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INTELLECTUAL PROPERTY RIGHTS AND BARGAINING BREAKDOWN: THE CASE OF BLOCKING PATENTS

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This Article sets forth an economic rationale for a rarely-used but important doctrine in patent law, the "reverse doctrine of equivalents." The reverse doctrine is basically a rule of excused infringement; when it applies, it declares that even though a patentee has proven infringement, the infringer is free from liability. The reverse doctrine can be understood, this Article argues, as a judicial response to the likelihood of a breakdown in bargaining between inventors who pioneer a new technology and those who later develop key improvements. Under this interpretation, the reverse doctrine serves as a judicial "safety valve," releasing pressure that builds up when pioneers and improvers fail to agree to a license.

The failure of inventors and improvers to agree stems from two main causes. First, it is very difficult to place separate values on the relative contributions of the pioneer and the improver. In the scenarios we are interested in, both contributions are a "but for cause" of a highly lucrative technology. Second, as shown by many detailed case studies from the history of technology, there is immense uncertainty over the technology's future development path and profitability. In the early days of radio, computers, and a host of other technologies, pioneering inventors and businessmen grossly miscalculated which markets would develop, as well as how the technology would change over time. Given these problems of valuation and uncertainty, both pioneer and improver face a classic situation where bargaining will occasionally break down even though they could both realize substantial gains from agreement.

Isolating potential bargaining breakdown as the impetus for the reverse doctrine delineates a more coherent and consistent role for the doctrine. It

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1. See infra subpart 2A.

2. This applies only to one-shot transactions, which are the only ones discussed in this Article. Where holders of conflicting or overlapping property rights deal with each other repeatedly, we would expect some transactional mechanism to arise that would overcome bargaining impasses. See Robert P. Merges, Contracting into Liability Rules: Institutions Supporting Transactions in Intellectual Property Rights (forthcoming 1995) (on file with author) (arguing that high transaction costs imposed by strong property rules can encourage the formation of institutions among repeat-play transactors) [hereinafter Merges, Contracting into Liability Rules].
also opens the way for courts to expand their use of it. This Article argues that courts should enunciate a more vigorous reverse doctrine in important cases involving pioneers and key improvers in all fields. A simple model shows that the promise of a liberalized reverse doctrine will encourage more voluntary licensing in these cases. In effect, the increased threat that courts will apply the reverse doctrine will drive parties to strike deals in more cases. This will not only be cheaper than judicial resolution of these knotty disputes; it will also adhere more faithfully to the patent system's favoritism toward voluntary licensing, as opposed to either excused infringement or compulsory licensing under court pressure or statutory decree.

Part I is designed to illustrate just how anomalous the reverse doctrine is, by describing (with the help of some basic property rights theory) why injunctions are routinely granted in almost all patent cases. Part II justifies the reverse doctrine in light of the strong presumption favoring injunctions where infringement is found. It surveys historical cases for two purposes: to demonstrate the importance of key improvements to pioneering inventions, and to illustrate the large social losses, stemming from delayed introduction of improved technologies, that result from breakdowns in pioneer-improver bargaining. Part III describes the origin and confused rationale for the reverse doctrine and justifies its application as a way to break the impasse between pioneer and improver. Part IV describes the many foreign patent systems that order a compulsory license in the case of blocking patents. Part V, the conclusion, shows how the arguments of the Article point toward a novel "transactional" view of intellectual property rights, one in which the rules on validity, infringement, and remedies are seen as an "off the rack" framework for the exchange of rights.

I. REVERSE EQUIVALENTS AND PATENT LAW'S PRO-INJUNCTION POLICY

The reverse equivalents doctrine requires a coherent rationale because it is so anomalous in patent law. It is an exception to the general rule that infringement results not only in damages for past infringement, but also in a permanent injunction prohibiting infringement for the life of the patent. The purpose of this section is to provide a brief overview of the policy implicit in this strong pro-injunction bias. For, as clarified in Part II, only when the policy behind the strong injunction baseline is understood can we proceed to a plausible theoretical account of the reverse doctrine.

3. For a fuller account of this rule, which holds to a large extent for all intellectual property rights, see Robert P. Merges, Of Property Rules, Coase, and Intellectual Property, 94 COLUM. L. REV. 2655 (1994), which is part of the symposium, Toward a Third Paradigm for Intellectual Property Law.
The simplest way to explain the basic rule in patent cases is to use the classic theoretical framework of Guido Calabresi and A. Douglas Melamed. We begin by considering why the normal remedy in contract cases is an award of money damages to the aggrieved party, an example of what Calabresi and Melamed call a “liability rule.” Because it is relatively easy in most cases to determine the value of the contracted-for exchange by reference to an objective market price, it is possible for a court to accurately calculate the appropriate compensation for the injured party. This calculation of compensation has the added benefit that is often touted as the primary rationale for money damages in contract cases. It encourages breach where the breaching party can both fully compensate the injured party and enter into a substitute transaction with someone else who values the breaching party’s performance more highly. This is an efficient breach: a compensatory remedy predicated on the ease of valuing the costs of breach and the desirability (i.e., Pareto optimality) of having the breaching party’s performance go to the party who values it most highly.

The normal remedy for patent infringement also fits the Calabresi and Melamed framework. Since by definition each asset covered by a patent is in some sense unique—a characteristic guaranteed by various requirements for protectability in the patent statute—it is difficult for a court settling an infringement dispute properly to value the rightholder’s loss from the infringement. The basic rule is that the rightholder has an almost absolute right to obtain an injunctive remedy against the infringer.

The purpose of injunctive remedies goes beyond allowing the rightholder to prevent activities of the infringer. To the extent that a rightholder will consider negotiating a license with the infringer, the threat of an injunction will heavily influence the terms of the license. Specifically, it allows the rightholder to set her own price for the injury. In patent cases, it allows the rightholder, not the court, to set the terms of a license agreement settling the infringement litigation.

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4. Guido Calabresi & A. Douglas Melamed, Property Rules, Liability Rules, and Inalienability: One View of the Cathedral, 85 Harv. L. Rev. 1089 (1972). According to Calabresi and Melamed, whose pathbreaking framework grew out of an analysis of pollution/nuisance and eminent domain problems, the extent and nature of transaction costs in a particular case dictate whether one of the parties to the Coasean bargain ought to have an absolute property right or simply the right to collect damages caused by the other party’s encroachment (i.e., a “liability rule”). Id. at 1105-06. Under this framework, several factors point toward a property rule: few parties, difficult valuation problems, and otherwise low transaction costs. Id. Other factors indicate that a liability rule might better effectuate the bargain: many parties (especially where any single party has the power to hold up the whole enterprise), likelihood of strategic bargaining, and otherwise high transaction costs. Id. at 1107-10.

5. See id. at 1106-07 (using the example of the sale of small parcels of land to a buyer who needs all parcels, e.g., for a public park, to illustrate the necessity for a “liability rule,” such as eminent domain, as opposed to an absolute or “property rule”).
Calabresi and Melamed call this a "property rule." In this framework a property rule makes sense for patents because: (1) there are only two parties to the transaction, and they can easily identify each other; (2) the costs of a transaction between the parties are otherwise low; and (3) a court setting the terms of the exchange would have a difficult time doing so quickly and cheaply, given the specialized nature of the assets and the varied and complex business environments in which the assets are deployed. Hence the parties are left to make their own deal.

It is easy to see from this brief overview why the default remedy for infringement of patents is the opposite of the contract law default. In most cases, this rule works. The large and thriving market for patent licenses is proof enough that parties can and do engage in private patent transactions, presumably in the interests of both parties. This market thrives in the shadow of patent law's strong property rule for a pro-injunction baseline.

In one important group of cases, however, the baseline rule does not always work. It is to these cases, and to a consideration of the costs of failure, that we now turn.

II. STRATEGIC BARGAINING, THE RADICAL IMPROVER, AND BLOCKING PATENTS

In essence, patent law's property rule, which requires a voluntary patentee-infringer bargain or an injunction against infringement, assumes that if a bargain would benefit both parties, they will reach one. The burden in this Part is to show why, in terms of bargaining theory, this common sense assumption will occasionally fail in the context of pioneers and radical improvers, and why the resultant failure to agree justifies judicial action. Once that is accomplished, the stage will be set for a coherent account of the reverse doctrine as a theoretically sound response to socially costly bargaining impasse.

