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PRELIMINARY INJUNCTIVE RELIEF:
THEORY AND EVIDENCE FROM
PATENT LITIGATION

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ABSTRACT

This paper examines the suggestion that established plaintiffs request preliminary injunctions to engage in predation against less financially healthy firms. We first present a model in which differences in litigation costs drive the use of preliminary injunctions in civil litigation. The hypothesis is tested using a sample of 252 patent suits, which allows us to characterize the litigating parties while controlling for the nature of the dispute. The evidence is consistent with the predation hypothesis. We then explore various implications of the model and the impact of policy reforms.

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In an influential paper, John Leubsdorf [1978] argued that "the preliminary injunction may be the most striking remedy wielded by contemporary courts." These court orders, which are issued before a full hearing or final decision on a case's merits, require a plaintiff or defendant to perform a certain action or to refrain from an activity. Preliminary injunctions can have an immense impact: for example, in 1995 these orders delayed mergers, ordered compulsory licenses, and blocked strikes.¹

Preliminary injunctions have become an important feature of civil litigation in the federal and state courts. McLaughlin and Tallon [1987] note that

in a court system generally characterized by stultifying delay, the motion for a preliminary injunction has become popular as a rapid means of resolving disputes whose outcome cannot await the result of a full-blown trial on the merits.

Between 1980 and 1993, at least 23,000 hearings were held on requests for preliminary injunctions in the U.S. Federal courts, representing more than 12% of all civil Federal hearings held during these years.² Moreover, many settlements occurred between the request for a preliminary injunction and the hearing on the motion, or after the plaintiff threatened to file such a request.

An extensive legal literature examines the criteria used by judges in reviewing requests for preliminary injunctions, among which are the avoidance of "irreparable harm" and the protection of "the public good." Yet practitioner accounts suggest that requests for preliminary injunctive relief are often made for a reason that is rarely considered in these deliberations: the mechanism may allow financially strong firms to predate more effectively on weaker ones. The threat of higher legal costs combined with the possibility of a cessation of operations for the duration of the trial may be sufficient to drive a capital-constrained firm to settle a dispute on unfavorable terms.

¹See, for instance, *New Iberia Bancorp v. Schwing*, 1995 La. App. LEXIS 2416 (La. App. 3 Cir. 1995), *Tom Doherty Assocs. v. Saban Entertainment, Inc.*, 60 F.3d 27 (2d Cir. 1995), and *Alton & Southern Ry. Co. v. Brotherhood of Maintenance of Way Employees*, 883 F. Supp. 755 (D.C. Cir. 1995).

²Very limited published data is available on the frequency of preliminary injunctions. Several tabulations of the distribution of rulings on injunction requests in reported decisions are available: see, for example, Cunningham [1995]. However, only a fraction of cases generate judicial rulings and only a small portion of these are reported. The figure here is based on a special tabulation of the Federal Judicial Center's "Trials Database," which includes a separate record for each hearing or set of hearings in which evidence was presented by both parties. In addition to hearings on preliminary injunction requests, other entries include jury trials, non-jury trials, and administrative hearings. Certain circuits, however, apparently fail to consistently report hearings on preliminary injunction requests. The count of preliminary injunction hearings includes some hearings on temporary restraining orders.

To explore this predatory dimension of preliminary injunctive relief, we present here a simple two-stage model of the interaction between a plaintiff and a defendant with varying litigation costs. In the model, the plaintiff can request a preliminary injunction, or proceed directly to trial. Negotiations are possible before and after the injunction hearing. We show how the plaintiff's and defendant's equilibrium behavior--for example, going to trial versus settling--changes with the financing costs of the two parties, as well as other variables.

We then explore the predation hypothesis empirically by examining the use of preliminary injunctions in a sample of 252 patent lawsuits. Patent lawsuits provide a good testing ground for three reasons. First, cases tend to resemble one another in many respects. This consistency is facilitated by a specialized bar and judiciary. In many other classes of disputes, heterogeneity between cases may introduce noise and reduce the power of empirical tests. Second, the cases can be characterized in two important ways. Not only can the litigating parties be identified, but so can the patents over which the disputes are fought. Using various measures associated with the patents, we can control to some extent for uncertainty regarding case quality or legal standards. Since theoretical models of litigation suggest that uncertainty influences behavior, these controls help avoid incorrect inferences. Finally, an examination of preliminary injunctions in patent litigation is interesting in its own right. After the creation of a specialized federal appellate court to hear patent cases in 1982, the standards for preliminary injunctions in patent cases were relaxed (see Section III). The resultant increase in injunction requests has led to a great deal of controversy within the patent bar.

The empirical results are consistent with the predation hypothesis. In univariate comparisons, disputes in which preliminary injunctions are requested have plaintiffs almost twice as large, in terms of sales or employment, as those in disputes where preliminary injunctions are not requested. The plaintiff is also significantly more likely to be bigger than the defendant. In regression analyses, the size of the plaintiff has a substantial and statistically significant effect on the probability that an injunction will be requested. Evaluated at the means of the independent variables, a one standard deviation increase in plaintiff sales increases the predicted probability by nearly sixty percent. The results are robust to controls for several alternative explanations.

This finding is cause for concern. Even in the absence of preliminary injunctive relief, capital constraints may limit the ability of some firms to access the courts. Injunctive relief may worsen this

problem. In the final section, we use the model to investigate the effects of this legal remedy. The analysis suggests that allowing plaintiffs to request injunctive relief favors larger litigants and is likely to increase expenditures on legal fees in the process of dispute resolution. Finally, we examine the effects of two potential reforms: a loosening of the standards for preliminary injunctions and a relaxation of curbs on firms obtaining external financing for litigation (champerty).

The analysis is related to recent examinations of other aspects of the legal process such as fee-shifting rules [Spier, 1994], offer-of-settlement schemes [Bebchuk and Chang, 1995], and summary disposition [Beckner and Salop, 1995]. The claim that the use of preliminary injunctions may be affected by capital constraints is also closely related to the literature on the economics of regulation. Bankruptcy costs [Ang, Chua, and McConnell, 1982], drug approvals [Thomas, 1990], and environment and safety regulations [Pashigian, 1984] have been shown to affect large and small firms very differently. Bartel and Thomas [1987] describe how established firms can use costly regulation as a mechanism to forestall entry by potential new entrants or to handicap weaker rivals. These issues, however, have attracted little attention in the study of the litigation process itself.

The plan of the paper is as follows. In Section I, we briefly summarize the extensive legal literature on preliminary injunctive relief. Section II presents the model, and Section III our empirical analysis. The final section explores implications of the model, policy reforms, and areas of future research.

I. Preliminary Injunctions in Law and Practice

A preliminary injunction is typically issued shortly after a lawsuit has been filed, based on an abbreviated pre-trial hearing.³ Preliminary injunction requests are typically reviewed using four criteria:

³A prohibitory preliminary injunction is often confused with a temporary restraining order. Both are similar in their function and in the factors that the court takes into consideration. A temporary restraining order, however, differs in two significant ways from a preliminary injunction. First, it may be obtained without notifying the adverse party, while a preliminary injunction cannot be issued without notice. Second, there is no means to appeal a restraining order. The decision of the district court on the issuance of the preliminary injunction may be appealed immediately--that is, before the final decision on the case has been made.

- whether the party requesting the injunction (typically the plaintiff) has no adequate remedy at law or faces the threat of irreparable harm if the injunction is denied;
- the balance between this harm and the injury that granting the injunction would inflict on the defendant;
- the probability that the plaintiff will win the case on the merits; and
- the public interest.⁴

Although the *Federal Rules of Civil Procedure* offers guidelines to the courts for the granting of preliminary injunctions, standards actually used differ greatly. Courts that have the highest standards consider preliminary injunctions to be an "extraordinary and drastic"⁵ remedy. They follow the sequential approach which requires the movant to satisfy, in sequence, each of the four factors. At the other extreme, the *Sonesta* test considers only two factors--success on the merits and irreparable harm--and is often considered most favorable to the plaintiff. Some Federal circuits take into consideration additional elements, such as whether the preliminary injunction maintains the status quo [Heiny, 1987]. The uniform model, originated by Leubsdorf [1978] and formalized by Posner,⁶ weighs the costs and benefits of preliminary injunctions.

Practitioner accounts, however, suggest that many firms request preliminary injunctions not to avoid "irreparable harm" but rather to impose financial stress on their rivals. For example, if a plaintiff can shut down a significant fraction of a defendant's operations for months or years while an issue is being resolved, the defendant is likely to experience a sharp reduction in operating cash flows. In addition, an injunction proceeding itself raises the legal expenditure required to pursue a case through to a trial ruling. These financial burdens are exacerbated by legal limits on the ability of firms to raise external funds to finance litigation. Many states have adopted champerty prohibitions from the common law which prevent uninvolved third parties from investing in a lawsuit in return for compensation if it is successful. This restriction is particularly important in the context of patent litigation, where the large

⁴Sometimes this test is interpreted as having five factors, with the first factor being "no adequate remedy at law" and the second being "irreparable harm."

⁵*Canal Authority v. Callaway*, 489 F.2d 567, 573 (5th Cir. 1974).

