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**STANDARD SETTING AND MARKET POWER**

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Comments regarding Competition  
and Intellectual Property

# STANDARD SETTING AND MARKET POWER

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## Introduction: Patents, Standards and Value

Our interest in the economics of standard setting derives from our wish to understand the sources of market power arising in technology markets.<sup>1</sup> In the past, it was common to presume that a patent conveyed market power, possibly because of the use of the word “monopoly” in the term “patent monopoly,” or possibly because patents are valuable only when they do convey market power. We see this, for example, in the old “market power presumption” that the antitrust case law used to attach to ownership of a patent.<sup>2</sup> The invalidity of this presumption is now well understood. Empirical research by Scherer, Pakes, Schankerman, Lanjouw and others has established and confirmed a useful generalization: that the distribution of patent values is skewed; most patents (and patented inventions) are worth very little and only a very few have considerable value.<sup>3</sup>

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<sup>1</sup> Many of the opinions in this submission also appear in a draft paper, “Market Power in Technology Markets” available from the authors upon request. We have also developed certain of our ideas about standard setting in our role as economic consultants to Rambus Inc., a semiconductor memory technology developer. The opinions we voice in the hearings and in this submission are solely our own; neither Rambus nor our colleagues at NERA bear any responsibility for them.

<sup>2</sup> The market power presumption arose in *United States v. Loews, Inc.*, 371 U.S. 38, 45 (1962), which held that market power is “presumed when the tying product is patented or copyrighted.” The doctrine has been discredited in the antitrust case law since *Loews* without having been formally overturned, Justice O’Conner, writing for the concurring justices in *Jefferson Parish*, wrote “the time has therefore come to abandon the ‘per se’ label and refocus the inquiry on the adverse economic effects, and the potential economic benefits, that the tie-in may have.” (*Jefferson Parish Hospital District No. 2 v. Hyde*, 466 U.S. 2, 16 (1984)).

<sup>3</sup> See F.M. Scherer, “Firm Size, Market Structure, Opportunity, and the Output of Patented Inventions,” *The American Economic Review*, vol. LV, no. 5, Part 1, December 1965, pp. 1097-1125; F.M. Scherer, “The size distribution of profits from innovation,” *Annales D’Economie et de Statistique*, no. 49/50, 1998, pp. 496-516

Most patents are worth only a little because while the inventions they disclose may be novel and useful, they are minor, “commodity inventions” for which close substitutes exist. They convey no market power to their owners. Licensors – buyers of technology – will pay no more to obtain the right to use a new technology than the dollar value of the advantage the new technology affords over the next best alternative technology in the same application. The presence and quality of substitutes is an important determinant of market power in technology markets, as it is in product markets.

The value of a new technology, product or product characteristic can be approximated by the value to consumers of its advantage over the next best alternative — if the next best alternative is just as good, its value (price) will be no greater than the price of the alternative. The same applies to a cost-saving process patent whose value will equal its cost-saving advantage. If that advantage is small, then no matter how new and exciting the technology, it will not be worth much.

Of course, revolutionary inventions – useful technical advances with weak or nonexistent economic substitutes – by exactly the same principle convey great market power. Processes or products embodying such inventions will themselves be valuable either because the new product characteristics are desirable to consumers who are without alternative means to satisfy these desires or because product costs have been reduced in ways that could not be accomplished by other means.

Standard setting has the potential to create market power and enhance the market value of a technology by reducing the number of close substitutes. This is the reason why firms invest in competitions to become a standard whether these competitions occur in the market (*de facto*) or before standard-setting bodies (*de jure*). Whether standards are set *de facto* or *de jure*, standard setting can create market power where the grant of a patent alone could not. We note, though,

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(especially p. 513); Ariel Pakes, “Patents as Options: Some Estimates of the Value of Holding European Patent Stocks,” *Econometrica*, vol. 54, no. 4, July 1986, pp. 755-784; Schankerman, Mark, “How Valuable is Patent Protection? Estimates by Technology Field,” *RAND Journal of Economics*, Spring 1998, vol. 29, no. 1, p. 94; and Jean Lanjouw, “Patent Protection in the Shadow of Infringement: Simulation Estimations of Patent Value,” *Review of Economic Studies*, vol. 65, 1998, pp. 671-710.

that the set of conditions required for this to happen is restrictive: Standard setting does not always create market power for the standardized technology. In settings where compatibility requirements are high, standards competition may be very important as the choice of a standard may virtually eliminate, not merely disadvantage, competing technologies.

