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## WORKING PAPER SERIES

### **Different Rules of Legal-Cost Allocation and Patent Hold-Up**

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# Different Rules of Legal-Cost Allocation and Patent Hold-Up

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**Abstract.** We study how different rules of legal-cost allocation impact on negotiated royalties in an environment where patent hold-up is possible. The model assumes that the courts routinely grant stays of permanent injunctions to allow the infringers to redesign their products or deny injunctive reliefs outright. In these scenarios we consider the American system, where each party bears its own costs, the British system, where the loser incurs all costs, and the system favoring the defendant, where the defendant pays its own costs if it loses and nothing otherwise. Our main conclusions are that when stayed injunctions are granted the system favoring the defendant provides the best results, while under denied injunctions the American system is preferable.

*Keywords:* licensing, permanent injunctions, patent hold-up, litigation costs.

*JEL Classification:* K41, O34.

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## 1. Introduction

By using a simple model of patent settlement, in this paper we compare the payoffs from pre-trial licensing agreements to the patent holder and to the licensee under different systems of legal-cost allocation, namely, the “American system”, where each party bears its own costs; the “British system”, where the loser incurs all costs; and the “system favoring the defendant”, where the defendant pays its own costs if it loses and nothing otherwise (Shavell, 1982).<sup>1</sup>

To our knowledge, although some papers exist that discuss the role of legal-cost allocation in favoring patent litigation or settlement (Meurer, 1989, Aoki and Hu, 1999, Llobet, 2002) , and many more have dealt with the problem by referring to civil suits in general (Shavell, 1982, Reinganum and Wilde, 1986, Hylton, 1993, Hughes and Snyder, 1995, Polinsky and Rubinfeld, 1998, among others), only little attention had been paid to the implications on the royalty-bargaining process. A notable exception is Aoki and Hu (1999), where the issue is analyzed distinguishing between legal systems depending on their degree of patent protection.<sup>2</sup> The paper concludes that where patent protection is low, the patent holder is better off under the American system, and the opposite occurs where the patent protection is high. Here we adopt a different point of view, that is we assume that if a patent is declared invalid or not infringed this is because, after a thorough scrutiny, the court shows that truly the invention at issue does not meet the novelty and non-obviousness requirements or the patent claims are so narrow as not to concern the feature under investigation (Farrell and Shapiro, 2008). This allows us to treat the so called “patent hold-up” as a real problem, and to study how different rules of legal-cost allocation impact on it.

Our model is heavily based on Lemley and Shapiro (2007a) and Shapiro (2010), where patent licensing negotiation is studied under the assumption that a patent owned by a non-practicing subject covers a technology feature incorporated into a product sold by a downstream firm. In their framework negotiations occur in the shadow of litigation, and the downstream firm bargains over the licensing terms under the threat

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<sup>1</sup> Shavell (1982, p. 55-56) notes that the system favoring the defendant is a departure from the norm (the American system in the U.S. and the British system in Europe), but it is sometimes employed. For example the state of Florida has adopted this allocation rule in medical malpractice cases.

<sup>2</sup> Put in another way, “their approach assumes that if a patent is ruled invalid or not infringed it is a court (or legal system) error” (Farrell and Shapiro, 2008, p. 1354).

that, if the patent is found valid, the court issues a permanent injunction to immediately withdraw the infringing product from the market. Lemley and Shapiro stress that it is just the threat of these injunctive reliefs, together with the money costs and delays required to redesign the product, that enables the patent holder to hold-up the downstream firm.<sup>3</sup> Hence the recommendation that in situations where the patent holder does not compete against the downstream firm, and the alleged infringing feature is only a little component of a complex product, the courts consider staying permanent injunctions for a time long enough to give the downstream firm the opportunity to redesign its product.<sup>4</sup> Since during the time required to redesign the product the downstream firm could continue to sell the infringing version in exchange for paying “reasonable” royalties to the patent holder, under stays of permanent injunctions routinely granted the hold-up effects would be reduced to those of redesign costs.<sup>5</sup>