⁶*American Hospital Supply Corporation v. Hospital Products, Ltd.*, 780 F.2d 589, 593 (7th Cir. 1985).

costs of litigation often preclude financing suits through contingency fee arrangements with attorneys. If a defendant is unable to raise capital to finance the litigation through the external capital markets, he may be forced to settle the dispute, no matter what the ultimate merits of his case.

These claims are related to the 'long-purse' theories of predatory behavior in which capital market imperfections enable better capitalized firms to force financially weaker but more efficient firms to exit, even when there is symmetric information [see Tirole, 1989, Chapter 9, and the references therein]. Empirical studies of capital constraints [reviewed in Hubbard, 1996] suggest that an inability to obtain external financing limits many forms of business investment. Particularly relevant in the context of patent litigation are studies by Himmelberg and Petersen [1994] and Hall [1992] which show that capital constraints appear to limit research-and-development expenditures, especially in smaller firms. Several related works indicate that investments in R&D yield high rates of return [see Griliches, 1986, and Nadiri, 1993], similarly suggesting that research-intensive firms may be capital-constrained.

Recent patent cases where preliminary injunctions have been used in allegedly predatory ways have attracted public notice. To cite one example, California-based start-up American Multisystems was sued for infringement by a major corporation with considerable patent litigation experience. In the words of founder Vern Blanchard [1995]:

The [plaintiff] filed for a preliminary injunction, which was granted.... The aggressor in my particular case, of course, went into my particular industry and waved around the preliminary injunction. Effectively, we could no longer partake in that market. I'm out of business and in debt over \$100,000. The realities are, this happens all the time.

The powerful impact of this weapon is underscored by Dennis Sullivan, senior patent counsel of Navistar, which settled several patent disputes while the firm was completing a protracted Chapter 11 reorganization [McConville, 1994]:

It's [preliminary] injunctive relief that's the killer. When the court says you can't make the product anymore, you've got a big problem. That means when guys like Mr. Lemelson [a notorious plaintiff who has amassed a large fortune by litigating patents of questionable merit] come around and start waving papers, you'd better listen. It's a big incentive to settle patent cases.

Thus, we anticipate seeing disproportionate numbers of injunction requests when large plaintiffs are litigating against smaller, financially weak firms.

II. A Model of Preliminary Injunction Requests

This section presents a simple two-stage game representing the interaction between two potential litigants. We will specifically examine a patentee and a firm against which the patentee has filed a suit for patent infringement, although most features of the model would carry through to a more general setting.

The Structure of the Model

We model the two parties' interaction as follows. At time zero, a risk-neutral patentee-producer⁷ faces a potentially infringing action on the part of another risk-neutral firm (henceforth, the infringer). A suit is filed immediately after the commencement of the infringement, at which point the patentee makes a take-it-or-leave-it settlement offer to the infringer.⁸ If the offer is accepted, the two parties settle. If the offer is refused, the patentee may either drop the case, request an injunction, or proceed directly to trial without requesting a preliminary injunction. If the patentee asks for an injunction, the court immediately rules on the request. After the injunction hearing, the patentee can make another take-it-or-leave-it offer. If the offer is accepted, the parties settle. If the offer is refused, the patentee may then either drop the case or proceed to trial. Regardless of whether there is an injunction proceeding, trials take n years. The patent continues to have value until time $n+m$.

⁷A firm is typically not able to obtain an injunction if it is already licensing because licensing demonstrates that the harm is not irreparable. See, for instance, *Illinois Tool Works, Inc. v. Grip-Pak, Inc.*, 906 F.2d 679, 683, 15 U.S.P.Q.2d 1307, 1310 (Fed. Cir. 1990). Relaxing the assumption of risk-neutrality would lower the parties' valuation of the payoffs associated with (uncertain) trial outcomes.

⁸Departing from the single offer bargaining structure posited here, there are many other ways that the two parties might conceivably split the profits from the innovation. As long as the bargaining structure is such that settlement payoffs are a function of outside options, the qualitative results are the same as those in the single offer game. For example, assuming that parties arrive at the Nash bargaining solution—where each receives the value of his outside option and then any residual left after these payments is divided equally—generates the same results. On the other hand, a standard alternating offers bargaining model, where parties with equal time preferences split the surplus, does not. In this case, the patentee's threat to use an injunction to make the infringer's outside option worse (by driving up his legal costs or making him bear damages) does not enable the patentee to obtain a better settlement.

Let P_i be the probability that the court grants the injunction and let P_r be the probability the patentee wins at trial. For simplicity these probabilities are assumed here to be independent of both the value of the patent and the amount spent on litigation. (Relaxing this assumption is discussed in Section III.) Moreover, we assume that the outcome of the injunction hearing has no effect on the probability that the patentee wins at trial. In other words, there is no information content in the results of the injunction proceeding. This assumption is admittedly very strong. (See Section IV for a discussion.)

We assume that all payoffs and costs are common knowledge. This assumption is somewhat more realistic in the case of patent infringement suits than it would be for most other types of civil suits because much of the information relevant to patent validity is in the public domain. Extensions of the model which allow for asymmetric information are considered in Section IV.

Let V_1 , V_s , and V_2 be the total annual profits derived from using the innovation, respectively, if the patentee uses it alone, if both the patentee and the infringer use it having settled with a licensing agreement, or if they both use it without any agreement between them. We assume here that $V_2 \leq V_s \leq V_1$. V_s is likely to be less than V_1 both because of limits on the terms of licensing contracts imposed by patent and antitrust law and because of practical difficulties in contract enforcement.⁹ For simplicity, we assume that, in the absence of an agreement, one-half of the total duopoly profits, V_2 , is obtained by each of the firms.¹⁰ Thus, if the patentee fails to get an injunction, his damages during the trial are $n(V_1 - \frac{1}{2}V_2)$.

We make the standard assumption that the legal expenditure in a civil suit is proportional to the size of the case (the potential damages). Let $L = \gamma[n(V_1 - \frac{1}{2}V_2)]$ be the direct trial costs without an injunction proceeding. If the parties engage in an abbreviated hearing associated with an injunction

⁹Patentees may be able to use licensing contracts to extend monopoly power into other markets or to extend that power past the expiration of their patents, yielding $V_s > V_1$ [see Gallini and Trebilcock, 1995]. In situations where this is possible, and licensing is clearly beneficial to the parties, it seems unlikely that a case filing would be required to bring about an agreement. Since we deal here with the population of disputes where a case is filed, the assumption made seems reasonable.

¹⁰This suggests that the firms are of similar size, an assumption which may seem inconsistent with the following discussion in which firms are allowed to have different financing costs. The equal split, however, only relates to profits derived from using the innovation in question. The total size of the firms may still be very unequal.

proceeding, they purchase only $(1-\lambda)$ of the legal services required for a full trial. The legal services purchased for an injunction, however, are more expensive because the accelerated preparation for the injunction hearing is likely to entail greater reliance on outside counsel and be costlier [Trubeck, *et al.*, 1983]. Let $k(1-\lambda)L$, where $k \geq 1$ and λ is in $[0,1]$, be the legal costs for an injunction hearing. If a trial follows an injunction proceeding, only λ of total legal services remain to be purchased.

We assume that the cost of financing litigation differs across firms. Let A and a be the financing cost for the patentee and the infringer, respectively; where $A, a \geq 0$. That is, for any net legal cost L , the gross cost of financing L is $(1+A)L$ for the patentee and $(1+a)L$ for the infringer. Typically, a firm's finance costs will depend on its liquidity. If an injunction is granted, the patentee obtains monopoly profits during the trial. We assume that this lowers his subsequent legal expenditure by a proportion δ . On the other hand, the injunction forces the infringer to stop using the innovation, increasing his subsequent costs by, for simplicity, a symmetric proportion δ .

In addition to altering legal costs, injunctions may reverse the party bearing damages. If the alleged infringer is precluded from using the innovation, he becomes the compensated party if he later wins the case. An injunction will also alter the absolute size of damages. Without an injunction, damages to the victorious patentee will be $n(V_1 - \frac{1}{2}V_2)$; with an injunction, damages to the infringer if victorious will be $n(\frac{1}{2}V_2)$. This feature of injunctions may lead an infringer to prefer an injunction, and a patentee to be worse off from having the option of requesting one (see Section IV).

Damages awarded after the trial may not equal actual damages paid, particularly when the party paying damages is financially weak.¹¹ To capture this idea, we assume that the payment the damaged party expects to receive if he wins is a fraction of his true damages, where the fraction depends on the loser's financial status. Specifically, let $D = (1-\beta a)n(V_1 - \frac{1}{2}V_2)$ be the damages received by the patentee

¹¹In order to have a preliminary injunction issued, the movant is required to post a bond. The amount of this bond is determined by what the court determines to be the possible costs and damages that the adverse party will have incurred if the preliminary injunction is later judged to have been wrongly issued. If the plaintiff is small or capital-constrained, the court will not require a bond, or will require only a nominal bond. That is, in cases where it matters, the guarantee of a financial ability to pay damages is absent. For a discussion of this issue, see Morton [1995]. It is worth emphasizing that the bond serves as the defendant's only source of compensation if it turns out that he was wrongfully enjoined. See *W.R. Grace & Co. v. Local 759, Int'l Union of United Rubber, Cork, Linoleum & Plastic Workers*, 461 U.S. 757, 770 n. 14 (1983).

if he does not get an injunction and then wins at trial. Similarly, let $d = (1-\beta A)n(\frac{1}{2}V_2)$ be the damages received by the infringer if he is enjoined and then wins at trial, where $0 \leq \beta \leq \min\{1/A, 1/a\}$.