When the value of the technology is not high to begin with (because the innovation is minor or because there are many economically comparable inventions), formal standard setting has the potential to enhance value. Let us begin by thinking about the case of a new technology that represents a minimal advance over pre-existing alternatives. If the application had low compatibility requirements so that establishing a standard were not necessary and the new technology were available for license, the license would carry only a low royalty as substitute solutions are at hand. Assume now that compatibility requirements are high and setting a *de jure* standard is desirable. The formerly low-value technology representing a minimal advance over ready substitutes could now command a high royalty because the formerly plentiful, ready substitutes are now disqualified by the standard. The new technology stands alone and firms would be willing to pay for it in order to remain compatible and in compliance with the standard. The act of naming the technology the standard increased the value that consumers placed on the technology. The invention outside of the standard carried little value on its own.

Now let us replay the story with a new technology that represents a substantial advance in price/performance characteristics over older solutions to the same problem. In version one of a hypothetical market with minimal compatibility requirements and no need for standard setting, the new technology wins on its own merits and is likely to command a high royalty (although obviously not so high as to render it inferior when one considers the price versus performance tradeoff). While there may be no need for a *de jure* standard, we expect to see the market behave as if the new revolutionary technology were an agreed upon standard.

Suppose we change the minimal compatibility assumption and require a standard, all else equal. In this case, because the new technology would have won the standards war, *de facto*, in the market, its adoption as a formal standard, *de jure*, adds little or nothing to its value. The

older substitutes were inferior substitutes to begin with and are made no more so by the standard-setting body.

Standard setting has the potential for increasing the value of a technology when a technology with close substitutes wins a formal standard-setting competition. Standard setting can create market power by making otherwise close substitutes inferior, and thereby increasing the royalty rate (price) a technology can command. By contrast, when the invention would dominate the alternatives in a technology market on its own inherent merits, ratification of the market outcome by formal standard setting is an afterthought; it changes nothing.

One of the goals of standard-setting organizations (SSOs) is to choose a technology as the standard that will yield the best performance at the lowest possible cost. The technology that offers the best performance is not necessarily the first choice if the cost of that technology exceeds its performance advantage. A predicament facing the SSOs in trying to choose the technology with the best price performance trade off is that price of the chosen technology can change after the standard is determined if the technology owner attempts to extract the value added by the standardization process in royalty fees for the standard technology. If the SSO were not aware that the technology it was including in the standard was proprietary, it would not be aware of the likely ex-post cost of the standard.

To ensure that it has the most information possible about the potential for the technologies it is considering to be subject to royalties, the SSO requests that its members disclose any relevant patents that they have to the SSO during the standard-setting process. In addition, the SSO also requires that a member whose proprietary technology is included in the standard, will license that technology to other members of the SSO either free of charge or on “fair, reasonable or non-discriminatory terms.” The impact and our interpretation of these patent policies is the focus of the remainder of this paper.

### **The Impact of Disclosure rules**

SSOs rely upon disclosure rules to accomplish important objectives. Disclosure rules enable the SSO to obtain information about whether technologies under consideration for inclusion in

the standard are proprietary and subject to licensing. They thereby reduce the potential for a technology to be included in a standard without the knowledge that a technology owner, with intellectual property that reads on the standard, may try to extract royalties for the use of the technology.