In standard economic theory, strategic bargaining will sometimes cause a bargain to fail despite the availability of a cooperative surplus. The

6. Id. at 1105.
7. I cannot here consider why in some intellectual property cases rightholders are limited to collecting royalties from infringers, e.g., in the compulsory licensing provisions of the copyright code, an example of a "liability rule." The rationale for compulsory licensing statutes is described and critiqued in Merges, Contracting into Liability Rules, supra note 2.
8. See, e.g., 4 KENNETH J. ARROW, COLLECTED PAPERS OF KENNETH J. ARROW: THE ECONOMICS OF INFORMATION 222-24 (1984) (explaining that in the presence of uncertainty, i.e., when one party to a bargain does not know the other's utility function, there is no guarantee that rational Coasean bargaining will take place; Coasean markets are problematic because they lack large numbers of parties and do not meet other criteria assumed necessary for normally functioning markets); see also THRA'INN EGGERTSSON, ECONOMIC BEHAVIOR AND INSTITUTIONS 109 n.50 (1990) (noting that "one possible outcome
example given here describes this result in the case of the radical improver. In the next Part we will examine several historical case studies that show this dynamic at work.

A radical—as opposed to “ordinary”—improver builds on a pioneer’s contribution, but in a very significant way: The improvement is the source of very high profits, as opposed to the pioneer’s substantial but much lower profits. In a groping and intuitive way, courts have recognized that while the cooperative surplus may well be high in these cases, bargains may also be difficult to achieve. Courts have seen that if a socially beneficial transaction is to take place between the pioneer and the improver, they must intervene (or at least pose the threat of intervention).

To see why the courts must intervene, consider an example. A pioneering inventor patents a basic discovery which leads to a product that yields $100 in profits. An improver comes up with a radical extension of the technology that builds on the insight of the pioneer, but produces a product yielding the much higher profits of $1000. The improver can make an improved version of the pioneer’s product. The total expected revenue from the improvement is $1000, which is $900 more than the pioneer’s current expected revenue of $100. Although the production technology is such that the improvement product can be made and sold independently of the pioneer’s product—i.e., the improvement is not simply an improved component of the pioneer’s overall product, but is instead a radically improved substitute for it—the patent rights of the pioneer force the improver to bargain with the pioneer. In this sense, their agreement is necessary to realize the $1000 revenue of the improver. Hence, I would conclude that there is a cooperative surplus of $1000.

Furthermore, I assume that the pioneer’s $100 revenue stream is unaffected by the improver’s product. This implies two things: (1) in the absence of an agreement the pioneer will continue to realize the same revenue she would have if the improver had never produced her invention; and (2) proceeds from an agreement will be in addition to her original revenue stream. Although this may seem unrealistic, we can think of it as a case where the pioneer’s product is less desirable compared to the improver’s product, but is much cheaper; or a case where the brand name of the pioneer continues to have some effect in the market; or perhaps a case where the improver so expands the market originally created by the pioneer that the pioneer reemerges as a “niche” player. Whatever the exact
scenario, the pioneer has a moderately acceptable alternative to a negotiated agreement with the improver; for her, the cooperative surplus is all a matter of gains realized, rather than losses avoided. There are, of course, Kahnman and Tversky-style reasons to believe this will make her drive a harder bargain. But even putting these reasons aside, this simple story shows that the improvement is pure gravy for the pioneer, while permission from the pioneer is absolutely essential to the improver. Thus, we assume that the pioneer stays in the market even if the improver enters, an assumption which highlights the asymmetry in the two parties' positions.

There are two possible scenarios concerning the respective intellectual property rights of the parties: First, the improver may receive no patent for her improvement, in which case she is merely an infringer. Second, she may receive an improvement patent, which would allow her to exclude everyone else from practicing her improvement, but requires her to obtain a license from the pioneer to sell products incorporating her improvement. This is the case of blocking patents. In either case, the original patentee can be expected to try to garner as much of the value of the improvement as possible.

11. This refers to the influential duo of cognitive psychologists, Amos Tversky and Paul Slovic, who pioneered research in human decision-making and problem solving in complex situations. See Judgment Under Uncertainty: Heuristics and Biases, (Daniel Kahneman et al., eds. 1982); Daniel Kahneman & Amos Tversky, Prospect Theory: An Analysis of Decision Under Risk, 47 Econometrica 263 (1979). Tversky and Slovic found that, when making decisions, people are biased in the direction of (1) the first data they receive (primacy), and (2) the most recent (recency), and that (3) Daniel Kahneman and people are biased against risk portfolios containing a risk of loss, even when the portfolios reflect an overall expected payoff scheme that is more profitable. Id.

12. For an example, see Standard Oil v. United States, 283 U.S. 163 (1931); International Mfg. Co. v. Landon, Inc., 336 F.2d 723 (9th Cir. 1964); see also infra notes 33-36 and accompanying text.

Ward S. Bowman, Jr. described the economic forces that drive the holders of blocking patents together, and that argue for relaxed antitrust scrutiny of cross-licensing in these cases:

If . . . one patent was subservient to the other, an improvement patent unusable without infringing the basic patent, then combining or pooling them eliminates no user alternative. In terms of possible trade restraint, this case is indistinguishable from a vertical merger. The two patents combined . . . could not restrict output or raise price any more than if the two were exploited separately.


13. One way to describe this is to characterize it as an example of a broader class of bargaining problems, known as the holdup problem. This was originally applied to situations in which one buyer needs to acquire complementary assets from a number of sellers; some of the sellers may raise their prices to capture some of the value the buyer attributes to holding all the assets. See, e.g., Calabresi & Melamed, supra note 3, at 1106-07. The holdup problem has been extended to two-party contracts. See Benjamin Klein, Transaction Cost Determinants of "Unfair" Contractual Arrangements, 70 AM. ECON. REV. PAP. &
Where the improver has no patent, imagine the negotiations between the improver and the patentee. The improver would claim that she had an addition to the patentee’s technology that will yield $900 more in profits. The improver, in the best Coasean tradition, will offer to split the $1000 cooperative surplus, which represents the amount the improver could make selling the improved product. That would leave the patentee—that is, the pioneer—with $600: her $100 profits from selling her product, plus the royalty of $500, which again is half of the cooperative surplus of $1000.

To realize her half of the $1000, however, the improver must overcome an especially acute case of what economists call Arrow’s paradox of information. This refers to the general problem with selling information: To sell, one must disclose the information, but once the information is disclosed, the recipient has the it and need not buy it. On the other hand, if one does not disclose anything the buyer has no idea what is for sale.

Here the patentee has an even bigger threat over the improver than the “disclosee” party normally has over the disclosing party, namely that the disclosed information is by its terms within the scope of the patentee’s patent. There are obviously serious risks in revealing this information. While it is not impossible for the disclosing party (the improver) to bring a breach of trade secret suit in such a case, it surely complicates matters that the pioneer patentee has rights that cover the information in question.

In fact, this transactional standpoint provides a clear rationale for the existence of blocking patents. Because there are significant social welfare gains from pioneer-improver transactions, property rights must be structured to encourage improvers to approach pioneers with licensing proposals. An independent patent on an improvement serves this goal nicely. Since it grants exclusivity over its discrete subject matter, while preserving the exclusionary force of the broad pioneer patent, it facilitates improver-pioneer bargaining. Blocking patents thus represent an interesting property rights institution that balances incentives for pioneers with incentives for independent inventors to push pioneering technology forward.


15. For an explanation of the detailed doctrine in this area, see Robert P. Merges, Patent Law and Policy 549-552 (1992), in the section entitled “Enablement and the Temporal Paradox.” Indeed, patents in general protect the licensor’s property so that she can confidently offer it for sale. In other words, patents solve Arrow’s Paradox. Note that under Arrow’s Paradox, exchange is the genesis of patents. This transactional rationale for patents applies to some extent to all intellectual property. See Merges, supra note 3.
Let us return to the example described above, aided by the assumption that the improver has her own patent. The improver has approached the pioneer with an offer to license her improvement. All the pioneer need do is agree to a deal. The cooperative surplus on the table is very large—in our example, ten times the patentee’s profits. Moreover, the patentee has a highly effective threat: the right to banish the improver from the market altogether. We would expect this to influence the patentee’s bargaining strategy considerably; she will be inclined to ask for more than half the surplus, at least as a “first shot” in the negotiations. Meanwhile, the improver will be crafting her strategy, which is in part an anticipation of the inventor’s strategy and in part (as the negotiations continue) a response.6

Those familiar with the Coase Theorem7 might interject to point out that the parties will agree in any event. Indeed, they might well argue that agreement would not even depend on the existence of a patent; the Coase Theorem contends that in the absence of transaction costs, parties will bargain to a mutually satisfactory result regardless of the initial assignment of legal entitlements (including property rights, such as patents).18 Where transaction costs are positive, this cannot be assumed. The theorem thus dictates that we pay attention to transaction costs in assigning initial rights to make it more likely that the rights will wind up in the hands of the party with the best use for them.19 Since transaction costs are pervasive, this is now seen as the true import of the Coase Theorem.20

Even in light of this reassessment, however, scholars have identified an important flaw in the Coase Theorem—a flaw that calls into question its usefulness in the case of pioneer-improver transactions. Coase makes the critical assumption that whatever their strategies, the parties will always agree on an exchange.21 This might also be described loosely as assuming that they have no strategies, or that their strategies always include a strong desire to reach some sort of agreement. In other words, the Coase Theorem overlooks strategic behavior itself as an important transaction cost.