When the patentee makes a settlement offer to the infringer, his threat to request an injunction (or to go to trial) if the offer is rejected must be credible. We assume that trial threats are always credible.¹² An injunction threat may not always be credible because it entails greater legal costs than a trial. Before making his initial settlement offer, however, the patentee can sink part of his legal costs, in order to make an injunction threat credible.¹³ Like legal services purchased at time zero for an injunction proceeding, services purchased at time zero for this reason are also more expensive by a cost factor k .

Payoffs

With all this in hand, we are now ready to define the patentee's payoffs in the game. If the patentee goes directly to trial, then his expected payoff is:

$$T = n\frac{1}{2}V_2 + P_T[mV_1 + D] + (1-P_T)m\frac{1}{2}V_2 - (1+A)L,$$

where the first term is his profits from the innovation during the trial, the second term is his post-trial profits and expected damages if he wins, the third term is his post-trial profits if he loses, and the last term is his gross legal costs. If the patentee asks for an injunction, fails, then goes to trial, his expected payoff is:

$$T_I = T - (1+A)(k-1)(1-\lambda)L,$$

where the extra term captures the incremental costs of the injunction hearing. If the patentee has an injunction request granted and then goes to trial, his expected payoff is:

¹²Earlier versions of the model without this assumption yielded similar results for sensible parameter values.

¹³One mechanism is to maintain in-house counsel [see Nalebuff, 1987].

$$T_e = nV_1 + P_T mV_1 + (1-P_T)[m\frac{1}{2}V_2 - d] - (1+A)[k(1-\lambda) + (1-\delta)\lambda]L,$$

where again the first term is his profits during trial, the second is his post-trial profits if he wins, the third is his profits if he loses less the damages he must pay, and the last term is his legal costs.

If the patentee requests an injunction, fails, and then makes a settlement offer following the injunction hearing, his payoff is:

$$S_f = (n+m)V_s - \{n\frac{1}{2}V_2 + (1-P_T)m\frac{1}{2}V_2 - P_T D - (1+a)\lambda L\} - k(1+A)(1-\lambda)L.$$

The first term is the total profits generated by the innovation with licensing. The term in braces is the minimum amount that the patentee must give to the infringer to convince him to accept the settlement offer. This amount equals the infringer's expected return from refusing to settle and going instead to trial. The final term is the cost of the injunction hearing. If the patentee obtains an injunction and then makes a settlement offer his payoff is:

$$S_g = (n+m)V_s - \{(1-P_T)[m\frac{1}{2}V_2 + d] - (1+a)(1+\delta)\lambda L\} - k(1+A)(1-\lambda)L.$$

The term in braces is now smaller, and the payoff to the patentee consequently larger, because the injunction both drives up the infringer's expected trial costs and lowers his expected profit.

We can now define the patentee's expected payoff from requesting an injunction as:

$$I = P_I \max\{T_e, S_g\} + (1-P_I) \max\{T_f, S_f\}.$$

If he obtains the injunction, he chooses at that stage between continuing to trial or settling, and similarly if he fails to obtain the injunction.

Finally we define the patentee's settlement payoffs at stage one. If the patentee can credibly threaten to request an injunction if his offer is refused ($I \geq T$), then the patentee's settlement payoff is:

$$S_i = P_I S_g + (1-P_I) S_f + k(1+a)(1-\lambda)L + k(1+A)(1-\lambda)L,$$

where the third term is the extra amount that the patentee can extract when he makes an offer before an injunction hearing because the infringer wants to avoid the expense of going through the hearing, and the last term is his own cost savings.

If the patentee cannot credibly threaten to request an injunction because $T > I$, he can obtain a settlement payoff:

$$S_T = S_I + k(1+a)(1-\lambda)L + k(1+A)(1-\lambda)L.$$

Alternatively the patentee may sink costs before making an offer, thereby making the threat to request an injunction credible. He does this by purchasing (at a premium price k) legal services of amount C . After doing so, going to trial becomes more attractive: the amount of legal services that must be purchased prior to the trial falls by C . Having pre-paid some of legal costs also means that C fewer legal services need to be purchased before an injunction hearing. Recall, however, that legal services for an injunction hearing must be purchased at a premium price. Purchasing legal services in advance reduces the cost differential associated with a preliminary injunction request: there are fewer legal services that must be purchased at a premium prior to the hearing. To have a credible threat, the patentee must purchase legal services C such that the price premium paid equals the differential between the payouts from going directly to trial and seeking an injunction, or $(k-1)C = (T-I)$. In this case, the patentee receives a settlement payoff:

$$S_I^* = S_I - k[(T-I)/(k-1)].$$

Outcomes

We consider sub-game perfect equilibria. The patentee's strategy is to choose the action in stage one corresponding to $\max\{S_I, I\}$ if $I \geq T$, or $\max\{S_T, S_I^*, T\}$ if $I < T$. If an injunction is requested, in stage two he chooses the action corresponding to $\max\{T_I, S_I\}$ or $\max\{T_S, S_S\}$. The infringer's strategy is to accept any settlement offer which leaves the patentee with the relevant payoff of S_T , S_I , or S_I^* (stage one), S_I or S_S (stage two), or less, and to refuse any offer which leaves the patentee with more.

The payoffs are functions of the parameter vector $\omega = \{\gamma, \lambda, k, \delta, \beta, P_T, P_I, n, m, V_2, V_S, V_I\}$ and the patentee and infringer's financing cost parameters, A and a . The model generates a multitude of possible equilibrium outcomes in (A, a) space. Due to the large number of parameters, these are defined by rather complex credibility and optimality constraint equations. Because it proved difficult to devise sensible simplifying assumptions that would collapse the number of outcomes, we do not derive analytical predictions. Rather, we choose plausible parameter values for the vector ω and investigate visually the characteristics of the set of equilibrium outcomes implied by the model. While this limits the results to a specific case, other parameter vectors that generate equilibrium outcomes both with and without preliminary injunction requests yield similar results.

The parameter vector that we shall treat as the base case is $\omega = \{0.16, 0.8, 3, 0.15, 0.3, 0.75, 0.4, 2, 5, 1, 1.05, 1.25\}$.¹⁴ The five possible equilibrium outcomes for this parameter vector are indicated in Figure 1. On the axis are different levels of the financing cost parameters, A and a , with low-cost litigants near the origin. The thick line represents (A, a) pairs where the patentee is indifferent between going directly to trial or requesting an injunction: $T = I$. In the region above and to the left of the line, patentees can credibly threaten an injunction if a settlement offer is rejected. They find an injunction request attractive either because their financing costs are very low or because the firm which is infringing is small and, in the absence of an injunction, would not be able to pay much in compensation for damages. The dot-dashed line represents pairs within this region where the patentee is indifferent between requesting an injunction and settling: $I = S_I$. Relatively high-cost infringers prefer settlement because they want to avoid legal expenses, and high-cost patentees do not demand big settlement offers because they too want to avoid legal expenses. For both reasons, parties above the dot-dashed line prefer to settle. In the region to the right of the bold line, patentees have such

¹⁴Most of these values are suggested by secondary sources or the data which is described in the following section. $2^*\gamma$ is the size of total legal fees relative to total damages, typically assumed to be 1/3 [Priest and Klein, 1984]. $\lambda = 0.8$ is based on the percentage of total docket entries which relate to preliminary injunctions (17.5%) (Section III). The cost factor $k = 3$, in conjunction with a λ of 0.8, implies that total trial costs are $[3(0.2)+0.8] = 1.4$ times, or forty percent higher, with a preliminary injunction hearing. $P_T = 0.75$ is based on the average win proportion (Table 2, Panel A). $P_I = 0.4$ is about the average proportion of injunction requests which are granted, excluding those cases that settled (Table 3, Panel A). Two years is an approximation of the average time between filing and case close (Table 3, Panel B). Seven years ($n+m$) is representative of the useful economic life of a U.S. patent [Mansfield, Schwartz, and Wagner, 1981]. The final two elements, V_S and V_I , imply monopoly profits 25 percent above non-cooperative duopoly profits and only a moderate ability to restrict output via licensing--raising profit five percent above the duopoly level.

high costs that they prefer to go directly to trial and avoid injunction hearings. The dashed line represents (A, a) pairs such that the patentee is indifferent between going directly to trial or settling: $T = S_T$. Again, above the dashed line the patentees prefer to settle. Some patentees within the group to the right of the bold line can improve their payoffs by sinking costs to make an injunction threat credible. The thin solid line indicates pairs where the patentee is indifferent between this strategy and the relevant alternative: $S_I^* = \max\{T, S_T\}$. To the left, patentees prefer to sink costs and obtain the settlement payoff S_I^* instead of T or S_T .

When an injunction is requested in stage one, it is either granted or denied. With the base case parameter vector, the parties continue to trial in the second stage regardless of the outcome. In other words, if settlement occurs at all, it happens at stage one. This need not be the case. For example, if P_I is low, an infringer threatened by an injunction proceeding may not settle at stage one because he expects the request to be denied. If, in addition, a preliminary injunction substantially diminishes his profits (large δ), the infringer may decide to settle in the second stage if the court rules against him.