In the absence of knowledge about proprietary IP rights in the technologies under consideration, manufacturers may find themselves the victims of opportunism after the standard has been set. That is, the patent holder may charge a royalty that reflects a premium arising from irreversibility – the cost of revising the standard to save the cost of royalty. A patent-holder may charge such a premium when the patent emerges after manufacturers have made sunk investment in the patented feature of the standard without having predetermined the license fee. Avoiding a license entails new investment cost if the old (potentially infringing) investments cannot be modified to evade the patent.

In order for a technology owner to profit from opportunism of this sort and for such opportunism to be a concern to the standard-setting body, three important conditions must be met. First, the proprietary technology must be essential to the standard or else it could simply be omitted. An attempt by the patent owner to charge opportunistic royalties would result in manufacturers leaving that particular technology out of the final product. Second, there must be costs associated with changing either the standard or the manufacturing process that are greater than the royalty demanded. If investments were not sunk, the standard could be costlessly changed to evade the license. Finally, there must be alternatives to the chosen patented technology that could plausibly have been adopted had disclosure taken place. If there were no economic alternative, the patent holder would have been able to extract the full value of preventing manufacturers from making on-standard products by means of the exclusionary power of the patent alone. Thus, if there were no economic alternatives, the SSO could not benefit from the proprietary nature of the technology at issue having been disclosed.

Because of the potential for opportunism in standard setting, SSOs employ a variety of disclosure rules and enforce them with varying degrees of strictness. One rule is that issued patents essential to the standard being considered be disclosed by standard-setting participants

who are active proponents of the adoption of their technology.<sup>4</sup> Somewhat more rigorous is a requirement that all participants disclose issued patents, essential or otherwise and whether the technology owner is an active proponent of its own technology or otherwise. More rigorous still is a rule requiring disclosure of both issued patents and patent applications.

Disclosure rules vary because along with the potential benefits of disclosure, described above, there are costs of compliance. These costs are borne directly by the organization members and indirectly by the SSO if compliance costs cause some technology owners to opt out of the SSO making the SSO less effective. Compliance costs fall into two categories: transaction costs and the risk of diminishing the property right.

The more rigorous the disclosure rule, the higher the cost of complying. It is costly for the SSO representative of a member firm to first learn the patent portfolio of his firm, particularly if that firm is a large, research-based organization, and then to ascertain whether any patents read on the standard. The need to do this for as-yet-unpatented projects increases the cost.<sup>5</sup>

Rules that require the disclosure of unprotected IP such as patent applications pose obvious risks for the IP owners. U.S. patent applications are filed in secrecy precisely so that premature disclosure does not lead to unprotected use of the invention. Patent applicants are guaranteed secrecy not only of the type or general field of technology covered by the application but also of the fact of the application itself.<sup>6</sup>

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<sup>4</sup> Since patents are public documents, a rule requiring disclosure of patents merely saves the association patent searching costs. If the disclosure rule is accompanied by a requirement that a standard-setting participant's patents be licensed on reasonable and non-discriminatory (RAND) terms, as is often the case, the SSO's objective is to nullify, not merely discover, the potential for licensing at a premium.

<sup>5</sup> Without a requirement that any firm's representative be knowledgeable about his or her firm's actual and potential intellectual property, any disclosure rule can be evaded by sending a deliberately ignorant representative. Because full compliance by an ignorant representative does not yield any of the benefits of disclosure to the SSO, we assume that member firms feel some obligation to send a knowledgeable representative.

<sup>6</sup> "Most patent applications filed on or after November 29, 2000, will be published 18 months after the filing date of the application, or any earlier filing date relied upon under Title 35, United States Code. Otherwise, all patent applications are maintained in the strictest confidence until the patent is issued or the application is published." See "General Information Concerning Patents," USPTO website at: <http://www.uspto.gov/web/offices/pac/doc/general/index.html>. We understand that if the applicant wishes, the

Disclosure of published applications, opens the applicant up to additional costs in the form of interferences in the patent application procedure. These interferences will be costly to the applicant and may be brought by a competitor whose goals are to increase its rivals' costs or steer the standard-setting committee towards a less desirable technology.

