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http://www.jstor.org/
Tue Apr 8 18:44:34 2003
Protecting early innovators: should second-generation products be patentable?

Suzanne Scotchmer*

Incentives to develop basic technologies are greater if the patentholder profits from applications or other second-generation products. Assuming that such products infringe the basic patent and that there is not much delay between the innovations, I argue that (i) patents on second-generation products are not necessary to encourage their development and (ii) the patentholder of the basic technology collects a larger share of the profit if applications or other second-generation products are not patentable.

1. Introduction

Inventors of basic technologies are not always the same firms that find commercial applications for them. This is partly because a firm that does basic research might lack the expertise to develop applications, but also because the potential profit from such applications might attract competitors. For example, pharmaceuticals developed with bioengineering techniques are seldom achieved by the research institutions that hold patents on those techniques.

The possible division of R&D effort among many firms places an additional burden on the patent system. Not only must it try to ensure that research firms earn enough profit in total to cover the total costs of R&D, but in addition the profit must be divided among them such that each firm covers its costs. The problem of dividing profit seems particularly acute when the entire commercial value is contained in the applications facilitated by the basic research, and when the basic innovation has no commercial value on its own. If the inventor of the basic technology is not also the inventor of the applications, the only way it can cover its costs is by collecting licensing fees. Such fees may not be sufficient to cover costs.

The problem of dividing profit was the focus of Green and Scotchmer (1995) and is also addressed by Scotchmer (1991a, 1996), Chang (1995), Matutes, Regibeau, and Rockett (1996), and Chou and Haller (1995). In those articles it is assumed that the second-generation product is patentable, and the division of profits is linked to whether the second product infringes the first patent, or more precisely, to the first patent’s breadth. In this article I investigate the division of profit from the opposite point of view: Assuming that the second-generation product infringes the prior patent, for example because it uses the prior technology, I investigate how the division of profit is affected by patentability of the second product.

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I thank the National Science Foundation, grant no. SES 90-11910, for financial support. I thank Jim Ratliff, Ben Hermalin, Jerry Green, and Joe Farrell for useful comments.
Patents on basic technologies are an essential underpinning for R&D incentives but are not necessarily required for applications or other second-generation products. There is another way to ensure monopoly profit, namely with an exclusive license on the basic technology. The same total profit is collected on the application if (i) it infringes the prior patent and must license but does not receive its own patent, (ii) it receives its own patent and does not infringe the basic patent, or (iii) it is both infringing and patented. One might therefore have thought that infringement and patentability were redundant policy tools. On the contrary, although they yield the same total profit from the application, they do not yield the same division of profit. I argue that denying patentability of the second product increases the share of profit collected by the first innovator.

If denying patents on applications increases the profit share of the first innovator, one might worry that not enough is collected by the second innovator. Provided that licenses can be granted ex ante, before investing in the application, rather than ex post, this worry is unfounded. If the value of the application exceeds its incremental cost, the first patentholder can profit by granting an ex ante license to a firm with expertise to develop it, on terms that allow the second firm to profit too. Ex ante licensing permits firms to share profits in a way that avoids the ex post holdup problem.

The argument in this article can be interpreted as supporting a demanding “patentability” requirement (or “novelty” requirement); in particular, it suggests that applications and other second-generation products should not be patentable. The argument is essentially that if applications are denied patents, their inventors have less bargaining power in the licensing negotiation with the first patentholder. Thus the first patentholder ends up with more profit. This is a different reason for a stringent patentability requirement than given by Scotchmer and Green (1990), who assumed (contrary to this article) that whenever improved products were patentable they were also noninfringing. In their model a strong patentability (novelty) requirement increases profit by prolonging the time until the next generation, and also by softening the competition between different generations of vertically differentiated products. A similar argument is given by O’Donoghue (1995) for an infinite sequence of innovations.