Here we study how such courts’ policy would affect negotiated royalties under different systems of legal-cost allocation. We will see that, in general, one cannot decide which of the two “normal” systems, American and British, guarantees better results. More specifically, when the patent at issue is relatively weak –in the sense that in court the patent would be deemed invalid or not infringed with a relatively high probability – the British system supports the effect of stay: in this case it acts as a device to reduce the residual hold-up component in the negotiated royalty rate, while the American rule proves to be basically neutral. By contrast, if the patent is relatively strong the opposite is true: the propensity to be neutral of the American system at least does not exacerbate

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<sup>3</sup> Lemley and Shapiro’s arguments on hold-up and the resulting proposals for patent policy have been criticized by, among others, Golden (2007) and Denicolò et al. (2008). For some responses to these critiques see Lemley and Shapiro (2007b) and Shapiro (2010).

<sup>4</sup> In *MercExchange, L.L.C. v. eBay, Inc.*, 275 F.Supp.2d 695 (2003), the Virginia District Court went beyond this proposal, concluding that “the evidence of the plaintiff’s willingness to license its patents, its lack of commercial activity in practicing the patents, and its comments to the media as to its intent with respect to enforcement of its patent rights, are sufficient to rebut the presumption that it will suffer irreparable harm if an injunction does not issue”. Some time later, in *MercExchange, L.L.C. v. eBay, Inc.*, 547 U.S. 388 (2006) the U.S. Supreme Court refused the Virginia District Court conclusion arguing that “traditional equitable principles do not permit such broad classifications. For example, some patent holders, such as university researchers or self-made inventors, might reasonably prefer to license their patents, rather than undertake efforts to secure the financing necessary to bring their works to market themselves. Such patent holders may be able to satisfy the traditional four-factor test, and we see no basis for categorically denying them the opportunity to do so”.

<sup>5</sup> A case in which a permanent injunction was granted despite the plaintiff and the defendant were not direct competitors in the product market is *Broadcom Corp. v. Qualcomm Inc.*, 543 F.3d 683, 704 (Fed. Cir. 2008). The Federal Circuit however approved “the district court’s 20-month ‘sunset’ delay on its injunctive remedy, noting that this would probably allow for redesign” (Boyle, 2012, p 41). This seems an exemplary application of Lemley and Shapiro proposal.

the hold-up problem, as instead it is the case under the British system. These conflicting results will lead us to consider the possible merits of the much less usual system favoring the defendant. We will see that this system supports the effects of stays over a wide range of patent strengths.

We will also show how results change when the courts routinely deny injunctive reliefs. In these circumstances, if the two parties have the same bargaining skill the American system assures that patent holders' remunerations are the "right" ones whatever the patent strength.

In Section 2 we present a version of Shapiro's (2010) model with stays of permanent injunctions where the effects of expected legal costs in determining the negotiated royalties are not a priori neutral. The role of different legal-cost allocations will be studied in Section 3. Section 4 considers the case where the courts deny permanent injunctions, and Section 5 concludes.

## **2. Royalty negotiation**

A patent holder  $P$  owns a patent protecting a technological feature which allows increasing the value to consumers of a downstream firm's product by an amount  $v \geq 0$  in comparison with the best non-infringing alternative. The patent holder and the downstream firm, called  $D$ , do not compete each other. We call  $vX$ , where  $X$  denotes the number of units produced by  $D$  per unit time, the "value of the patented technology". In what follows we assume that when  $D$  has already incorporated the patented technology into its product, redesigning it to avoid using the patented technology entails a fixed cost  $F$  and a time lag  $L$ .

Let  $p$  denote per unit price for products incorporating the patented feature. To make things as simple as possible, we assume that the number of units sold per unit time are constant at  $X$  for all prices equal or less than  $p$  and reduces to zero for prices greater than  $p$ . Analogously, if  $D$  initially designs its product avoiding to incorporate the patented feature, the number of units sold per unit time are constant at  $X$  for all price equal or less than  $p - v$  and reduces to zero for price greater than  $p - v$ . This implies that the patented feature does not induce consumers to make extra purchases, which merely facilitates exposition. Moreover, let us call  $c$  the marginal cost to  $D$  both for products

incorporating and not incorporating the patented features, apart from any royalty payments to P. The relevant patent lifetime is normalized to 1, so that  $X$  denotes the total amount of sales during the patent life, and the discount rate is assumed to be zero. If the parties go to court, trial takes time  $T < 1$ .

