# To merge or to license: implications for competition policy[¤]

Ramon Fauli-Oller[y] and Joel Sandonis[z]

January 1st, 2000

Abstract

The optimal merger policy when efficiency gains are not merger specific but can also be achieved through licensing is derived in a differentiated goods Cournot duopoly. We show that whenever both royalties and fees are feasible instruments to license technology, mergers should not be allowed, which fits the prescription of the U.S. Horizontal Merger Guidelines. When only one instrument is feasible, however, the possibility of licensing cannot be used as a definitive argument against mergers.

Keywords: merger, licensing, optimal contracts, competition policy.

J.E.L. Classification: L13, L41, D45.

[¤] This paper has been partially written while the second author was visiting the Kellogg Graduate School of Management at Northwestern University. We would like to thank R. Casadeus, M. Kamien, D. Pérez-Castrillo and seminar participants at Northwestern University for helpful suggestions. Financial support from projects DGES PB97-0603 and UPV 035.321-HB159/98 is gratefully acknowledge.

[y] Universidad de Alicante. Departamento de Fundamentos del Análisis Económico. Campus de Sant Vicent. 03071 Alicante. Spain. e-mail: fauli@merlin.fae.ua.es

[z] Universidad del País Vasco. Departamento de Fundamentos del Análisis Económico. Avd. Lehendakari Aguirre 83. 48015 Bilbao. Spain. e-mail: jepsadij@bs.ehu.es

# 1. Introduction

Nowadays, companies all over the world seem to have an insatiable appetite for mergers, with the goal of capturing complementarities, scale economies, integrating technologies and production facilities and achieving cost efficiencies. This phenomenon demands a severe control by antitrust authorities to prevent anticompetitive behaviors. Until 1997, Section 5 of the 1992 U.S Horizontal Merger Guidelines (HMG), prescribed to forbid mergers whenever the efficiency gains were less than their competitive risks or whenever "equivalent or comparable savings can reasonably be achieved by the parties through other means". In April 1997, this section on efficiencies was extended to explicitly include among them the possibility of licensing.[1] This is probably due to the increasing importance played by licensing in the diffusion of new technologies in the last few years. For example, Arora and Fosfuri (1998) document a widespread incidence of licensing in the chemical industry. Anand and Khanna (1997) report that licensing is also very common in biotechnology and find that licensing has increased in frequency between 1990-1993 (the time period of their study). Finally, evidence of the importance of licensing in computers, automotive, biopharmaceuticals, engineering and electronics is also reported in different surveys.

In this paper we evaluate the accuracy of the HMG prescription. To address this issue, the optimal merger policy when licensing is an alternative to a merger to transfer a superior technology is derived. We focus on a simple case in which both instruments are assumed to allow the perfect and complete transmission of the innovation. In other words, we consider both instruments equivalent from a technological point of view, ignoring problems of asymmetric information between licensor and licensee, as well as the possibility that a merger can create synergies that could give a merger a technological advantage over licensing. Considering licensing and mergers technologically equivalent, while making the analysis tractable, will not significantly affect the qualitative results we obtain. Its main consequence will be that, when deriving the optimal merger policy in this setting, we will never be too permissive

[1] "The agency will not deem efficiencies to be merger specific if they could be preserved by practical alternatives that mitigate competitive concerns, such as divestiture or licensing."

with respect to mergers.

The crucial aspect we focus on in this work is that licensing and merging are not equivalent regimes with respect to their impact on competition. A merger eliminates competition but e±ciency gains are completely exploited by the emerging monopoly when deciding outputs. On the other hand, under licensing market competition remains but the licensee's output is distorted, as the optimal licensing contract always includes a royalty. We compare social welfare under both policies in a di®erentiated goods Cournot duopoly, which allows us to derive the optimal merger policy, and to check whether that policy ¯ts the prescription of the HMG. We show that, regardless of the type of competition, the optimal merger policy ¯ts the prescription of the HMG whenever both ¯xed fees and royalties are feasible instruments to license the superior technology. Otherwise, we show that the HMG is too restrictive because it could lead to forbid welfare improving mergers. In particular, when royalties are not feasible due for example to lack of veri¯ability of the licensee's output, the HMG is too restrictive because large enough innovations make licensing unpro¯table for the patentee. On the other hand, if only royalties are feasible due for example to existing riskiness associated to the innovation that precludes the use of fees, the patentee tends to charge a greater royalty, distorting even more the licensee's output and thus additionally reducing welfare.

