Licensing Innovations with Exclusive Contracts[†]

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Abstract

We look for the existence of (simple) licensing contracts that can generate revenues for an innovator equal to those that would be obtained by a monopolist using the cost reducing innovation that is being licensed. The contracts we focus on specify an exclusive territory clause and a fixed fee as a form of payment. While such licensing contracts are commonly observed their effects have not been investigated in the licensing literature. We find that their existence are greatly influenced by three factors: the size of the market relative to the pre-innovation marginal cost, the quality of the innovation, and the degree of substitutability between the goods being produced in the market.

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1 Introduction

Licensing of patents and innovations is important for at least two reasons. Not only it is a commonly observed contractual agreement between firms but it is also a significant mechanism of technology transfer. Since the way licenses are priced and sold can have a major impact on the market structure of an industry and on the incentives to innovate, it is not surprising that the theoretical literature has established the properties of many licensing schemes in a variety of contexts (see Kamien (1992) for a survey). For instance, an innovator can auction a given number of licenses (Katz and Shapiro (1986)). Alternatively, it can offer fixed fee or royalty based contracts and let firms decide whether or not they want to acquire a license. Kamien and Tauman (1986) show that although contracts based on a fixed fee generate more licensing revenues than those relying on royalties, these revenues are less than the profit a monopolist using the innovation would obtain. One exception to this result is the case where perfect competition prevails on the market, the innovator uses a fixed fee licensing contract, and the innovation is drastic.

Erutku and Richelle (2000 and 2006) show that an innovator licensing its patented technology with a contract specifying both a fixed fee and a royalty can obtain a revenue equal to the profit a monopolist using the innovation would obtain whatever the number of firms and the quality of the innovation. According to Rostocker (1983)'s study, 46% of the licensing contracts under review specify the payment of a fixed fee as well as a royalty. However, when the number of firms exceeds two, licensing contracts in Erutku and Richelle (2000) depend not only on a firm's output but also on the output of other firms. While it is not uncommon to observe licensing contracts based on a firm's revenue (which in turn depends on total industry output if firms compete according to the Cournot model, for example),[1] it has been alleged that such contracts are seldom used (Sen and Tauman, 2002).

The purpose of this paper is to enlarge the set of contracts that guarantee, along the equilibrium path, licensing revenues equal to the those a monopolist using the innovation would obtain. In particular, we focus on (simple) licensing contracts that specify exclusive territory clauses. Anand and Khanna (2000) show that licensing contracts often include an exclusive territory clause in addition to a specified payment scheme. This is similar to Caves et al. (1983) who find that 34% of the licensing agreements in their survey include a market restriction clause while another 34% include a production location restriction clause. Such restrictions generally prohibits a licensee from selling the products flowing from the license agreement outside certain specified markets. While often observed, the effects of exclusive territory clauses have not been investigated in the licensing literature.

We find that the existence of licensing contracts specifying an exclusive territory clause and a fixed fee (as a form of payment) and generating revenues for the innovator equal to those that would be obtained by a monopolist using the innovation depends on three factors: the size of the market relative to the pre-innovation

[1]For example, Mortimer (2004) states that revenue-sharing contracts consisting of an upfront fee per unit of inventory and a revenue split paid on the basis of rental revenue started to be adopted in the late 1990s between video stores and movie distributors.

marginal cost, the quality of the innovation, and the degree of substitutability between the goods in the market.

The paper is organized as follows. Section 2 describes the model and section 3 presents the equilibria in the marketplace. Section 4 looks at firms' decisions to accept or to refuse the proposed licensing contract and section 5 is devoted to the analysis of optimal and strongly optimal contracts. Section 6 concludes.

2 Model

We consider an industry with two firms, i and j, and two markets, 1 and 2. Firm i (j) is located in market 1 (2) and produces good i (j). Each good can be produced at a constant marginal cost $c \geq 0$ and can be sold in each market m, with $m = 1, 2$, where inverse demand functions for firms i and j are respectively

$$p_{im} = a - q_{im} - \beta q_{jm} \tag{1}$$

$$p_{jm} = a - q_{jm} - \beta q_{im}. \tag{2}$$

In (1) and (2),[2] q_{im} (q_{jm}) stands for the total quantity purchased of good i (j); $a > c$ gives the absolute size of the market; and, $\beta \in [0, 1)$ is an indicator of the degree of substitutability between goods. This degree of substitutability increases in β: goods are independent when $\beta = 0$ while they tend to be perfect substitutes