Section 2 develops a motivating example to show how patentability affects the division of profit, and Section 3 continues the same example with a focus on efficient contracting. The message of these sections is that patentability of applications does not determine which are undertaken (conditional on having the first innovation), but only affects the division of profit. Section 4 presents a richer model of R&D costs that illuminates a subtlety of contracting under the threat of renegotiation, namely that the contract giver (first patentholder) can hold the research firms to less than their “apparent” reservation profits by setting up a “prisoner’s dilemma” in the contract he offers them. In Section 5 I point out how the same arguments also apply to two other types of second-generation products: those that are improvements of the original patent, and those that are accessories. Section 6 remarks on how patent law can accommodate the policy implications of this article.

2. **Motivating example: an auction**

   Suppose that an initial patentholder has already sunk a cost, say \( c_b \), in a basic patent. The patented technology has no value to consumers as a stand-alone product. Suppose that two firms, say 1 and 2, are capable of developing an application with monopoly value \( \nu(T) \), which is the discounted sum of per-period monopoly profit until time \( T \), when the patent expires. The total profit available to the two innovators is \( \nu(T) - (c_b + c_a) \), where \( c_a \) is the incremental cost of the application, which would have to be incurred by any firm that invests in it. If there were no problem of dividing
profit, we would choose $T$ so that $v(T) - (c_b + c_a) = 0$. A longer patent life $T$ would unnecessarily prolong monopoly distortions, and a shorter patent life would discourage innovation.

This is a model with symmetric information, and one might therefore hope that an auction for rights to develop the second product (i.e., an auction for an exclusive license on the first patent) would enable the first patentholder to collect all the surplus $v(T) - c_a$ so that both innovators’ costs are covered if $v(T) - (c_b + c_a) = 0$. A firm’s maximum bid is the difference in profitability between winning and losing the bid. If the losing bidder will be shut out entirely and the winning bidder will have an exclusive license worth $v(T)$, then the firms should be willing to bid $v(T) - c_a$.

However, the losing bidder will not necessarily be shut out if the application is patentable. If the losing bidder invests $c_a$, he achieves the application first with probability $\frac{1}{2}$. If he patents the application, the winning bidder cannot independently achieve and market it without infringing the losing bidder’s patent. Therefore his exclusive license becomes worthless unless he negotiates a deal *ex post* with the losing bidder, who now owns the patent on the application. I assume that the two patentholders bargain over the value $v(T)$ (all costs are sunk), and for simplicity that each receives $v(T)/2$. Since the losing bidder wins the patent on the application with probability $\frac{1}{2}$, his expected profit is $(v(T)/4) - c_a$, and he will invest if this is positive. The expected profits of the winning bidder and losing bidder are respectively $(3v(T)/4) - c_a$ and $(v(T)/4) - c_a$. The difference, which is the winning bid, is therefore only $v(T)/2$, rather than $v(T) - c_a$. The profit collected by the first patentholder in the auction is $v(T)/2$, which is smaller than $v(T) - c_a$ in the case where this happens, namely when $c_a < (v(T)/4)$.

Compare this with what happens if the improvement or application is not patentable. After the winning bidder and the first patentholder have sunk research costs, they can simply wait for their investment to pay off. Since they have nothing to gain by bargaining with the losing bidder, the losing bidder will never invest, and the winning bid will be $v(T) - c_a$, which is the first patentholder’s expected profit. Thus we have the following proposition.

**Proposition 1.** Suppose that the first patentholder auctions an exclusive license before the research firms invest costs. Then (a) If the second-generation product is patentable, each research firm receives expected profit $\max\{0, (v(T)/4) - c_a\}$. If the second-generation product is not patentable, each research firm receives expected profit zero. (b) If $(v(T)/4) - c_a > 0$, then the profit of the first patentholder is smaller if the application is patentable than if not.

By part (b), to cover the first innovator’s costs $c_b$, the patent life $T$ might have to last longer when the second-generation product is patentable than when it is not. In fact there are two reasons that patentability of the second product reduces the first innovator’s profit. Patentability increases the research firms’ expected profits, and it also wastes R&D costs when $(v(T)/4) - c_a > 0$ because both firms invest.

Notice that the second-generation product will be developed if $v(T) - c_a > 0$ whether or not it is patentable. Patentability is not required to stimulate the investment.