Regarding existing literature on mergers, Salant et al. (1983) showed that mergers can be unpro¯table in a symmetric Cournot setting and Perry and Porter (1985) that e±ciency gains can make mergers pro¯table. Regarding welfare consequences of mergers, Farrell and Shapiro (1990) derived conditions based on market shares of ¯rms under which a merger increases welfare. However, to the best of our knowledge, ours is the ¯rst paper that derives the optimal merger policy when licensing is a substitute of a merger to transfer a superior technology.

On the other hand, the licensing literature has mainly focused on the performance of ¯xed fees and royalties as instruments to market cost-reducing innovations. Kamien and Tauman (1986) and Katz and Shapiro (1986), ignoring information problems, show that licensing by means of a ¯xed fee is superior to licensing by means of a royalty for an external laboratory,

in a homogeneous goods Cournot oligopoly. Muto (1993) extends those works to the case of Bertrand competition and shows that for the case of close substitute goods a royalty can be superior to a fee. On the other hand, for the case of an internal patentee, Katz and Shapiro (1985) analyze ¯xed fees in a homogeneous goods Cournot duopoly, showing that licensing a cost-reducing innovation is not always pro¯table for the patentee. Wang (1998) extends their analysis to the comparison between fees and royalties and shows that a royalty is always superior to a fee for the patentee. Finally, Faul¶-Oller and Sandon¶s (1999) extend the set of feasible contracts to allow for the possibility that both fees and royalties can be simultaneously used and derive the optimal two-part tari® licensing contract in a di®erentiated goods duopoly for both Cournot and Bertrand competition. Including asymmetric information problems, Gallini and Wright (1990), Macho-Stadler and P¶erez-Castrillo (1991) and Macho-Stadler et al. (1996) show that both fees and royalties should be included in the optimal licensing contracts. Royalties are useful either to signal good innovations or to separate the potential licensees that are willing to pay more for the innovation.

The remainder of the paper is organized as follows: Section 2 presents the model. Section 3 derives the optimal merger policy for the case of Cournot competition and analyzes under what circumstances it ¯ts the prescription of the HMG. Finally, a section with the main conclusions closes the paper.

## 2. The model

We consider two ¯rms, denoted by i = 1,2, each producing a di®erentiated good (goods 1 and 2 respectively). They face inverse demand functions given by:

$$p_i = 1 - x_i - \gamma x_j; i; j = 1; 2; i \neq j;$$

where $\gamma \in [0; 1]$ and represents the degree of product di®erentiation. Following Singh and Vives (1984), these demands come from the maximization problem of a representative consumer with utility separable in money (m) given by:

$$u(x_1; x_2) = x_1 + x_2 - \frac{x_1^2}{2} - \frac{x_2^2}{2} - \gamma x_1 x_2 + m:$$

The direct demand functions are given by:

$$x_i = \frac{1}{1+\gamma}\left(\frac{p_i}{1-\gamma^2} + \gamma\frac{p_j}{1-\gamma^2}\right); i,j = 1,2; i \neq j:$$

Firm 2 has constant unit production costs of $c_2$: Firm 1 is assumed to have a patented process innovation that allows to produce good 1 at a lower marginal cost $c_1$, that we set, without loss of generality, to be zero. Two different mechanisms to transfer the superior technology to firm 2 are considered: a licensing agreement and a merger. Both mechanisms are assumed to reduce the marginal cost of producing good 2 to zero, that is, we ignore problems of asymmetric information between the contracting parties in licensing agreements and the possibility that a merger creates synergies.