[2] These inverse demand functions can be obtained from the maximization problem of a representative consumer with a quadratic utility function separable in money (see Vives (1999)) and have been used in the licensing literature (see Fauli-Oller and Sandonis (2003)).

when $\beta \to 1$. From (1) and (2), firms i and j's demand functions in any market m are respectively

$$q_{im} = \begin{cases} a - p_{im} & \text{for } p_{im} \text{ and } p_{jm} \text{ such that} \\ & a(1-\beta) - p_{jm} + \beta p_{im} \leq 0 \\ \\ \dfrac{a(1-\beta) - p_{im} + \beta p_{jm}}{1-\beta^2} & \text{for } p_{im} \text{ and } p_{jm} \text{ such that} \\ & a(1-\beta) - p_{im} + \beta p_{jm} \geq 0 \\ & \text{and } a(1-\beta) - p_{jm} + \beta p_{im} \geq 0 \\ \\ 0 & \text{for } p_{im} \text{ and } p_{jm} \text{ such that} \\ & a(1-\beta) - p_{im} + \beta p_{jm} \leq 0 \end{cases} \quad (3)$$

$$q_{jm} = \begin{cases} a - p_{jm} & \text{for } p_{im} \text{ and } p_{jm} \text{ such that} \\ & a(1-\beta) - p_{im} + \beta p_{jm} \leq 0 \\ \\ \dfrac{a(1-\beta) - p_{jm} + \beta p_{im}}{1-\beta^2} & \text{for } p_{im} \text{ and } p_{jm} \text{ such that} \\ & a(1-\beta) - p_{jm} + \beta p_{im} \geq 0 \\ & \text{and } a(1-\beta) - p_{im} + \beta p_{jm} \geq 0 \\ \\ 0 & \text{for } p_{im} \text{ and } p_{jm} \text{ such that} \\ & a(1-\beta) - p_{jm} + \beta p_{im} \leq 0. \end{cases} \quad (4)$$

There is also an independent research lab, hereafter referred to as the licensor or the innovator, who owns a patent for a technology that reduces the marginal cost of production of the two goods from c to $c-\varepsilon$ where $\varepsilon \in [0, c)$ stands for the innovation quality. Following Arrow (1962), an innovation is said to be drastic if the price a monopolist using the innovation would charge does not exceed the pre-innovation marginal cost. Given our model, an innovation is drastic if $\varepsilon \geq a - c$.

The licensor is not a member of the industry and only seeks to license its innovation to maximize its licensing revenues. While the licensor can choose among a variety of licensing contracts, we focus on contracts specifying an exclusive territory clause and a fixed fee. The exclusive territory clause guarantees to a licensee that no other firm using the innovation can sale its product in the licensee's market. This means that if both firms accept the licensing contract then, in each market, only one product is available. In such a case, we adopt the convention that good i is sold in market 1 and good j is sold in market 2. Thus, if both firms become licensees, then the demand for product l, $l = i, j$, in market m, $m = 1, 2$, is

$$q_{lm} = \begin{cases} a - p_{lm} & \text{if } p_{lm} \leq a \\ 0 & \text{otherwise.} \end{cases} \tag{5}$$

When only one firm accepts the licensing contract, the exclusive territory clause does not prevent the licensee and the nonlicensee from selling in both markets and demand functions for goods i and j in market m are given by (3) and (4), respectively.

Interactions between firms and the licensor are described by a three-stage game. At the first stage, the licensor offers a licensing contract that includes an exclusive territory clause and a fixed fee $\alpha > 0$. Contracts are costlessly enforceable by courts and include a clause that prohibits a licensee from reselling its license. At the second stage, both firms, having observed the quality of the innovation ε as well as the characteristics of the licensing contract, decide simultaneously to accept or to reject the contract. The marginal cost of a firm that accepts the contract, a licensee, is $c_l = c - \varepsilon$ while the marginal cost of a firm that refuses the contract, an unlicensed firm, is $c_u = c$. At the third stage, both firms, having observed whether or not the other has accepted the licensing contract, decide simultaneously the price for their good in each market where it can be sold.

The main goal of this paper is to find when a licensor is able to design a strongly optimal contract specifying an exclusive territory clause and a fixed fee.