More obviously, a disclosure requirement covering patent applications reduces the value of a patent later obtained because it affords others – typically, competitors in the technology market – a head start toward evasion or design-around efforts that will diminish the value of the patented technology. Application owners will weigh the benefits of joining a standard-setting organization against the cost of revealing potentially valuable IP before it is protected by a patent.

The disclosure of issued patents affords manufacturers the possibility of designing around the disclosed patents and design-around solutions can save royalties, all of which is consistent with the trade-off that patents provide to inventors: disclosure and the risk of design-around balanced by a right to exclude or claim royalties. In contrast, for unprotected inventions to be disclosed creates hazards for inventors who participate in standard-setting discussions. This is because such disclosure enables potential licensees to devise ways of evading expected patents before they are granted.

The costs of disclosure fall not only upon members but upon the standard-setting organizations themselves. This is because, as cost and risk rises for individual member firms, the attractiveness of opting out of participation in standard-setting increases. This is dangerous for the SSO and for economic efficiency in industries for which formal standard setting is an efficiency-enhancing activity.

In addition, mandating disclosure of patent applications has the potential for facilitating collusion among various factions of standard-setting members to the detriment of other members. Buyers of technology have an incentive to depress prices while sellers of technology

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application and its contents can remain confidential in some circumstances, and that the law contains a provision preventing interferences in the USPTO based upon a disclosed application.



have an incentive to raise prices. Technology buyers may work against technology sellers by attempting to design around prematurely disclosed patentable claims to depress royalties and to deter the entry of technological mavericks. Alternatively, some members of the SSO may try to get the standard to move in a particular direction to create a weaker competitor to its own proprietary technology. That is, a committee member with a proprietary competing technology may object to any features of the standard that may become patentable by other members of the committee if those features add performance benefits to the standard, thus making it a more formidable competitor to the member's own out-of-standard proprietary technology.

We do not know what the optimal rule for standard-setting disclosures might be. There is bound to be variation by industry or technology in the value sacrificed by an inventor as a result of premature disclosure, just as there are inter-industry differences in the value that patent protection affords.<sup>7</sup> To the extent that the benefits and costs described above are unmeasurable in any industry, the optimal rule is unknowable as well.

Because of differences across industries in the reward afforded by patent protection and in the incentives of standard-setting members, no rule would be optimal for all situations. Because of this heterogeneity across industries, the policy choice that leaves the disclosure rule and the rigor of enforcement up to standard-setting organizations themselves may be best. Standard-setting bodies themselves may be the best suited (1) to understand their industry, (2) to determine how susceptible they are to capture or hold-up by one of their members and, (3) absent capture, to optimize the tradeoff between the benefits and costs of disclosure that these rules entail. This conclusion does not rule out antitrust enforcement against firms which abuse standard-setting to monopolize technology markets. It does imply an approach to antitrust enforcement that is tailored to the specific characteristics of the industry and the technology.

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<sup>7</sup> Schankerman, Mark (1998). "How Valuable is Patent Protection? Estimates by Technology Field," *RAND Journal of Economics*. Spring, Vol. 29, No. 1, p. 94.

### **Reasonable and Non-Discriminatory Royalty Rates in Standard Setting**

Having learned through disclosure what elements of the standardized technology may be proprietary and subject to royalties, the standard-setting body is still left with the problem of trying to forecast what royalty or licensing fees the technology owner is likely to charge after the standard is determined. The typical SSO patent policy mandating that a royalty be “fair, reasonable and non-discriminatory” gives little guidance for royalty determination because “reasonable” can mean different things to a technology owner and a technology buyer.

One approach is to consider as reasonable a royalty that reflects the inherent benefits of the technology over the next best alternative. A reasonable royalty for a standardized technology should not be less than the expected royalty the technology owner would have been able to command had the standard-setting body never been formed and technology owners competed in the market to become a *de facto* standard. This gives a lower bound for a reasonable royalty for a *de jure* standard: the technology owner should be able to earn at least the expected royalty he could have earned in an open and competitive market.