Depending on the size of the innovation we will distinguish between drastic and non-drastic innovations. We will call an innovation drastic when firm 1 may monopolize its market. In particular, this is the case if $c_2 > c_2^M$; where $c_2^M = \frac{2-\gamma}{2}$:

Let us define the social welfare function as

$$W(x_1,x_2) = u(x_1,x_2) - c_1x_1 - c_2x_2:$$

The timing of the game is the following:

In the first stage, the antitrust authority decides whether or not to allow mergers. In the second stage, the firms have the possibility to merge (if allowed in the first stage), or to sign a licensing contract. Given this decision, market competition takes place in the third stage, with the cost functions inherited from the second stage. We solve by backwards induction, obtaining the subgame perfect Nash equilibrium of the proposed game.

We will consider three different licensing scenarios: two-part tariff $(f,r)$ licensing contracts, royalty $(r)$ contracts and fee $(f)$ contracts, where $f$ represents a flat lump-sum license fee and $r$ represents a per unit of output fee (royalty). Scenario 2 arises when riskiness associated to the innovation precludes the use of fees. Scenario 3, when royalties are not feasible due, for example, to lack of verifiability of the licensee's output. Otherwise, scenario 1 arises. The licensing game is modelled as follows: first, the patentee makes a take-it-or-leave-it offer to firm 2; second, this firm accepts or rejects the contract. We do not allow for negative

fees because, otherwise, as argued by Katz and Shapiro (1985), contracts would include the possibility for the patent holder to \bribe(s) ¯rm 2 to exit the industry...and would likely be held to be illegal by antitrust authorities."[2] It should be noted that the licensee's marginal cost whenever a royalty is included in the licensing contract (scenarios 1 and 2) is given by r and thus, the patentee plays the role of a leader, as he determines the reaction function of the licensee by deciding the royalty to be included in the contract. On the other hand, under fee licensing (scenario 3) or under a merger, ¯rm 2's marginal cost becomes zero.

Next section derives the optimal merger policy under the three possible licensing scenarios.

## 3. The optimal merger policy

We start by calculating the third stage ¯rms' Nash equilibrium outputs, pro¯ts and total incomes, given that ¯rm 2 has accepted a $(f; r)$ contract. They are given, respectively, by:

$$x_1(r) = \min\{\frac{2 - \theta(1 - r)}{4 - \theta^2};\ \tfrac{1}{2}\};\ x_2(r) = \max\{\frac{2(1 - r) - \theta}{4 - \theta^2};\ 0\};$$

$$\pi_1(r) = x_1(r)^2;\ \pi_2(r) = x_2(r)^2;$$

$$\Psi_1(r; f) = \pi_1(r) + r x_2(r) + f;\ \Psi_2(r; f) = \pi_2(r) - f:$$

By substituting $c_2$ for r in the above expressions, the equilibrium outputs and pro¯ts under the status quo situation are obtained. Notice that when ¯rm 2 is not active, ¯rm one produces the monopoly output $x_1 = 1=2$:

Finally, we de¯ne industry outputs and pro¯ts under a merger. They are given by:

$$x_1^m = x_2^m = \frac{1}{2(1 + \theta)};\ \pi^m = \frac{1}{2(1 + \theta)}:$$

Notice that merging is always preferred to licensing by the ¯rms because while both policies transfer the superior technology a merger, in addition, eliminates market competition.

[2] Notice that we do allow for contracts including negative royalties. Nevertheless, for the case of substitute goods, it is never optimal for the patentee to charge a negative royalty. This would be the case, however, for complementary goods, that are not considered in this work.

Therefore, if allowed by the antitrust authority, the ¯rms will always choose to merge.[3]

We start the analysis by scenario 1, comparing two-part tari® licensing with a merger.