Definition 1. *Let* $\Pi^M = [(a - c + \varepsilon)/2]^2$ *be the profit a monopolist with marginal cost* $c - \varepsilon$ *achieves on a market. A contract proposed at a subgame perfect Nash equilibrium of the game is referred to as an optimal contract if it leads to a revenue of* Π^M *for the licensor on that market. An optimal contract is said to be strongly optimal if the subgame that follows the proposition of this contract has a unique equilibrium outcome.*

To characterize the set of parameters values for which a strongly optimal contract exists at a subgame perfect Nash equilibrium, we must first determine, for a given contract, the firms' decisions in the last two stages of the game. This is what we turn to next.

3 Equilibria in the Marketplace

At the third stage of the game, firms choose their price simultaneously knowing the characteristics of the licensing contract, whether or not this contract has been accepted by their rival, and the cost reduction ε allowed by the innovation. Three cases need to be considered: *i*) both firms accept the licensing contract; *ii*) both firms reject the licensing contract; and, *iii*) one firm accepts the licensing contract.

First, if both firms accept the licensing contract, then they each become a monopolist in their respective market and incur a marginal production cost of $c - \varepsilon$. Denoting the equilibrium price of firm l in market m by p_{lm}^{AA}, we have

$$p_{lm}^{AA} = \frac{a + (c - \varepsilon)}{2} \quad \text{for } l = i \text{ in } m = 1 \text{ and } l = j \text{ in } m = 2$$

which leads to an equilibrium profit gross of α for each licensee l, $l = i, j$, of

$$\pi_l^{AA} = \left\{ \frac{(a - c) + (\varepsilon - \rho)}{2} \right\}^2.$$

Second, if both firms reject the licensing contract, then their marginal cost equals c. Denoting the equilibrium price of firm u in market m by p_{um}^{RR}, we have

$$p_{um}^{RR} = \frac{a(1 - \beta) + c}{2 - \beta} \quad \text{for } u = i, j \text{ and } m = 1, 2.$$

Since firms sell their good in both markets, the equilibrium profit of any unlicensed firm u, $u = i, j$, is

$$\pi_u^{RR} = 2 \left(\frac{1}{1 - \beta^2} \right) \left[\frac{(a - c)(1 - \beta)}{2 - \beta} \right]^2$$

which is strictly positive given our assumptions that $a > c$ and $\beta \in [0, 1)$. Note that when $\beta \rightarrow 1$, i.e., when goods tend to be perfect substitutes, equilibrium prices tend to c and equilibrium profits tends to 0. In comparison, when $\beta = 0$, i.e., when goods are independent, equilibrium prices equal the monopoly price $(a + c)/2$ and equilibrium profits equal two times the monopoly profit.

Third, if one firm accepts the licensing contract, then the exclusive territory clause does not prevent any firm from selling in both markets and, a priori, both goods are available in each market. In addition, firms become asymmetric as the licensee's marginal cost is $c_l = c - \varepsilon$ while the unlicensed firm's marginal cost is $c_u = c$. A large asymmetry in marginal cost is expected to lead to a large asymmetry in equilibrium prices while an innovation of low quality should lead to equilibrium prices close to those found when no firms accept the contract.

Let us define ε^D and ε^M as follows

$$\varepsilon^D = \frac{(a-c)(1-\beta)(2+\beta)}{\beta} \tag{6}$$

$$\varepsilon^M = \frac{(a-c)(2-\beta)}{\beta}. \tag{7}$$

Denoting the equilibrium price of the licensee and of the unlicensed firm in market

m by p_{lm}^{AR} and p_{um}^{AR}, respectively, we have

$$p_{lm}^{AR} = \begin{cases} \dfrac{(2+\beta)[a(1-\beta)+c]-2\varepsilon}{4-\beta^2} & \text{if } \varepsilon \leq \varepsilon^D \\ \\ \dfrac{c-a(1-\beta)}{\beta} & \text{if } \varepsilon \in [\varepsilon^D, \varepsilon^M] \quad \text{for } m=1,2 \\ \\ \dfrac{a+c-\varepsilon}{2} & \text{if } \varepsilon \geq \varepsilon^M \end{cases} \tag{8}$$

$$p_{um}^{AR} = \begin{cases} \dfrac{(2+\beta)[a(1-\beta)+c]-\beta\varepsilon}{4-\beta^2} & \text{if } \varepsilon \leq \varepsilon^D \\ & \qquad\qquad \text{for } m=1,2. \\ c & \text{if } \varepsilon \geq \varepsilon^D \end{cases} \tag{9}$$