The two parties assign the same probability  $\theta < 1$ —called “patent strength”—to the event that, if litigated in court, the patent will be ruled valid and infringed. We assume that under all systems of legal-cost allocation we consider, expected costs of a possible lawsuit are small enough relative to the stakes, so that both D and P prefer going to court rather than withdraw. In any case, litigation in court can be avoided by negotiating a royalty  $r^*$  per unit product incorporating the patented feature sold by D.<sup>6</sup> We assume that P and D split any gains from negotiation through a Nash Bargaining game. Denoting P’s bargaining skill by  $\beta \in [0, 1]$ , if negotiation succeeds it captures its disagreement payoff plus a fraction  $\beta$  of the gains from trade. The remaining fraction  $1 - \beta$  goes to D, together with D’s disagreement payoff.

## 2.1. Staying permanent injunction

Let us now study the royalty-negotiation game when the courts routinely stay the permanent injunctions that they grant for a time long enough to allow D to redesign its product. To determine the expected payoff to P and D if the initial negotiation succeeds, we must first consider what would be the payoffs in the case of litigation after the court decision. If D wins, its payoff will be  $mX(1-T)$ , where  $m \equiv (p - c)$ , and P will earn nothing. When the court decides in favor of P, the two parties can sign a license agreement, in which case their combined payoff amounts to  $mX(1-T)$ . If an agreement were not reached, P’s payoff would be  $sXL$ , where  $s < v$  denotes the “reasonable” royalty rate applied to D’s sales during the stay of the permanent injunction,  $sXL$ , while D’s payoff would be given by  $(m - s)XL + (m - v)X(1 - T - L) - F$ . This implies that the joint gains from licensing amount to  $vX(1 - T - L) + F$ . Since under Nash

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<sup>6</sup> It is well known that when the patent holder does not compete against the downstream firm, optimality requires a pure fixed-fee licensing scheme, at least if we are willing to make some simplifying assumptions such as both-sided risk neutrality and symmetric information (see, for example, Farrell and Shapiro, 2008). However, given our assumption that D sells a fixed number of units, allowing for a per-unit royalty agreement amounts to assume a fixed licensing fee.

Bargaining P captures its disagreement payoff,  $sXL$ , plus the fraction  $\beta$  of the joint gains from licensing, we can conclude that P's payoff from post-verdict licensing is

$$sXL + \beta[vX(1-T-L) + F]. \quad (1)$$

In turn, D's payoff if P wins is given by the combined payoff  $mX(1-T)$  minus P's payoff in equation (1), that is

$$mX(1-T) - sXL - \beta[vX(1-T-L) + F]. \quad (2)$$

With these results in mind, we are now able to go back to P and D's pre-trial decisions to agree on some licensing terms or to litigate. In case of litigation, net of litigation costs, P will obtain zero with probability  $1-\theta$  and with probability  $\theta$  it will obtain the payoff in equation (1) plus the damages  $sXT$  calculated on D's sales during the trial,  $XT$ . In turn, net of litigation costs, D will earn  $mX$  with probability  $1-\theta$  and, with probability  $\theta$ ,  $(m-s)XT$  plus the payoff in equation (2). Then, simplifying the resulting expressions, we can write the expected payoffs from litigation to P and D as

$$\theta sX(T+L) + \theta \beta[vX(1-T-L) + F] - E_P \quad (3)$$

and

$$mX - \theta sX(T+L) - \theta \beta[vX(1-T-L) + F] - E_D, \quad (4)$$

respectively, where  $E_P$  and  $E_D$  denote the litigation costs that P and D expect to bear in accordance with the allocation rule in force.

