Since $B'(\alpha) < 0$, Assumption 5 implies that the inequality holds. Thus, the unique stationary point is a maximum. It is interior to the interval $[\underline{\alpha}, \bar{\alpha}]$ if A is interior to the interval $[\underline{A}, \bar{A}]$. Finally, this local interior maximum must be the global maximum because, if it were not (if there were a higher local maximum at either $\underline{\alpha}$ or $\bar{\alpha}$), then there would have to be an interior minimum between the two local maxima and we already know there is a unique stationary point. Thus, the function $\alpha = \alpha^L(A)$ provides the unique best reply for L1 to the strategy $r(\alpha)$. QED

Proof that $\underline{\alpha}$ is less than 1 in the two-type case when F is unconstrained
　　　　Let α^k solve the equation $s = \Pi^L(\alpha, \bar{A}) - \Pi^L(1, \underline{A}) + s + \Pi^C(\alpha, \underline{A})$. This defines the value of α at which the "kink" occurs in Figure 3. Let $\underline{\alpha}$ denote the equilibrium contingent fee for $\underline{A}$. We have already noted in the text that $\underline{\alpha}$ cannot be less than α^k. Therefore, $\underline{\alpha}$ maximizes the expression:

$$s(\Pi^L(\alpha, \underline{A}) - \Pi^L(1, \underline{A}) + s + \Pi^C(\alpha, \underline{A}))/(\Pi^L(\alpha, \bar{A}) - \Pi^L(1, \underline{A}) + s + \Pi^C(\alpha, \underline{A})).$$

Let $n(\alpha) \equiv \Pi^L(\alpha, \underline{A}) - \Pi^L(1, \underline{A}) + s + \Pi^C(\alpha, \underline{A})$ and let $\Delta(\alpha) \equiv \Pi^L(\alpha, \bar{A}) - \Pi^L(\alpha, \underline{A})$. Then, equivalently, $\underline{\alpha}$ maximizes $n(\alpha)/[\Delta(\alpha) + n(\alpha)]$. Both $n(\alpha)$ and $\Delta(\alpha)$ are increasing functions on $[0, 1]$ with $n'(1) = 0$ and $n(1) = s$. Differentiating and collecting terms implies that the sign of the first derivative is the same as the sign of the expression $\Delta(\alpha)n'(\alpha) - n(\alpha)\Delta'(\alpha)$. Evaluating this expression at $\alpha = 1$ yields $- s\Delta'(1) < 0$. Thus, by moving α down below 1, the $\underline{A}$-type of lawyer improves his profit and thus $\underline{\alpha}^* < 1$. We cannot rule out the possibility of a boundary solution at α^k (although there are parameter values that preclude it).

Comparative statics
　　　　At an interior solution (i.e., $\underline{\alpha}^* > \alpha^k$), $\underline{\alpha}$ will satisfy $\Delta(\underline{\alpha}^*)n'(\underline{\alpha}^*) - n(\underline{\alpha}^*)\Delta'(\underline{\alpha}^*) = 0$ and the associated second-order condition $\Delta(\underline{\alpha}^*)n''(\underline{\alpha}^*) - n(\underline{\alpha}^*)\Delta''(\underline{\alpha}^*) < 0$. The claim that $\underline{\alpha}^*$ falls as s rises follows directly: $d\underline{\alpha}^*/ds = \Delta'(\underline{\alpha}^*)/[\Delta(\underline{\alpha}^*)n''(\underline{\alpha}^*) - n(\underline{\alpha}^*)\Delta''(\underline{\alpha}^*)] < 0$. Finally, the claims that $dr(\underline{\alpha}^*, \varphi(\underline{\alpha}^*, \underline{A}))/ds < 0$, as long as $r(\underline{\alpha}^*, \varphi(\underline{\alpha}^*, \underline{A})) < 1$, and that the $\underline{A}$-type's payoff rises as s increases both follow from differentiation (recalling that s enters $n(\underline{\alpha}^*)$ directly).

Power-function example for the asymmetric information, (α, F) case for two and three types
　　　　For the power-function example when there are two types, $\Delta'(\alpha) = \Delta(\alpha)/\alpha(1 - \theta)$; thus, the function $\Delta(\alpha)n'(\alpha) - n(\alpha)\Delta'(\alpha)$ has the same sign as $\alpha(1 - \theta)n'(\alpha) - n(\alpha) = (1 - \theta)z\underline{A}^{1/(1 - \theta)}(1 - \alpha^{(1 - \theta)/\theta}) - s$. This expression is positive at $\alpha = 0$ (under Assumption 4'), negative at $\alpha = 1$, and strictly decreasing. Thus there is a unique solution, $\underline{\alpha}^* = (1 - s/[(1 - \theta)z\underline{A}^{1/(1 - \theta)}])^{(1 - \theta)/\theta}$, which maximizes the payoff of the $\underline{A}$-type lawyer.

　　　　Finally, if there were, for example, three possible values of A, $\{\underline{A}, A_m, \bar{A}\}$, with $\underline{A} < A_m < \bar{A}$, then $\bar{\alpha}^* = 1$, $\alpha_m^* = (1 - s/[(1 - \theta)zA_m^{1/(1 - \theta)}])^{(1 - \theta)/\theta}$, and $\underline{\alpha}^* = (1 - s/[(1 - \theta)z\underline{A}^{1/(1 - \theta)}])^{(1 - \theta)/\theta}$. The fraction of the case that the lawyer purchases is increasing in case value, with only the highest-value case being purchased in full.