**Preliminary and Incomplete: Please do not quote without permission**

# Refusal to License: A Transaction Based Perspective

Ashish Arora
Heinz School, Carnegie Mellon University
Pittsburgh PA 15213
ashish@andrew.cmu.edu

and
Dept. of Economics, Stanford University
Stanford, CA 94305

28th April, 2002

Prepared for DOJ/ FTC Joint Hearings on Competition and Intellectual Property Law and Policy in the Knowledge-Based Economy, Refusals to License Session, May 1, 2002, Department of Justice. I am grateful to Robert Merges for helpful discussions, and to the Department of Economics, Stanford, for hospitality during the preparation of this essay.

## Introduction

My comments reflect my long-standing interest in technology as an economic commodity, and therefore, in technology licensing and other forms of market trades in technology. A working market in technology, where technologies can be traded is socially beneficial. It reduces duplicative R&D; enhance use of technology and therefore increase the productivity impact of technological change. Trade in technology also facilitates greater specialization in innovation and encourage high tech start ups e.g., biotechnology.) Such specialization further enhances the rate of innovation in the economy, as well as its diffusion.[1]

I shall begin with an overview of what we know about voluntary licensing, especially in the chemical industries, and the implications for what *could* be done about refusal to license. Making a virtue of a necessity, I will not confine myself to a narrow anti-trust perspective. My sense of the discussion on the question of refusal to license is that the only clear principled approaches are the "one monopoly rent" approach, or the "patents entail monopoly" approach, both of which entail the policy prescription that a refusal to license ought never to face an anti-trust challenge. I shall not address the question of whether and when refusal to deal can reduce social welfare. The single monopoly rent theory appears to be formally incorrect (e.g., Whinston, 1990; Borenstein, Mackie-Mason and Netz, 2000). Carlton, [1999] summarizes cases where a refusal to deal can and cannot reduce social welfare. I also find the idea of immunizing patents (and intellectual property rights more generally) from anti-trust challenge a troubling one. If followed, I believe that such immunity is likely to have undesirable consequences in a future where software, and especially embedded software, becomes increasingly ubiquitous. However, as MacKie-Mason (2002) and others have pointed out, the difficulty is in implementing a sensible tradeoff between the need to provide incentives for innovation via intellectual property rights and anti-trust objectives.

Therefore, my concern here is specifically with refusal to license and my objective is to try to suggest a framework for a defensible cost-benefit calculation. In the final part of this essay, I build upon a recent theory of "disproportionate leverage" advanced by Robert Merges [1999] and propose a way to make this theory operational in the context of refusal to license.

## II. Voluntary licensing and markets for technology

Some commentators have said that innovations are not bought and sold in markets. This is only partly true. Using a variety of data sources, my co-authors and I estimate that that the technology trade in the OECD countries amounted to around $30-$50 billion dollars per year between 1990-

[1] For instance, a very substantial fraction of biotechnology firms specialize in licensing candidate drugs, further developed and marketed by established pharmaceutical firms, or in licensing technologies that increase the efficiency of drug discovery (or both). The presence of such specialized suppliers enhances the rate of innovation. In the chemical industry, the diffusion of chemical process technologies has been facilitated by the presence of specialized engineering firms. These firms have been an important source of technology for entrants to the industry and for firms in developing countries. There is also evidence that these firms facilitated the diffusion of "best practice" technology in the chemical industry (Spitz, 1988).

1997, or between 10-15% of total civilian R&D (Arora, Fosfuri and Gambardella, 2001).[2] We find that there is a market for both developed and developing technologies, although this market is subject to a variety of imperfections. Sectors, such as chemicals, refining, pharmaceuticals and, to some extent, semiconductors, where clearly defined ("crisp") property rights prevail, are sectors where a market for technology is better developed. (Anand and Khanna, 2000; Teece, 1998; Arora and Gambardella, 1994.)

