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# DOES BANNING SIDE PAYMENTS IN PATENT SETTLEMENTS SUFFICE TO FULLY PROTECT CONSUMERS?

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# Does Banning Side Payments in Patent Settlements Suffice to Fully Protect Consumers?

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**Abstract**. By using a simple model of patent settlement, in this paper we show that even if side payments (negative fixed fees) are banned, a licensing agreement to settle a patent dispute may harm consumers in comparison with the expected outcome of the lawsuit. This may occur when the challenger's expected return from litigation is low, that is when probabilistic damages are high relative to the challenger's duopoly profits. Our model suggests that: (1) there may be large benefits to consumers from post-grant reexamination of commercially valuable patents -as stressed by Farrell and Shapiro (2008) in another context; and (2) the threat of punitive damages for patent infringement may harm consumers in the short run, perhaps without being of any help in providing the right incentive to innovate.

*Keywords*: Patent settlements, litigation costs, licensing, consumers' welfare.

*JEL codes*: K2, O34.

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## 1. Introduction

It is widely recognized that there are good reasons for antitrust regulators to regard as suspect any licensing agreement providing for a negative fixed fee, i.e. a fixed payment running from the patentee to the licensee. Absent antitrust scrutiny, in a two-part tariff scheme a negative fixed fee would be coupled to a per-unit royalty higher than that enough to render the licensing contract acceptable by both parties, so unnecessarily restricting market competition.[1] As it has been remarked, in extreme cases a licensing contract having a large royalty rate and a negative fixed fee would correspond to a bribe paid by the incumbent patent holder to induce an alleged infringer or a potential entrant to exit, or not to enter, the market (Shapiro, 1985).

Of course, the issue of pro or anti-competitive effects of the terms on which licensing contracts are signed is relevant per se, but it can be better understood if placed in the context of agreements settling a patent dispute, where licensing conditions are heavily affected by the perceived patent strength, that is by the probabilities the patent holder and the licensee assign to a court's decision in favor of the patent holder if the attempt to negotiate a license fails. In particular, it seems that from the antitrust point of view the question should be: if the parties settle the dispute, will consumers be at least as well off as they would have been from on-going patent litigation? The existence theorem in Shapiro (2003) shows that profitable agreements under this constraint generally are feasible. However, as acknowledged by the author, depending on the types of product-market competition between the incumbent and the challenger, some licensing contracts that satisfy the above constraint with strict equality can require negative fixed fees. Now, while we can reasonably believe that it is relatively easy for antitrust to identify licensing agreements providing for negative fixed fees, we cannot believe that it is just as easy to establish the strength of the patents in question without a final decision in court. But knowing the patent strength is essential to judge whether or not a licensing agreement harms consumers in comparison with the expected outcome of litigation. We can then ask ourselves: in absence of information about the strength of disputed patents, can the antitrust protect consumers by simply applying a ban on negative fixed fees?

[1] In pharmaceutical industries, often negative fixed fees are not part of a licensing agreement, rather they are used by patent holders (branded drug suppliers) to delay the entry by generic drug producers. Shapiro (2003) and Hovenkamp, Janis, and Lemley (2003), for example, maintain that such so-called "reverse payments" should be banned, at least when they exceed the saving of litigation costs. Willig and Bigelow (2004) have the opposite opinion.

In this paper we face the question by using a standard −and very simple− framework, similar to the common-information models of patent settlement in Meurer (1989) and Shapiro (2003). We will show that despite the ban on negative fixed fees the goal of preserving consumers' welfare is not always reached, that is patent licensing agreements which do not concern antitrust may generate a lower consumer surplus than expected from litigation. This occurs when probabilistic damages are high enough, and the patent holder is able to make a take-it-or-leave-it offer to settle the dispute. Moreover, by using linear versions of the model, we will obtain more specific information about the range of patent strength in which consumers' gains from settlement are negative.

## 2. Settlement licensing

As we anticipated, our framework is very similar to the common-information model in Meurer (1989) and to the Cournot and Bertrand examples measuring the gains from settlement in Shapiro (2003) −apart from the explicit consideration of damages.[2] Let us begin by expounding the basic characteristics of the framework, which refers to a product innovation, or a drastic process innovation, giving the patent holder full monopoly power if the patent is litigated and ruled valid and infringed. The extension to non-drastic innovations is straightforward.

### 2.1. The baseline framework

Consider two competitors, called respectively the patent holder or the incumbent and the alleged infringer, the challenger, or the entrant, engaged in a patent dispute.[3] The patent is not an ironclad one, that is if litigated in court it will be ruled invalid or not infringed with probability $1-\theta>0$. We assume that the patent holder and the alleged infringer share common belief about the probability $\theta$, labeled as *patent strength* (Shapiro, 2003).