What though, provides the upper bound on what a “fair and reasonable” royalty might be? Should a reasonable royalty reflect the value of the technology before or after it was chosen as the standard? In the presence of economic alternatives, the selection of a technology as a standard has the potential for creating market power because the value of the technology embedded in the standard rises at the moment the standard is set and alternatives are thereby excluded.<sup>8</sup> This means that a royalty determined after the choice of the standard will in all likelihood be higher than a royalty chosen for the identical technology beforehand.

A useful way of thinking about the reasonableness issue is to imagine the outcome of a royalty negotiation as a sharing of the gains from achieving a bargain between a patent holder and potential licensees. Whether any particular split of the value created by the standard is “fair” is

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<sup>8</sup> Assuming, as described above, that the technology is essential to the final product, that switching costs are high, and that the industry is subject to high compatibility requirements such that standardization itself has value.

not up to an economist to decide. Economics, though, can provide useful insights into the incentive properties of any solution and rule out solutions that yield undesirable incentives.

It is desirable to encourage firms to design technology with an eye on achieving compatibility in industries where technology users benefit from compatibility. It is also desirable to encourage technology-intensive firms to offer their technologies to standard-setting bodies for consideration in industries where standards matter. The implication is that built into the definition of reasonableness there ought to be an incentive for bringing technology to a standard-setting body. Put another way, the reasonable and non-discriminatory standard should not be set so as to deprive patent holders of the incentive to propose their technology as a standard.

Note, however, that incentives are already in place to design for standardization. Since market forces can determine the winner in a standards war, and becoming the standard can create market power, firms wishing to see their technology become the standard will invent with the objective of winning in the market. They will have incentives to submit their inventions for consideration to formal standard-setting agencies in hope of saving the cost of a standards war, but only as long as doing so does not deprive them of the fruits of winning. If all gains were taken away, then firms would rather go to war in the market than submit to the profit-destroying restrictions of a standard-setting body.

The gains from formal standard setting can be defined as the difference between the royalty that the technology owner can charge after being selected formally as the standard and the royalty that she could charge if no formal standard were set.<sup>9</sup> Consider three possible divisions of the gains from formal standard setting when compatibility requirements are high:

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<sup>9</sup> And, by implication, her ability to charge was set by the cost of employing the next best alternative. A technology with a close substitute will gain value from formal standard setting as the substitute will be ruled out-of-standard. A technology with no close substitute will gain little or no value from formal standard setting because it would have been the *de facto* standard.

1. Award to the patent holder all the extra gains from formal standard setting. This is the maximum; anything higher would be pure windfall with no useful incentive properties.
2. Award to the patent holder none of the extra gains from formal standard setting. This is the minimum; anything lower would fail to reward inventors from bringing their technologies to standard-setting agencies for consideration.
3. Estimate the maximum and minimum and divide the surplus between the technology owner and the technology users.

To award the patent holder all the gains from formal standardization creates a strong incentive for firms to invent with the goal of becoming a formal standard and for bringing inventions, especially those which are not major advances, into the formal standard-setting process. However, because all of the gains of standardization will be absorbed by the patent owner, users of the standardized technology will be no better off than if a standard had not been chosen (the value to them of having a standard will equal the cost of purchasing the standardized technology).

Under the second, no-extra-gains-to-the-patent-holder choice, patent holders may choose to try to win a standards war in the market, which would allow them to capture all of the gains from becoming a *de facto* standard. The patent owner will weigh the probability of winning a standards war in the market and earning higher royalties against the probability of being chosen as a *de jure* standard and earning royalties reflecting only the pre-standardized value of his technology. The expected value of a technology reflects the probability of winning the standards war, the costs of waging the war, and the price the technology could command if it became a *de facto* standard. The probability of winning a standards war depends on the extent of the technological advance of the patented technology at issue. Technology owners whose patents represent significant advances will have a greater incentive to let the market choose the standard than technology owners whose patents represent minimal advances.