If, however, the parties settle the dispute by agreeing on a per unit royalty  $r^*$ , P and D's payoffs will respectively be  $r^*X$  and  $(m-r^*)X$ . Since the combined payoff from settlement is  $mX$ , while the combined payoff from litigation (the sum of equations (3) and (4)) is  $mX - (E_P + E_D)$ , joint gains from settlement will amount to  $E_P + E_D$ . Under Nash Bargaining, P captures the fraction  $\beta$  of these joint gains plus its disagreement payoff in equation (3), so its payoff from settlement will be

$$r^*X = \theta sX(T+L) + \theta \beta[vX(1-T-L) + F] - (1-\beta)E_P + \beta E_D. \quad (5)$$

Let us now define  $s = \beta v$  as the "natural benchmark level" for a reasonable royalty rate—that is, the royalty rate that would be negotiated if D before designing its product were aware of P's patent and the patent were known to be valid and infringed (Shapiro,

2010). Then, assuming that courts actually set the reasonable royalties with which they burden the infringers at their benchmark levels, equation (5) reduces to

$$r^*X = \bar{r}X + \theta\beta F - (1 - \beta)E_P + \beta E_D, \quad (6)$$

where  $\bar{r} \equiv \theta\beta v$ . Equation (6) allows us to distinguish among three components in the negotiated royalty  $r^*$ : 1) a benchmark level  $\bar{r} \equiv \theta\beta v$  –that is, the royalty rate that would be negotiated in the shadow of litigation if D could redesign its product without costs and lags, and expected litigation costs were zero or neutral; 2) the hold-up component resulting from P’s ability to hold-up D because of redesign costs, given by  $\theta\beta F / X$ ; and 3) the term  $[\beta E_D - (1 - \beta)E_P] / X$  measuring the effect of expected litigation costs. It is worthwhile noticing that the hold-up component does not depend on the time required to redesign the product. This is due to the combined effects of the two rules adopted by the courts, that is “staying permanent injunctions” and “setting the reasonable royalty to its natural benchmark level”.

## 2.2. Measuring the effects of stays

If the courts routinely grant permanent injunctions and do not stay them, D’s bargaining position significantly worsens. To see this, consider the post-trial phase when P wins and an agreement is not reached. If during the trial D has developed a non-infringing version of its product to avoid the risk of having to stop selling for a time  $L$  after the court verdict, its payoff will be  $(m - v)X(1 - T)$ , from which redesign costs  $F$  incurred during the trial have to be subtracted. If  $s = \beta v$ , the sum  $(m - v)X(1 - T) - F$  is less than the corresponding payoff when the injunction is stayed,  $(m - s)XL + (m - v)X(1 - T - L) - F$ , by an amount of  $(1 - \beta)vXL$ . In this case, the initial negotiation will give a payoff to P equal to

$$r^*X = \bar{r}X + \beta F - (1 - \beta)E_P + \beta E_D \quad (7)$$

(Shapiro, 2010, p. 294 and Appendix), with a hold-up component equal to  $\beta F$ .

When, instead, during the trial an infringing version of the product has not been developed, D’s post-trial payoff when P wins and an agreement is not reached will be  $(m - v)X(1 - T - L) - F$ . This payoff is less than the corresponding payoff when the



injunction is stayed by an amount of  $(m-s)XL$ . If  $s = \beta v$ , this leads to a P's payoff from initial negotiation equal to

$$r^* X = \bar{r}X + \theta\beta[(m-v)XL + F] - (1-\beta)E_P + \beta E_D \quad (8)$$

(Shapiro, 2010, p. 293 and Appendix), where the hold-up component amounts to  $\theta\beta[(m-v)XL + F]$ .

Consider now the following numerical example taken from Lemley and Shapiro (2007a):  $(m-v)/v = 9$ ,  $L = 10\%$ , and  $F/vX = 20\%$ . It can be shown that with these numerical values D finds it profitable to develop a non-infringing version of the product during the trial if  $\theta > 0.36$ .<sup>7</sup> When this is the case, without stays of permanent injunctions the hold-up component amounts to a percentage of the benchmark payoff decreasing from 55% to 20% as  $\theta$  increases from 0.36 toward 1. With stays, the percentage amounts to 20% for all  $\theta > 0.36$ . For all  $\theta < 0.36$ , without stays of permanent injunctions the percentage of the hold-up component to the benchmark payoff rises to 110%. With stays, it drops to 20%.