In order to derive positive hypotheses, as well as to make normative judgements later about the impact of policy changes, we assume that the distribution of (A, a) in the population of filed cases is bivariate uniform.¹⁵ Then Figure 1 suggests the following:

- on average, patentees choosing to request an injunction are lower-cost firms than those who proceed directly to trial. (These are likely to be larger firms.)
- on average, infringers which are subject to an injunction proceeding are somewhat higher-cost (smaller) than those which are taken directly to trial. This distinction is less pronounced than the first.
- on average, patentees choosing to request an injunction are lower-cost (larger) firms than the infringers they face; and patentees proceeding directly to trial are higher-cost firms than the infringers they face.

It follows from the last point, and the bivariate uniform density, that more than 50 percent of the time, a patentee who requests an injunction has lower costs than the infringing firm. Similarly, less than 50 percent of the time, a patentee who proceeds directly to trial has higher costs than the infringing firm.

¹⁵Because the population is filed cases, the distribution has positive density in the positive quadrant with an upper bound implicitly defined as (A, a) pairs such that when both players choose their optimal strategy they receive a payoff of zero net of filing costs. Since payoffs are strictly decreasing in own costs, this bound is unique.

III. Empirical Analysis

The empirical analysis examines the use of preliminary injunctions in patent cases. The treatment of preliminary injunction requests in patent cases today differs modestly from that in other cases. Prior to 1982, patent holders found it very difficult to obtain preliminary injunctions in patent cases. In 1982, Congress created a centralized appellate court for all patent cases, the Court of Appeals for the Federal Circuit [CAFC]. The CAFC has sought to put the pursuit of preliminary injunctions in patent cases on a common footing with other cases.¹⁶

The Data Set

Our primary source for identifying and characterizing the lawsuits was the PACER databases compiled by the various Federal district courts. For each suit, the databases provide a detailed listing of the litigating parties and an item-by-item catalog of the docket entries. While a considerable number of districts began compiling cases in late 1989, others have done so only recently. Furthermore, some districts have begun deleting closed cases from their databases.

Unfortunately, the PACER system software does not allow the user to identify all cases of a particular type without downloading every case (a costly process). We consequently used a second database to identify patent cases. The Federal Judicial Center's Integrated Database provides basic information on cases, such as docket number, filing and termination dates, and case type. [For a description, see Fournier and Zuehlke, 1989.] After identifying the docket numbers of the patent cases in this database, we downloaded them from the PACER systems.

¹⁶This has largely been accomplished by relaxing the third test for the granting of a preliminary injunction. Before the creation of CAFC, the "likelihood of success" criterion was often interpreted as requiring the patentee to show "beyond question" that his patent was valid and infringed. The trend since the establishment of the CAFC has been to merely require a "clear or strong showing" that the patent is valid and infringed. For discussions, see Cunningham [1995] and Gerstein [1994].

Table 1 describes the construction of the sample. We began by selecting the 1841 patent cases filed between January 1990 and June 1991.¹⁷ We did not download cases from districts where closed cases were deleted from the system, where the PACER system did not begin adding cases until after January 1990, or where there were fewer than 35 patent cases during the eighteen-month period.¹⁸

After a few deletions due to misclassified cases or missing data, our final sample consisted of 252 cases filed in six Federal districts. Panel A of Table 2 summarizes the distribution of the cases across districts, as well as their current status. The tabulation indicates that only in 11% of the cases was a verdict ever rendered: most cases settled prior to a trial. Only 6% of cases remained open in June 1995, almost all of which were under appellate review.

Our third step was to characterize the litigating parties. The resources of the firms were assessed using two measures: sales and employment. We associate size with litigation costs in the empirical analysis for several reasons. First, a Price Waterhouse study shows that firms with lower legal costs tend to rely heavily on internal counsel for certain functions [Bellis and Gustin, 1992]. In our data, the larger firms were more likely to employ internal corporate patent counsel. The mean sales of firms listing internal counsel in the case files was \$15.3 billion compared to sales of \$1.5 billion for those with outside counsel alone, with mean employment of 52,426 versus 11,039. (Both differences are significant at the one percent confidence level.) Second, as noted above, previous work has demonstrated that smaller firms have relatively higher costs in complying with regulations and litigation [Pashigian, 1982]. Indirect evidence is provided by Bhagat, Brickley, and Coles' [1994] event study, which documents that thinly capitalized defendants have significantly larger negative stock price reactions to the filing of lawsuits than

¹⁷Our starting date was determined by the fact that a significant number of district courts did not begin adding cases to PACER until late 1989. Our ending date was determined by the leisurely manner in which the Federal Judicial Center compiles the Integrated Database. In March 1995, when we requested the database tapes, they were only available through the fiscal year ending in June 1991.

¹⁸We did not include a district that, for instance, began compiling cases in January 1991 because we were concerned about potential selection biases. In particular, cases initiated before that point would only be included in the database if they were still open in January 1991. Longer-running cases might be more likely to involve preliminary injunctions, or might be uncharacteristic in other respects. We did not include districts with fewer than 35 cases because of cost concerns. As described below, we needed to gather some information from the docket files. By concentrating on districts with more cases, we limited the number of courthouse visits required.

do other firms. Finally, even if smaller firms spend the same amount on litigation, these expenditures are likely to be more costly in terms of the dilution of management's equity ownership.

The 1990 sales and employment of firms that litigated patents were compiled from several sources. For publicly traded firms, we employed the domestic and international Compustat files, supplemented when necessary with annual reports, initial public offering prospectuses, and other filings. For privately held firms, we employed, in order of preference, the 1991 editions (which contain data gathered around the end of 1990) of Corporate Technology Information Services' *Corporate Technology Directory* [1991], Dun's Marketing Service's *Million Dollar Directory* [1991], Gale Research's *Ward's Business Directory of U.S. Private and Public Companies* [1991], National Register Publishing Company's *Directory of Leading Private Companies* [1991], and a considerable number of state and national business directories in the collections of the Harvard Business School's Baker Library, the Boston Public Library, the Library of Congress, and other libraries. For smaller foreign firms, we used a variety of international and country business directories in these libraries. For firms that we could not find in these sources, we gathered 1990 sales and employment data from historical records extracted from the American Business Information database. In all, we obtained employment data on 78% of the litigating firms, and sales data on 76%. Panel B of Table 1 indicates our success in gathering information on the litigating firms; Panel B of Table 2 summarizes the characteristics of the litigating parties.

Our final step was to identify and characterize the patents in each case. As discussed below, we used this information to control for the selection of cases for litigation. We used four sources to identify the patents. At the time a patent suit is filed, the Clerk of the Court is required to submit a form to the Commissioner of the U.S. Patent and Trademark Office [USPTO]. The form indicates the district in which the suit was filed, the docket number, and the patent(s) in dispute. This information is printed in the USPTO's *Official Gazette* and compiled in the "LIT/REEX" field in LEXIS's PATENTS database. Unfortunately, these forms are submitted in only about one-half the cases. We also used two other databases to determine the patents involved in these cases. First, Research Publications [1995] prepares an annual listing of patent litigation, based on the information provided by the clerks to the USPTO and on the firm's independent searches of activity in the district courts. The Intellectual Property Reserve Corporation, a provider of patent litigation insurance, has compiled its own proprietary database of patent suits that the firm employs when designing policies. The firm provided us with their data on all patent

suits filed during the sample period in our selected districts. Finally, for cases that we did not find in any of these three sources, our research assistants collected the information from the docket files.¹⁹

Once the disputed patents were identified, we collected a variety of information about them. First, we measured the extent of the prior art in the subclass to which the disputed patent (or patents) was assigned.²⁰ We compiled the number of patents that had been previously awarded in each patent's primary subclass as of mid-1991. Second, we determined how many of these previously awarded patents in the subclass had been reexamined. Reexamination is a procedure by which a firm can ask the USPTO to reassess (and hopefully scale back) a rival's patent award. We determined both the number of previous awards, and the extent to which they had been reexamined, using the USPTO's two CD-ROM databases. Third, we tabulated how many U.S. patents each firm had been assigned between 1969 and 1990 using the USPTO and LEXIS databases. This included awards to subsidiaries, which were identified through the business directories listed above. Finally, we determined how often the patent in dispute had been previously litigated using the "LIT-REEX" field in LEXIS's PATENT database, a search of Research Publications' annual compilations, and the compilations of judicial decisions, news stories, and USPTO interference decisions available through LEXIS. [See Lerner, 1995, for a detailed description of these sources.] Panel C of Table 2 summarizes these control measures.

Empirical Analyses

Table 3 summarizes the role of preliminary injunctions in our set of cases. In 19% of the cases, the plaintiff requested a preliminary injunction. In cases where preliminary injunctions were requested,

¹⁹In some cases, firms will add charges of infringement of additional patents after the initial suit is filed. (See Conway and Lerner [1995] for an example and a discussion of the rationales for such a strategy.) In these cases, an additional form must be filed with the USPTO. We check for this possibility in the cases not in the three databases by examining not only the plaintiff's original complaint, but any amended complaints filed by the plaintiff.