A recent (unpublished) study (Walsh, Arora, and Cohen, 2002) on the patenting and licensing of research inputs in biotechnology, illustrates the working of the market for technology. We find that although there has been an increase in patents on the inputs to drug discover ("research tools"), drug discovery has not been substantially impeded by these changes.[3] There is, however, some evidence of delays associated with negotiating access to patented research tools, and there are areas where patents over targets and foundational discoveries have limited access for other researchers. In all cases where a license was not available, it was because the patent holder was working on it himself. These restrictions on access are consistent with the intent of the patent system of providing temporary exclusivity, and industry participants view them as such. Simply put, the market for innovations appeared to be working reasonably well, although a number of irritants remain.

One important finding from this study of patenting and licensing of bio-medical research inputs is that there are very few instances where an entire line of therapeutic research is blocked off to all except a single firm. In most cases, there are multiple biological pathways to be investigated. For instance, if a human gene has been patented as a target, an animal gene may be used as an (imperfect) substitute. The availability of (possibly imperfect) substitutes therefore pushed patent holders to license on reasonable terms. Further, technical opportunity in this field is high and firms will sometimes redirect research away from areas where there are lots of patents. Of course, there are cases where a broad patent on a target (e.g., Cox-2 inhibitor) can potentially block off the area and require interested parties to license from the patent holder. In such cases as well, the patent holder will license unless he intends to conduct research and develop therapies himself. Even where patent holders have fairly broad patent rights, they tend to license others for applications they do not intend to develop or where others possess complementary technology.[4] It is significant, however, that general purpose technologies which might come close to some notion

[2] Royalty flows received from unaffiliated entities by US firms in 1996 amounted to 66$.5 billion, of which about 50% are likely to have been for 50% for *industrial processes and products*. This implies that in the US technology licensing royalty flows amounted $37.5 billion in 1996. The value of deals is estimated to be $18-20 billion using licensing plus royalty deals. In addition, we estimate an additional $20-30 billion in R&D funding and equity investment for outsourced R&D.

[3] Of the 30 respondents who addressed the issue, 29 could not point to a specific project stopped due to having difficulties getting agreement from multiple IP owners (the anti-commons problem). For example, one respondent indicated that about a quarter of his firm's projects were terminated in the past year. Of these, none were terminated due to any difficulties with in-licensing of tools. Instead, the key factors leading to the termination of projects included pessimism about technical success and the size of the prospective market. One biotechnology executive stated: "I am hard pressed to think of a piece of research that we haven't done because of blocked access to a research tool. We have dropped products because others were ahead in proprietary position, but that is different."

[4] For instance, in regenerative technology, Geron is said to have a strong position with its portfolio of patents on stem cells, telomerase technology, and cloning technology (acquired through its acquisition of Roslin Institute in Scotland). Geron has licensed a variety of other firms for use of the technology in animal breeding applications, as well as for thereapeutic uses.

of an "essential facility", such as recombinant DNA, PCR and the genomic databases, are available for license.

The market for technology is not ubiquitous. A variety of factors can inhibit such trades. One such factor is tacit knowledge. Technology is more than access to patents. Know-how, much of it often tacit, is needed, and this means that the technology owner may have to make substantial effort, and incur substantial costs, to transfer technology. Studies of international technology licensing find that the extent of know-how and engineering services are an important determinant of technology licensing payments (Contractor, 1981; Teece, 1977). It is likely to be difficult for government agencies to effectively monitor whether all required know-how has been transferred.[5]

Contracts for know-how can be complicated. Technology owners have to protect know-how from being misappropriated. Bundling with patents is one feasible strategy. Such bundles contracts are more efficient than contracts for know-how by themselves, but may be misconstrued as illegal tying. In this sense IPR *are* different from other types of property, namely that effective use may require transfer of a bundle of different types of knowledge, some protected as patent or copyright and some not. Flexibility in contracts is required to make the transfer of technology possible. (See for instance, Arora, 1996; and Arora and Merges, 2002). Bundling may also involve physical products, specific to the licensed technology (in that the licensed technology would not work well without the physical product), but that otherwise are sold in competitive markets.