In what follows the hold-up component  $\theta\beta F$  not deleted by regular stays of permanent injunctions will be called the “residual hold-up component”.

### 3. Litigation costs

In this section we first study how different rules of legal-cost allocation strengthen or weaken the positive effects of stays in limiting the distance of the negotiated royalty from its benchmark level.

#### 3.1. American vs. British system

Consider first the so called American system, where each party bears its own litigation costs, assumed identical and equal to  $C$ , whatever the trial's outcome.<sup>8</sup> In this case

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<sup>7</sup> Shapiro (2010, p. 292 and Appendix) shows that D's choice of developing a non-infringing version during the trial is profitable if and only if

$$\theta > \frac{1}{\beta} \frac{F}{(m-v)XL + F}.$$

<sup>8</sup> The model can be easily amended to account for different individual litigation costs. The quality of results would not change.

$E_P = E_D = C$ , and P's payoff from the initial agreement determined by equation (6) can be written

$$r_A^* X = \bar{r}X + \theta\beta F - (1 - 2\beta)C. \quad (9)$$

Unlike the American system, the British one envisages that the loser in court will bear all legal costs. In this case,  $E_P = 2(1 - \theta)C$  and  $E_D = 2\theta C$ , implying that P's payoff from reaching agreement amounts to

$$r_B^* X = \bar{r}X + \theta\beta F - 2(1 - \beta - \theta)C. \quad (10)$$

By comparing equations (9) and (10) we can immediately deduce the following proposition.

**Proposition 1.** Suppose that the courts set reasonable royalties at their benchmark level  $s = \beta v$  and routinely grant stays to permanent injunctions. Then, if the patent at issue is relatively weak, i.e.  $\theta < 0.5$ , under the American rule of legal-cost allocation P is able to extract a royalty rate greater than that it could obtain under the British rule, that is  $r_A^* > r_B^*$ . When P and D have the same bargaining skill, i.e.  $\beta = 1/2$ , under the American (British) rule the negotiated royalty rate exceeds the benchmark level  $\bar{r}$  by an amount equal to (less than) the residual hold-up component  $\theta\beta F / X$ .

So, for relatively weak patents the British rule strengthens the effect of stay: P cannot entirely appropriate the residual hold-up component. This is because by charging the loser with the entire litigation costs, for a relatively weak patent the British rule puts D in a better bargaining position than that it would enjoy in the American system. More specifically, when P and D have equal bargaining skill under the American rule litigation costs are neutral, that is they do not affect the parties' bargaining positions, and P can appropriate all fruits of its residual ability to hold-up D. By contrast, under the British rule litigation costs are not neutral, that is they positively affect D's bargaining position, and P's residual ability to hold-up D is (partially or totally) offset.

It may be interesting to show how relevant could be the mitigating effects of the British rule on the residual hold-up in comparison with the American rule. To do this, let us write the ratios of the distances of negotiated royalty rates under the two rules

from their benchmark level,  $r_A^* - \bar{r}$  and  $r_B^* - \bar{r}$ , relative to the benchmark level  $\bar{r} \equiv \theta\beta v$ .

We have

$$\frac{r_A^* - \bar{r}}{\bar{r}} = \frac{F}{vX} - \frac{1 - 2\beta}{\theta\beta} \frac{C}{vX}, \quad (11)$$

for the American system, and

$$\frac{r_B^* - \bar{r}}{\bar{r}} = \frac{F}{vX} - \frac{2(1 - \beta - \theta)}{\theta\beta} \frac{C}{vX}, \quad (12)$$

for the British system.