Equations (8) and (9) show that there exists a critical quality of innovation, ε^D, such that the equilibrium price of the unlicensed firm is equal to its marginal cost c with the result that it does not sell strictly positive quantities in any market. However, this does not necessarily allow the licensee to charge the monopoly price. Indeed, when ε is lower than but sufficiently close to ε^D, the unlicensed firm could sell strictly positive quantities in each market if the licensee were to start charging the monopoly price. For the licensee to be able to charge the monopoly price at the equilibrium, ε must be greater than or equal to ε^M. As a result, since both firms can sell their product in both markets, the equilibrium profit of the licensee and of the unlicensed firm are respectively given by

$$\pi_l^{AR} = \begin{cases} 2\left(\frac{1}{1-\beta^2}\right)\left[\frac{(a-c)(1-\beta)(2+\beta)+\varepsilon(2-\beta^2)}{4-\beta^2}\right]^2 & \text{if } \varepsilon \leq \varepsilon^D \\ 2\left[\frac{\beta\varepsilon-(a-c)(1-\beta)}{\beta}\right]\left[(a-c)(1-\beta^2)\right] & \text{if } \varepsilon \in [\varepsilon^D, \varepsilon^M] \\ 2\left[\frac{a-c+\varepsilon}{2}\right]^2 & \text{if } \varepsilon \geq \varepsilon^M \end{cases} \quad (10)$$

$$\pi_u^{AR} = \begin{cases} 2\left(\frac{1}{1-\beta^2}\right)\left[\frac{(a-c)(1-\beta)(2+\beta)-\beta\varepsilon}{4-\beta^2}\right]^2 & \text{if } \varepsilon \leq \varepsilon^D \\ 0 & \text{if } \varepsilon \geq \varepsilon^D \end{cases} \quad (11)$$

where π_l^{AR} is gross of α.

The possibility of exclusion depends not only on the quality of the innovation, ε, but also on β and on the size of the market, a, relative to the unlicensed firm's marginal cost, c. Indeed, we impose that $c > \varepsilon$, that is we impose that c_l remains strictly positive. Accordingly, if $\varepsilon^D > c$, then $\varepsilon^D > c > \varepsilon \geq 0$ and equilibrium sales and profits of the unlicensed firm are strictly positive for any $\varepsilon \in [0, c)$. In addition, ε^D is a decreasing function in the degree of substitution, tends to zero as $\beta \to 1$, and is lower than c when

$$1 \geq \beta > \frac{\sqrt{a^2 + 8(a-c)^2} - a}{2(a-c)} = \hat{\beta}. \quad (12)$$

Hence, the unlicensed firm cannot be excluded from any markets unless goods are sufficiently close substitutes. For instance, if goods were independent, then the price charged by one firm would not affect the sales made by the other.

Similarly, we can identify values of the degree of substitution that allow the licensee to charge the monopoly price at the equilibrium. Since ε^M is a decreasing function in β, it is lower than c when

$$\beta > \frac{2(a-c)}{\alpha} = \tilde{\beta}. \tag{13}$$

Finally, suppose that $c \to a$ implying that equilibrium sales pre-innovation or when no firms accept the licensing contract are sufficiently small. Then, since ε^D tends to zero as $c \to a$, the unlicensed firm is pushed out of the market by the licensee for any quality of the innovation.

Having described the equilibrium configurations that can arise in the third stage of the game, we can now turn to the second stage of the game.

4 Decisions to accept or to reject the licensing contract

At the second stage of the game, firms observe the cost reduction ε allowed by the innovation as well as the characteristics of the licensing contract. Then, they decide simultaneously to accept or to reject the contract. If a firm accepts the contract, it immediately pays the fixed fee α. We assume that if a firm obtains the same profit by accepting or rejecting the contract, it accepts the contract. Consequently, no firm accepts the contract at an equilibrium of the subgame that starts after the proposition of the contract when $\pi_l^{AR} - \alpha < \pi_u^{RR}$; this is the only equilibrium when $\alpha > \max\left\{\pi_l^{AR} - \pi_u^{RR}, \pi_l^{AA} - \pi_u^{AR}\right\}$. Moreover, one firm accepting the contract is the only equilibrium of the subgame that starts after the proposition of the contract when $\pi_l^{AR} - \alpha \geq \pi_u^{RR}$ and $\pi_l^{AA} - \alpha < \pi_u^{AR}$. Finally, at the equilibrium of the subgame that starts after the proposition of the contract, both firms accept the contract when $\pi_l^{AA} - \alpha \geq \pi_u^{AR}$; this is the only equilibrium when $\alpha \leq \min\left\{\pi_l^{AR} - \pi_u^{RR}, \pi_l^{AA} - \pi_u^{AR}\right\}$.