An indirect way that policy can facilitate technology transfer is to promote competition in technology market. Multiple sources of differentiated technology are not a theoretical curiosity; the biotech and chemical industries (and sections of the semiconductor industry) provide a number of instances of reasonably well functioning markets for technology. It is no surprise that patents are generally thought of as being effective in the chemical industry. It is also no surprise that technology licensing is an important source of revenue for firms in the industry. However, firms resort to licensing either if they themselves are unable or unwilling to commercialize the technology on a large enough scale, or if they face competition from other technology holders (with technology that is a reasonably close substitute).[6] In particular, the presence of specialist technology suppliers appears to play an important role in encouraging even established firms to offer technology for license (Arora and Fosfuri, 2000 ).

Licensing in the chemical industry took place as early as the 1860s and 1870s. However, an active market for technology emerged only after World War II (Spitz, 1988). In addition to the effects of

[5] There are two interesting instances of "compulsory" licensing. After both WW I and WW II, the industrial property (including patents) of German chemical firms was appropriated and made available to US firms. In neither case is there evidence that this was a major disincentive for foreign firms to invest in R&D. Arguably, the specific circumstances of the expropriation were responsible. The other lesson, relevant for this point, is that using those patents proved to be extremely difficult. Hounshell and Smith [1986] detail the difficulties Du Pont faced in using German patents alone (without know-how) to enter organic dyestuffs. A similar conclusion emerges from Standard Oil (NJ) technology agreement with IG Farben where IG Farben did not provide know-how (contrary to the agreement) to Standard Oil, with the result that the latter could not effectively make use of the Buna patents for synthetic rubber (Spizt, 1988).

[6] These ideas are formalized in Arora and Fosfuri [2000], which also provides empirical evidence that shows that for instance that multinationals are more likely to license if other technology holders are present, and that chemical producers are more likely to license in products markets where independent technology suppliers are active.

the war itself, the anti-trust pressure on Du Pont and ICI played an important role as well. ICI was required to license its basic polyethylene patents (other firms had developed expertise in producing polyethylene) while Du Pont was nudged into licensing nylon technology (and know-how) to a Monsanto joint venture, Chemstrand.[7] The more general point is that licensing flourished when firms faced competition from other technologically capable firms (whether at home or abroad) and licensing itself facilitated entry into the industry. The second tentative conclusion from the history of the chemical industry is that anti-trust enforcement, including the occasional episodes of compulsory licensing, does not appear to have had a chilling effect on innovation. Part of the reason that innovation flourished is that the *in the US*, the industry has had multiple sources of innovation. No single firm, not even Du Pont, has dominated the chemical industry, in the way IG Farben and ICI dominated their respective national industries in the inter war years.[8] The extent to which anti-trust enforcement contributed to these multiple sources of innovation is unclear, but it certainly did not hurt.

Government agencies must be alert to attempts to restrict competition, for instance in reviewing proposed mergers.[9] *In this sense, intellectual property rights are no different from other types of property rights. Firms may use a variety of means to acquire market power, not only in markets for goods, but also in markets for technology, and, at least in principle, neither are the anti-trust considerations any different.*

Refusal to license: Preliminaries

Most of the discussion on this question that I have read concerns cases where the technology holder has market power in an existing product market, and its refusal to license in related markets raises anti trust concerns. This is the situation in the CSU-Xerox case. A related case is where the technology holder with market power in an existing market agrees to give a license only if certain conditions are met (such as license to technology held by the other firm asking for a license), as in the Intel-Intergraph case. I think there is widespread agreement that if the firm refusing to license does not have significant market power, there is no basis for *anti-trust* concern.[10] Similarly, I believe that a situation where, for instance, a pharmaceutical firm with substantial market power in a particular therapeutic category refuses to license its existing or prospective drugs, most of us