The following sections show that a longer patent life is required when the second product is patentable, even when contracting is efficient.

3. Efficient contracting with fixed R&D costs.

- There are two ways that the patentholder’s contract can be inefficient: It can give some of the surplus to the research firms (contractees) or it can permit inefficient investment. The auction above is inefficient in the latter sense, since both firms will
invest if $c_a$ is low enough, and that is inefficient. I now compare contracts that are efficient in both senses for the cases that the second product is or is not patentable, and show that patentability still reduces the first innovator’s profit because it raises the reservation payoffs for the research firms.

The patentholder will offer a contract simultaneously to both firms, and each research firm can say “yes” ($y$) or “no” ($n$). There is no asymmetric information or moral hazard in this model, so it does not matter which firm is assigned the patents and the responsibility to bear the research costs. For concreteness I shall assign both to the first patentholder, who offers the contract. The contract offered jointly to the two firms will specify a payment to each, and will specify which firm undertakes the research project. (But the latter does not matter, since the first patentholder bears the research costs.) For convenience I refer to firms as “members” or “nonmembers” according to whether they accept or decline the contract, and I refer to the patentholder and the partners who accepted as a “joint venture.” A firm accepts the contract if it provides at least the firm’s reservation payoff.

The following assumption is what drove our result in Section 2.

*Assumption 1 (Efficient renegotiation of licenses).* If the two patents have been awarded and are owned respectively by two firms or by a firm and a joint venture, the two patentholders will negotiate a license in which they split the *ex post* bargaining surplus $v(T)$ equally.

That is, blocking patents will not prevent the application from being marketed, as a license will be negotiated instead. My main point below is that this very reasonable assumption limits the ability of the first patentholder to collect profit when the application is patentable. If the patentholder could commit himself against negotiating a license with a nonmember firm that was awarded the second patent, he could hold the research firms’ reservation payoffs to zero. Without such commitment powers, the research firms may earn positive expected profit.

*Proposition 2 (Characterization of the efficient contract).* Assume that the second-generation product is patentable, that Assumption 1 holds, and that firms in patent races play pure strategies (either invest or not).

(i) Each research firm can guarantee itself profit of at least $\max \{0, (v(T)/4) - c_a\}$.

(ii) There is a contract that provides $\max \{0, (v(T)/4) - c_a\}$ to each research firm and profit $v(T) - (c_a + c_a) - 2 \max \{0, (v(T)/4) - c_a\}$ to the first patentholder.

*Proof.* Consider first the case that $(v(T)/4) - c_a > 0$. (i) A research firm can assure itself at least $(v(T)/4) - c_a$ by declining the contract. If no other firm invests, its expected profit is $(v(T)/2) - c_a$, since it is awarded the second patent for sure. If the other firm or the joint venture also invests, it wins with probability $\frac{1}{2}$, and its expected profit is $(v(T)/4) - c_a$. (ii) The payoffs written in the cells of Figure 1 represent a contract offered by the patentholder, where $\epsilon$ is a small positive number that breaks ties. We shall show that the equilibrium is $(y, y)$, which provides the profits stated in part (ii), where $\epsilon$ is taken to be close to zero. The cell $(n, n)$, where neither firm accepts the contract, contains the expected payoffs in the patent race between two nonmembers, namely $(v(T)/4) - c_a$. Consider cells $(y, n)$ and $(n, y)$. Both the joint venture and the nonmember will invest. The expected profit of the nonmember is nonnegative whether or not the joint venture invests, since it is either $(v(T)/4) - c_a$ or $(v(T)/2) - c_a$. The joint venture will also invest, because without investment its expected profit is $(v(T)/2) - c_a$ and with investment its profit is $3(v(T)/4) - c_a - c_a$, which is larger. Of this expected profit, I assume that the contractual payment to the member firm is $(v(T)/4) - c_a + \epsilon$. The payoffs in $(y, y)$ are specified in the contract, and the contract giver will designate one firm to invest. Since
the equilibrium of the game in Figure 1 is \((y, y)\), and since the contract giver will designate only one firm to invest, the equilibrium payoffs are as specified in (ii).