At the time zero the patent dispute is initiated and immediately resolved by trial or by settlement. The remaining discounted duration of the patent is normalized to $1$. If the patent is litigated and the entrant wins the suit, then during the remaining patent life the market will results in a duopoly, with identical individual profits $\pi_d$.[4] If instead the patent holder wins, it

[2] On the subject see also Aoki and Hu (1999) and Crampes and Langinier (2002).
[3] Some entry barrier other than the patent prevents the entry of other firms (Meurer, 1989). Note that by assuming a single entrant we avoid the issue of information revelation analyzed in Choi (1998).
[4] The assumption of identical profits is made in order to save notations. It can be relaxed without any change in qualitative results.

will earn the monopoly profits $\pi_m > 2\pi_d$ and the court will award the damages $D$ for the past patent infringement. In any case, the dispute can be stopped through a licensing agreement providing for a fixed fee $F$ running from the challenger to the patent holder and a royalty rate $r$ per unit output sold in the future by the challenger. If the two firms settle the dispute in this way, the incumbent's profits inclusive of royalties for the remaining patent life will be $\pi_1(r)$, while the entrant's profits will amount to $\pi_2(r)$. Denoting by $r_m$ the solution of $\pi_1(r) = \pi_m$, and correspondingly of $\pi_2(r) = 0$, we assume $\pi_1'(r) > 0$, $\pi_2'(r) < 0$ and $\pi_1'(r) + \pi_2'(r) > 0$ for all $0 \le r < r_m$.

As regards the patent liability rule, we suppose that the court, if called upon to resolve the dispute, in the case of patent validity and infringement awards lost profits, with possible enhancements for willful infringement.[5] Since $\pi_m$ and $\pi_d$ are defined as profits in the unit of time (the remaining patent life), under this rule we will have

$$D = \gamma(\pi_m - \pi_d), \tag{1}$$

where the parameter $\gamma$ depends on three factors: 1) the length of the alleged infringement in terms of the remaining patent life; 2) the probability that, if the patent is ruled valid and infringed, the court establishes willful infringement; 3) the percentage by which assessed damages are increased in this case. We will call $\gamma$ the *liability parameter*.

### 2.2. Gains from settlement

For simplicity, we ignore litigation costs such as attorney fees, expert witness fees, and similar parties' expenses. This allows us to focus on the role of damages, and to assign the patent holder the ability to make a take-it-or leave-it licensing offer that will be accepted by the alleged infringer. In fact, if we were to assume that litigation costs are relevant relative to probabilistic damages, we should reasonably take into account that the alleged infringer has some power in contracting licensing conditions (Farrell and Shapiro, 2008, p. 1360). Consequently, we should extend our model to complex bargaining, without any real benefits in terms of qualitative results.

With zero litigation costs, the gains from settlement to the incumbent amount to

[5] For an analysis of how alternative damage rules (lost profits, unjust enrichment, reasonable royalty) affect competition when patents are probabilistic, see Choi (2008). Schankerman and Scotchmer study the effectiveness of damages rules and property rules (injunctions to stop infringement ) mainly in protecting proprietary research tools.

$$G_1 = \pi_1(r) + F - \theta\pi_m - (1-\theta)\pi_d - \theta\gamma(\pi_m - \pi_d)\,. \tag{2}$$

Given $F$, these gains increase with $r$ from a minimum of $F - \theta(\pi_m - \pi_d) - \theta\gamma(\pi_m - \pi_d)$ for $r = 0$, where $\pi_1(r) = \pi_d$, until a maximum of $F + (1-\theta)(\pi_m - \pi_d) - \theta\gamma(\pi_m - \pi_d)$ for $r = r_m$, where $\pi_1(r) = \pi_m$. In turn, the gains to the challenger, given by

$$G_2 = \pi_2(r) - F - (1-\theta)\pi_d + \theta\gamma(\pi_m - \pi_d)\,, \tag{3}$$

decrease (with $r$ increasing) from a maximum of $-F + \theta\pi_d + \theta\gamma(\pi_m - \pi_d)$ for $r = 0$, where $\pi_2(r) = \pi_d$, until a minimum of $-F - (1-\theta)\pi_d + \theta\gamma(\pi_m - \pi_d)$ for $r = r_m$, where $\pi_2(r) = 0$.