Assume now, as in the previous numerical example, that  $\beta = 1/2$  and  $F/vX = 20\%$ . Moreover, suppose that individual litigation costs amounts to 20% of redesign costs, that is  $C/F = 20\%$ . With these numerical values, the ratio  $(r_A^* - \bar{r})/\bar{r}$  is equal to 0.2 whatever the patent strength and litigation costs, that is, as seen in Proposition 1, the effect of litigation costs is zero. In turn, the ratio  $(r_B^* - \bar{r})/\bar{r}$  is equal to 0.2 for  $\theta = 0.5$ , but it decreases toward zero as  $\theta$  decreases toward 0.22. To further specify our example, for a patent whose probability of being declared valid and infringed in court does not exceed 0.4,  $(r_B^* - \bar{r})/\bar{r}$  is not greater than 0.16. That is, under the British rule the relative departure of the negotiated royalty rate from its benchmark value is less than that under the American system by a percentage not less than 20%. For  $\theta < 0.22$ , the negotiate royalty rate falls below its benchmark level and continues to decreases  $\theta$  as decreases. This suggests that the British rule discourages patent applications of inventions poorly fulfilling the novelty and non-obviousness requirements.

Things are drastically different when the patent at issue is relatively strong. In this case, the rule that charges the loser with all legal costs plays in favor of P, implying that Proposition 1 is exactly reversed. In particular, when P and D have the same bargaining skill, i.e.  $\beta = 1/2$ , under the American (British) rule the negotiated royalty rate exceeds the benchmark level  $\bar{r}$  by an amount equal to (greater than) the residual hold-up component  $\theta\beta F/X$ . For example, when  $F/vX = 0.2$ ,  $C/F = 0.2$ , and  $\theta = 0.7$  the ratio  $(r_B^* - \bar{r})/\bar{r}$  in equation (12) amounts to 0.25. That is, under the British system the

legal cost effect causes the departure of the negotiated royalty rate from its benchmark level to increase by a percentage of 25% with respect to the American system.

### 3.2. Legal-cost allocation favoring the defendant

Considering the opposite performances of the British system depending on patent strength, it seems useful to explore the merits of a system of legal-cost allocation much less usual than the American and British ones, namely the system favoring the defendant.<sup>9</sup> Actually, as suggested by its own label, this system is more effective than the British system in limiting P's bargaining power (and a fortiori more effective than the American one) when the patent is relatively weak, and correspondingly it is more effective than the American system (and a fortiori more than the British one) when the patent is relatively strong.

Since the system favoring the defendant envisages that D does not pay legal costs if it wins in court and only its own costs if it loses, P and D's expected litigation costs are given by  $E_P = 2(1-\theta)C + \theta C = (2-\theta)C$  and  $E_D = \theta C$ , respectively. So, P's payoff from licensing will amount to

$$r_{FD}^* X = \bar{r}X + \theta\beta F - [2(1-\beta) - \theta]C. \quad (13)$$

The following proposition is immediately evident.

**Proposition 2.** Suppose that the courts set reasonable royalties at their benchmark level  $s = \beta v$  and routinely grant stays to permanent injunctions. Then, if  $\theta < 2(1-\beta)$  under the system of legal-cost allocation favoring the defendant the negotiated royalty rate exceeds its benchmark level  $\bar{r}$  by an amount smaller than the residual hold-up component  $\theta\beta F / X$ . When P and D have equal bargaining skill, i.e.  $\beta = 1/2$ , this occurs for all patent strengths  $\theta < 1$ .

The basic difference from the British system lies in the fact that when P and D have equal bargaining skill, the system favoring the defendant does not imply that for strong patents the residual hold-up problem is exacerbated by the legal-cost effect. Moreover, we can show that the system favoring the defendant proves sensibly more effective than

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<sup>9</sup> We do not consider the symmetrically opposed system favoring the plaintiff because it obviously enhances P's bargaining position with respect to both the American and British systems, so exacerbating the hold-up problem.