Now consider the case that \((v(T)/2) - c_a > 0 > (v(T)/4) - c_a\). The payoffs in the efficient contract are shown in Figure 2. In a patent race between two nonmember firms at most one will invest, and we shall assume without loss of generality that it is the row player. The payoffs \(((v(T)/2) - c_a, 0)\) in the cell \((n, n)\) are the expected payoffs in a patent race between nonmember firms. Unlike the previous case, if the firms play \((y, n)\) or \((n, y)\) and the contract specifies that the member will invest, then the nonmember will not invest, since his payoff from doing so would be \((v(T)/4 - c_a) < 0\). Thus the payoff to a single nonmember firm is zero. If the contract provides the profits specified in Figure 2, the equilibrium is \((y, y)\) and payoffs are as specified in (ii).

Finally, consider the case that \(0 > (v(T)/2) - c_a\). Then no nonmember firm would invest in a patent race, so the payoffs in \((n, n)\) of Figure 2 would be replaced by \((0, 0)\). The remaining payoffs are the same in the efficient contract.

We have thus found contracts for all the cases that provide for efficient investment and restrict the research firms’ profits as stated in the proposition. \(Q.E.D.\)

**Proposition 3 (Patent lives can be shorter without stifling investment if second-generation products are not patentable).** Suppose that the patent life \(T\) is such that \(v(T) - (c_b + c_a) = 0\). If \((v(T)/4) - c_a > 0\), the first innovator earns zero profit whether or not the second-generation product is patentable. If \((v(T)/4) - c_a < 0\), the first innovator earns negative profit if the second-generation product is patentable and zero profit if it is not patentable.

**Proof.** If the second product is not patentable, the efficient contract is described by Figure 2, except that the payoffs in cell \((n, n)\) are \((0, 0)\). Without a patent, the first innovator could simply appropriate the patented application ex post, so nonmember firms will not invest. Using the contracting game in Figure 2, the efficient contract provides the research firms \(\epsilon\) profit, just as it does when the second product is patentable.
and \((v(T)/4) - c_a < 0\). Hence the first innovator earns all the profit (except \(-2\varepsilon\), which is arbitrarily small), and investment is efficient. But if \((v(T)/4) - c_a > 0\), each research firm earns \((v(T)/4) - c_a\) according to Proposition 2; hence the first patentholder’s profit is \(v(T) - (c_h + c_a) - 2[(v(T)/4) - c_a] < 0\). \(Q.E.D.\)

4. Efficient contracting with endogenous R&D costs

In Section 3 I discussed a particularly simple research environment with lump-sum costs of R&D where it is efficient for only one firm to invest. In this section I show that these simplifications can be relaxed without changing the conclusion that patentability of the second product reduces the first innovator’s profit, and the patent life must therefore be longer. The richer cost structure introduced in this section illustrates an additional complexity of contracting with renegotiation, namely that there are externalities in reservation payoffs between the firms’ contracting decisions. Firm 1’s reservation payoff with renegotiation may be affected by the contract between firm 2 and the first patentholder.\(^1\)

Assume again that the two research firms are identical.\(^2\) In contrast to the previous model, assume further that efficient investment requires both firms to participate, and that \(v(T)\) is the present discounted value of the second product from when the patent begins. Suppose that the joint expected profit of all firms jointly is \(G(v(T), x_1, x_2)\) when firms 1 and 2 invest at rates \((x_1, x_2)\). Suppose that \((x^*, x^*)\) are the rates of investment that maximize joint profit \(G(v(T), x_1, x_2)\).