As regards consumers, under litigation they will enjoy the monopoly surplus $S_m$ if the incumbent wins the suit and the duopoly surplus $S_d > S_m$ if the patent is declared invalid or not infringed. If the two firms settle, consumer surplus amounts to $S(r)$, with $S'(r) < 0$ for all $0 \le r < r_m$. So, the gains from settlement to consumers, given by

$$G_C = S(r) - \theta S_m - (1-\theta)S_d\,, \tag{4}$$

decrease (with $r$ increasing) from a maximum of $\theta(S_d - S_m)$ for $r = 0$, where $S(r) = S_d$, to a minimum of $-(1-\theta)(S_d - S_m)$ for $r = r_m$, where $S(r) = S_m$.

### 2.3. Licensing agreements

Consider now feasible contracts between the two firms. Suppose first that the incumbent makes a non-negotiable offer to settle the dispute in exchange for a per-unit royalty rate $\bar{r}$ on the challenger's future sales and a fixed fee $\overline{F}$. Perhaps because of the reputation for firmness achieved by the incumbent in dealing with similar cases, the threat of litigation in the event of refusal is deemed credible by the challenger.[6]

Under the conventional assumption that when indifferent between settlement and litigation the challenger chooses to settle, for the incumbent's licensing offer to be accepted it suffices that $G_2 \ge 0$. The way in which this weak constraint together with the antitrust limit on fixed fees will be fulfilled depends on the challenger's expected return from litigation. Suppose for the moment that negative fixed fees are not banned. Then, maximization of $G_1$

[6] Litigation credibility is a more complex issue in contexts with multiple entrants (see Choi, 1998, and Farrell and Shapiro, 2008, p. 1361).

subject to $G_2 \geq 0$ yields $\bar{r} = r_m$ and $\overline{F} = -(1-\theta)\pi_d + \theta\gamma(\pi_m - \pi_d)$ . Consider now the antitrust constraint $\overline{F} \geq 0$. When $\gamma \geq \tilde{\gamma}$ ,

$$\tilde{\gamma} = \frac{1-\theta}{\theta} \frac{\pi_d}{\pi_m - \pi_d}, \tag{5}$$

this constraint is not strictly binding. Then, the incumbent will make just the take-it-or-leave-it offer described above, which implies that the challenger exits the market after paying a fixed fee to obtain a license, or a covenant not to sue, for the past use of the patented technology. Since litigation is a credible threat, the challenger will accept the offer, and the gains from settlement to the patent holder will amount to $G_1 = (1-\theta)(\pi_m - 2\pi_d) > 0$ (recall that $\pi_m > 2\pi_d$ ).[7]

When, on the contrary, $\gamma < \tilde{\gamma}$ , the above offer would imply $\overline{F} < 0$ : by assumption, such a licensing contract is not feasible due to the antitrust constraint. Then, the incumbent's take-it-or-leave-it proposal must be different: in particular it must include a royalty rate $\bar{r} < r_m$, which implies that the challenger is allowed to use the patented technology in the future in exchange for compensation to the incumbent. In this case, the optimal licensing offer for the patent holder will consist of a zero fixed fee and, because of the patent-holder's ability to make a take-it-or leave-if proposal, of a royalty rate $\bar{r}$ determined by $G_2 = 0$.[8] Putting the two cases together we can write

$$\pi_2(\bar{r}) = \begin{cases} 0 & \text{if } \gamma \geq \tilde{\gamma} \\ (1-\theta)\pi_d - \theta\gamma(\pi_m - \pi_d) & \text{if } \gamma < \tilde{\gamma}. \end{cases} \tag{6}$$

**Proposition 1**. In the interval $0 \leq \gamma < \tilde{\gamma}$ there exists a $\gamma_0$ such that for $\gamma \geq \gamma_0$ the gains from settlement to the patent holder are non-negative. If $\bar{r} = r_0$ solve $\pi_2(\bar{r}) = (1-\theta)\pi_d - \theta\gamma_0(\pi_m - \pi_d)$ , in the take-it-or-leave-it proposal acceptable by the challenger the royalty rate $\bar{r}$ will increase from $r_0$ to $r_m$ as $\gamma$ increases from $\gamma_0$ to $\tilde{\gamma}$ and beyond.

[7] Of course, such situations can only occur if not anticipated from the outset by the challenger, perhaps because of its unawareness of the patent. Otherwise, entry in the protected market would not take place.

[8] It must be remarked that, when $\gamma < \tilde{\gamma}$ , in the privately optimal offer probabilistic damages are charged on the challenger's future output. Then, the rules applied in calculating damages do affect the royalty rate settling the dispute because, other things equal, on them depend the parties' expected returns from litigation, and licensing occurs in the "shadow of litigation" (Shapiro, 2010). From the consumers' point of view it would be preferable that licensing terms held separate the two kinds of compensation.