Robert Cooter and others have pointed out that this is an important oversight. According to the Cooter view, one might consider the opposite assumption, which he calls the “Hobbes theorem”:

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19. Although there are actually several versions of the Coase Theorem, this is a broad, consensus statement. See id.
20. See, e.g., Eggertsson, supra note 8 at 104-05 (recognizing that “Coase’s main contribution . . . was to arouse our awareness of positive transaction costs.”).
21. See supra notes 17-20 and accompanying text.
[T]here is no guarantee that rationally self-interested players will agree about how to divide the stakes. Rationality requires the players to adopt strategies in which they risk destroying the surplus [i.e., disagreement] in order to gain a larger share of the stakes in the event of settlement. . . .

.... This line of thought leads to the polar opposite of the Coase theorem, which could be called the Hobbes theorem: "Private bargaining to redistribute external costs will not achieve efficiency unless there is an institutional mechanism to dictate the terms of the contract for dividing the stakes."22

Others have spotted this "bilateral monopoly" problem in a variety of places.23 Indeed, it has become the cornerstone of a wide-ranging reassessment of the Coase Theorem.24 But the critique is not universal; there are many who adhere to the basic premise that a value-increasing transaction can simply be expected to occur, and that the rare occasions when it does not are worthy of a distinct brand of analysis. The large volume of patent licensing, and, most pertinent, cross-licensing, activity attests to the basic soundness of this proposition in the context of patents. Yet three questions remain: (1) whether these bilateral monopolists (i.e., the pioneer and improver) are more likely than others to reach an impasse in a given "round" of bargaining; (2) whether their impasse is likely to be more harmful in terms of social welfare loss; and (3) whether there are any reasons to believe that an impasse in an early round will make ultimate agreement less likely.

Support for affirmative answers to the first and third questions can be found in an interesting article by Steven N. Wiggins and Gary D. Libecap.25 These economists studied the problem of oil field "unitization," where multiple holders of oil development claims on an oil reservoir enter into a one-shot transaction to license or create a single firm to develop the oil field and share in the proceeds.26 The authors found that, despite the sizeable gains that could be realized from this efficient contractual solution,

26. Id. at 368-69.
private unitization contracting was generally ineffective. They found, for instance, that unitization contracts take years to negotiate, and often are never completed. In some states, more than 60% of the potential unitization situations resulted in breakdown of bargaining and no unitization deal. The authors used a model of *ex ante* imperfect information regarding relative lease values to explain the contractual failure, and supported their explanation with detailed empirical tests using actual negotiation records of the firms involved. The authors’ key finding for my purposes is that divergent valuations of potential oil field revenue lead to most bargaining breakdowns. If sophisticated parties with experience in oil field development often cannot reach an agreement to split the (sizeable) cooperative surplus, how can we assume that parties will always (or even usually) arrive at compatible valuations of new technology which is, by statutory definition, unique and reflective of a significant advance over former knowledge?

I find that the oil field unitization analogy is persuasive because it fits with the observed cases of bargaining breakdown in the patent field, two of which are described in the next section. The first involves radio transmission and reception technology.

**A. Examples of Bargaining Breakdown Involving Patents**

The Marconi Wireless Telegraph Company used several basic patents to establish an imposing presence in the early radio industry, which was dedicated primarily to large-scale commercial uses such as ship-to-shore communications. One of these patents was the “Fleming valve,” a key radio component invented by Alexander Fleming. His patent covered an early form of the oscillating radio tube, an essential component in early radio transmission. This patent was asserted by the Marconi group against Lee De Forest (and thus, indirectly, De Forest’s licensees, which included

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27. *Id.* at 369-70.
28. *Id.* at 383.
29. *Id.* at 368.
30. *Id.* at 377-82.
31. *Id.* at 379. Although more than two parties are often involved in unitization, the authors explicitly state that it is the informational asymmetry, rather than the number of parties, that usually leads to bargaining breakdown: “[P]arties disagreed about the relative values of leases, leading to a breakdown in negotiations. These observations suggest bargaining problems that are more complex than a simple hold-out problem.” *Id.*
American Telephone and Telegraph (AT&T)). Although the Marconi group admitted infringement of two of De Forest's patents that disclosed improved designs for the oscillating tubes, a series of court decisions upheld the basic or pioneering patents of Fleming. Thus, Marconi was in a position to block the application of the De Forest improvements, which had been developed by AT&T and others for use in long-distance overland transmission.

The deadlock between the Marconi Company and the De Forest interests was a classic instance of blocking patents. Marconi's diode patent was held to dominate De Forest's patented triode, yet neither party would license the other. The Fleming patent was issued in 1905, and De Forest's two improvements were issued in 1906. The case was decided by the district court in 1916. According to one historian, "Some time after the decision, the two companies tried to work out a scheme whereby De Forest produced the tubes and Marconi distributed them, but that arrangement was faltering when the exigencies of war made it unnecessary." Not until 1919, when RCA was formed (at the urging of the Navy) to break the patent logjams besetting the industry, was the impasse finally resolved. While it is impossible to specify precisely the magnitude of the social welfare loss due to this impasse, it is instructive that immediately after its formation RCA

33. Marconi Wireless & Tel. Co. v. De Forest Radio Tel. & Tel. Co., 236 F. 942 (S.D.N.Y. 1916), aff'd, 243 F. 560 (2d Cir. 1917). The Second Circuit noted, "Plaintiff [Marconi, Fleming's assignee] asserts that, while the [De Forest] audion may be for some practical purposes an improvement on the Fleming valve, it is nevertheless an infringement, and it has given evidence of faith in its own theory by admitting infringement of the two patents . . . which essentially describe one form of [the] audion [tube] . . . ." 243 F. 560, 562.

34. While originally treated from a patent point of view as an improvement on Marconi's diode, the De Forest audion or triode was in fact a very significant advance; it was called "the heart and soul of radio." GEORGE H. DOUGLAS, THE EARLY DAYS OF RADIO BROADCASTING 8 (1987). See Radio Corp. of Am., Inc. v. Radio Eng'g Lab., Inc., 293 U.S. 1, 11 (1934) ("The device established itself almost at once as a revolutionary improvement in the art of transmitting sounds at great distances by wire and through the air."). Hugh Aitken, a noted historian of technology, stated that the invention of the triode "is one of the 'great divides' in the history of radio technology; the whole basis of radio communication begins to shift with the introduction and diffusion of this device." HUGH G. J. AITKEN, THE CONTINUOUS WAVE: TECHNOLOGY AND AMERICAN RADIO, 1900-1932, AT 195 (1985).

35. Marconi, 236 F. at 955.

36. See FEDERAL TRADE COMM'N, REPORT OF THE FEDERAL TRADE COMMISSION ON THE RADIO INDUSTRY IN RESPONSE TO HOUSE RESOLUTION 548, 67th Cong., 4th Sess. 26 (1923). As a result of this decision the De Forest Co. ceased manufacturing vacuum tubes in their improved form and the Marconi Co. was limited to the manufacture of the two-element tube, which was incapable of performing all the functions of the modern vacuum tube.

recorded astronomical sales growth: $1.5 million in 1921, $11.3 million in 1922, $22.5 million in 1923; $388 million in 1928, and almost $600 million in 1929.38 And, consistent with the point made by Wiggins and Libecap in their work on oil field unitization, these figures bear no relationship to the apparent revenue predictions made by the parties during negotiations, because they were in large part the result of the rapid growth of wide area broadcasting and the concomitant sale of home radio receiver sets; as Reich says, "[C]ommercial broadcasting had not been anticipated at the time of the . . . agreement."39 This story of immense uncertainty is repeated many times in the annals of major new technologies, including plastics,40 computers,41 and VCRs.42 Great initial uncertainty is perhaps the only constant among the surge of new technologies.43

38. Id. at 297 n.21.
39. Id. at 226.
40. The following story, told of Leo Baekeland, the inventor of one of the first synthetic plastics, involves the sale of his first significant invention, Velox photographic paper:

Leo Baekeland [the inventor of Bakelite, the first synthetic plastic] was a relatively young scientist when he invented Velox, the first photo paper that could be printed using artificial light. George Eastman, the maker of Kodak cameras, immediately invited Baekeland to Rochester to discuss buying the rights to the process. Baekeland fancied himself as a hard-headed businessman and after some thought decided to ask for $50,000, and settle for no less than $25,000, reasonably large sums of money in those days.

Eastman offered him a million.