### 3.1. Merging vs. two-part tari® licensing

First of all, two-part tari® licensing is always pro¯table for the patentee because it may always reproduce the status quo by setting a royalty that just equals the reduction in unit costs that the licensee achieves on account of the new technology. This would leave the licensee indi®erent between licensing or not, and let the licensor enjoy the gains from the licensee's improved e±ciency.[4] On the other hand, two-part tari® licensing is also welfare improving because it never reduces competition, provided that the royalty cannot exceed $c_2$. Therefore, in order for the antitrust authority to prescribe when a merger should be allowed it has to compare the licensing policy and a merger from a social point of view.

First of all, we have to obtain the optimal two-part tari® licensing contract (the contract that maximizes the patentee's total income). As shown in Faulí-Oller and Sandonís (1999) the optimal two-part tari® contract $(f; r)$ always includes a positive royalty, and is given by:

$$r^{\alpha} = \min\{c_2; r_c^{00}\}; \text{ where } r_c^{00} = \frac{\circ(2 - \circ)^2}{2(4 - 3\circ^2)};$$

$$f^{\alpha} = \max\{\tfrac{1}{2}(r_c^{00}) - \tfrac{1}{2}(c_2); 0\}:$$

For the sake of completeness, the proof is included in the Appendix.

Observe that for the case of homogenous products ($\circ = 1$), $r_c^{00} = c_2^M$; which implies that drastic innovations ($c_2 < c_2^M$) are not licensed (see Wang, 1998). However, whenever $\circ < 1$; even drastic innovations are licensed because, in that case, $r_c^{00} < c_2^M$:

[3] Because we are interested in the social welfare consequences of mergers, we will not enter into the analysis of how the merging ¯rms share monopoly pro¯ts. However, intuitively, the technologically superior ¯rm would not accept less than what she could guarantee under the optimal licensing contract and, the other ¯rm, should receive not less than what she would receive in that case. Provided that monopoly pro¯ts are never less than the joint pro¯ts under the optimal licensing contract, a merger agreement would always be feasible.

[4] In fact, strictly speaking, two-part tari® licensing only guarantees non-negative pro¯ts for the patentee because, as we will see later, for large enough innovations particular cases exist such that the patentee is indi®erent between licensing and the status quo.

In order to prescribe when mergers should be allowed in this scenario, let us first denote by $W^m; W^u$ and $W^r$ social welfare under a Merger, under the optimal Unrestricted royalty ($r^* = r_c^{00}$) and under the optimal Restricted royalty ($r^* = c_2$). They are defined by:

$$W^m = u(x_1^m; x_2^m);\ W^u = u(x_1(r_c^{00}); x_2(r_c^{00}));\ W^r = u(x_1(c_2); x_2(c_2)):$$

Next proposition derives the optimal merger policy for scenario 1.

Proposition 3.1. When two-part tariff licensing contracts are feasible, mergers should never be allowed.

Proof. First, for $c_2 \cdot r_c^{00}$; a merger is socially preferred to a royalty regime if $W^m - W^r$ is positive. Directly comparing the corresponding expressions results in that $W^m \geq W^r$ if and only if $c_2 \geq c_2^{mc}$, where $c_2^{mc} = \frac{8-6\gamma^2+2\gamma^3-\sqrt{2(4-\gamma^2)^2(2+4\gamma-\gamma^2-3\gamma^3)}}{2(-4-4\gamma+3\gamma^2+3\gamma^3)}$.

Now, comparing $c_2^{mc}$ and $r_c^{00}$ we obtain $c_2^{mc} \geq r_c^{00}$; which implies that for $c_2 < r_c^{00}$; licensing is always socially preferred to a merger. Second, for $c_2 \geq r_c^{00}$; welfare under royalty licensing is constant in $c_2$: As welfare under a merger does not depend on $c_2$, in order to compare both regimes in this region we just need to know the sign of $W^m - W^r$ evaluated in $c_2 = r_c^{00}$: But we know that at this point licensing is socially preferred to a merger, which closes the proof. ■

The result in Proposition 3.1 exactly fits the prescription of the U.S. merger guidelines: when the efficiency gains are not merger specific and can be also attained through licensing, mergers should be forbidden. Notice that the result arises in a context in which both fixed fees and royalties are feasible. This requires output to be verifiable and uncertainty low enough as not to preclude the use of royalties and fixed fees, respectively. We will next proceed to derive the optimal merger policy in scenarios 2 and 3.