**Proof**. If $\gamma < \tilde{\gamma}$ , from equations (2) and (6) we obtain the derivative

$$\frac{dG_1}{d\gamma} = \frac{\theta(\pi_1'(\bar{r}) + \pi_2'(\bar{r}))(\pi_m - \pi_d)}{-\pi_2'(\bar{r})}, \tag{7}$$

which, under the assumptions $\pi_1'(\bar{r}) + \pi_2'(\bar{r}) > 0$ and $\pi_2'(\bar{r}) < 0$, is positive. Moreover, $G_1$ approaches the positive value $(1-\theta)(\pi_m - 2\pi_d)$ as $\gamma$ approaches $\tilde{\gamma}$ from below. Define $\gamma_0$ as $\gamma_0 = \max[0, \gamma_a]$, where $\gamma_a < \tilde{\gamma}$ denotes the possible positive value of $\gamma$ such that $G_1 = 0$. Then, for $\gamma \geq \gamma_0$ we will have $G_1 \geq 0$.[9] The second part of the statement follows from the fact that $\pi_2'(\bar{r}) < 0$. □

Note that the two distinct cases $\bar{r} = r_m$ and $\bar{r} < r_m$ correspond to what some lawyers call *retroactive settlement licenses*, where "the licensee does not receive permission to use the patent in the future and is expected to cease its infringing activity after the agreement is executed", and *forward-looking settlement licenses*, where "the parties agree to terms that permit the alleged infringer to continue using the patent-at-issue in exchange for compensation to the patent holder" (Chapman, 2009, p. 316). Also note that the two cases roughly correspond to the distinction between *injunctive settlements* and *standard settlements* in Hylton and Cho (2010, 2011).[10]

Moreover, a question arises regarding delays between discovery of alleged infringement and affirmative communication to the challenger. Whatever the cause of these delays, intentional or not, damages claims could rise with them. According to some courts' decisions, we assume that a delay higher than a given number of years bars patent-holder's claims so that for each situation there exists an upper bound to probabilistic damages (Lemley, 2002).[11] This limits strategic behavior by the patent holder aiming at forcing the challenger to accept a retrospective license −and then to exit the market− when accumulated damages will be high enough.

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[9] Naturally, if there exists a positive $\gamma_a$, for $0 \leq \gamma < \gamma_0 = \gamma_a$ the patent older will prefer to litigate.

[10] Injunctive settlements include, but are not limited to, reverse settlements involving "… a plaintiff (for example, a pharmaceutical company with a patent on a drug) paying the defendant (for example, a manufacturer of a generic drug) to settle the case" (Hilton and Cho, 2010, p. 181-182). In what follows we will define as *injunctive* a settlement under which the challenger agrees to exit the market solely because of the threat of probabilistic damages.

[11] "The doctrine of laches is based on unreasonable delay, and bars only retrospective relief. By contrast, the doctrine of estoppel completely bars enforcement of the patent" (Lemley, 2002, p. 1922). In any case, starting from the discovery date of the alleged infringement the patent holder cannot delay the affirmative communication beyond a certain time. Then, in each situation there exists a maximum duration of the alleged infringement admissible in court.

Switching now to consumers' gains, let $\hat{r}$ be the solution of $G_C = 0$ in equation (4), that is

$$S(\hat{r}) = \theta S_m + (1-\theta) S_d \,. \tag{8}$$

Since $G_C$ decreases as $r$ increases, the gains from settlement to consumers will be negative (positive) if the running royalty rate $\bar{r}$ is greater (smaller) than $\hat{r}$. Then, if the patent is not ironclad, retroactive settlement licenses (injunctive settlements) surely harm consumers in comparison with the expected outcome of the lawsuit. However, the effects of forward-looking settlement licenses (standard settlements) are uncertain.

## 3. Retroactive licenses/Injunctive settlements

Given patent strength $\theta$, both the running royalty $\bar{r}$ and the royalty $\hat{r}$ which would leave consumers as well off as under litigation depend on the intensity of product-market competition between the incumbent and the challenger, that is on $\pi_d$. Moreover, the running royalty $\bar{r}$ depends on the liability parameter $\gamma$ –at least for intensities of market competition less than that prevailing in a homogeneous-product Bertrand duopoly, where, as we will see, $\bar{r}$ is the same for all $\gamma > 0$. On $\theta$, $\pi_d$ and $\gamma$ depends in the first place the nature of the settlement agreement: in particular, when $\gamma \geq \tilde{\gamma} = (1-\theta)\pi_d / \theta(\pi_m - \pi_d)$, the settlement agreement is equivalent to a court injunction requiring the challenger to cease its infringing activity. In this section we identify conditions under which settlements of this kind, which surely harm consumers if the challenger has some chance of winning in court, are feasible under different intensities of product-market competition.