[7] Du Pont reportedly charged $125 million dollars to Monsanto.
[8] Indeed, it has been argued that the splitting up of IG Farben into three of the largest firms out of which IG Farben was formed greatly encourage innovation and growth in the post WW II German chemical industry (Stokes, 1988).
[9] The agencies challenged the acquisition of Union Carbide by Dow Chemicals in part on the grounds that the merger would greatly reduce competition in the market for polyethylene process technology While there are a number of producers of polyethylene, Dow and Exxon-Mobil were the leaders in metallocene catalyst technology for polyethylene and UCC was the leading supplier of polyethylene process technology and a joint venture partner with Exxon to supply advanced metallocene catalyst based polyethylene process technology. Dow and BP were partners in a rival joint venture. Under the terms of the order, Dow would be required to divest and license intellectual property that is critical to the production of linear low-density polyethylene - to BP. Earlier, the FTC and the EU had stepped in to require Shell to divest to Union Carbide, Shell's interest in polypropylene technology, to address various concerns, including the concern that the formation of Montell Polyolefins, a $6 billion joint venture between Montedison and Shell, could substantially reduce competition in polypropylene licensing markets.
[10] This may raise other concerns, namely that such concentrated control over a technology is unlikely to be conducive to the rapid development of that technology.

would accept that refusal as part of the rights of a patent holder.[11] Thus, I shall focus on the case of a firm with market power in one market facing a request for a license in a related market.

For the most part, the discussion of these issues has centered around what a firm with market power should or should not be compelled to do regarding its intellectual property. My view is that intellectual property should be treated no differently from other property, with three caveats. First, as already noted, insofar as intellectual property consists not only of patents and copyrights, but also proprietary information and other types of know-how, it may be difficult to compel a firm to transfer this know-how to others. The second caveat is that the scope of an intellectual property right is difficult to delineate, far more difficult than for rights in tangible property. For instance, sometimes the real issue is that a patent is believed to be excessively broad. The standard response is that this is something that should be addressed by the PTO or by a court challenge on the scope of the patent. The standard response is fine but, in specific cases, may not be enough. For instance, no single infringer may have adequate incentives to challenge the patent, because a successful challenge conveys a beneficial pecuniary externality to all other infringers who are not part of the suit. Thus, an anti-trust challenge may be one way for public policy to mitigate the problem. However, this is an issue that requires further thought.

A third caveat relates to price. It is also a commonplace that compulsory licensing is problematic because it requires outsiders to put a price on the technology, and technology by its nature is unique, making its pricing by outsiders difficult. The problem is real, but overstated. In some industries, such as industrial and organic chemicals, oil refining, and pharmaceuticals, at least, it is possible to use information on similar transactions to determine the price of a license if two parties had freely entered into a transaction. Moreover, for the same reason it is unlikely that courts will be actually required to monitor these transactions very frequently – the parties are likely to be able to bargain in the shadow of what is likely to happen in the court. On the other hand, as already noted, requiring transfer of know-how may be a formidable challenge for third parties, such as courts or anti-trust agencies, and may require divestiture of entire lines of business. Further, there is the distinct possibility that a tougher stance on refusal to license patents may encourage firms to protect more of their technology as trade secrets. In general, society benefits from patents because the knowledge is disclosed more effectively, and patents make technology licensing easier. Thus a move towards secrecy would likely reduce social welfare.

Having acknowledged the practical difficulties involved in mandating licensing, I shall ignore these in the next section. The objective there is to propose a different way of thinking about the question of refusing to license. But the proposed framework here is suited only to licensing of intellectual property and is different, therefore, from the more general analyses of "duty to deal" analyzed, for instance in Gilbert and Shapiro [1998] or Carlton [1999] .

[11] This has not always been so. As noted earlier, after World War II, Du Pont was pushed to license nylon patents and know-how to another producer. Similarly, ICI had to license polyethylene patents to US firms (in addition to the license given to Du Pont). My own reading of the history of the chemical industry is that these events enhanced the rate of innovation in the industry. They obviously increased competition and increased consumer welfare in the short run as well.