the British system in limiting the patent holder's bargaining power for weak patents –and only too effective for patent strengths below certain levels. To see this, let us write the ratio of  $(r_{FD}^* - \bar{r}) / \bar{r}$ , that is

$$\frac{r_{FD}^* - \bar{r}}{\bar{r}} = \frac{F}{vX} - \frac{2(1-\beta) - \theta}{\theta\beta} \frac{C}{vX}. \quad (14)$$

As previously, suppose that  $\beta = 1/2$ ,  $F / vX = 0.2$ , and  $C / F = 0.2$ . Then, for  $\theta = 0.4$  the ratio  $(r_{FD}^* - \bar{r}) / \bar{r}$  is equal to 0.08, while, as we have seen, under the British system the corresponding ratio amounts to 0.16. For  $\theta < 0.28$ , the negotiated royalty rate falls below its benchmark level. Summing up, in this example the system favoring the defendant proves superior to both the American and British systems for all relevant patent strength. Figure 1 illustrates how  $r_{FD}^*$  varies with patent strength in comparison with  $r_A^*$ ,  $r_B^*$  and  $\bar{r}$ .

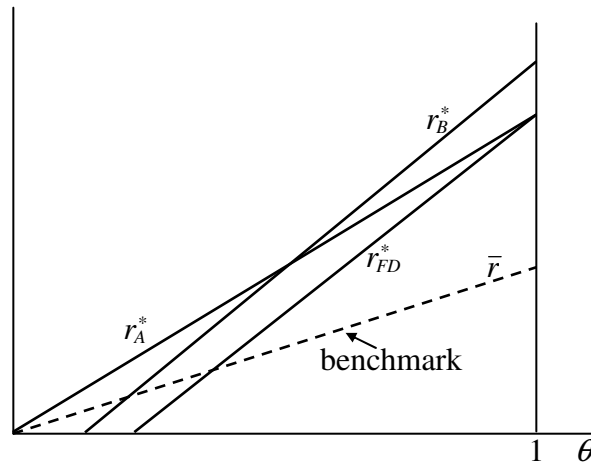


Figure 1. Negotiated royalties under stays of permanent injunctions.

### 3.3. Reasonable royalties in self-fulfilling equilibrium

The assumption that reasonable royalties are set at their natural benchmark level can be questioned on the ground that it may be very difficult to estimate  $\beta v$  with accuracy. As a matter of fact, in setting  $s$  the courts resort to certain practical criteria that necessarily introduce some degree of circularity: for example, if the courts use as proxies the royalties actually negotiated for other comparable patents, the reasonable royalties that they fix depend in part on themselves, since the royalties actually negotiated depend in part on what the courts decide. However, this circularity can be theoretically resolved

by searching for a fulfilled-expectations equilibrium (Shapiro, 2010, p. 301 and Appendix).

A fulfilled-expectations equilibrium requires that for a valid patent –i.e.,  $\theta = 1$ – in equation (5) the equality  $r^* = s$  holds. Then, solving for  $s$  we have

$$s = \beta \left[ v + \frac{F}{X(1-T-L)} \right] - \frac{(1-\beta)\bar{E}_P - \beta\bar{E}_D}{X(1-T-L)}, \quad (15)$$

where  $\bar{E}_P$  and  $\bar{E}_D$  denote expected litigation costs for  $\theta = 1$ . Equation (15) tells us that the reasonable royalty rate in self-fulfilling equilibrium contains itself a residual hold-up component  $\beta F / X(1-T-L)$  to be added to the benchmark level  $\beta v$  (Shapiro, 2010, p. 301). Moreover, it is influenced by the rule of legal-cost allocation on which  $\bar{E}_P$  and  $\bar{E}_D$  depend. At this point, proceeding as before, we can show that, apart from some quantitative differences, the results in Proposition 1 and 2 are confirmed.

#### 4. Denying permanent injunctions

Lemley and Shapiro (2007a) argue that if the redesign costs are high relative to the value of the patented invention (in fact, there is nothing to prevent  $F$  from exceeding 100% of  $vX$ ), then permanent injunction should be denied outright. When permanent injunctions are denied, provided that reasonable royalties are set at their benchmark level  $s = \beta v$ , the hold-up component is completely deleted: the downstream firm benefits by a compulsory license at a price lower as compared to what would be negotiated if an injunctive relief (even if stayed) were granted.