To this purpose it is convenient to consider the classic Singh and Vives model (1984) of differentiated-product duopoly with linear and symmetric demand functions. Suppose then $P_1 = 1 - q_1 - \lambda q_2$ and $P_2 = 1 - q_2 - \lambda q_1$, where $P_i$ and $q_i$ denote prices and individual quantities, respectively, while the parameter $\lambda$ measures the degree of product differentiation (the two products are independent for $\lambda = 0$ and perfect substitutes for $\lambda = 1$). Moreover, suppose the two firms are equally efficient and unit production costs are constant, so that they can be normalized to zero. Some standard calculations show that under these demand and cost assumptions we can write $\pi_d = (1 - v\lambda)/(2 + \lambda - v\lambda)^2$, where $v$ is a conjectural variation

parameter such that for $\nu = 0$ the two firms are Cournot rivals, while $\nu = \lambda$ corresponds to Bertrand competition.[12] Then, since $\pi_m = 1/4$, equation (5) can be written

$$\tilde{\gamma} = \frac{1-\theta}{\theta} \frac{(1-\nu\lambda)/(2+\lambda-\nu\lambda)^2}{(1/4)-(1-\nu\lambda)/(2+\lambda-\nu\lambda)^2}. \tag{9}$$

What happens when the two firms are Bertrand competitors in supplying a homogeneous product ($\nu = \lambda$ and $\lambda = 1$) is easy to understand. Since in this environment duopoly profits $\pi_d$ are null, from equation (9) we have $\tilde{\gamma} = 0$ for all positive $\theta$, so that for all positive $\gamma$ the condition $\gamma > \tilde{\gamma}$ is fulfilled, which implies $\bar{r} = r_m$. If notwithstanding this the challenger had entered the market, the patent dispute will be settled with a retroactive license, that is with the challenger exiting the market after paying a fixed fee to the patent holder. Obviously, if the entrant anticipates the event it does not enter the market from the outset, unless $\theta = 0$.

**Proposition 2**. Suppose the two firms are potential or actual Bertrand rivals in a homogeneous product market. Then, from the outset or after settlement the incumbent will enjoy full monopoly power even when the patent strength is close to zero.[13]

In conclusion, if Bertrand pricing competition prevails, in a homogeneous product environment the amount of damages and the patent strength, provided positive, are not relevant: the patent holder is able to capture the monopoly profits even if the liability parameter $\gamma$ and the probability $\theta$ are arbitrarily small (but still greater than zero). Among all duopoly games, under this type of competition consumers' losses from the lack of a ruling on patent validity are at the maximum level for any given patent strength, and they are greater the weaker the patent involved. Precisely, some calculations show that $G_c/(\theta S_m + (1-\theta)S_d) = -(9-7\theta)/(16-7\theta)$. So, the above losses in percent of expected consumer surplus from litigation approaches $0.52$ as $\theta$ approaches zero. This suggests that, as Farrell and Shapiro (2008) stressed in another context, there may be large social benefits from expanding post-grant reexamination of issued patents covering valuable technologies that are useful to actual

[12] The conjectural variations solution for oligopoly games as been widely used both in empirical and theoretical industrial organization literature. Such solution is usually viewed as the equilibrium of a reduced-form model that summarizes complex behavioral schemes. See, for example, Cabral (1995), Schmalensee (1988), Farrell and Shapiro (1990).

[13] This proposition is substantially the same as Proposition 5 in Shapiro (2003), which refers to delayed resolution of patent litigation with interim competition.

or potential entrants, thus reducing the number of weak patents which unduly restrict market competition.

When the challenger enters the market with a product that is distinct from that offered by the patent holder $(\lambda < 1)$, duopoly profits $\pi_d = (1-\nu\lambda)/(2+\lambda-\nu\lambda)^2$ are positive even if the two firms are Bertrand rivals. The same holds true irrespective of the degree of product differentiation if the intensity of competition is lower than Bertrand. Of course, in these cases injunctive-settlement feasibility requires that the liability parameter $\gamma$ is not less than a certain positive level, dependent on $\theta$ and $\lambda$.

Consider, for instance, a relatively low degree of product differentiation, say $\lambda = 0.9$. Under Bertrand competition $(\nu = \lambda)$ we will have $\tilde{\gamma} \approx 0.2(1-\theta)/\theta$, so that a patent with a 50% chance of being validated in court will allow the patent holder to impose an injunctive settlement if the past alleged infringement had lasted for a period equal to (or greater than) 20% of the remaining patent life. If the two firms are Cournot competitors $(\nu = 0)$, conditions for injunctive-settlement feasibility are much more stringent. In fact, in this case, we will have $\tilde{\gamma} \approx 0.9(1-\theta)/\theta$. Obviously, given the patent strength, $\tilde{\gamma}$ increases with the degree of product differentiation, that is as $\lambda$ decreases, whatever the intensity of competition.