²⁰At the time of award, the patent examiner assigns the patent to a primary subclass (out of over 120,000 U.S. patent subclasses). In addition, the patent may be assigned to one or more other subclasses. The examiner has a strong incentive to classify these patents carefully, because he uses these classifications in his searches of the prior state-of-the-art. To insure the accuracy of the classification and to maintain consistency across examining groups, an official known as a "post classifier" reviews the classification of all issuing patents. We use the classification scheme as it existed in mid-1991. [For an overview, see U.S. Department of Commerce, 1984.]

they had a prominent role in the litigation. On average, such cases had 10.2 docket entries directly addressing the request for a preliminary injunction, which is nearly one-fifth (17.5%) of all docket entries in these cases. Preliminary injunctions were granted in 12, or 52%, of the 23 cases proceeding through a ruling on the request. (Because some cases were withdrawn, this represents 43% of the cases that were not settled.) As assumed in the model, cases with preliminary injunction requests took on average about the same amount of time to resolve as other cases.

The raw data are displayed in Figure 2. The figure shows the distribution of cases with and without an injunction request across plaintiffs and defendants. As in Figure 1, larger firms are located nearer the origin, with size measured by employment. Cases located above the 45 degree line are those where the plaintiff was greater than the defendant. In this region, there appears to be a higher concentration of cases with an injunction request than there is below the 45 degree line. The area enclosed by the bent line is a representation of the region in Figure 1 where injunction requests are predicted in equilibrium. In this area, there is clearly a greater concentration of cases with an injunction request than elsewhere.

We next examine how the characteristics of litigating parties differ in lawsuits where the plaintiff did or did not request preliminary injunctive relief. Table 4 presents comparisons of means and medians across cases with and without an injunction request. In some cases, there were multiple plaintiffs and defendants. The table uses the average level of employment and sales for the co-litigants. The distributions of these variables are highly skewed, and the appropriateness of a t-test questionable. We consequently also compare the logarithm of each observation.

Consistent with the predation hypothesis, corporate plaintiffs are substantially larger in cases where preliminary injunctions were requested. The differences are significant at conventional confidence levels in sales (and, when using logarithms, employment). The median tests also indicate significant differences for both sales and employment. Similarly, preliminary injunction requests are significantly more common in cases where the plaintiffs had greater sales than the defendants. These patterns are only of borderline significance when we compare employment. There is no distinguishable difference in the size of defendants.

We now turn to an examination of the patterns in a regression framework. The dependent variable is a dummy indicating whether a preliminary injunction was requested by the plaintiff. (Cases with such a request are assigned the value of one.) The explanatory variables include measures of the plaintiff and defendant sales and employment. Because the two size measures are highly collinear, we employ them in separate regressions.

The patent data is used to control for variations in the information environment across cases. We expect that patents awarded in new areas of technology, with few prior patents, are likely to be characterized by greater uncertainty. Standard models of suit and settlement [for example, the composite model in Cooter and Rubinfeld, 1989] suggest that litigation is more frequent when there is more uncertainty. While in many areas (for example, inorganic chemicals), the criteria for novelty and discovery are clearly defined, in new technologies such as software and biotechnology there is much greater uncertainty. Thus, we include the extent of patenting in the subclass in which the disputed patent has its primary assignment as a measure of how settled the law is in the area. Similarly, patents in subclasses where awards are frequently reexamined are likely to be in areas with substantial legal uncertainty.

Further controls include a measure of previous litigation involving the patent. Prior litigation suggests that much of the uncertainty about the extent of the protection provided by the patent has been resolved. It may also indicate, however, that the patent is economically more valuable (larger V_1). Standard models suggest that litigation is more common when stakes are larger, so the net effect is unclear. We also employ a dummy indicating whether the case was filed in the First Circuit.²¹

We run the regressions using the various size measures and the logarithm of size. When there are multiple co-litigants, we use the characteristics of the average litigating party (for example, the mean

²¹Plaintiffs are almost twice as likely to request preliminary injunctions in the First Circuit. This probability is significantly different from the other circuits at the 5% confidence level. In applying the four-part test described above, the First Circuit has placed particular emphasis on the third, or "probability of success," factor. See McLaughlin and Tallon [1987] for a discussion of the differences across circuits. Two cases that illustrate the First Circuit's approach are *Massachusetts Association of Older Americans, Inc. v. Sharp*, 700 F.2d 749 (1st Cir. 1983) and *Wald v. Regan*, 708 F.2d 794 (1st Cir. 1984). In unreported regressions, we employ dummy variables for the other circuits. Their effect is negligible.

employment of the plaintiffs in the suit) and extreme values (for example, the employment of the largest plaintiff). We similarly measure the disputed patents using the extreme patents in each case--for example, the most litigated patent in each case--and the average patent. Results are similar for all specifications.²²

Six of these regressions are reported in Tables 5 and 6. In Table 5 the plaintiff and defendant size measures both enter as explanatory variables, while in Table 6 the difference between the size of the plaintiff and that of the defendant is used instead. The coefficients on plaintiff size are significant at the five percent level in all of the regressions. Using the first set of estimates in Table 5, at the mean of all the independent variables, a one standard deviation increase in the plaintiff's sales increases the predicted probability of a preliminary injunction request from 15% to 24%. In Table 6, we see that the extent to which a plaintiff is larger than the defendant also has a positive and significant effect on the probability of an injunction request. The coefficients on defendant size are negative but not significant in both tables. Only one of the control variables for the information environment--the number of prior patents in the subclass--is of borderline significance.

While the empirical results are consistent with the hypothesis that financially strong plaintiffs use preliminary injunctive relief to predate on weaker firms by driving up their costs, the results are also consistent with other hypotheses. We will briefly discuss four alternative explanations here.

First, the importance of creating and maintaining a reputation for litigiousness may increase when a firm expects to be engaged in future disputes [for a general model, see Kreps, *et. al.*, 1982]. Larger firms may expect to be involved in litigation more frequently because they have more patents. If requesting injunctions contributes to a reputation for being aggressive, then reputational concerns might induce a positive relationship between firm size and the likelihood of an injunction request. We use the patent data to control for variations in the importance of reputation to the two parties. In unreported regressions, the numbers of patents held by each party are added as independent variables. The inclusion of these variables has little effect on the results. The coefficients on plaintiff sales often increase in magnitude and significance, while those on plaintiff employment decrease somewhat, but always remain

²²Some privately held firms are missing employment and sales data. These omitted observations may introduce biases. Because the missing domestic firms are overwhelmingly very small ones, we check the robustness of the results by rerunning the regressions under the assumption that they have no employment or sales. This change has little impact.

significant at the ten percent confidence level. The coefficients on the patent stock variables themselves, which proxy for reputational effects, are not significant.

Another possible explanation for the results is that the value of the patents in dispute differ with firm size (that is, the set of profits, V_1 , V_s , and V_2). For instance, small start-ups may be concentrating on particularly promising technologies. In our model, however, what matters for the choice between settlement, trial, and injunction is not the absolute size of profits, but the ratio between total profits with and without infringement. It is not obvious that this should be related to the size of patentees. We also address this concern in unreported regressions by adding dummy variables for the two-digit Standard Industrial Classification (SIC) codes of the plaintiffs and defendants, and for the class of the patents in dispute (using the USPTO's classification scheme). These may control to some extent for differences in the value of the disputed patents. The dummy variables are rarely significant, and the coefficients on the original independent variables change little.

Third, the probability of winning an injunction may be improved with greater expenditure on legal services, and larger firms may spend more on such services. If so, then an alternative interpretation of the results is that the expected probability of obtaining an injunction, P_1 , differs with firm size. What this implies about the likelihood of requesting an injunction, however, is ambiguous: it is likely that greater expenditure would also increase the probability of winning at trial, P_T . The effect on the relative payoffs, and therefore the equilibrium regions, would depend on the sensitivity of the two win probabilities to legal expenditures.

Finally, it may be that small firms (and individuals) are less sophisticated in intellectual property disputes. They may be less able to accurately assess whether other firms are or are not infringing their patents. If so, small firms would have lower probabilities of winning in court (lower P_1 and P_T). Once again, the predicted effect on the choice of whether to request an injunction is ambiguous.²³

²³One way to assess this alternative explanation is to examine the behavior of infringers after preliminary injunctions are granted. If we relax the common knowledge assumption of the model, the predation hypothesis suggests that we may see a distinct pattern. Suppose that the plaintiff does not know the financial condition of the infringer, and consequently does not know on what terms the infringer will settle. In this situation, if an injunction request is granted, the infringing firm might try to take advantage of the patentee's uncertainty. The infringer can give the appearance of having low financing costs by refusing to settle for a time, and thereby obtain a more favorable settlement. Lower-cost firms would

IV. Implications of the Model

In this section we investigate some of the implications of the model. First, we consider how the availability of preliminary injunctive relief affects the share of cases going to trial and the impact of this legal remedy on high- and low-cost plaintiffs and defendants. Second, we consider two potential policy reforms: an increase in the probability that injunction requests are granted and a relaxation of the limits on firms' ability to obtain external financing for lawsuits. Finally, we briefly discuss two areas for future research.