41. A good example is the well-known story of IBM’s prediction regarding the future market for computers, retold recently by Stanford economist Nathan Rosenberg:

[T]he computer again illustrates the difficulties in anticipating the great potential of a new technological capability. The computer was regarded by its inventors as a purely scientific device . . . . Even Thomas Watson, Sr., an executive with extensive business experience, foresaw no commercial demand for the computer. He believed that a single computer . . . could solve all the important scientific problems in the world involving scientific calculations.

42. When Ampex Corporation of Redwood City, California developed the forerunner of the modern VCR in 1956, company officials estimated that they would sell 30 units in four years. JAMES LARDNER, FAST FORWARD: HOLLYWOOD, THE JAPANESE, AND THE ONSLAUGHT OF THE VCR 59 (1987). They originally saw it as a high-cost, high-quality product that would be used by broadcasters to record television shows for later broadcast. To the executives, the non-broadcast market was not terribly important. This is one reason why they licensed the basic VCR technology to Sony for peanuts—in retrospect, a huge mistake. See Richard S. Rosenbloom & Karen J. Freeze, Ampex Corporation and Video Innovation, in 2 Research on Technological Innovation, Management & Policy 113, 126 (Richard S. Rosenbloom ed., 1985) (noting that an ambiguous letter from U.S.-based Ampex Corp. to Sony inadvertently gave away a license over basic video recorder technology). See generally Richard S. Rosenbloom & Michael A. Cusumano, Technological Pioneering and Competitive Advantage: The Birth of the VCR Industry, 29 CAL. MGT. REV. 51 (1987).
43. See, e.g., JON ELSTER, EXPLAINING TECHNICAL CHANGE 111 (1983) (standard microeconomic models of technical change are inadequate because there is too much uncertainty in the situation for rational choices to be well-defined); JOEL MOKYR, THE LEVER
As the above figures show, the cooperative surplus between Marconi and De Forest was surely quite large. Nevertheless, the parties haggled for over ten years on the tube-triode bargain alone. With all the constituent radio technologies under one roof, RCA established itself as the technical leader in radio and dominated its advance until the antitrust enforcement actions of 1958.44

Even so, up to ten years of delay was no doubt quite costly; perhaps FM broadcasting, which was not invented until the 1930s, would have appeared sooner. Perhaps music programming would have flourished earlier. Perhaps more of the important "second generation" improvements made predominately in Europe (mostly by Philips of the Netherlands) would have been made in the U.S. Regardless of the precise effects, the consensus among historians who have studied the situation is that "the control of key patents by opposing interests contributed to a stalemate that retarded the best utilization of radio."45

In a sense it is unnecessary when discussing patents to justify the proposition that there are social welfare losses from delayed introduction of a given technology. A host of individual rules in the patent code—indeed, the entire structure of this branch of law—punish delay in completing inventions and perfecting patent rights over them. It is a bedrock patent policy that earlier is better.46 Early commercialization even provides a rare exception to the rule that a first inventor has rights to a patent, since an inventor who is second in time but first to commercialize wins a patent over an inventor who is first in time but dilatory in commercializing or publicizing. Cases are legion that justify this rule under a primitive theory of social welfare loss.47 Under these cases, it would be thought absurd to defend a ten-year delay in marketing a product.

The second example, which I treat more briefly, involves steelmaking technology. Bessemer's revolutionary discovery that pig iron could be made

44. MARGARET B. GRAHAM, THE BUSINESS OF RESEARCH: RCA AND THE VIDEODISC 41 (1988). Note that the presence of a more active antitrust enforcement mechanism might have prevented the "integration" solutions imposed to solve some of the blocking patent impasses I have studied, or at least made them more expensive—yet another reason to encourage private arm's length agreements to resolve such impasses.

45. CHRISTOPHER FREEMAN, THE ECONOMICS OF INDUSTRIAL INNOVATION 75 (2D ED. 1982).


stronger by blasting it with oxygen while in the furnace led to a basic patent in
Britain on the blast furnace concept.48 Meanwhile, a crude frontier inventor
named Kelly had established patent priority in a blast furnace-type process in the
United States.49 Bessemer’s patent position was therefore compromised in the
United States. By itself, however, the Bessemer-Kelly technique, though an
important conceptual advance over older methods, did not lead to a radically
superior metal. Because the pig iron’s strength was achieved with higher carbon
content, the resulting iron was more brittle. Only with the development of Robert
Mushet’s new alloying compound called speigeleisen was the true potential of the
blast furnace unleashed. Mushet showed that the manganese in speigeleisen,
when combined with the iron and subjected to the intense blast of oxygen, took
up much of the excessive carbon, which made the resulting iron alloy much
stronger.50

It was apparent that Bessemer’s British patent blocked Mushet, who had
received his own patents on the use of speigeleisen in iron making. It was also
apparent that there was significant synergy between the two inventions. However,
contemporary judgments of the relative value of each of the two components were
widely skewed. One independent expert wrote: “Such as it is, however,
[Bessemer’s process] is substantially a new manufacture, but its value would
appear to be due to the discovery of Mr. Mushet to an extent at least equal to that
due to the Bessemer process itself.”51 But Bessemer himself said that the only
value of the Mushet patents was “that they pointed out to me some rights which
I already possessed, but of which I was not availing myself.”52 Despite their
efforts, the parties never reached an agreement. When Mushet’s patent was later
declared invalid on a technicality, the two techniques were finally integrated in a
single process in Britain.

The story was different in the U.S., though, where the Mushet patents were
never invalidated. It took quite some time for the Kelly and Mushet patents to
be integrated in a single firm, during which time the U.S. iron industry was
operating at a distinct disadvantage. It is difficult, once again, to place a hard
monetary value on the resulting delay, but contemporary accounts have more than
a flavor of the frustration of wasted opportunity.53

There are other stories like these from other industries, some quite contempo-
rary. The point of telling them is to demonstrate why the normal assumption—
that parties will bargain to a rational solution in the presence of a cooperative
surplus—is subject to strain in the case of the one-shot pioneer-radical improver
bargaining situation. I recognize how unique this is, and in no way do I question

48. Jeanne McHugh, Alexander Holley and the Makers of Steel 99-111
(1980)
49. Id. at 112-35.
50. Id. at 142-67.
405 (1864).
Bessemer: An Autobiography 293 (1905)).
53. Id.
the basic findings of those who have documented empirically the prevalence of rational bargaining to a cooperative solution. 54 I do, however, point out the analogy with the oil field development case studied by Wiggins and Libecap. 55 I would also add that while most strikes and wars are averted, it would be desirable if some subset of them were even more likely to be averted due to special rules to encourage bargaining. I believe that the pioneer-improver scenario is just such a subset.

The upshot is that the bilateral monopoly problem can be expected to show itself frequently in the realm of technology licensing. Should doctrine not reflect this?

B. The Anatomy of Bargaining Breakdown

The examples just described can be interpreted as cases where there were perfectly rational grounds for non-agreement. 56 That is, the parties can be said to have acted rationally based upon the information they had about the value of their own technology and the opposing party’s situation. In other words, each party may have acted rationally given a key assumption, but that assumption turned out to be incorrect. The most common example would be a mistake in assessing the value of the other party’s technological contribution. There have been numerous examples where pioneers failed to grasp the significance of important extensions of their basic work. 57 And the opposite case is surely just as common. Where high uncertainty attends the valuation of assets to be exchanged, bargaining can be difficult. 58 In these cases, the bargaining moves

55. See supra notes 25-32 and accompanying text.
56. Another class of cases where rational bargaining breakdown might occur is described in Benjamin Klein et al., Vertical Integration, Appropriable Rents, and the Competitive Contracting Process, 21 J.L. & ECON. 297 (1978). This paper describes the opportunities for exerting holdup rights where one firm, after investing in an asset with a low salvage value and a rent stream that is highly dependent on an asset owned by another firm, can be held up by the other firm’s attempt to capture a large proportion of the rent stream of the combined assets. The owner of an improvement that contributes a very significant part of the value of the “original patent plus improvement” combination—i.e., an improvement that represents a major technical advance—is subject to the same sort of “holdup” by the original patent holder.
57. See supra notes 34-56 and accompanying text; Merges & Nelson, supra note 10.
58. ARROW, supra note 8, at 224 (noting that in presence of uncertainty, i.e., when one party to a bargain does not know the other’s utility function, there is no certainty that rational Coasean bargaining will take place); THE ECONOMICS OF BARGAINING, (Ken Dinsmore & Partha Dasgupta eds. 1987). See also James A. Wilson, Fishing for Knowledge, 66 LAND ECON. 12 (1990) (since there is a “rule of capture” in the fishing industry—if you catch fish, they’re yours—you would expect under-investment in acquiring knowledge about where fish are, since (a) you can only catch so many fish yourself, and (b) there are high
made by the parties may make sense given their assessment of the situation; but these assessments may simply turn out to be incorrect. Where one party's assessment is wrong, the other party has to decide whether the assessment was made in good faith, or whether the "assessment" is in fact a bargaining stratagem. For example, one party may threaten to terminate negotiations unless its assessment of the technological merits of the other party's contribution is accepted. As Thomas Schelling has written, "[T]he one making the threat may pretend that he himself erroneously believes his own costs [of carrying out the threat] to be small, and therefore would mistakenly go ahead and fulfill the threat." From this we see how quasi-rational assessments interact with strategic bargaining to present very difficult decisions for the parties—with the result that efficient bargains may not always be struck.