**Proposition 3**. Given the patent strength and the degree of product differentiation, the likelihood of observing injunctive settlements increases with the intensity of competition. Irrespective of the intensity of competition, the likelihood decreases as the degree of product differentiation increases or the patent strength decreases.

## 4. Forward-looking licenses/Standard settlements

When $\gamma < \tilde{\gamma}$ the patent holder must be content to settle the patent dispute with a forward-looking license which allows the challenger to stay on the market. In these cases, given $\theta$, $\pi_d$, $\pi_m$, $S_d$, and $S_m$, for some values of the liability parameter $\gamma$ the patent settlement benefits consumers. In particular, the following proposition holds.

**Proposition 4**. Suppose $\pi_d > 0$ and $\gamma < \tilde{\gamma}$. Then, if $\hat{r} > r_0$ in the interval $\gamma_0 < \gamma < \tilde{\gamma}$ there exists a $\gamma^*$ such that for $\gamma < \gamma^*$ $(\gamma > \gamma^*)$ the licensing agreement settling the patent dispute leaves consumers better off (worse off) than under litigation.

**Proof**. As we have seen in Proposition 1, with $\gamma$ increasing from $\gamma_0$ to $\tilde{\gamma}$ and beyond, the royalty rate $\bar{r}$ settling the patent dispute increases from $r_0$ to $r_m$. On the other hand, since $S(r_m) = S_m$, the royalty rate $\hat{r}$ which leaves consumers as well off as under litigation is strictly smaller than $r_m$, and for $\bar{r} > \hat{r}$ the gains from settlement to consumers become negative. The statement follows immediately. □

Summing up, when challenger's duopoly profits $\pi_d$ are positive, the less the damages at stake –i.e., given $\pi_d$ and $\theta$, the greater the challenger's expected returns from litigation– the more likely settlement is preferable to litigation from the consumers' point of view. In other words, the gains from settlement to consumers are positive when damages awarded by the court if called upon to resolve the dispute are low enough to render the litigation option not so unattractive for the challenger. For higher damages, instead, litigation becomes more hazardous for the challenger, allowing the patent holder to extract a royalty rate high enough to reduce consumer surplus below the level expected from a final verdict by court.[14]

In the case of homogeneous product ($\lambda = 1$) it is relatively easy to build an example that may be useful in clarifying the relationship between the critical level of the liability parameter $\gamma^*$, the patent strength $\theta$ and the intensity of competition $\nu$. In particular, as shown by the calculations given in Appendix, we can explicit $\gamma^*$ as a function of $\theta$ and $\nu$, with $\partial\gamma^*/\partial\theta < 0$, $\partial\gamma^*/\partial\nu < 0$, $\lim_{\theta\to 1}\gamma^*(\theta,\nu) = 1$, and

$$\lim_{\theta\to 0}\gamma^*(\theta,\nu) = \frac{(1-\nu)(3+2\nu-\nu^2)}{(1+\nu)(5-2\nu+\nu^2)}. \tag{10}$$

Some numerical results are shown in Figure 1.[15] A settlement involving a patent with a 50% chance of winning in court benefits (harms) consumers if $\gamma < 0.34$ $(\gamma > 0.34)$ under Cournot competition and benefits (harms) consumers if $\gamma < 0.18$ $(\gamma > 0.18)$ when the intensity of competition is at the intermediate point between Bertrand and Cournot competition $\nu = 1/2$. When damages at stake are so large as to imply $\gamma \geq 0.6$ under Cournot

[14] It is worth remembering that the antitrust ban of side payments, although not sufficient in some cases, is however essential in protecting consumers against anticompetitive settlements: without this ban the patent-holder would be able to enjoy full monopoly power in every circumstances, with particularly serious consequences when the patent is very weak.

[15] Standard calculations show that in this model $\gamma_0 = 0$, that is the gains from settlement to the patent holder are positive for all $\gamma > 0$.

competition, the settlement leaves consumers worse off than under litigation whatever the patent strength. The same occurs when $\gamma \geq 0.29$ and $\nu = 1/2$.