Frequency of Trials and Distributional Effects

We first examine whether the possibility of requesting an injunction encourages the parties to settle disputes. To do this we return, in Figure 3, to the diagram of the "base case" which was presented in Figure 1. The shaded area indicates (A, a) pairs who settle when the option of such relief is available (they are above the dot-dashed $I = S_I$ line and the thin $S_I^* = T$ line) but who would have gone instead to trial if preliminary injunctive relief were not available (they are below the dotted $T = S_T$ line). Thus, the opportunity to request an injunction leads in the base case to fewer trials. The reason for this is that the option of an injunction allows some patentees to credibly threaten to drive up the infringers' costs, both through the higher legal costs imposed by an injunction proceeding as well as from the possibility of having to cease operations involving the patented innovation. This allows patentees to be more aggressive in their settlement demands and consequently more willing to settle. We shall see below, however, that this finding is not robust to changes in the parameter vector.

What type of litigants gain from the availability of injunctive relief? As modelled, all plaintiffs have cases which are identical--they are of equal size and merit. Although all of the cases are identical, the payoffs are not. Even without the option of preliminary injunctive relief, the net benefit received by

tend to hold out for a longer period. One would not expect such systematic behavior if small firms operated in a naive fashion. Looking at the 12 cases in our data where a preliminary injunction was granted, we find that larger (lower-cost) firms hold out longer in settlement negotiations after they have been enjoined. The correlation between the number of days from the date of the injunction grant to the date of the closing of the case on the one hand and the defendant's average sales on the other is 0.80 (with p-value of 0.03) and that between days and employment is 0.20 (with a p-value of 0.67).

each party to a suit is decreasing in own costs, A or a .²⁴ This asymmetry becomes more pronounced with the introduction of injunctive relief.

Before considering the distributional impact of injunctive relief in detail, it is useful to note the somewhat counter-intuitive fact that a patentee may be worse off from having the opportunity to request an injunction. This situation can arise in a settlement equilibrium as follows. When there is a settlement, the innovation profits under licensing, $(n+m)V_s$, are divided between the parties. The share going to the infringer is determined by the payoff he expects if he refuses to settle. Low-cost infringers may actually prefer to be enjoined because an injunction provides a legal method to generate monopoly profits over the period of trial, thereby limiting damages. In addition, when the infringer has low costs, an injunction proceeding is not financially troublesome. Against such infringers, the effectiveness of the patentee's threat in settlement negotiations is lowered if he can no longer credibly commit to going directly to trial when the option of requesting an injunction is available.

We now turn to patentees in each of the five regions delineated in Figure 1. Patentees who request an injunction (those in region I) are clearly better off from being able to do so since they are not constrained from choosing T , which would be their equilibrium payoff if the option were not available. Similarly, the decision to sink costs (in order to obtain S_1^* , rather than the best alternative without the injunction option, T or S_T) indicates that the payoff with a credible injunction threat is higher than the payoff without. Patentees who chose S_T or T when injunctive relief is an option are indifferent between a world with or without such an option, since it does not affect the outcome.

The final group that must be evaluated is the patentees choosing S_1 , *i.e.*, those settling the dispute after making a credible threat to seek an injunction. To evaluate this group, we need to add one additional demarcation: the finely dotted line in Figure 3. This indicates (A,a) pairs where the patentee is indifferent between his settlement payoff when he can threaten an injunction and that when he cannot: $S_1 = S_T$. Patentees above the line prefer the settlement payoff that they can obtain with a credible injunction threat, S_1 , and, for the reason discussed above, those below prefer *not* to have a credible injunction threat. The line is close to horizontal because the difference in the payoffs S_1 and S_T depends

²⁴See the definitions of T and S_T . It is assumed that the cost disadvantages felt by small firms outweigh any benefit that they derive from being financially unable to pay large damages.

primarily on the costs of the infringing firm rather than those of the patentee. We see in Figure 3 that the area where the plaintiff prefers S_T is below the region where parties end up settling for S_I in equilibrium. In no cases does the plaintiff's credible threat to pursue an injunction lead to a settlement where he is worse off than if he did not have the option to seek such relief.

Now consider the infringers. First, like patentees, infringers are indifferent in the regions S_T and T : the patentees' option to request an injunction has no impact on the outcome. Second, recall that in any equilibrium with settlement, profits under licensing are shared in some way by the parties. Thus, if the patentee prefers one settlement outcome over another, it must be the case that the infringer has the opposite preference. It follows that infringers in the regions S_I and S_I^* are worse off with an injunction threat, since the patentees prefer those payoffs to S_T .

Finally, the infringer's preferences in region I can be determined in two steps as follows. First note that the opposing preferences of the two parties in settlement mean that the horizontal line in Figure 3 has the opposite interpretation for infringers: above the line, infringers prefer the payoff associated with S_T and, below the line, they prefer that associated with S_I . Second, recall that all settlement offers leave the infringer indifferent (in expectation) between settlement and the relevant alternative. It follows that one can reinterpret the horizontal line as indicating the infringer's preferences regarding trial versus an injunction. Within the region marked I , infringers above the horizontal line prefer the payoff associated with T and thus are worse off, while those below the line prefer the payoff associated with I and thus are better off.

To summarize, in the base case patentees are never worse off from having the option to request an injunction. On the other hand, the result for infringers varies. While high-cost infringers are either worse off or indifferent, low-cost infringers faced by low-cost patentees may actually prefer to be enjoined. By harming high-cost infringers and improving the lot of low-cost plaintiffs and defendants, the option of injunctive relief increases the unequal benefits received by firms in litigious situations.

Policy Reforms

We turn now to consider two possible policy reforms. The first is a further relaxation of the standards for obtaining a preliminary injunction. Figure 4 displays the equilibrium results of increasing

the probability that an injunction is granted, P_i , from 0.4 to 0.65. The second policy reform is an easing of the financing costs associated with litigation. Figure 5 displays the results of a reform which lowers the injunction cost premium, k , from 3 to 2. This reform implies that total trial expenditures are 20%, rather than 40%, higher with an injunction proceeding.

Turning first to Figure 4, we see the dot-dashed line ($S_i=I$) shifting out and the bold line ($T=I$) shifting right as injunctions become more attractive to the patentee. Not surprisingly, there are more injunction requests. Because the dot-dashed line is now outside of the dashed ($T=S_T$) line, there are now (unlike in the base case) suits which are tried that would have been settled in the absence of the option to request an injunction (the shaded area).

Again we can ask what type of litigants benefit. The reform has no effect on either patentee or infringer payoffs for those (A,a) pairs who remain in regions T or S_T . For the patentees, those in regions where injunctions are requested or threatened— I , S_i , and S_i^* —all receive higher payoffs, with payoffs for patentees that actually seek an injunction increasing the most. Thus the lowest-cost patentees benefit the most and the inequality of access to the courts is made worse. Now consider infringing firms. High-cost infringers are worse off because they now receive less favorable settlements. The lowest-cost infringers, however, may benefit: as explained above, they may prefer to be enjoined because the injunction increases joint profits. Since in the base case the option to request a preliminary injunction already benefitted low-cost patentees and infringers the most, this policy change makes this asymmetry even more acute.

A policy change which lowers the cost premium of an injunction, k , also increases the number of cases going to trial (the shaded region in Figure 5). Low-cost patentees who actually seek an injunction benefit the most as legal expenditure falls. High-cost patentees who settle obtain lower payoffs with this reform. Injunction hearings become less costly for infringers and therefore are less effective as a threat. In fact, with this reform there is a small triangular region where patentees settling with a payoff of S_i would prefer to have the payoff S_T (they are below the horizontal $S_i=S_T$ line). That is, patentees within this region would be better off without the option to request an injunction. Unlike an increase in P_i , however, a reform which lowers the cost of an injunction hearing reduces the asymmetry of treatment among infringers. By making an injunction less expensive, a fall in k increases the payoff to low-cost infringers. It has, however, an even more beneficial impact on the high-cost infringers.

The finding that lowering litigation financing costs enhances equality of treatment raises the question of why many states prohibit outsiders from financing lawsuits in return for a financial return (champerty). Prohibitions against champerty, which date back to English common law, remain in force in Florida, Illinois, Massachusetts, New York, Pennsylvania, and many other states.²⁵ Furthermore, concerns have been expressed about the impact of Federal securities laws on investments in litigation. [Many of these barriers are summarized in Abraham, 1992.] Perhaps an even greater impediment to third-party financing of litigation is the distaste with which legal leaders view this practice. For instance, former Chief Justice Warren Berger has noted [1995]:

we have long accepted the idea that certain behavior is prohibited--for example, our laws against champerty and maintenance. But assuming for the moment that the Constitution permits a lawyer to finance a client's lawsuit, surely professional standards prohibit it.... [While] shyster lawyers [will be] inclined to do anything and everything to secure clients, ...if the idea of a profession means anything, it means that a profession must adhere to standards that are above the minimum commands of the law.

This discussion is disturbing in view of the evidence presented here regarding preliminary injunctions, and the more general body of work on capital constraints and investment. The analysis above suggests that relaxing champerty restrictions, by lowering the cost of litigation, would increase the number of suits ending up going to trial. At the same time, however, relaxing champerty restrictions would put smaller firms on a more equal footing. This is particularly important in intellectual property cases, since young firms whose primary assets are intangible are most likely to find it difficult to raise capital elsewhere.