A separate ground for disagreement may be labelled "irrational." This is not to suggest that a party pursuing this course must be mentally ill or deficient; instead, it is meant to be a catch-all phrase to include motives such as spite, pride, and anger. In our example, the inventor might convince herself that she has a sort of moral claim: But for her invention, the fabulously profitable improvement would not have been made. Does this not entitle her to more than half the surplus? Indeed, who is this improver to claim the right to anything based on what the inventor did? Did the inventor not spend years perfecting the pioneering invention? For what—to give ground to a measly hack who just happened to twiddle things the right way? And so on. Over a scotch and soda, patent lawyers can tell many stories along these lines.

59. This point is made concerning potential bargaining problems between a patentholder and a subsequent researcher bent on improving or experimenting with the patented technology:

[T]here are a number of reasons to believe that private bargaining between the parties in this context would not lead to an efficient outcome. First, uncertainty or disagreement as to the value of the patented invention, the likely outcome of the research project, and the validity and scope of the patent claims might make it difficult for the parties to agree on a price for a license. It might be possible to work around some of these problems through a license agreement . . . [but] [f]or research projects requiring access to many different patented inventions, these transaction costs could become insurmountable. Second, if the subsequent researcher and the patent holder are research rivals, the subsequent researcher might be reluctant to disclose valuable research plans to the patent holder in the course of negotiations . . . . Third, the loss of monopoly profits to the patent holder if the subsequent researcher succeeds in inventing around the patent may be greater than the anticipated profits to the subsequent researcher of using the new technology in competition with the patent holder.


60. SCHELLING, supra note 16, at 36.

61. For a sampling, see TERESA M. AMABILE, THE SOCIAL PSYCHOLOGY OF
Meanwhile, of course, the improver has strategic considerations and non-rational thoughts of her own with which to contend. Although the pioneer provided the shoulders, she may be tempted to reason that it was she who actually saw much further than the pioneer. The vast preponderance of the profits in this market will stem from her improvement. Finally, the improver will have the tantalizing thought that maybe the pioneer was not such a pioneer after all, that in fact the improver would have soon discovered the basic technology herself. Couple these natural thoughts with a bargaining strategy designed to minimize royalties paid to the pioneer, and we see the same problem outlined above: deals that should be struck (viewed ex post) may not be.

III. “REVERSE EQUIVALENTS” AND THE RADICAL IMPROVER

As Cooter has pointed out, rational bargaining will produce deadlocks in a certain number of cases. In the divorce cases he and his co-authors were interested in, this result was sad but not catastrophic; a wasteful trial is necessary to divide the marital assets. In the example of the radical improver, however, the social consequences of a failure to reach agreement are much worse. There is a possibility in these cases that the wonderfully effective improvement developed by the improver will be kept off the market until the pioneer’s patent expires. Indeed, in several historical instances of significant blocking patents, government intervention was necessary to break a persistent deadlock. In other instances, the now diminished threat of antitrust liability probably restrained the pioneer from bargaining too aggressively with various improvers. Without these interventions, there is a very real risk that deadlocks will occasionally occur.

However, patent law has evolved a seldom-used but potentially effective response to this problem. This is the doctrine of reverse equivalents. When an infringer’s device is so fundamentally different from the inventor’s, this doctrine removes it from the zone of infringement liability, despite the fact that it is clearly covered by the patent. It in effect excuses infringement for equitable reasons. The doctrine gets its name because it is the converse of infringement under the doctrine of equivalents, where a device is found to infringe despite not being literally covered by the terms of the patentee’s claim.

Creativity 15 (1983) (noting that the best inventions are made for intrinsic, not financial, motives); Ron Westrum, Motives for Inventing, Paper presented at the Society for the History of Technology Annual Meeting (Oct. 1990) (detailing non-rational elements of inventors’ motivations). Surely many cases attest to the fact that inventors often come to identify themselves very closely with their inventions, which often complicates rational settlement of conflicts over priority, licensing, and the like. See, e.g., James T. Flexner, Steamboats Come True 100 (1944) (describing early steamboat inventor John Fitch, whose erratic behavior made business dealings unpredictable and who ultimately committed suicide in despair).

62. See Cooter, supra note 18, at 459.
63. See Cooter & Marks, supra note 22, at 230.
64. See, e.g., discussion of the triode supra subpart IIA.
Very few cases have actually applied the doctrine of reverse equivalents, but fortunately one of the key ones that did is the Supreme Court case of *Westinghouse v. Boyden Power Brake Co.* In 1869, George Westinghouse invented a train brake that used a central reservoir of compressed air for stopping power. Further advances in his design, primarily the addition of an air reservoir in each brake cylinder, resulted in a brake that was patented in 1887. An improvement on this 1887 brake, invented by George Boyden, added an ingenious mechanism for pushing compressed air into the brake piston from both the central reservoir and a local reservoir in each brake cylinder. This was a considerable improvement over Westinghouse’s brake which required a complicated series of passageways to supply air from the two sources. With the added stopping power of the Boyden brake, engineers could safely operate the increasingly long trains of the late nineteenth century.

The Westinghouse patent included a claim for “the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder, a triple-valve [the device that coordinated the airflows from the main reservoir and the individual brake reservoir] and an auxiliary valve device, actuated by the piston of the triple-valve . . . for admitting air in the application of the brake.” The Court noted that the literal wording of the Westinghouse patent could be read to cover Boyden’s brake, because it included what could be described as a “triple valve.” But the Court refused to find infringement on the ground that Boyden’s brake was a significant contribution that took the invention outside the equitable bounds of the patent. “We are induced,” the Court wrote,

to look with more favor upon this device, not only because it is a novel one and a manifest departure from the principle of the Westinghouse patent, but because it solved at once in the simplest manner the problem of quick [braking] action, whereas the Westinghouse patent did not prove to be a success until certain additional members had been incorporated into it.

66. 170 U.S. 537, 537-38 (1898).
68. *Id.*
69. *Id.*
70. *Id.* at 542-44.
71. *Id.* at 561.
72. *Id.* at 568; see also Charles F. Pigott, Jr., *Equivalents in Reverse*, 48 J. PAT. OFF. SOC’Y 291, 295 (1966) (noting that in *Westinghouse* “the claims literally read upon [i.e., covered] the accused structure”).
73. *Westinghouse*, 170 U.S. at 572. On the application of this standard to specific cases, see Jacoby-Bender, Inc. v. Foster Metal Prods., Inc., 152 F. Supp. 289, 291-92 (D. Mass. 1957) (“I am disposed to regard [the accused] device as . . . an equivalent unless what
The *Westinghouse* decision has influenced a number of more recent cases.\(^7^4\) In *Scripps Clinic & Research Foundation v. Genentech, Inc.*,\(^7^5\) an especially important case currently on remand to the district court, the Federal Circuit recognized the potential significance of the reverse doctrine for the biotechnology industry. In *Scripps*, Genentech, the accused infringer, argued that even if its recombinant version of the Factor VIII:C protein infringed plaintiff’s product patent on the purified natural protein, it was different “in principle” from plaintiff’s version and so should escape infringement.\(^7^6\) The court suggested that this might be a viable argument in this case, because the “[a]pplication of the doctrine requires that facts specific to the accused device be determined and weighed against the equitable scope of the claims . . . .”\(^7^7\) The force of Genentech’s argument stemmed from the fact that Genentech’s recombinant version of the Factor VIII:C protein was by far the most commercially significant one; it was much cheaper to produce than the Scripps version, which was derived from natural blood products. Thus, although Scripps held a broad patent that covered the Genentech version, Genentech’s contribution was in fact more significant. In the parlance of this paper, Genentech was a radical improver.

These cases demonstrate the potential use of the reverse equivalents doctrine to limit the reach of a patentee’s claims in the face of substantial technological improvements. But the doctrine is seldom invoked, and even more rarely actually applied by courts.\(^7^9\) Nevertheless, because the

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\(^7^4\) See, e.g., Leesona Corp. v. United States, 530 F.2d 896, 905-06 (Ct. Cl. 1976), *modified*, 599 F.2d 958 (Ct. Cl. 1979), *cert. denied*, 444 U.S. 991 (1979); Precision Metal Fabricators, Inc. v. Jetstream Sys. Co., 693 F. Supp. 814, 819 (N.D. Cal. 1988) (holding that no infringement occurred where defendant’s “machines did not operate on the same principle as plaintiff’s . . . . This appears to be a case where defendants are not gaining the benefit of plaintiff’s patents, but their equipment could fall within the literal language of the patents.”); Mechanical Plastics Corp. v. Unifast Indus., Inc., 657 F. Supp. 502, 504 (E.D.N.Y. 1987) (“Where a device serves the same or a similar purpose to the patented invention, but functions in a substantially different way, the fact that it falls within the literal language of the claim does not warrant a finding of infringement.”), *aff’d*, 846 F.2d 78 (Fed. Cir. 1988).