### 3.2. Merging vs. royalty licensing

As licensing by means of a royalty is always profitable for the licensor as well as welfare improving, in order to prescribe when a merger should be allowed in this scenario it is sufficient to compare royalty licensing and a merger from a social point of view.

Next proposition shows the optimal royalty contract (the contract that maximizes the patentee's total income).

Proposition 3.2. The optimal royalty contract is given by:

$$r^{\alpha} = \min\{c_2; r_c^{\emptyset}\}; \text{where } r_c^{\emptyset} = \frac{(2 - \circ)(4 + 2\circ - \circ^2)}{2(8 - 3\circ^2)}:$$

Proof. The optimal royalty solves:

$$\max_r \{\frac{1}{4}_1(r) + rx_2(r)\}$$
$$\text{s.t.: } r \cdot c_2:$$

Direct resolution of this problem results in the optimal contract shown in the proposition. ■

Next proposition derives the optimal merger policy for scenario 2 by direct comparison of welfare under both regimes:

Proposition 3.3. When only a royalty can be included in the licensing contract, a threshold value $c_2^{mc}$ exists such that a merger should be allowed if and only if $c_2 \geq c_2^{mc}$.

Proof. First, observe that for $c_2 \cdot r_c^{\emptyset}$; we are in the case of restricted royalty and in this case we compute $W^m - W^r \geq 0$ if $c_2 \geq c_2^{mc}$, where $c_2^{mc}$ has been de¯ned in Proposition 3.1. Second, comparing $c_2^{mc}$ and $r_c^{\emptyset}$ we obtain that $c_2^{mc} \cdot r_c^{\emptyset}$ and $c_2^{mc} \cdot c_2^M$. This implies that for $c_2 < c_2^{mc}$, licensing is socially preferred to a merger and for $c_2 \geq c_2^{mc}$ a merger is socially preferred to licensing. ■

This proposition shows that licensing by means of a royalty is not always socially preferred to a merger. The reason is that the patentee must use the only feasible instrument (the royalty) not only to soften competition but also to appropriate the surplus generated by the superior technology, which results in a higher royalty, in a higher distortion in the licensee's output, and lower social welfare.

### 3.3. Merging vs. ¯xed fee licensing

Licensing by means of a fee is pro¯table whenever it increases industry pro¯ts. As shown by Katz and Shapiro (1985) for the case of homogeneous goods, for large enough innovations

the e±ciency gains can be more than compensated by the rent dissipation e®ect, making duopoly pro¯ts decrease. In these cases, licensing will not occur and a merger becomes the only alternative to transfer technology. Next proposition characterizes the conditions under which ¯xed fee licensing is pro¯table for the patentee.

Proposition 3.4. A threshold value $c_2^L$ exists such that if $° \cdot \hat{°}$, licensing by means of a fee is always pro¯table; if $° > \hat{°}$; it is pro¯table if and only if $c_2 \cdot c_2^L$; where $\hat{°} = 0{:}82$:

Proof. Directly comparing industry pro¯ts under fee licensing with the status quo situation, we obtain that $¼_1(0) + ¼_2(0) \geq ¼_1(c_2) + ¼_2(c_2)$ if either $° \cdot \hat{°}$; or if $° > \hat{°}$ and $c_2 \cdot c_2^L$, where $c_2^L = \frac{2(4 - 4° + °^2)}{4 + °^2}$: ■

When the goods are close substitutes ($° > 0{:}82$), licensing is pro¯table only for small innovations. Otherwise ($° \cdot 0{:}82$), licensing is pro¯table regardless of the size of the innovation. This result is very intuitive: when the goods are very di®erentiated, market competition is not intense and, therefore, the e±ciency gains more than compensate the rent dissipation e®ect produced by the license, making licensing always pro¯table.