5 Equilibrium licensing contracts

From Definition 1, an optimal contract is such that the innovator's licensing revenue equals the sum of profits a monopolist using the innovation would achieve on each market. Thus, a licensing contract is optimal if it generates a revenue equal to $2\left[(a-c+\varepsilon)/2\right]^2$ for the innovator at the equilibrium; the contract is strongly optimal if such an equilibrium is unique. In our setting, the innovator's revenue is equal to the fixed fee α specified in the licensing contract times the number of firms that decide to accept the contract. Consequently, to find the equilibrium contract, we need to look at the innovator's revenue for two specific contracts.

Let us first consider a contract that specifies a fixed fee such that only one firm becomes a licensee, i.e., a contract such that $\pi_l^{AR} - \alpha \geq \pi_u^{RR}$ and $\pi_l^{AA} - \alpha < \pi_u^{AR}$.

Proposition 1. *If a licensing contract is accepted by only one firm, then this contract is not optimal.*

Indeed, when both firms reject the contract, the equilibrium profit of a firm,

π_u^{RR}, is strictly positive. Thus, even when the equilibrium profit of the licensee is equal to the monopoly profit (which is the case when $\varepsilon \geq \varepsilon^M$), the sum of the licensing revenue collected by the innovator through the fixed fee is less than the sum of profits a monopolist using the innovation would make in each market.

Let us now consider a contract that is accepted by both firms, i.e., a contract such that $\pi_l^{AA} - \alpha \geq \pi_u^{AR}$.

Proposition 2. *For any $\varepsilon \geq \varepsilon^D$, there exists a strongly optimal contract that stipulates a fixed fee equal to the monopoly profit $[(a-c+\varepsilon)/2]^2$ and an exclusive territory clause. However, for any $\varepsilon < \varepsilon^D$, there does not exist a strongly optimal or an optimal contract that stipulates a fixed fee and an exclusive territory clause.*

The exclusive territory clause allows both producers to obtain the monopoly profit in their respective market. Consequently, for this contract to be optimal, we must have that the equilibrium profit of a firm that rejects the contract equals zero whenever the other firm accepts the contract, i.e., $\pi_u^{AR} = 0$. According to (11), a necessary and sufficient condition for this to arise is when the innovation quality exceeds ε^D given in (6). In addition, for the contract outlined in Proposition 2 to be strongly optimal, the subgame that follows the proposition of this contract must have a unique equilibrium outcome. Since the fixed fee $\alpha = [(a-c+\varepsilon)/2]^2$ is such that $\pi_l^{AR} - [(a-c+\varepsilon)/2]^2 \geq \pi_u^{RR}$ and $\pi_l^{AA} - [(a-c+\varepsilon)/2]^2 \geq \pi_u^{AR}$ for any $\varepsilon \geq \varepsilon^D$ and any $\beta \in [0,1)$, the contract is strongly optimal.

Having established the condition for the existence of a strongly optimal contract that relies on a fixed fee and an exclusive territory clause, we can now suggest when the use of such contract is more likely to occur. Obviously, the larger the quality of the innovation the more plausible is the existence of a strongly optimal contract. For instance, we can compare the quality of the innovation required for a strongly optimal contract to exist, ε^D, with the quality required for an innovation to be drastic, $\varepsilon \geq a - c$.

Corollary 1. *If $\beta \in [\sqrt{3} - 1, 1)$, then $\varepsilon^D \leq a - c$ and there exists a strongly optimal contract specifying a fixed fee and an exclusive territory clause even though the innovation is non-drastic. If $\beta \in [0, \sqrt{3} - 1)$ and a strongly optimal contract specifying a fixed fee and an exclusive territory clause exists, then $\varepsilon^D > a - c$ and the innovation is drastic.*

Another factor that plays an important role in the existence of a strongly optimal contract is the degree of substitution between the two goods.