\(^7^5\) 927 F.2d 1565 (Fed. Cir. 1991), *rev’d in part* 666 F. Supp. 1379 (N.D. Cal. 1987) (earlier decision on infringement).

\(^7^6\) *Id.* at 1581.

\(^7^7\) *Id.*

\(^7^8\) For an analysis along these lines, see Robert P. Merges, *A Brief Note on Blocking Patents and Reverse Equivalents: Biotechnology as an Example*, 73 J. PAT. & TRADEMARK OFF. SOC’Y 878 (1991).

\(^7^9\) Ethyl Molded Prods. Co. v. Betts Package Inc., 9 U.S.P.Q.2d 1001, 1026 (E.D.
doctrine is still good law, a pioneer always has some risk that a court will excuse a radical improvement from infringement despite the fact that it is clearly covered by the patentee’s claims.

This Part puts forth a rationale for the doctrine of reverse equivalents. It is justified here on the basis of the likelihood of bargaining breakdown, coupled with the large social welfare loss caused by lack of agreement. Specifically, this Part asserts that the doctrine creates enough of a threat to a pioneer patentee to positively influence the chances of a socially productive agreement between the pioneer and a radical improver. The upshot is that the doctrine serves as a good example of a mechanism that can encourage transfers without recourse to a statutory compulsory license.

Here is a simple example that shows how this doctrine might affect bargaining. Let us say that a pioneer is making a current profit of $100. The pioneer is approached by a radical improver who asserts, due to a radical improvement developed at a cost of $400 by the improver, that the joint profit can be raised to $1000 if the pioneer will grant her a license. The pioneer understands that the improvement is significant, but also foresees an 80% chance of duplicating it. Moreover, the pioneer is willing to spend up to $300 on the duplication project which, if successful, will yield a net profit of $600, the $900 gross profit from the improvement less the $300 cost of duplicating it. If the duplication project fails, the pioneer loses the project’s $300 cost.

Given these figures, the pioneer’s expected value before any agreement is $520 (that is, the current $100 profit plus the $420 expected value from the improvement duplication project $[(.8)($900-$300) - (.2)($300)]$). In order to make an agreement with the pioneer, the improver will have to offer more than this. The light gray portion of the bar in Figure 1 shows the range of payments that the improver will consider; they range from $520 to $900, the full value of the improvement.

Unfortunately, the most that the improver can offer is $500—the net profit if the pioneer does agree. (This is the net profit because the $400 cost of development must be subtracted from the $900 gross profit). The black portion of the bar in Figure 1 shows the range of payments that the

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Ky. 1988) (“The reverse doctrine of equivalents, although frequently argued by infringers, has never been applied by the Federal Circuit.”); see Smithkline Diagnostics, Inc. v. Helena Lab. Corp., 859 F.2d 878, 890 (Fed. Cir. 1988) (rejecting reverse the equivalents defense); Del Mar Avionics, Inc. v. Quinton Instrument Co., 836 F.2d 1320, 1325 (Fed. Cir. 1987) (finding that the accused infringer “had not carried the burden of its argument, invoking the ‘reverse doctrine of equivalents . . .’”); Studiengesellschaft Kohle, M.B.H. v. Dart Indus., Inc., 726 F.2d 724, 728 (Fed. Cir. 1984) (“The so-called ‘reverse doctrine of equivalents’ does not apply in this case because Dart’s catalyst is not so dissimilar to those contemplated by Ziegler and his co-inventors that it would be inequitable to regard the former as being within the scope of the claims.”); Phillips Petroleum Co. v. United States Steel Corp., 6743 F. Supp. 1278, 1350 (D. Del. 1987) (pointing out that reverse equivalents is rarely successfully asserted), aff’d, 865 F.2d 1247 (Fed. Cir. 1989).
improver is willing to make; they range from $0 to $500. Any payment over $500 makes the whole venture a net loss. Because the two ranges do not overlap, the parties will not agree. The improvement will be developed only if the pioneer is successful in a duplication project. The improver’s investment, if any, will be wasted.

**Figure 1**

<table>
<thead>
<tr>
<th>$0</th>
<th>500</th>
<th>520</th>
<th>900</th>
</tr>
</thead>
</table>

![Improver's Range](Image)

![Pioneer's Range](Image)

Now consider the effect of reverse equivalents. If a court found this doctrine applicable in this case, the improver could enter the market without obtaining a license from the pioneer. Of course, empirically, the chances that a court will apply the doctrine are very small. But perhaps the mere threat of the doctrine is enough to create a zone of bargaining overlap between the parties.

To illustrate, assume that there is a 10% chance that a court will invoke the doctrine in this case. (Note that this is a very conservative assumption; it assumes that a court will apply the doctrine in a small subset of a small subset of cases—10% of the radical improvement cases.)

This changes the pioneer’s outlook. The 10% chance that a court will invoke the doctrine lowers the expected value. Specifically, there is now an extra 10% chance that the pioneer will fail in an effort to duplicate the improvement and thus lose $300. This would happen if the pioneer invests the $300 and successfully duplicates the improvement, but is foreclosed from selling it.80 Thus, the expected value, taking into account the possibility that a court might apply the reverse doctrine, is $430, or ($100

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80. The pioneer could be foreclosed either because the improver’s first-mover advantage keeps the pioneer from becoming established in the market for the improvement or because the improver has a patent on her improvement. In either case, recall that when a court applies the reverse doctrine, it gives the improver the right to sell the improvement without a license from the pioneer. Note that the second foreclosure reason provides further support for the current practice of awarding improvement patents. By enhancing the bargaining position of improvers, improvement patents make cross-licenses more likely. They represent an intriguing and successful tailoring of property rights to a difficult private bargaining situation.
This creates an overlap between the ranges that the two parties are willing to consider—a zone of agreement. Figure 2 shows this; the zone is between $430 and $500.

Figure 2: A Zone of Agreement

<table>
<thead>
<tr>
<th>$0</th>
<th>430</th>
<th>500</th>
<th>900</th>
</tr>
</thead>
</table>

| Improver’s Range | Pioneer’s Range |

This result can also be modeled with a slight adaptation of the classic settlement model by Robert Cooter and Steven Marks. In this model parties seek to increase their share of the surplus created by settlement; they set their settlement demands so that the last dollar demanded is just worthwhile when compared to the increased probability of non-settlement, and thus a trial, due to this last dollar. In symbols, the Cooter-Marks model has each party solving the following equation for the value of $x$, their demand in the settlement negotiation: $p(x - T) = P($1.00), where $p$ is the incremental increase in the probability of non-settlement, $T$ is the payoff from non-settlement—that is, the expected outcome of a trial—and $P$ is the expected probability of settlement. Expressed as a function of $x$, this works out to:

$$x = \frac{P($1.00)}{p} = \frac{pT}{p}$$

Because the goal of my proposal is to make non-settlement less attractive, I want to reduce the value of $T$, the payoff to the party from non-settlement. Again, the rationale is that non-settlement has social costs, such as delayed introduction of an improvement invention, that are not reflected

81. It might actually be lower, depending on whether the improvement is a good substitute for the pioneer’s original product. If it is, the pioneer may lose the $300 from the improvement duplication project plus some of the $100 profit on the original product.

82. See Cooter & Marks, supra note 22.

83. See id. at 227-31.
in the private costs of the parties. One way to do this is to put a “tax” on $T$ to reduce its value by some measure that brings private incentives more closely in line with social welfare. This can be modeled simply by reducing $T$ by introducing a “minus factor.” The minus factor is the expected reduction in value due to occasional invocation of the reverse doctrine of equivalents. This lowers the payoff from non-settlement and thus makes settlement in the form of voluntary licensing more attractive and hence more likely. In symbols, the idea is to add the minus factor $[MF]$ to the equation. Thus we would have

$$x = \frac{P(1.00) + (pT)[MF]}{P}$$

Any value of $[MF]$ between zero and one reduces the value of $x$. Lower values of $x$ mean lower demands, and therefore a greater likelihood of settlement.

A second example will serve to illustrate how the reverse doctrine can increase the chances that an agreement will be reached where some zone of agreement already exists. Assume that the improvement costs the improver only $300 to invent. In this case the parties would have some zone of agreement even without the reverse doctrine, as Figure 3 shows. The improver is willing to pay up to $600 because the improvement cost only $300 to develop.