"Disproportionate Leverage"? A suggested approach using "Stand Alone Value"

The basic reason for presuming that the owner of property can dispose of an asset as he wishes is that to take away this right reduces the private value of the assets and impairs investment in creating the asset in the first instance. This is said to apply especially to technology and related intangible assets. Thus, permitting refusal to license is said to be important for preserving incentives to innovate, not simply for the firm in question but for all potential innovators. However, all innovations are not equal and neither is the protection accorded to them. Thus, one might ask whether the private benefit being gained (from the innovation or from the intellectual asset more generally) is commensurate with the social benefit from the innovation.

Robert Merges [1999] has put forward a theory of "disproportionate leverage". The simple idea, attractive in many respects, is that "small property rights" should not be used to leverage very large markets. What is a "small property right" then? Merges does not provide a definition but does provide a number of instances that exemplify the point. One such case is the use of copyright to protect interface in game cartridge cases, where copyrights in very short sequences of computer code effectively permitted game cartridge sellers to prevent the sale of competing cartridges by "unauthorized" competitors. Merges also provides the example of *Alcatel USA, Inc. v. DGI Technology., Inc*., where copyright in a digital phone switch operating system was sought to be used to prevent competitors from designing and introducing competing switches. The Lotus-Borland case on copyrights over menu command structures is another case in point.

Although most of such examples are about copyright, clearly, there is nothing special about copyrights. Rather, what is important is that copyrights are property rights easily gained (with very little by way of requirements other than originality). Although patents have to satisfy a higher threshold (namely, novelty, utility and non-obviousness), it is also true that that in the current times, a very substantial number of patent applications manage to do so.[12] A recent study claims that the true probability that a patent application will result in a patent grant is above 90% (Quillen and Webster, 2001). In other words, while a patent may be a "bigger" property right than a copyright in some sense, it does not follow that a patent can provide immunity whereas a copyright could not. Thus, in the after market service cases Merges suggests that the key test is whether the proprietary software and other technologies are substantial enough and the service market small enough for a refusal to license be acceptable.

How could a "small right" leverage a large market? Isn't the ability to leverage a large market itself evidence that the right in question is large? In answering the question one gets further insight into the usefulness of this perspective. Sometimes, though possibly not always, the ability to leverage a large market arises because the property right is owned by a firm that dominates a related market. The obvious examples are well known and are usually thought of as pertaining to standards and network economies.

[12] I have heard it suggested, and only partly in jest, that we in the United States are approaching a "registration" system, and a patent attorney who fails to secure a patent for his client may deserve to face charges of malpractice. The recent announcements about the PTO being reorganized to serve its "customers" (i.e., patent applicants) does not help dispel such apprehension.

One way of thinking about it is to ask whether the property right would be able to leverage the market if it were owned by someone other than a firm dominating the related market. As a thought experiment, consider putting all the patents and know-how in question and spinning off a separate firm (owned by the same shareholders but with an independent management charged with maximizing the profits of the spinoff). One can then ask – How would this firm behave? Would this firm refuse to license? How valuable would this firm be?[13] The answers to these questions can prove helpful in delineating different types of situations and the welfare implications of refusal to license.

For instance, in bio-pharmaceuticals, the independent technology firm may decide that an exclusive license would maximize its profits. Further, the original firm may have the highest willingness to pay for the exclusive license. This appears to be the case for patents covering new compounds. However, this is typically not the case for patented technologies such as databases, gene chips or even "targets". Biotech firms that have patents on such technologies typically do not license these exclusively. By the same token, it is not common for pharmaceutical firms to patent or offer for license such input technologies.[14]