In the ¯rst stage of the game, the antitrust authority has to decide whether or not to allow mergers. We have to take into account that licensing by means of a fee is always socially preferred to a merger because, whereas both regimes achieve the same e±ciency gain a merger, additionally, erodes competition. Therefore, mergers should be allowed whenever licensing is not pro¯table for the patentee and a merger improves welfare with respect to the technological status quo. Next proposition compares social welfare under a merger and under the status quo situation.

Proposition 3.5. A threshold value $c_2^m$ exists such that regardless of the degree of product di®erentiation, a merger is socially pro¯table if and only if $c_2 \geq c_2^m$.

Proof. Direct comparison of welfare under the two regimes results in the proposition, where $c_2^m = \frac{-24 - 8° + 18°^2 - 2°^4 + (4 - °)\sqrt{2(18 - 19°^2 + °^3 + 2°^4)}}{2(-12 - 12° + °^2 + °^3)}$. ■

The above proposition shows that for large enough innovations and regardless of the degree of product di®erentiation, the e±ciency gains attained through a merger compensate for

its anticompetitive effect, thus making mergers socially desirable. Observe that Proposition 3.5 can be seen as the optimal merger policy when the efficiency gains attained through a merger are merger specific.

Next proposition combines Propositions 3.4 and 3.5 to derive the optimal merger policy for scenario 3.

**Proposition 3.6.** When only a fee can be included in the licensing contract, mergers should be allowed if and only if $\alpha > \hat{\alpha}$ and $c_2 \geq c_2^L$.

**Proof.** Whenever licensing is not privately profitable and mergers are socially preferred to the status quo, mergers should be allowed. This proposition just brings together the corresponding conditions from the two propositions above, taking into account that $c_2^L \geq c_2^m$. ■

Summarizing, from the optimal merger policies derived in Propositions 3.1, 3.3 and 3.6, an interesting policy implication can be derived. When licensing is an alternative to a merger for (perfectly) transferring technology, a more restrictive optimal merger policy is called for. This argument seems to be present in the HMG, that prescribes to forbid mergers whenever the efficiency gains can be alternatively achieved through licensing. The optimal merger policy derived above fits that prescription only when both fixed fees and royalties are feasible instruments to license the superior technology. Otherwise, the possibility of licensing cannot be used as a definitive argument against mergers. In particular, it may be too restrictive because it may lead to forbid welfare improving mergers: in scenario 2, it may occur because the patentee imposes a high royalty that distorts the licensee's output a lot and reduces welfare. On the other hand, in scenario 3 because, as Proposition 3.4 shows, fee licensing is not always profitable and, in these cases, a merger is the only effective instrument to transfer technology.

## 4. Conclusions

The traditional merger policy analysis prescribes to allow mergers if and only if efficiency gains compensate their impact on competition. In this paper, we extend this analysis by considering also the existence of an alternative instrument that may allow firms to attain those efficiencies, namely, licensing. In this case, a more restrictive merger policy is called for. The 1992 U.S. Horizontal Merger Guidelines was revised in 1997 to incorporate this idea, and it prescribes to forbid mergers whenever efficiency gains are not merger specific, but can also be achieved through licensing. In this work, we have shown that the prescription of the HMG is too restrictive. In particular, for large innovations mergers tend to be superior to licensing: when royalties are not feasible, it is true because large innovations make licensing unprofitable and, at the same time, make mergers socially desirable; on the other hand, when royalties are feasible, because for large innovations the patentee tends to impose high royalties, reducing total output and welfare.

In absence of licensing, the traditional merger policy is more restrictive the less differentiated the goods are. This is still true when royalties are feasible. When only fees are feasible, however, the result is reversed: mergers should be allowed only when the goods are close substitutes. The reason for this counterintuitive result is that what determines the merger policy in this case is whether licensing is profitable or not. It turns out that it is not profitable when goods are close substitutes.