**Figure 3**

<table>
<thead>
<tr>
<th>$0</th>
<th>520</th>
<th>600</th>
<th>900</th>
</tr>
</thead>
</table>

**Improver’s Range**

**Pioneer’s Range**

With the reverse doctrine, the range expands (to between $430 and $600), again because the pioneer is willing to take less money because of the risk of the reverse doctrine. Figure 4 shows this.
Figure 4

$0 430 600 900

**Improver's Range**  

Thus, we see that the reverse doctrine can, in some cases, expand the zone of agreement between parties. But if we are so concerned with getting the parties to agree in these cases, why not simply mandate an agreement—by means of a compulsory license? We turn to this question in a moment. But first, some comments on the example are in order.

**A. Some Comments on the Example**

The preceding example may provoke the question of why we should encourage a license under these circumstances. After all, the example itself makes several assumptions which seem to suggest that there is no need for a license: the improvement can be made more cheaply by the pioneer than the improver ($300 versus $400, presumably because the pioneer has less to learn given its familiarity with the technology); the pioneer estimates that it has an 80% chance of success in duplicating the improvement; and finally, without the pioneer's original invention, no opportunity exists for an improvement in the first place.

To begin, the first and third objections are closely related. The pioneer's headstart in the race for improvements provides support for the intuition that the pioneer ought to have wide latitude in developing improvements. But the key point to recall is that the pioneer has not in fact made the improvement in question. Indeed, nothing in the example is meant to suggest the pioneer has even contemplated this improvement. The improver signals this possibility by approaching the pioneer to negotiate a license. When this is kept in mind, the improver may be seen as very much the victim of Arrow's Paradox: The disclosure of the nature of the improvement sets the pioneer off on the consideration of a duplication project, with the attendant calculation of expected value.84

Likewise, the 80% estimate of success is not necessarily an indication that a license here would be wasteful. Again, the improver must notify the pioneer to begin negotiations. At this point some information about the improvement will emerge; it must if the offer to take a license is to be understood. Once the idea

84. *See supra* note 14 and accompanying text.
of the improvement is out, the example assumes, the pioneer’s estimate that it is very likely (an 80% chance) to duplicate the improvement follows. The key is that the idea of the improvement, and not the working out of this idea in detail, may well be what is important. Stated differently, the example does not assume that the pioneer has an 80% chance of coming up with this idea.

One might also consider the possibility that the pioneer’s 80% estimate is off the mark considerably; assume that the pioneer in fact has only a 40% chance of duplicating the invention. Then, at least in the one-round bargaining example given above, society stands a good chance of never receiving the improvement at all. In some situations at least, it can be argued that pioneers possess the kind of hubris that leads to such an overestimate.

An entirely different objection might be made on the ground that the pioneer’s patent should never cover an improvement that adds so much independent value. While perhaps true in principle, this objection calls into question well settled doctrines of patent breadth under which very broad claims issue to pioneers. These doctrines have been analyzed elsewhere. Here, I take them as given.

B. Comparing Reverse Equivalents and Compulsory Licenses

The examples listed earlier in Part III illustrate the direct costs of the reverse doctrine. An additional cost, of course, is the reduction of the pioneer’s incentive and the incentives of pioneers to follow. In general this cost will be quite small, though; again, we are dealing with a small subset (10%) of a subset of infringement cases, specifically those cases involving radical improvements.

Now we will examine the drawbacks of a compulsory licensing system, assuming that compulsory licensing would apply only in the case of radical improvements. The primary argument against compulsory licensing is that it allows courts, not the parties themselves, to set the terms of exchange. The valuation problems discussed earlier in the context of licensor-licensee negotiations are exacerbated significantly when a court is asked to set the terms and royalty rate of a license. Although Scherer has shown that compulsory licensing has not on the whole been deleterious when applied as part of an antitrust remedy, he is also careful to limit his support to this context only.

In many ways, the case against compulsory licensing mirrors the case against court-determined damages for breach of contract. Those who argue that specific performance is the most appropriate form of relief for breach.

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85. See Merges, supra note 15, at 549-52.
86. See Figure 1 and accompanying text.
88. For a general defense of the strong property rule for intellectual property rights, which requires face-to-face bargaining, see Merges, supra note 3.
of contract emphasize that this remedy permits the injured party, the victim of the
breach, to set the price of breach. Because specific performance gives the injured
party the right to demand performance, the idea is that the injured party holding
this right will not surrender it for less than its true value to him or her. This is
in contrast to court-determined damages. The court may underestimate the
damages, fail to take into account special subjective value of performance to this
contracting party, and the like.

Whether they are enough to make specific performance the basic remedy in
contracts cases, these arguments seem potent in the context of technology licenses.
Perhaps in run-of-the-mill commercial contracts cases courts are not likely to
calculate the damages incorrectly. However, this is not the case with respect to
the transfer of new and unique technologies. Valuation errors are rife in this
context.\[89\] Moreover, a highly firm-specific and therefore subjective component
exists in the valuation of many technological assets. This is due in part to the fact
that the value of a technology is primarily a function of a firm’s predictions about
the technology’s potential market. This will vary depending on the firm’s pre-
existing experience with that market, among other things. Thus, objective
measures such as the cost of inventing a particular technology do not provide a
solid foundation upon which to base a royalty rate. By default, more subjective
measures will be used. It is in precisely this context that party-to-party valuation,
as opposed to court valuation, will usually make sense.\[90\]

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89. Extensive evidence shows that technology licensing involves significant
transaction costs and that valuation problems are a main cause. See, e.g., DAVID J.
TEECE, THE MULTINATIONAL CORPORATION AND THE RESOURCE COST OF INTERNATIONAL
TECHNOLOGY TRANSFER 43-44 (1976) (noting that transaction costs consume approximately
20% of the value of a typical technology transaction involving international firms); FAROK
J. CONTRACTOR, INTERNATIONAL TECHNOLOGY LICENSING: COMPENSATION, COSTS, AND
NEGOTIATION 105 (1981) (noting that transaction costs averaged over $100,000 for licensing
deals studied); David J. Teece, The Market for Know-How and the Efficient International
Transfer of Technology, ANNALS AM. ACAD. POL. & SOC. SCI., NOV. 1981, 81, 88
(‘‘[N]either [the] buyer nor seller of technology seems to have a clear idea of the value of
the commodity in which they are trading,...’’ which means that ‘‘royalty rates may simply
be a function of [the] negotiating skills of the parties involved.’’) (quoting Peter Killing,
Technology Acquisition: License Agreement or Joint Venture, COLUM. J. WORLD BUS., FALL
1980, at 38, 44-45)); see also Richard E. Caves et al., The Imperfect Market for Technology
Licenses, 45 OXFORD BULL. ECON. & STATS. 249, 260-262 (1983) (noting that most
transactions occur between firms in different nations with elevated costs); Richard R. Nelson,
What is ‘‘Commercial’’ and What is ‘‘Public’’ About Technology, and What Should Be?, in
TECHNOLOGY AND THE WEALTH OF NATIONS (Nathan Rosenberg et al. eds., 1992) (noting
that generic knowledge or know-how, which is very difficult to codify and transfer, is a large
component of many technologies); FRANCIS BIDAULT, TECHNOLOGY PRICING (Brian Page
& Peter Sherwood, trans., 1989) (collecting earlier studies and relating an empirical study
correlating transfer costs with licensing strategy).

90. An additional argument against compulsory licensing can be made if one admits
the possibility that firms will spend money trying to influence the compulsory licensing
tribunal. If the proceeding is overseen by a tribunal with little knowledge of the industry in
C. Would the Parties Prefer An All-or-Nothing Rule?

In the face of opposition to any form of compulsory licensing, one must consider whether one actually prefers the "all-or-nothing" rule of the reverse doctrine. In reality, it is so seldom applied that parties would not think of themselves as preferring it over compulsory licensing; so we are in some sense defending a choice that is at best implicit. Even so, the question remains: How could a firm prefer an all-or-nothing rule?

The answer will turn on how often the parties think a court, operating under a compulsory licensing regime, will demand that a compulsory license be given. Licensing negotiations can be very expensive, and we can surmise that where parties are trying to influence a third party decision maker, negotiations will be even more expensive. Consequently, if patentees believe that the prospective error rate is high enough, they could rationally conclude that the aggregate cost of determining reasonable compensation through a compulsory licensing mechanism outweighs the benefits of being compensated in those cases where bargaining breaks down and courts apply the reverse doctrine of equivalents. In other words, they may actually prefer to get nothing in those few cases rather than get something, but at a higher cost, in many cases. Remember that the reverse doctrine is applied by this Article's hypothesis in only 10% of the radical improvement cases. In other words, expected returns under the all-or-nothing (reverse equivalents) rule may be higher when administrative costs are taken into account.