In an after market service scenario, imagine a durable equipment producer with market power in the equipment market, and a related market for service and repair, where the equipment producer has patented software and parts. Consider the case where the diagnostic software and patented parts are owned by a separate profit maximizing firm spun off from the durable equipment producer. If the technology is markedly superior to alternatives, the spin off may be able to leverage the after service market. Furthermore, if there are efficiency-based reasons for refusal to license, they would apply to the spinoff as well. Thus, the spinoff is unlikely to license to others and may decide to provide the technology exclusively through its own services. Alternatively, the spin off may license exclusively, perhaps even to the equipment producer itself.[15]

However, if the technology is not markedly superior, other firms (including the firm producing the hardware being serviced) are likely to be able to develop other methods. Indeed, in the extreme case, if the principal reason that spinoff's intellectual property is valuable is because it incorporates the "interface" to the machines produced by the equipment maker, then it is likely that spinoff would have only limited value. Rather than license the spinoff's technology, the equipment maker may simply create a new interface and develop similar (but non-infringing) diagnostic software and parts. More precisely, the costs of developing and implementing a new

[13] The *CSU v Xerox* decision appears to be clear that, from a legal viewpoint, one need not, and indeed, ought not to inquire into the why the technology holder refuses to license. Indeed, there are efficiency reasons for refusal to license (e.g., Gilbert and Shapiro []). On the surface, this seems perfectly sensible. Yet, if the premise of anti-trust law is that a firm enjoying monopoly power in a market may not engage in actions that would be permissible for a firm not enjoying market power, it seems necessary to understand the reasons for a refusal to license. Only if one concludes that by virtue of having intellectual property, as opposed to other types of property, is intent of no consequence.

[14] Responding to complaints about restricted access to their patented targets, a respondent from a pharmaceuticals firm stated: "Your competitors find out that you've filed against anything they might do. They complain, 'How can we do research?' I respond, 'It was not my intent for you to do research.'" (cited in Walsh, Arora and Cohen, 2002).

[15] A clarification: It is tempting to conclude that the spinoff would simply turn back and license to the original firm, defeating the purpose of the test. But the test has two components: value of the spinoff and and its behavior. Even if the original firm is the going to be the highest bidder, the price it would be willing to pay for the IPR will depend on how easily the original firm can develop a substitute. The easier the substitution, the lower the price.

interface and costs of developing non-infringing software set the limits for the value of the license. In this case, it is likely that the property rights leveraging the service and repair market are "small".

Put differently, it is worth asking why a license is needed in the first instance? It is rare that there be exactly one way to achieve a particular technical result or effect. Moreover, the history of innovation teaches us that these different ways usually have additional social value. Thus, a license is needed if the technology in question is markedly superior or if the technology covers a "standard" (in the broad sense of the term). If the latter, some, if not all, of the value derives from investments made by others, such as consumers. Thus, following Merges's analysis, it is unfair and possibly also inefficient to reward the standards owner. In Intel v. Intergraph, presumably a great deal of the value of Intel's know-how arose because it was not possible to design workstations compatible with Intel microprocessors without the know-how. However, it is possible that the know-how would be valuable even beyond Intel microprocessors, and if that were the case, Intel would have a stronger claim.[16]

The principal virtue of this approach is that it leads directly to cost-benefit analysis. It requires an economic, not technical valuation of the patent and intellectual property. If applied to a case where the firm refusing to license does not enjoy market power in a related market, the analysis would directly return a finding of no anti-trust concern. If there are significant efficiency reasons for not licensing, these ought also to come out from an analysis of how the spun off property rights would be used.

There are three principal types of objections from *economists* that I can foresee. First, that this "stand-alone value of intellectual property" approach discounts complementarities. For instance, might it not be the case that the hypothetical spinoff of the sort being contemplated be of limited value because the technology it possesses is complementary with other technologies and assets owned by the dominant producer? Alternatively, though small, the property rights of the spinoff may be a part of a conscious strategy. Thus, the dominant firm may have made substantial investment in creating a brand and a service organization, with the intellectual property being a small, but key, part of the strategy (e.g., Teece, 1986). Thus, what may appear to be a "small" property right is so because it has been unbundled from other complementary technologies and assets. There is considerable merit to this objection. The point, however, is to probe the source of these complementarities. When firms have significant market power, one cannot assume that whatever creates private value also creates social value. Thus, for the purpose of understanding refusal to license, it is useful to understand, on a case-by-case basis, the source of the complementarities. Clearly, doing so is difficult and expensive, but surely not impossible.