As before, an efficient contract would elicit efficient rates of investment \((x^*, x^*)\) and minimize the research firms’ profits. However the minimum profits that must be given to the research firms are harder to identify in this environment, since each firm’s reservation payoff will depend not only on the possibility of negotiating an ex post license as a nonmember firm, but also on whether the other firm formed a joint venture with the first patentholder, and on the joint venture’s rate of investment. After firm 1 has accepted the offer, the reservation payoff of firm 2 is determined by the anticipated patent race against the joint venture. High investment by the joint venture would reduce firm 2’s reservation payoff, possibly to zero. However, the threat of high investment is not credible if it would inefficiently dissipate the joint venture’s profit. I maintain my previous assumption of ex post rationality: Even if a contract specifies otherwise, members of a joint venture will renegotiate ex post to invest efficiently in a patent race.

**Assumption 2 (Patent races determine reservation payoffs).** A firm’s reservation payoff for accepting a contract is equal to its expected profit in the Nash equilibrium of a patent race that would otherwise ensue. The prize for a nonmember firm in a patent race is \(\pi^o\) when the invention is patentable and \(\pi^u\) when it is not, where \(v(T) > \pi^o > \pi^u\).

The assumption \(v(T) > \pi^o > \pi^u\) means that a nonmember firm races for a smaller prize if the invention is unpatentable. (In Section 3 we assumed that \(\pi^o = v(T)/2\) and \(\pi^u = 0\).) Whether or not the second product is patentable, Assumption 2 permits that firm \(i\)’s reservation payoff, \(i = 1, 2\), may be different if he races against another

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\(^1\)The most profitable contract is usually found by first characterizing the feasible contracts that respect reservation payoffs and incentive constraints, using the revelation principle. This technique is not available with renegotiation of contracts, as here, because each firm’s reservation payoff depends on the action of the other firm. Here the word “efficient” means among the contracts of the form specified.

\(^2\)I assume for convenience that rates of investment are observable, but this may be unrestrictive. Gandal and Scotchmer (1993) point out in a similar model that the observability of rates of investment is irrelevant. Since the contract giver can reward firms differently according to when and whether they achieve the application first, there are enough ex post signals on which to base payments so that first-best rates of investment can be elicited without constraining the division of profit.
nonmember firm than if he races against a joint venture consisting of the first patent-holder and the other research firm.

As before, the first patentholder offers a contract simultaneously to the two research firms, and each firm can say "yes" (y) or "no" (n). The contract specifies that the first patentholder shall own the application, and in return the patentholder pays the firms, specifies their rates of investment, and reimburses costs. The payment and rate of investment can depend on how many firms accept the contract. The first patentholder’s expected payoff is $G(v(T), x_1, x_2)$ minus the payments to the research firms.

Let $P(n, y, \pi)$ represent the expected payoff to a nonmember firm (the firm that plays "no") in a race against a joint venture consisting of the first patentholder and the other research firm. The reward to the nonmember firm if it wins the race is $\pi$ (either $\pi^0$ or $\pi^\alpha$), and the reward to the joint venture is $v(T)$ if it wins and $v(T) - \pi$ if it loses. Further, let $P(n, n; \pi)$ represent the expected payoff to each nonmember firm if they race against each other for reward $\pi$.

Assumption 3 below is reasonable on grounds that the nonmember firm races against a more determined opponent when the opponent is the joint venture than when it is another nonmember firm. In both cases the opponent’s difference between winning and losing is $\pi$, but for fixed probabilities of winning and losing, say $(\alpha, 1 - \alpha)$, the opponent’s expected profit is higher if it is a joint venture (namely, $\alpha v(T) + (1 - \alpha)(v(T) - \pi) = v(T) - \pi + \alpha \pi$) than if the opponent is another nonmember firm (namely, $\alpha \pi$). Hence a joint-venture opponent wants to finish the patent race sooner, and will invest more in the race.

**Assumption 3** (A nonmember firm earns greater expected profit if it races against another nonmember than if it races against a joint venture). $P(n, n; \pi) > P(n, y; \pi)$.

**Proposition 4** (Characterization of the efficient contract). Suppose that Assumptions 1–3 hold. Then there is a contract that holds the profit of each research firm to the payoff $P(n, y, \pi)$ and provides the first patentholder with profit $G(v(T), x^*, x^*) - 2P(n, y; \pi)$.

**Proof.** The contracting game induced by the optimal contract is described in Figure 3, where $(y, y)$ is the unique Nash equilibrium. Q.E.D.