D. Responding to the Incentive Bugaboo

Any scholar who writes on intellectual property rights and who advocates that some rights should be scaled back can anticipate the criticism that incentives will which the pioneer and improver operate, significant sums will be spent educating the tribunal. More than this, resources will be expended to influence the tribunal's perception of the costs and merits of the pioneer's and improver's research efforts and commercial products. Because there is a chance that the tribunal can be persuaded to accept overgenerous figures by either party, the parties can be expected to try. Thus, in each case, detailed accounts will be given of the technology and market conditions that will determine the outcome of the case. In a sense, the naivete of the tribunal creates the possibility of a "rent" that both parties will attempt to capture. Note that expenditures in this regard are over and above those made to influence the outcome of the bargaining between the parties themselves.

The money expended in compulsory licensing proceedings would be wasted. The only justification for such a system, however, is that it would force agreements in those few cases where a bargain is not struck between a pioneer and an improver. Perhaps this would not be so bad. But in light of the patent system's strong preference for property rules, and keeping in mind the rules of last resort mentioned above ("equitable" non-enforcement and eminent domain), the actual threat of lost social value in these cases seems low.
be harmed. My point in this subpart is that any such harm in the cases I am discussing is quite minimal.

To see why, one needs only to look at Figure 5, which illustrates the "tree" that leads to the application of the reverse doctrine. At the far left is the decision of whether or not to try to develop an invention. This might also be thought of as a decision of whether or not to commercialize an invention that is already in hand. Going from left to right, the invention faces the following contingencies: it might not be a market success; it might not give rise to improvements; if it does give rise to improvements, the pioneer might have an advantage in developing them; if the pioneer does not have an advantage, independent third parties may have an advantage and might reach a bargain with the original inventor; if they do not reach a bargain with the original inventor, the reverse doctrine will be applied, but only in 10% of the subset of cases where the third party has made a radical improvement. The point is simple: the events on the far right hand side of the tree are the result of many contingencies, some of which are quite unlikely. When one adds to this the fact that the bargaining breakdown and court resolution are likely to occur many years after the initial invention is made, it is clear that the impact of the reverse doctrine can be expected to be quite minimal. And if it is objected that the reverse doctrine will have a deleterious effect on the pioneer's incentives to develop improvements, an immediate response presents itself. Why should the pioneer be favored in the race for improvements?

IV. A BRIEF COMPARATIVE NOTE

The patent statutes in many countries include a compulsory "dependency

91. For a discussion of the relationship between decisions to invent and commercialize, and an analysis of the sensitivity of invention-related investment decisions to patentability standards, see Merges, Uncertainty, supra note 32.

92. Technically, the diagram is incomplete. It should show the possibility that even where the pioneer has an advantage, a third party may come up with an improvement; even where a third party has an advantage, the pioneer may make an improvement. Thus, the diagram shows the most likely path that would lead to a bargaining breakdown and hence the application of the reverse doctrine.

93. One possible answer is that the pioneer is better disposed, on average, to develop these improvements. But as I have pointed out, the reverse doctrine will not affect incentives much in these cases because it is so unlikely that it will be applied. For an exploration and critique of the theory that pioneers need broad "prospecting" rights, see Merges & Nelson, supra note 10, at 839. Another point to consider is that in some sense the pioneers are already favored in the race for improvements because they know more about the pioneering invention and know it much earlier than competitors.
license” in the case of blocking patents. These statutes provide, in varying ways, for a liability rule in the case of an improvement invention that infringes a dominant patent. In this section, I argue briefly that (1) these provisions give credence to the concerns identified here; (2) very few cases are ever adjudicated under these provisions, suggesting that their primary effect is to influence the terms of the private bargain reached by the parties; and (3) these provisions have no discernable effect on the incentives for European firms to invent.

First, I will describe the major variants on the dependency license concept. Some countries, such as France, Italy, and Japan, grant licenses for all blocking patents; others, such as China and Sweden, reserve the license for cases where the improvement makes a “significant technical advance” over the basic invention, roughly the same as my notion of radical improvements. In many cases, the grant of a compulsory license in favor

94. See Gianna Julian-Arnold, International Compulsory Licensing: The Rationales and the Reality, 33 IDEA 349, 349-50 (1992) (“[T]he three most prevalent compulsory licensing provisions [revealed in a worldwide survey of patent laws] are applicable where a dependent patent is being blocked, where a patent is not being worked, or where an invention relates to food or medicine.”).

95. See infra notes 96-98 and accompanying text.


97. Similar provisions can be found in the patent laws of many other countries in Europe and elsewhere, including Austria (compulsory license may be granted to a dependent patentee of an invention of considerable commercial or industrial significance) and China (“technically superior” junior invention accorded compulsory license). For the interesting case of Switzerland, see SR 232.14, reprinted in Walter, Compulsory Licenses in Respect of Dependent Patents Under the Law of Switzerland and other European States, 21 INT’L REV. INDUS. PROP. & COPYRIGHT. L. 532, 533 (1990) (describing patent law provisions where compulsory licenses can be ordered for improvements that either serve different markets or are significantly technically advanced over the invention in the dominant patent; also describing a provision that permits a cross-license to be ordered in the case where the improvement and dominant inventions service the same market). One variant on the two basic models discussed here, adopted in several countries including the Netherlands and New Zealand, is where a compulsory license is available for a dependent, patented invention only after a certain number of years following the grant of the dominant patent. See, e.g., Patents Act of the Kingdom of the Netherlands (1910), amended by The Act of the Kingdom of the Netherlands (1987) (Rijkszochtcreowet) § 34, in 5 WORLD INTELLECTUAL PROPERTY ORGANIZATION, INDUSTRIAL PROPERTY LAWS AND TREATIES (1980 & Supp. 1991); New Zealand Patent Act §§ 46, 51 (1953), in BROWN & GRANT, THE LAW OF INTELLECTUAL PROPERTY IN NEW ZEALAND § 6.67 (1989).
of the improver is accompanied by a license to the holder of the domi-
nant/pioneer patent—which makes the exchange in fact a mandatory cross-
license.98

As might be expected, disputes under these provisions are seldom
litigated. The last grant of a dependent compulsory license in Japan is said
to have occurred over 20 years ago.99 Likewise, one author states that no
case of this sort has reached a Swiss court since the current provision took
effect almost 40 years ago.100 Another author suggests that the procedural
intricacy and expense of dependency patent licensing forces parties to
bargain privately for a cross-license.101 Even if this is true, one would still
expect that the threat to resort to the procedure will influence the terms of
the license agreement reached in the shadow of the compulsory licensing
rule.102

As mentioned, no evidence suggests that the availability of a dependen-
cy license appreciably diminishes the incentives of inventors and patent
owners in countries subject to these provisions. I agree that no matter how
attenuated the effect, in actuality as in our economic models is, or is
modelled as being,103 it is there and can be assumed to have some effect
on the marginal pioneer. But it must be presumed, on the basis of current
information, that this effect is so small that it makes no practical difference.
In the absence of any evidence showing why the use of reverse equivalents
in the United States as advocated here could be expected to have a bigger
impact on incentives, one must assume that the impact would be minimal.

100. Walter, supra note 97, at 536.
101. [P]rior to application for a compulsory license, an improvement invention must be
created, a patent application granted, the improvement patent applicant may have had
to survive a lengthy opposition proceeding, and an attempt at voluntary negotiations
must have been made. These steps discourage compulsory license applications owing
to the time and money involved. It seems where the improvement is an important
technological advance, a cross license would best meet the economic interests of both
parties.
Julian-Arnold, supra note 94, at 351.
102. Implicit in this is the notion, which I develop at length elsewhere, that the
compulsory licensing procedure will at best duplicate, but rarely exceed, the performance of
face-to-face bargaining under a property rule (as modified here, of course, by the thrust of
reverse equivalents). See Merges, Contracting into Liability Rules, supra note 2. Even if
one rejects this analysis, however, there is another reason to prefer the reverse equiva-
103. C.f. supra Figure 5.

V. Conclusion

I have tried in this Article to resolve the difficult tension between the baseline property rule in patent cases and the need to encourage more transactions in some segments of the market for patents. Viewed in this way, the problem is how to maintain the institution of voluntary transactions while making them more frequent.

Just as the basic rationale for patents is the need to give incentives in the face of the externality or spillover created by costly inventions and original works of authorship, I am interested in a parallel rationale for encouraging exchanges of patents: the positive spillovers created by the pooling of intellectual assets. In some cases, for example collective works agencies such as ASCAP and BMI, carrying out this rationale is simply a matter of creating a framework that lowers transaction costs to the point where consensual exchange becomes cost-effective. In other cases, such as the ones dealt with above, encouraging transactions requires some fine-tuning in the detailed rules of infringement liability. In still other cases, the largely neglected doctrines on remedies influence decisions about the optimal amount and duration of borrowing that can be done; adjustments to these doctrines, and in some cases wholesale changes, are called for as a way to encourage more transactions.