The second objection is that all of this is besides the point. The patent system exists to provide incentives to innovate. These incentives are provided by the prospect of rents. These rents would include rents from a variety of markets covered by the patents. It is therefore arbitrary (at least to an economist) to exclude some markets ex post facto. Thus, not allowing refusal to license will

[16] Interestingly enough, in this case, if Intergraph had spun off a separate firm that owned the Clipper patents and related technology, arguably Intel would have had not basis to deny Intergraph access to its know-how. The bundling between Intergraph's workstation operations and its microprocessor technology (surely the result of historical accident) appears to have created much of the problem

reduce incentives to innovate. This objection too has merit. However, since this discussion is all predicated on a firm already having acquired substantial market power (and by extension, a substantial return on invention), the objection loses some of its sting. Not all of its sting to be sure, because surely the incentives of the dominant firm to innovate further are impaired, as are firms that anticipate market dominance. However, this must be balanced against the incentives of other firms to invest in innovation as well. For instance, I firmly believe that the uncoupling of application from operating system in desktop computers (as was once contemplated by the government in the Microsoft case) would have encouraged greater experimentation and innovation in both. Similarly, I believe that while the pressure on Du Pont and ICI to license their technologies may have impaired their incentives (and other firms that anticipated being similarly situated), it also unleashed innovation by others, including the development of complementary process technologies, in part by expanding the pool of producers who would be buyers of such complementary technology. For instance, Union Carbide and others developed superior methods of producing polyethylene with improved properties,

A variant on the second objection is that the patent system contemplates the grant of a temporary period of exclusivity in exchange for the disclosure of an invention. Stated thus, it appears that the matter is settled. But there is, as I understand it, a doctrine of "duty to deal" and a notion of "essential facilities" in the law, albeit not very clearly defined and somewhat controversial. By implication, the property rights of a patent holder are limited (as are the rights of owners of other types of property). Regardless, this objection taken literally would remove all refusals to license from scrutiny and my proposal is based on the premise that such an exclusion is unwarranted. More generally, it seems to me that the principled approaches do not take us very far (as evidenced by the conflicting court judgments on this issue). If so, then rather than argue about principle, it seems more useful to try to apply cost benefit calculus to guide policy.

A third, and potentially more powerful, objection to the proposed "stand alone value" analysis is that it cannot be done: We simply lack the data needed to satisfactorily carry out such an analysis. I do not have an adequate response to this objection, except the hope that the growth of markets for technology will begin to generate the sorts of data needed to make this exercise feasible. I should also note that some variants of what is proposed here likely are already done when estimating the value of patents in infringement cases, especially where technologies have not been fully developed.

## Conclusion

My perspective is one which stresses the importance of intellectual property rights, not only for providing incentives for innovation, but also for facilitating the diffusion and use of innovation. In this view, intellectual property rights are a crucial ingredient trade in technology and for facilitating a market for technology. This perspective also suggests that, policy action, such as mandatory or compulsory licensing, is both more difficult and less difficult. It is more difficult because it is difficult to enforce the transfer of know-how. It is easier because as technology itself becomes a tradable commodity, fixing a price for a license becomes easier.

In this view, there is little basis for special treatment of intellectual property in terms of immunity from anti-trust action. More generally, the growing use of software, and especially embedded software, implies that such an exceptionalism may have undesirable and unanticipated effects. If one accepts that there are situations where a refusal to license diminishes social welfare (even taking into account the likely beneficial impact in the form of greater incentives to innovate), then some structured approach seems desirable.