Finally, an interesting extension of the model is to derive the optimal merger policy for the case of Bertrand competition. This is in fact work in progress. The results obtained in Bertrand are qualitatively similar to those in Cournot. They incorporate, however, the fact that Bertrand competition is more intense, which implies first, that the licensor tends to impose greater royalties in order to soften competition and, second, that mergers are more anticompetitive. While under Cournot licensing is always profitable for the patentee, under Bertrand competition and even when both instruments are feasible, for large enough innovations licensing becomes non-profitable for the patentee, that uses the royalty to keep the other firm out of the market. In these cases, a merger becomes the only effective instrument

to transfer the superior technology and thus, it should be allowed whenever it is welfare improving.

# 5. Appendix

## Derivation of the optimal two-part tari® licensing contract

The optimal two-part tari® licensing contract solves:

$$\max_{r;f} f\pi_1(r) + rx_2(r) + fg$$
$$s:t: \quad f \cdot \pi_2(r) - \pi_2(c_2)$$
$$f \geq 0:$$

This program can be rewritten in a simpli¯ed way. As the ¯rst constraint is always binding, it can be substituted in the objective function and the second constraint can be replaced with $r \cdot c_2$; that guarantees that the fee is never negative. The maximization problem thus becomes:

$$\max_r f\pi_1(r) + rx_2(r) + \pi_2(r) - \pi_2(c_2)g$$
$$s:t: \quad r \cdot c_2:$$

Solving this program directly results in the optimal contract shown in the proposition.

# 6. References


Arora, A. and Fosfuri, A., 1998, Licensing in the chemical industry, forthcoming, Stanford Technology Law Review.

Anand, B.N. and Khanna, T., 1997, Intellectual property rights and contract structure, WP 97-016, Harvard Business School.

Calvert, R., 1964, The encyclopedia of patent practice and invention management. New York: Reinhold.

Farrell, J. and Shapiro, C., 1990, Horizontal mergers and equilibrium analysis, American Economic Review 80, 107-126.

Faul¶-Oller, R. and Sandon¶s, J., 1999, Optimal two-part tari® licensing contracts in a di®erentiated goods duopoly, working paper, University of Alicante, Spain.

Gallini, N. and Wright, B., 1990, Technology transfer under asymmetric information, Rand Journal of Economics 21 (1), 147-160.

Kamien, M. and Tauman, Y., 1986, Fees versus royalties and the private value of a patent, Quarterly Journal of Economics, 101, 471-491.

Kamien, M., 1992, Patent Licensing. In: Aumann, R. J., Hart, S. (eds), Handbook of Game Theory, chapter 11.

Katz, M. and Shapiro, C., 1985, On th licensing of innovations. Rand Journal of Economics, 16, 504-520.

Katz, M. and Shapiro, C., 1986, How to license intangible property, Quarterly Journal of Economics, 101, 567-590.

Macho-Stadler, I. and D. P¶erez-Castrillo, 1991, Contracts de licence et asym¶trie d'information, Annales d'Economie et de Statistique, 24, 189-204.

Macho-Stadler, I., Mart¶nez-Giralt, X. and P¶erez-Castrillo, D., 1996, The role of information in licensing contracts design, Research Policy 25, (1), 25-41.

Muto, S., 1993, On licensing policies in Bertrand competition, Games and Economic Behavior 5, 257-267.

Perry, M. and Porter, R., 1985, Oligopoly and the incentive for horizontal merger, American Economic Review 75, 220-227.

Rostocker, M., 1984, A survey of corporate licensing. IDEA, 24, 59-92.

Salant, S., Switzer, S. and Reynolds, S., 1983, Losses from horizontal merger: the e®ects of an exogenous change in industry structure on Cournot-Nash equilibrium, Quarterly Journal of Economics 98, 185-199.

Singh, V. and Vives, X., 1984, Price and quantity competition in a di®erentiated duopoly, Rand Journal of Economics 15, 546-554.

Wang, X., 1998, Fees vs. royalty licensing in a Cournot duopoly model, Economics Letters 60, 55-62.