Dividing the gains from standardization between the patent owner and the standard users can ensure that innovators have an incentive to join SSOs and that technology users maintain some benefit from having a standard. Note though, that the minimum royalty that will induce an innovator of a significant technological advance to join a standard setting organization will be different than the minimum royalty that will induce the owner of a technology with many economically equivalent alternatives to join. The inventor of a significant technological achievement will likely require a greater share of the benefits of standardization to be willing to forego the chance of becoming a *de facto* standard and having freer rein to set his royalty.

As to the “free of unfair discrimination” condition that standard-setting bodies strive to impose, one possible interpretation relates to the economist’s definition of price discrimination. Price discrimination refers to the act of charging two or more customers — licensees in this case — different prices where the differences are not explained by differences in the economic costs of dealing with them. Economic costs include not only direct costs but also, for example, opportunity costs and the risks imposed on the licensor by the licensee and other economic costs. If this interpretation is appropriate, its implication is that to agree to license on terms free of unfair discrimination entails an agreement to charge licensees the same royalty rate, except where the economic costs of licensing customers differ. In those instances, the prices (royalties) should differ with differences in licensing costs.

Limiting the ability of a licensor to charge different royalties to different licensees may reduce the use of technology.<sup>10</sup> Charging different customers different royalties induces more licensing than imposing a single-rate rule would. Indeed, this is efficient and can enhance welfare because a licensor can establish low prices for price-sensitive licensees and higher prices for less price-sensitive licensees. The result is that output (i.e., licenses sold and, conceivably, goods or services sold with licensed technology) increases. If a technology owner were forced to set one royalty rate schedule for all licensees, then the chosen price may be too

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<sup>10</sup> For example, a requirement for no price discrimination might rule out the use of lump-sum payments, either alone or in combination with running royalties. Lump-sum payments that are not calibrated to different levels of sales are likely to imply price discrimination because, with lump-sum payments, high volume licensees will pay lower per-unit licensing fees than low volume licensees.

high for some manufacturers who would opt out of the technology market. Since these manufacturers would be willing to license the technology at a lower price and the technology owner would be willing to charge them a lower price if he could do so without sacrificing the higher royalty he gets from other licensees, the “one-price” rule can create what economists refer to as dead-weight loss — a loss in welfare as a result of market imperfection. To avoid these welfare losses, economic price discrimination can be beneficial. However, a standard-setting body may legitimately be concerned that a participant in the standard-setting process may attempt to raise its rivals’ costs or otherwise discriminate against its rivals. Thus, a rule against unfair discrimination that requires that the same royalty be offered to “similarly situated” licensees enables the technology owner to expand output to the benefit of welfare without the risk that it could use price discrimination to hinder its rivals in competition in the product market. It permits both pricing where the cost differences of licensing different parties fully explain price differences, and true price discrimination where it cannot harm competition.

## **Conclusion**

We tend to think about patents and standards as conveying market power because that is the interesting case. Reality is more varied not only because few inventions are blockbusters but also because patents matter more in certain industries than others. The same applies to standards. The main message of this brief paper is that realism requires looking beyond the convenient abstractions to the specific characteristics of individual technology markets.

- Formal standard-setting does not create market power for technologies that do not have close substitutes;
- Disclosure rules have benefits and costs whose balance will vary with the nature of technology markets, their differing dependence on compatibility and standardization and the characteristics of innovative and imitative activity within them;
- The reasonableness of a royalty may be assessed in terms of the division of gains from licensing between licensor and licensees. While there is no single right answer, we may

be able to rule out as unreasonable royalties that leave the patent owner worse than he would have been had he not joined the SSO and royalties that absorb all of the gains from standardization. The threshold for what is reasonable will depend on the nature of the invention that is chosen as the standard; and,

- In standard-setting policy determination, preserving the incentive to participate in standard-setting activities must be part of the solution. Because the link between efficiency and standard-setting participation is likely to vary by industry, so must the rules.