Areas for Future Research

This paper has examined the role of preliminary injunctions in civil litigation. We built a simple model which was motivated by suggestions that injunction requests can be used as a tool for predating on capital-constrained weaker firms. The empirical results were consistent with the predictions of the model. In this final section, we consider two aspects of preliminary injunctive relief that deserve further attention.

²⁵Federal law also limits such arrangements in cases before the U.S. International Trade Commission, a venue where international patent disputes frequently surface. One recent example is "In the Matter of Certain Memory Devices with Increased Capacitance and Products Containing Same," U.S. International Trade Commission Investigation No. 337-TA-371, 1995 ITC LEXIS 40, 1995 ITC LEXIS 168, 1995 ITC LEXIS 287, 1995 ITC LEXIS 341.

The first is an analysis of the net social benefits of allowing preliminary injunctive relief. In situations such as the base case, the option to request a preliminary injunction lowers the share of cases which actually end up going to trial. The resources expended on injunction hearings, however, make those that do end up going through to trial more costly. As we have seen from the policy reforms considered above, making preliminary injunctions more attractive may lead to greater use of the courts. Because it is the lower-cost litigants who benefit (or are hurt the least), it also appears that the introduction of preliminary injunctive relief is detrimental to the goal of ensuring equal access to the courts.

In the specific context of patent litigation, preliminary injunctions that are granted lead to a monopoly during the trial period, lowering static efficiency and imposing costs on consumers. The motivation behind allowing patentees to obtain injunctive relief, however, was precisely to increase their monopoly profits in order to provide a greater stimulus to innovation. As we have seen, preliminary injunctions favor large firms over small firms.²⁶ There may be ways to encourage innovation that affect firms more equally. Such mechanisms might include altering patent length [Nordhaus, 1969], breadth [Klemperer, 1990], and renewal fee schedules [Cornelli and Schankerman, 1996]. An extensive literature compares the costs and benefits of such patent design elements: for instance, the tradeoff between patent length and breadth. An attractive area for future research is a comparison of patent design options and legal policy options.

Consideration of the use of preliminary injunctive relief in alternative information settings is a second interesting avenue of further research. For example, if the plaintiff has private information about case quality (P_1), a plaintiff with a good case may request an injunction because a favorable ruling would convey a credible positive signal to the infringer. The plaintiff could then extract a better settlement at stage two. The request itself could alter the infringer's beliefs so as to lead to settlement at stage one with a higher payoff to the patentee. One could also consider the case of an informed court and uninformed litigants: a plausible scenario in areas where legal procedure is unsettled. Here the plaintiff and defendant both learn about case quality from the injunction hearing at a lower cost than going through a full-blown trial. Similarly, if it is the defendant who has private information, the plaintiff may use an

²⁶Furthermore, as discussed above, in some cases the option to request a preliminary injunction may not increase the equilibrium payoff of the patentee.

injunction hearing as a way to extract that information before deciding whether to invest in further litigation.

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Table 1--The construction and completeness of the sample

<i>Panel A: Identifying the sample</i>	
	Number of cases
Patent cases in the Federal Judicial Center's Integrated Database initiated between January 1, 1990 and June 30, 1991*	1841
-Cases in districts with fewer than 35 patent cases initiated in this period	639
-Cases in districts where PACER system was not publicly available as of June 1, 1995	116
-Cases in districts where PACER system began compiling cases only after January 1, 1990	673
-Cases in districts where closed cases have been purged from the PACER system	151
-Cases missing from PACER system	5
-Copyright, trademark and other cases misclassified as patent cases	5
= Total sample	252
<i>Panel B: Completeness of information about the sample</i>	
Cases in sample where patents being litigated can be determined	249
Cases in sample where litigation is between businesses	221
Cases in sample where litigation is between businesses and sales of both parties can be determined	149
Cases in sample where litigation is between businesses and employment of both parties can be determined	157

*At the time that the sample of cases was drawn, the fiscal year ending in June 1991 was the last year for which data on cases was available from the Federal Judicial Center's Integrated Database. Very few federal districts entered cases into the PACER system prior to late 1989.

Table 2--Summary statistics of the sample cases

<i>Panel A: Dispute venue and status</i>				
	Mean	Std. dev.	Minimum	Maximum
Massachusetts District case (1st Circuit)	.218	.414	0	1
Eastern District of Michigan case (6th Circuit)	.163	.369	0	1
Northern District of Ohio case (6th Circuit)	.179	.384	0	1
Minnesota District case (8th Circuit)	.150	.359	0	1
Southern District of California case (9th Circuit)	.155	.362	0	1
Northern District of Georgia case (11th Circuit)	.135	.342	0	1
Verdict rendered in case	.110	.313	0	1
Verdict of infringement rendered in case	.081	.274	0	1
Case appealed to Federal Circuit	.065	.247	0	1
Case still open on June 1, 1995	.057	.232	0	1
<i>Panel B: Characteristics of litigating parties as of end of 1990</i>				
Plaintiffs include at least one business	.901	.300	0	1
Defendants include at least one business	.976	.153	0	1
Average corporate plaintiff's sales (\$M)	1523	3343	.26	19800
Average corporate plaintiff's employment	11820	27280	2	201000
Average corporate defendant's sales (\$M)	2422	8792	.30	86600
Average corporate defendant's employment	12252	28576	2	201000
Average plaintiff employs more than average defendant	.483	.501	0	1
Average plaintiff has more sales than average defendant	.465	.500	0	1
<i>Panel C: Characteristics of patent(s) in dispute as of June 1991</i>				
Number of disputed patents	1.68	1.27	1	9
Average number of other patents in subclass	182.8	185.8	0	1096
Average ratio of number of patent reexaminations to number of other patents in subclass	.003	.008	0	.046
Average number of earlier suits involving disputed patents	.373	1.386	0	16
Average corporate plaintiff's patent awards, 1969-1990	378	1216	0	11676
Average corporate defendant's patent awards, 1969-1990	256	879	0	5887

NOTE--The sample consists of 252 patent disputes in six Federal districts begun between January 1, 1990 and June 30, 1991. In some cases, there were multiple plaintiffs, defendants, and/or disputed patents. We present the average of the various measures across the litigating parties or the patents.

Table 3--The role of preliminary injunctions in the sample cases

<i>Panel A: Distribution of Cases</i>	
	Number of cases
Cases where plaintiff requested preliminary injunction	48
Cases where case settled prior to hearing	20
Cases where plaintiff withdrew preliminary injunction request prior to hearing	5
Cases where hearing on preliminary injunction request held	23
Cases where request for preliminary injunction granted	12
Cases where case request for preliminary injunction denied	10
Cases where settled between preliminary injunction hearing and ruling	1
Average fraction of docket entries relating to the request for preliminary injunction	17.5%

<i>Panel B: Timing of Cases</i>	
	Years
Average time, case initiation to preliminary injunction hearing	0.54
Average time, case initiation to preliminary injunction ruling	0.89
Average time, preliminary injunction granting to case close ^a	1.20
Average time, preliminary injunction denial to case close ^a	1.47
Average time, case initiation to close, cases with preliminary injunction request ^{a, b}	1.52
Average time, case initiation to close, cases without preliminary injunction request ^{a, b}	1.39

^aOnly includes cases that have closed.

^bIncludes cases where settlement prior to granting or denial of preliminary injunction request.

NOTE--The sample consists of 252 patent disputes in six Federal districts begun between January 1, 1990 and June 30, 1991.

Table 4--Comparisons of litigating parties in cases with and without requests for preliminary injunction

	Ratio of value in cases with preliminary injunction request to value in cases without	p-Value, test of equality	p-Value, test of equality (logarithms)
<i>Employment of average plaintiff</i>			
Mean	1.75	.121	.026
Median	9.37	.040	
<i>Sales of average plaintiff</i>			
Mean	1.95	.048	.041
Median	8.73	.047	
<i>Employment of average defendant</i>			
Mean	0.75	.550	.933
Median	1.00	.944	
<i>Sales of average defendant</i>			
Mean	1.45	.537	.917
Median	1.21	.884	
48 cases with request for preliminary injunction			
204 cases without request for preliminary injunction			
<i>Nature of litigating parties</i>			
Plaintiffs include at least one business	.896	.902	.898
Defendants include at least one business	.979	.975	.881
<i>Comparison of corporate plaintiffs and defendants</i>			
Average plaintiff employs more than average defendant	.667	.450	.099
Average plaintiff has more sales than average defendant	.621	.417	.014

NOTE--The sample consists of 252 patent disputes in six Federal districts begun between January 1, 1990 and June 30, 1991. The table compares the characteristics of the litigating parties in cases where preliminary injunctions were and were not requested. p-Values from Pearson χ^2 - and t-tests of equality are also presented. Because the distribution of some variables are very skewed, the p-value is also presented when the logarithms of the continuous variables are compared. In some cases, there are multiple plaintiffs and/or defendants. We report the average of the various measures across the co-litigants.