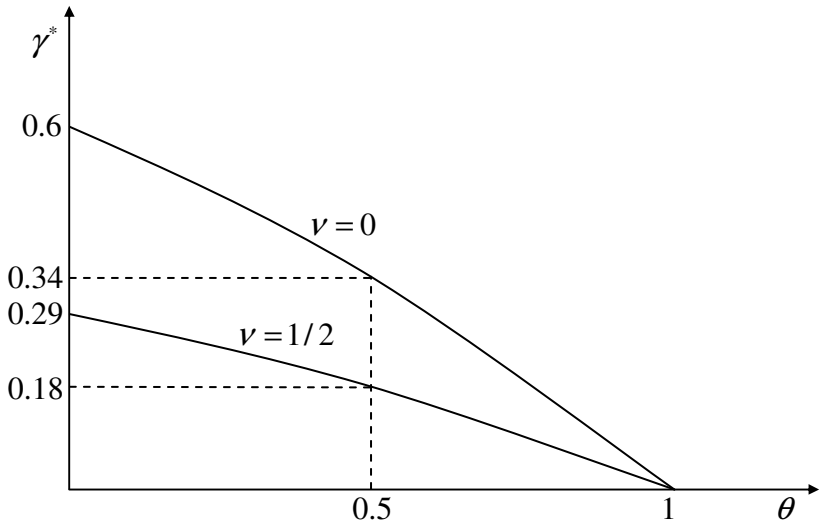


Figure 1.

Note that a value of $\gamma$ equal to 0.6 is consistent, under the US law, with a situation where the challenger, believing the patent to be invalid with some probability, had willfully infringed it for a period of time equal to twenty percent of the remaining patent life.[16] This example makes clear that the threat of punitive damages, by reducing the challenger's return from litigation, may drastically restrict competition even when the involved patent is very weak and an injunctive settlement is not feasible. As a policy implication, it is worthwhile stressing that it may well be the case that awarding "pure" lost profits suffices to preserve the right incentive to innovate, thus benefiting consumers in the short run (the settlement would provide for a lower royalty rate) without harming society in the long run.

## 5. Conclusion

By using a very simple model of patent settlement, in this paper we show that despite the antitrust ban of negative fixed fees a licensing agreement to stop a patent dispute can harm consumers in comparison with the expected outcome of the lawsuit. This may occur when the

[16] The US law holds that if the infringement was willful, damages can be increased up to three times the amount assessed (35 U.S.C. § 284). On the contrary, European courts tend to refuse recognition of damages that exceed actual losses (Blumer, 2001). Krouse and Krouse (2004, p. 191) maintain that, independently of punitive damages "...there are important differences between the losses awarder under the US case law and those that economic models of competition indicate would allow patentholders to just capture the social value of their innovations... providing an incentive for the patentholder to opportunistically claim infringement...".

challenger's expected return from litigation is low, that is when probabilistic damages are high relative to the challenger's expected profits from competing on the same technological footing with the incumbent. In these circumstances, the royalty rate proposed by the patent holder in its take-it-or-leave-it licensing offer may be so high as to drive the consumer surplus from settlement below the expect surplus from litigation.

If the two firms are Bertrand competitors in selling a homogeneous product, the patent holder can act as a monopolist whatever the strength of its patent. This is due to the fact that under this kind of competition the threat of probabilistic liability forces the challenger to stay out the market even if the probability of patent invalidity is close to one. In this case, consumers suffer the highest possible losses from the lack of a decision on patent validity. Since consumers' losses are very relevant when the patent involved is weak, our model suggests that there may be large benefits of "better examining commercially significant patents" in circumstances other than those identified by Farrell and Shapiro (2008, p. 1361).

A version of the model where the patent holder and the challenger are Cournot rivals, or Bertrand rivals in a differentiated-product duopoly, shows that even under these kinds of competition there may be situations in which, whatever the patent strength, consumers would prefer that the two firms resolve the dispute in court. This occurs when damages awarded in case of established patent validity are high enough, perhaps because of a long-lasting alleged infringement, or because, if deemed valid, the patent will also be deemed willfully infringed. In other circumstances, consumers are armed only by settlement involving patents whose strength exceeds some positive level. In any case, the model predicts that the threat of punitive damages, allowing the incumbent to extract a royalty rate higher than that which would have been accepted by the alleged infringer under a "pure" lost profit rule, may affect negatively consumers' welfare, perhaps in circumstances where awarding lost profits would be enough to ensure the right incentive to innovate.