The contract provides for efficient investment $(x^*, x^*)$ if the firms play $(y, y)$, and it holds the research firms to less expected profit than they receive in a patent race against each other, namely, $P(n, n, \pi)$. This might seem counterintuitive, as one might have thought that the relevant reservation payoff would be the firms’ payoffs when neither accepts the contract. But the patentholder holds them to smaller profit than the latter by setting up a “prisoner’s dilemma” in which they make less profit in equilibrium $(y, y)$ than if they could collude to decline the contract and race against each other.

**FIGURE 3**

<table>
<thead>
<tr>
<th>yes (y)</th>
<th>no (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes (y)</td>
<td>$P(n, y, \pi) + \epsilon, P(n, y, \pi)$</td>
</tr>
<tr>
<td>no (n)</td>
<td>$P(n, n, \pi)$</td>
</tr>
</tbody>
</table>
The next proposition points out that, as before, patentability of the application hurts the first patentholder. The hypothesis that $P(n, y, \pi^w) < P(n, y, \pi^v)$ is satisfied under the hypotheses of Section 3 that $\pi^w = 0$ and $\pi^v = v(T)/2$, and holds more generally under the reasonable condition that $P(n, y, \pi)$ increases with the prize $\pi$.

**Proposition 5.** Suppose $P(n, y, \pi^w) < P(n, y, \pi^v)$, and Assumptions 1–3 hold. Then the patentholder collects more profit in the joint venture when the application is un-patentable than when it is patentable.

5. **Other second-generation products: improvements and accessories**

- Other second-generation products might be “improvements” and “accessories.” An “improvement” is a new version of the patented product with greater commercial value. For example, the first product could be windshield wipers, and the improved product could be windshield wipers with an intermittent wipe. An “accessory” is a product that is useful only with the first product and whose availability enhances the value of the first product, e.g., computer software written for a particular patented computer.

The three types of second-generation products I have identified differ in how patent law treats them. It was natural to assume that applications infringe the prior patent, since applications use the patented technology, and that is what patents protect against. Accessories do not infringe, since they do not embody the original technology, and can be sold without a license. In the case of improvements, it is not obvious whether they infringe. One might interpret patent breadth to mean that if the improved product is sufficiently different from the original, it does not infringe. This is the interpretation taken by Green and Scotchmer (1995), Chang (1995), Matutes, Regibeau, and Rockett (1996), and O’Donoghue, Scotchmer, and Thisse (1995).

If improvements infringe the prior patent, they have the same strategic consequences that applications have. If the commercial value of the initial product is $x$ and the value of the improved product is $x + v(T)$, the analysis would be as above. For applications, $x = 0$.

The analysis of accessories is slightly different but leads to the same conclusions: Denying patentability on the accessory will not stifle its invention, and allows the first patentholder to collect more profit. Suppose the accessory is not patentable. If the accessory is competitively supplied, the owner of the first patent can increase the price of the basic product enough to capture the entire consumer’s surplus of the accessory. The first patentholder would thus be willing to fund development of the accessory even if it would then be supplied competitively. In contrast, if the accessory is patented, and if the two patentholders set their prices simultaneously, then any prices that sum to the joint value of the product and accessory together are an equilibrium. There is no longer a guarantee that the first patentholder collects all the surplus as profit. (See Scotchmer (1991b) for a more detailed argument.)

6. **Legal doctrine, policy implications, and caveats**

- This article has investigated whether second-generation products should be protected through exclusive licenses or through their own patents, assuming that they infringe the prior patent. However, their status regarding both infringement and patentability is ambiguous under the patent law. Patentability is governed by whether the invention is “novel” and “nonobvious,” and infringement follows either because the second-generation product “uses” the prior technology or because the second product falls within the scope of the claims. Merges (1992) describes the legal doctrine of
“anticipation,” in which the disclosures in a prior patent could compromise the novelty of a second-generation product, making it unpatentable. On the other hand, if the court rules that there is no anticipation in the prior patent, the second product could be both patentable and noninfringing. Two special categories are improvement and new-use patents, where the premise is that the improvement or new use (“application”) will infringe, but might or might not also be patentable. See Merges (1992) and Merges and Nelson (1990, 1994) for further description of these doctrines and a discussion of enforcement. The relevance here is that the patent law leaves room for interpretation.