Table 5--Probit regression analyses of requests for preliminary injunction, using plaintiff and defendant size proxies

	<i>Dependent variable: Plaintiff requests a preliminary injunction</i>	
	Litigating party measures use levels and are averages across the co-litigants	Litigating party measures use logs and are the maximum of the co-litigants
Plaintiff's sales (\$B)	0.09 [2.63]	0.10 [2.08]
Plaintiff's employment (000's)	0.01 [2.19]	0.12 [2.49]
Defendant's sales (\$B)	-0.08 [1.26]	-0.01 [0.16]
Defendant's employment (000's)	-0.01 [1.30]	-0.02 [0.36]
Prior patents in subclass (000's)	-1.18 [1.78]	-1.26 [1.88]
Ratio of reexaminations to other patents	-6.90 [0.47]	-7.85 [0.54]
Earlier suits involving disputed patent	0.01 [0.12]	0.02 [0.25]
Case filed in 1st Circuit	0.84 [3.01]	0.74 [2.64]
Constant	-0.96 [4.30]	-0.81 [3.78]
χ^2 -statistic	20.67	17.48
p-Value	0.002	0.008
Log likelihood	-61.24	-62.84
pseudo-R ²	0.14	0.12
Number of observations	147	155

NOTE--The sample consists of 252 patent disputes in six Federal districts begun between January 1, 1990 and June 30, 1991. The dependent variable equals one if the plaintiff requests a preliminary injunction; and equals zero otherwise. In some cases, there were multiple disputed plaintiffs, defendants, and/or patents. The first two regressions use the average level of the litigating parties' characteristics (e.g., the average sales of the plaintiffs). The second two regressions use the maximum of the litigating parties' characteristics, and express these measures in logarithms (e.g., the logarithm of the sales of the largest plaintiff). In each regression, the maximum of the patent measures are used (e.g., the maximum number of suits involving a litigated patent). Absolute t-statistics are in brackets.

Table 6--Probit regression analyses of requests for preliminary injunction, using differences between plaintiff and defendant sizes

	<i>Dependent variable:</i>	
	<i>Plaintiff requests a preliminary injunction</i>	
	Litigating party measures use levels and are the maximum of the co-litigants	
Difference between plaintiff's and defendant's sales (\$B)	0.09 [2.75]	0.01 [2.37]
Differences between plaintiff's and defendant's employment (000's)	-1.14 [1.76]	-1.18 [1.84]
Prior patents in subclass (000's)	-6.40 [0.43]	-5.59 [0.40]
Ratio of reexaminations to other patents	0.01 [0.11]	0.01 [0.10]
Earlier suits involving disputed patent	0.86 [3.07]	0.82 [3.03]
Case filed in 1st Circuit	-0.95 [4.34]	-0.94 [4.48]
Constant		
χ^2 -statistic	21.16	18.21
p-Value	0.001	0.003
Log likelihood	-60.99	-65.60
pseudo-R ²	0.15	0.12
Number of observations	147	155

NOTE--The sample consists of 252 patent disputes in six Federal districts begun between January 1, 1990 and June 30, 1991. The dependent variable equals one if the plaintiff requests a preliminary injunction, and equals zero otherwise. In some cases, there were multiple disputed plaintiffs, defendants, and/or patents. The regressions use the maximum of the co-litigating parties' characteristics (e.g., the sales of the largest plaintiff). Similarly, the maximum of the patent measures are used (e.g., the maximum number of suits involving a litigated patent). Absolute t-statistics are in brackets.

Figure 1--Base case

Parameter Vector {0.16, 0.8, 3, 0.15, 0.3, 0.75, 0.4, 2, 5, 1, 1.05, 1.25}

Infringer (a)

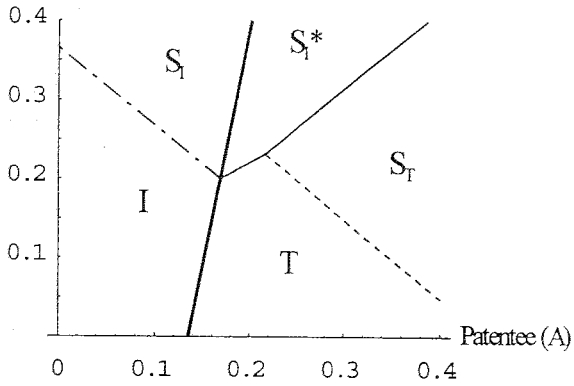
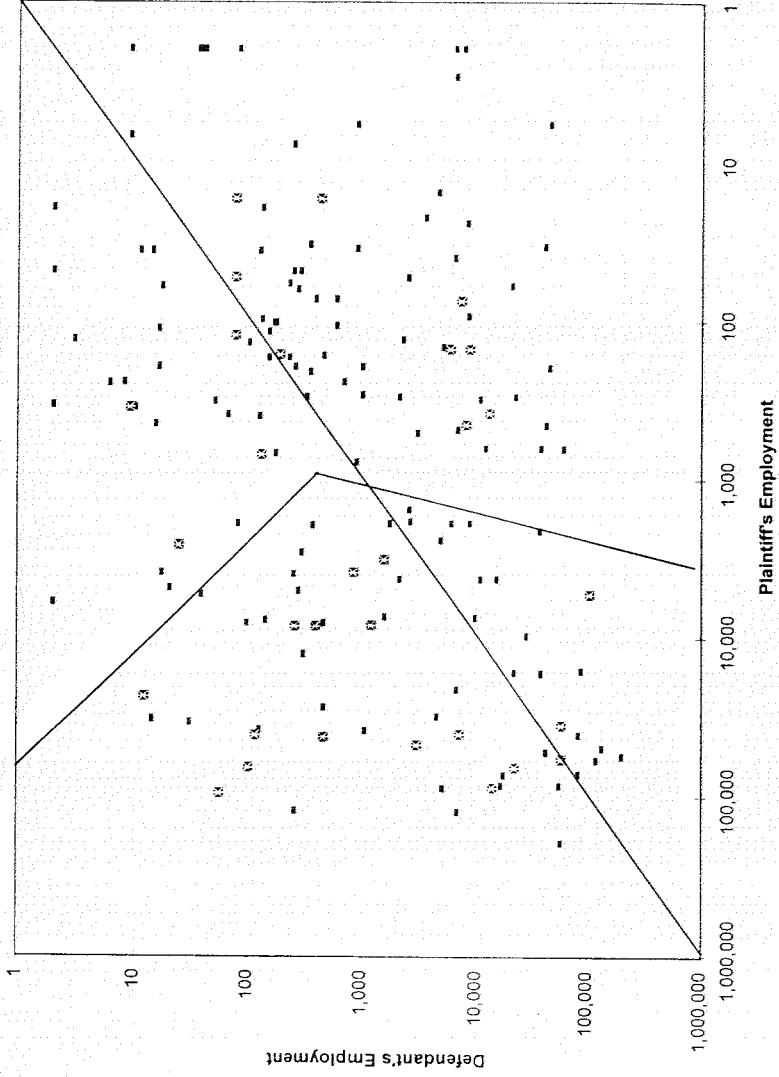


Figure 2--Distribution of cases with and without preliminary injunction requests



NOTE--The table presents the employment of the largest plaintiff and defendant in 252 patent disputes begun in six Federal districts between January 1, 1990 and June 30, 1991. The larger cross-hatched boxes denote cases where a preliminary injunction was requested.

Figure 3--Base case (alternative depiction)

Parameter Vector {0.16, 0.8, 3, 0.15, 0.3, 0.75, 0.4, 2, 5, 1, 1.05, 1.25}

Infringer (a)

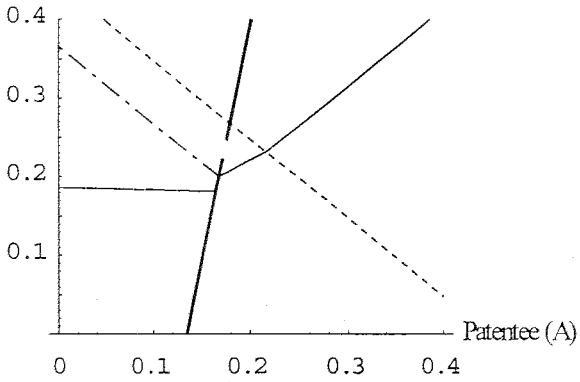


Figure 4--Effects of loosening standards for preliminary injunctions

Parameter Vector {0.16, 0.8, 3, 0.15, 0.3, 0.75, 0.65, 2, 5, 1, 1.05, 1.25}

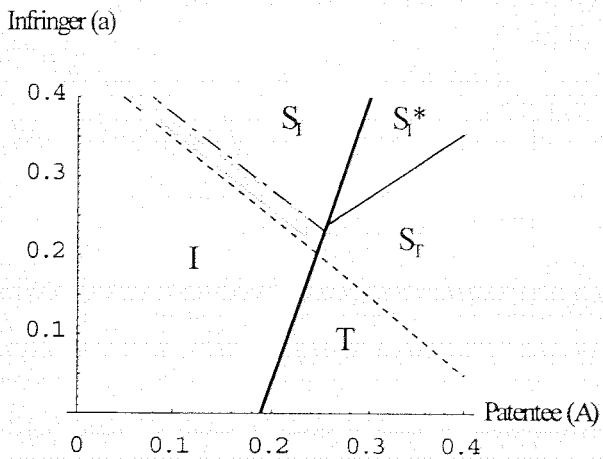


Figure 5--Effects of relaxing litigation financing constraints

Parameter Vector {0.16, 0.8, 2, 0.15, 0.3, 0.75, 0.4, 2, 5, 1, 1.05, 1.25}

Infringer (a)