Corollary 2. *For any innovation quality $\varepsilon \in [0, c)$, any pre-innovation marginal cost $c \in [0, a)$, and any demand intercept a, there is a degree of substitution such that a strongly optimal contract specifying a fixed fee and an exclusive territory clause exists as long as $\beta \geq \hat{\beta}$. However, if $\beta < \hat{\beta}$, then there does not exist a strongly optimal contract specifying a fixed fee and an exclusive territory clause.*

To show the existence of a strongly optimal contract, suppose that $\beta \to 1$. In this case, ε^D tends to zero and we are very close to a situation of price competition with homogeneous goods. As a result, the unlicensed firm's equilibrium profit equals zero even if the advantage in marginal cost allowed by the innovation is quite small, i.e., even if the innovation is of poor quality. The non-existence of a strongly optimal contract when the goods are not sufficiently close substitutes can be understood in a similar way. Indeed, suppose $\beta = 0$, i.e., the two goods are independent. Then, the equilibrium profit of an unlicensed firm remains positive whatever the cost of its competitor and no strongly optimal contract exists. Since ε^D is a decreasing function in β and must be smaller than c for the marginal cost of a licensee to remain strictly positive, it is possible to find for any innovation quality a degree of substitution such that there exists a strongly optimal contract specifying a fixed fee and an exclusive territory clause as long as goods are sufficiently close substitutes.

Finally, we know that ε^D tends to zero as $c \to a$.

Corollary 3. *For any innovation quality $\varepsilon \in [0, c)$ and any degree of substitution $\beta \in [0, 1)$, there exists a strongly optimal contract specifying a fixed fee and an exclusive territory clause when the level of pre-innovation cost c is sufficiently close to a.*

This means that it is more plausible for a contract to be strongly optimal when the market is very thin.

6 Conclusion

In this paper, we consider an innovator licensing its patented cost-reducing technology with contracts specifying a fixed fee and an exclusive territory clause. We find that the innovator can obtain licensing revenues equal to the sum of profits a monopolist would achieve in each market by using the innovation whenever the pre-innovation equilibrium quantity is small, the two products are close substitutes, or the quality of the innovation is large. Under such circumstances, it is not surprising to observe licensing contracts of the type analyzed here since there is no need for an innovator to use contracts specifying (complex) royalty schemes such as those in Erutku and Richelle (2000 and 2006). Finally, the analysis conducted here suggests that licensing contracts specifying an exclusive territory clause and a fixed fee can lead to a reduction in welfare. Indeed, when accepted by all firms, such contracts result in a reduction in variety in all markets. Furthermore, each market can also experience an increase in price (since there is a shift from an oligopoly - with differentiated goods - to a monopoly) if the innovation does not reduce sufficiently the marginal cost of production.

References

Anand, Bharat N. and Tarun Khanna (2000) 'The Structure of Licensing Contracts,' *Journal of Industrial Economics* 48, 103-35

Arrow, Kenneth (1962) 'Economic Welfare and the Allocation of Resources for Inventions,' in *The Rate and Direction of Inventive Activity*, ed. R.R. Nelson, Princeton University Press, Princeton

Caves, Richard E., Harold Crookell and J. Peter Killing (1983) 'The Imperfect Market for Technology Licenses,' *Oxford Bulletin of Economics and Statistics* 45, 249-67

Erutku, Can and Yves Richelle (2000) 'Optimal Licensing Contract and the Value of a Patent,' Cahier de Recherche 2000-7, Département de sciences économiques, Université de Montréal

Erutku, Can and Yves Richelle (2006) 'Licensing a New Product with Non-Linear Contracts,' forthcoming in the *Canadian Journal of Economics*

Fauli-Oller, Ramon and Joel Sandonis (2003) 'To Merge or To License: Implications for Competition Policy,' *International Journal of Industrial Organization* 21, 655-72

Kamien, Morton I. (1992) 'Patent Licensing,' in *Handbook of Game Theory*, Vol. 1, ed. R. Aumann and S. Hart, Amsterdam, North-Holland

Kamien, Morton I. and Yair Tauman (1986) 'Fees versus Royalties and the Private Value of a Patent,' *Quarterly Journal of Economics* 101, 471-91

Katz, Michael and Carl Shapiro (1986) 'How to License Intangible Property,' *Quarterly Journal of Economics* 101, 567-89

Mortimer, Julie H. (2004) 'Vertical Contracts in the Video Rental Industry,' mimeo, Harvard University

Priegue Freire, Armando (2002) 'On the Use of an Exclusive Territory Clause in Licensing Contract,' master thesis, Département de sciences économiques, Université de Montréal

Rostocker, Michael D. (1983) 'PTC Research Report: A Survey of Corporate Licensing,' *IDEA - The Journal of Law and Technology* 24, 59-92

Debapriya, Sen and Yair Tauman (2002) 'General Licensing Schemes for a Cost-Reducing Innovation,' mimeo, State University of New York at Stony Brook

Vives, Xavier (1999) *Oligopoly Pricing: Old Ideas and New Tools*, The MIT Press, Cambridge, Massachusetts