There are two policy interpretations of the arguments in this article. First, if there are no impediments to ex ante exclusive licenses, then social welfare can be improved by denying patents on infringing second-generation products. Denying such patents helps transfer profit to the first patentholder without stifling development of second-generation products, and it therefore permits shorter patent lives without undermining incentives for R&D. However, denying second-generation patents could stifle innovation if there were impediments to ex ante contracting, and for that reason it might not be a viable policy. The second interpretation is then the relevant one.

The second interpretation is that to stimulate R&D, patents must last longer when R&D is decentralized in many firms than when it is concentrated in one. This idea was set forth by Green and Scotchmer (1995) in a model where only one firm was capable of each innovation, assuming it was patentable. A question not addressed in that article is whether all the bargaining power is transferred to the first patentholder if several firms compete ex ante for an exclusive license. The arguments here show that the answer is no. The reason is that the first patentholder and the licensee cannot commit against renegotiation if a nonlicensee achieves the second patent.

Even if there are no problems of ex ante contracting, another reason to permit patents on second-generation products is that there might be substantial delay between the basic innovation and the second-generation product. The monopoly on the second-generation product will end when the patent it infringes ends or when its own patent ends, whichever comes first (see also Scotchmer (1996)). Thus if the second product were invented halfway through the life of the first patent, the monopoly profit available from the second product would be higher if it were patentable than if it were not. In this situation it might be better to give a patent on the second product. It seems that the requirements of novelty and nonobviousness are flexible enough to distinguish the case, e.g., by taking substantial delay as prima facie evidence that the second product was nonobvious. Of course such a policy could have offsetting pernicious effects: If patentability depends on the elapsed time between innovations, firms might strategically delay investments in order to qualify for patents.

This article should not be interpreted to mean that by denying patents on second-generation products the first innovator can necessarily collect all the incremental profit, but only that he can collect more profit than if the second product were patentable. Even with no delays and no problems of ex ante contracting, asymmetric information could undermine the first patentholder’s profit. If the research firms have private information about their R&D costs or private signals of the application’s value, then the winning bid will typically not be the winning bidder’s maximum willingness to pay. Nevertheless, my main point survives: Patentability of the second product may reduce the first patentholder’s profit still further, since the losing bidder may invest anyway, and if he is successful, the patent gives him bargaining power.

I close with a comment on the contracting situation studied in this article. Whether or not the second product is patentable, I have assumed that the first patentholder can offer a profit-sharing contract simultaneously to the research firms before they invest in the second product. His incentive to offer such a contract is to coordinate investments efficiently, and possibly to ensure that the application will be developed when otherwise
it might not be. One might have thought that since the first patentholder offers the contract, he can collect all the profit above the firms’ reservation payoffs. This is so, with the qualification that the reservation payoffs depend on whether the second product is patentable. Suppose that a firm declines the contract, invests on its own, and achieves the application first. If the application is patentable, the inventor and the first patentholder hold blocking patents on it, and they will negotiate a deal ex post that reflects symmetric bargaining positions. The first patentholder could make more profit by committing against such a renegotiation when he makes the initial offer. Such a commitment is not credible, but denying patentability on the application serves much the same purpose. Denying patentability undermines the second inventor’s bargaining position, since the first patentholder has the option to develop the application on his own. Thus patentability of the application increases the firms’ reservation payoffs.

Each firm’s reservation profit depends not only on the outcome of ex post renegotiation, but also on its competitors’ actions. Section 4 illustrates that each firm’s reservation payoff is smaller if its competitor joins a venture with the first patentholder than if it does not. As a consequence, the first patentholder can set up a prisoners’ dilemma in which he holds the competing firms to less profit than they could earn by colluding to decline the offer (play “no”).

References