## Appendix

Let us focus first on equation (6), which determines the take-it-or leave-it royalty proposal. By standard calculations we can show that for $\lambda = 1$ the challenger's profits under a generic licensing agreement will be $\pi_2(r) = (1-\nu)(1-2r)^2/(3-\nu)^2$. Then, if $\gamma \geq \tilde{\gamma}$ we have $\bar{r} = 1/2$, while if $\gamma < \tilde{\gamma}$ equation (6) gives, taking into account that $\pi_m = 1/4$ and $\pi_d = (1-\nu)/(3-\nu)^2$,

$$\bar{r} = \frac{1}{2}\left(1 - \sqrt{1 - \theta - \theta\gamma \frac{(3-\nu)^2 - 4(1-\nu)}{4(1-\nu)}}\right). \qquad \text{(A1)}$$

In turn, consumers will enjoy the surplus $S(r) = (2-(1+\nu)r)^2 / 2(3-\nu)^2$ under licensing, and, depending on whether the incumbent wins or loses the patent suit, the surplus $S_m = 1/8$ or $S_d = 2/(3-\nu)^2$ if the two firms litigate. So, the value of $\hat{r}$ in equation (8) will be

$$\hat{r} = \frac{1}{2(1+\nu)}\left(4 - \sqrt{\theta(3-\nu)^2 + 16(1-\theta)}\right). \qquad \text{(A2)}$$

At this point, some algebra shows that the condition $\bar{r} > \hat{r}$ under which the patent settlement harms consumers is equivalent to

$$\gamma > \gamma^* = \left(\frac{1-\theta}{\theta} - \frac{\left(\sqrt{\theta(3-\nu)^2 + 16(1-\theta)} - (3-\nu)\right)^2}{\theta(1+\nu)^2}\right)\frac{4(1-\nu)}{(3-\nu)^2 - 4(1-\nu)}. \qquad \text{(A3)}$$

The critical level $\gamma^*$ is a decreasing function of the patent strength $\theta$ and the intensity of competition $\nu$, with $\lim_{\theta \to 1} \gamma^*(\theta, \nu) = 0$. The limit in equation (10) in the text can be obtained by applying L'Hospital's rule.

## References


Aoki, R., Hu, J., 1999. Licensing vs. litigation: the effect of the legal system on incentives to innovate, Journal of Economics & Management Strategy 8, 133-160.

Blumer, F., 2001. Patent law and international private law on both sides of the Atlantic, WIPO forum on Private International Law and Intellectual Property (2001), available at http://www.cptech.org/ecom/hague/Blumer.pdf.

Cabral, L.M., 1995. Conjectural variations as a reduced form. Economics Letters 49, 397-402.

Chapman, M.J., 2009. Using settlement licenses in reasonably royalty determinations. IDEA: The Intellectual Property Law Review 49, 313-357.

Choi, J.P., 1998. Patent litigation as an information-transmission mechanism. American Economic Review 88, 1249-1263.

Choi, J.P., 2008. Alternative damage rules and probabilistic intellectual property rights: unjust enrichment, lost profits, and reasonable royalty remedies. Information Economics and Policy 21, 145–157.

Crampes, C., Langinier, C., 2002. Litigation and settlement in patent infringement cases. Rand Journal of Economics 33, 258-274.

Farrell, J., Shapiro, C., 1990, Horizontal merger: an equilibrium analysis. American Economic Review 80, 107-126.

Farrell, J., Shapiro, C., 2008. How strong are weak patents? American Economic Review 98, 1347-1369.

Hylton, K.N., Cho, S., 2010. The economics of injunctive and reverse settlements. American Law and Economics Review 12, 181-203.

Hylton, K.N., Cho, S., 2011. Injunctive and reverse settlements in competition-blocking litigation. European Journal of Law and Economics, First online 11-17- 2011, DOI 10.1007/s10657-011-9279-y.

Hovenkamp, H. Janis, M.D., Lemley, M.A, 2003. Anticompetitive settlement of intellectual property disputes. Minnesota Law Review 87, 1719-1766.

Krouse, B.R., Krouse, C.G., 2004. Patent infringement: lessons from industrial economics. Journal of Industry, Competition and Trade 4, 191-206.

Lemley. M.A., 2002. Intellectual property rights and standard setting organizations. California Law Review 90. 1889-1980.

Meurer, M.J., 1989. The settlement of patent litigation. RAND Journal of Economics 20, 77-91.

Schankerman, M., Scotchmer, S., 2001. Damages and injunctions in protecting intellectual property. Rand Journal of Economics 32, 199–220.

Schmalensee, R., 1988. Industrial economics: an overview. Economic Journal 98, 643-681.

Shapiro, C. 1985. Patent licensing and R&D rivalry. American Economic Review, Papers and Proceedings 75, 25-30.

Shapiro, C., 2003. Antitrust limits to patent settlements. RAND Journal of Economics 34, 391-411.

Shapiro, C., 2010. Injunctions, hold-up, and patent royalties. American Law and Economics Review 12, 280-318.

Sing, N., Vives, X., 1984. Price and quantity competition in a differentiated duopoly. Rand Journal of Economics 15, 546-554.

Willig, R., Bigelow, J., 2004. Antitrust policy toward agreements that settle patent litigation. Antitrust Bulletin 49, 655-698.