One possible approach, suggested in this essay, builds on the idea of "disproportionate leverage". The approach applies specifically to cases where a firm already enjoying market power in one market refuses to license intellectual property allegedly required for operating in a related market. The approach requires that one weigh the social value of the intellectual property in question against the likely social loss entailed by monopolization (or reduction of competition more broadly) in the market for which the license has been refused. It further suggests that this valuation be carried out by analyzing the hypothetical case where the intellectual property in question were spun out in a separate firm with an independent management charged with maximizing the profits of the spinoff. As a corollary, one would also investigate what actions the spinoff would take regarding the use of its intellectual property, including whether it would refuse to license.

References


Anand, B.N., and Khanna, T. 2000. The Structure of Licensing Contracts. Journal of Industrial Economics 48(1), 103-135.

Arora, A., Fosfuri, A and Gambardella, A. 2002. Markets For Technology, MIT Press, Cambridge MA.

Arora, A. and Merges, R.P. 2002. Intellectual property rights, firm boundaries and R&D inputs. Revised version of earlier working paper available as Berkeley Center for Law and Technology working paper at http://www.law.berkeley.edu/institutes/bclt/pubs/merges/

Arora, A., and Fosfuri, A. 2001. Licensing In The Presence Of Competing Technologies, *forthcoming*, Journal of Economic Behavior and Organization.

Arora, A., and Rosenberg, N. 1998. The U.S. success story: The growth of the United States chemical industry. in Chemicals and Long Term Economic Growth. Ashish Arora, Ralph Landau, and Nathan Rosenberg (eds.), John Wiley and Sons, NY.

Arora., A.. 1996. Contracting for Tacit Knowledge: The Provision of Technical Services in Technology Licensing Contracts. Journal of Development Economics, Vol. (50), 233-256.

Arora, A. and Gambardella, A. 1994. The Changing Technology of Technical Change: General and Abstract Knowledge and the Division of Innovative Labour. Research Policy 23, 523-532.

Borenstein, S., MacKie-Mason, J., and Netz, J.S. 2000. Exercising Market Power in Proprietary Aftermarkets. Journal of Economics and Management Strategy. Vol 9, No. 2.

Dennis W. Carlton, 2001, A general analysis of exclusionary conduct and refusal to deal — why aspen and kodak are misguided, NBER Working Paper 8105.

Contractor, F.J. 1981. International Technology Transfer. DC Heath and Company. Lexington.

Gilbert, R.J, and Shapiro, C. 1996. An Economic Analysis of Unilateral Refusal to License Intellectual Property. Proceedings of the National Academy of Sciences, USA. Vol 93, 12749-12755.

Gilbert, R.J, and Shapiro, C. 1998. Unilateral Refusals To License Intellectual Property And International Competition Policy, in Einar Hope and Per Maeleng (eds.) Competition and Trade Policies. Routledge. London and New York.

MacKie-Mason, J.K. 2002. What to do About Unilateral Refusal to License. Unpublished mimeo.

Merges, R.P. 1999. Who Owns the Charles River Bridge? Intellectual Property and Competition in the Software Industry. UC Berkeley School of Law, Working Paper No. 15.

Quillen, C. D., and Webster, O.H. 2001. Continuing Patent Applications And Performance Of The U.S. Patent Office. Federal Circuit Bar Journal, Vol. 11, No.1. 1-21.
Spitz, P. H. 1988. Petrochemicals: The Rise of an Industry. John Wiley & Sons, New York.
Stokes, R. G. Divide and prosper : the heirs of I.G. Farben under Allied authority, 1945-1951. Berkeley : University of California Press
Teece, D.J. 1977. Technology transfer by multinational firms: The resource cost of transferring technological know-how. The Economic Journal. June.
Teece, D.J. 1986. Profiting from Technological Innovation. Research Policy 15(6), 285-305.
Walsh, J, Cohen, W., and Arora, A. 2002. The Patenting and Licensing of Research Tools and Biomedical Innovation. unpublished mimeo. Carnegie Mellon University.