This can be put in formal terms considering that when permanent injunctions are regularly denied, P's threat point payoff in the initial negotiation is given by  $\theta s X - E_P$ , while joint payoffs from agreement amount to  $E_P - E_D$ . Since under Nash Bargaining P captures its disagreement payoff plus the fraction  $\beta$  of the joint gains from agreement, we will have  $r^* X = \theta s X - (1-\beta)E_P + \beta E_D$ , that is, by setting  $s = \beta v$ ,

$$r^* X = \theta \beta v X - (1-\beta)E_P + \beta E_D. \quad (16)$$

The following proposition holds.

**Proposition 3.** Suppose that the courts set reasonable royalties at their benchmark level  $s = \beta v$  and routinely deny permanent injunctions. Then, if the parties have equal bargaining skill, under the American system the negotiated royalties coincide with their benchmark level for all relevant patent strengths.

Figure 2 shows as  $r_A^*$ ,  $r_B^*$  and  $r_{FD}^*$  vary with  $\theta$ . The neutrality of the American system cancels any difference between negotiated royalties and their benchmark level.

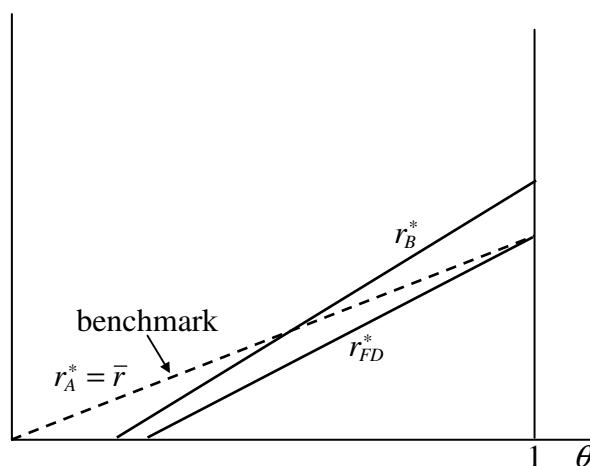


Figure 2. Negotiated royalties when permanent injunctions are denied

## 5. Conclusion

By using a model of licensing bargaining where a patent holder owns a probabilistic patent covering a technological feature which allows increasing the value to consumers of a downstream firm's product in comparison with the best non-infringing alternative, we studied the effect of different rules of legal-cost allocation on negotiated royalties.

As Lemley and Shapiro (2007) and Shapiro (2010) showed, when the downstream firm cannot redesign the product to avoid infringement claims without incurring money costs and time lags, under the threat of a permanent injunction the patent holder can extract royalty payments that include a hold-up component. This hold-up effect can be mitigated if the courts routinely stay the permanent injunctions that they grant to allow the downstream firm to redesign a non-infringing version of the product. A residual hold-up component due to redesign costs however persists.

The rule of legal-cost allocation in force may support or oppose the effects of stays. We first considered the American rule, where each party bears its own costs, and the

British rule, where the loser incurs all costs. We have seen that when in court the patented innovation would be deemed invalid or not infringed with a relatively high probability, then the British rule proves more effective in limiting the residual patent holder's ability to hold-up the downstream firm, also discouraging patent applications of inventions lacking novelty and non-obviousness. By contrast, the British rule exacerbates the residual hold-up problem when the patent is relatively strong.

These conflicting results have led us to consider the possible merits of the much less common system favoring the defendant, whereby the defendant pays its own cost if it loses and nothing otherwise. If the patent holder and the downstream firm have equal bargaining skill, this latter system mitigates the residual hold-up problem whatever the patent strength. Moreover, as the British system (and even more), it makes it unprofitable to apply for patents of inventions that in court would be ruled non-novel and obvious with a relatively high probability.

Finally, we showed that when permanent injunctions are routinely denied, and the two parties have equal bargaining skill, the American system cancels the departures of negotiated royalties from their benchmark level.

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