

PROPERTY RULES, LIABILITY RULES AND PATENT MARKET FAILURE

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Abstract

Relying on the economic theory of real property, commentators argue that patent law is better suited to a property rule regime than a liability rule system. The underlying assumption is that *ex ante* incentives for innovation are best promoted by enabling patent holders to negotiate licenses against the backdrop of an injunction. By contrast, judicially determined damage remedies systematically undervalue innovation. However, recent judicial developments have started to deny injunctions in patent infringement cases in favour of awarding damages, making it appear that patent law will now be increasingly governed by liability rules. This article reflects on this trend by considering the case of patent market failure. It argues that many of the preconditions that work against liability rules similarly affect property rules and private bargaining. Patent market failure is caused by difficulties in valuing (and pricing) innovation, establishing the boundaries of patents and resolving the externalities involved in patent licensing. Patent market failure strengthens the case for liability rules that provide follow-up innovators access to patents, while eliminating the detrimental effect of the anticommons.

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1 Introduction

The distinction between property rules and liability rules, set forth by the groundbreaking article ‘Property Rules, Liability Rules, and Inalienability: One View from the Cathedral’, is well established as one of the most prominent analytical tools in legal scholarship.¹ In this article on the protection of entitlements, Judge Guido Calabresi and Douglas Melamed have stimulated a new generation of scholars to cross boundaries between the different fields of law and reach beyond settled legal terminology in order to recognize similarities and analyze functional differences among legal systems and varying areas of the law. Unifying concepts, such as property and liability rule protection,² provide highly valuable instruments that can be used to critically examine remedial opportunities. Likewise, in the field of intellectual property law the property-liability rule framework has inspired a range of illuminating scholarship and lively debates over the appropriate legal protection for information goods.³

The distinction between liability and property rules has proved to be instrumental in explaining the role of collective rights organisation,⁴ analyzing the conditions amenable to compulsory licensing,⁵ determining the

¹ G. Calabresi and A.D. Melamed, ‘Property Rules, Liability Rules, and Inalienability: One View of the Cathedral’ (1972) 85 *Harvard Law Review* 1089.

² *Id.* at 1092 (‘Whenever someone may destroy the initial entitlement if he is willing to pay an objectively determined value for it, an entitlement is protected by a liability rule.’).

³ See generally on the question whether property rules are more or less likely than judicially administered liability rules to encourage bargaining to efficient licensing outcomes, R.D. Blair and T.F. Cotter, ‘An Economic Analysis of Damages Rules in Intellectual Property Law’ (1998) 39 *William and Mary Law Review* 1585. For a critical examination of the general presumption in favor of injunctive relief, see D.L. Burk, ‘The Trouble with Trespass’ (2000) 4 *Journal of Small and Emerging Business Law* 27 at 53 (in the Internet context); A. Kozinski and C. Newman, ‘What’s So Fair About Fair Use?’ (1999) 46 *Journal of the Copyright Society of the USA* 513 at 525-527 (in the context of copyright law).

⁴ R.P. Merges, ‘Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organisations’ (1996) 84 *California Law Review* 1293 at 1303–1309 (arguing that the strong property rule protection in copyright law prompted authors and users to contract out of a property rule into a liability rule regime enforced by copyright collectives, for instance with blanket licenses).

⁵ R.P. Merges, ‘Of Property Rules, Coase, and Intellectual Property’ (1994) 94 *Columbia Law Review* 2655.

appropriate protection of incentives to innovate,⁶ and examining the relationship between various intellectual property regimes, to give a few examples.⁷

In this article, I contribute to this literature by applying the liability-property rule toolkit, firstly to describe an emerging shift towards liability rule solutions in US patent law and, secondly, to analyse the causes of this liability rule trend in patent law more generally. I argue that, despite the current trend of applying property rules to analyse intellectual property rights, several factors of increasing importance in the field of technological innovation suggest that the property rule approach to patent disputes is becoming increasingly costly. Specifically, I argue that boundary costs, fragmentation costs, and the costs of bundling necessities have substantially increased the burden on patent licensing markets. By contrast, nuanced liability-based alternatives are able to ensure access to science without hurting incentives to innovate.

This article unfolds as follows. Part 2 describes the traditional property rights/property rule approach to intellectual property. Part 3 provides a concise summary of the recent judicial trend that has broadened the application of liability rules in patent law. Part 4 examines the transaction costs involved in patent licensing markets. Part 5 concludes by considering the advantages inherent in using liability rule defaults for follow-up innovations.

2 The property rule paradigm in patent law

To a high degree, the equitable remedy of injunction has dominated the law of intellectual property.⁸ For instance, when a court deems an author's copyright has been infringed upon by another's unauthorized derivative work, the copyright holder may exercise his or her right to halt the publication and dissemination of the infringing work.⁹ Similarly, patent holders may prevent non-licensed uses of their underlying technology in

⁶ See generally on remedial choices in patent law M. Schankerman and S. Scotchmer, 'Damages and Injunctions in Protecting Intellectual Property' (2001) 32 *Journal of Industrial Economics* 199.

⁷ J.H. Reichman, 'Legal Hybrids between the Patent and Copyright Paradigm' (1994) 94 *Columbia Law Review* 2558.

⁸ *Id.* at 2667 ('All familiar with the IPR field recognize the strong presumption in favor of injunctions.').

⁹ See 17 U.S.C. § 502 (enjoinment in civil cases) and 17 U.S.C. § 506 (a) (criminal cases).

subsequent technologies.¹⁰ Because of the strict liability nature of patent infringements, the patentee will in effect enjoin the unauthorized manufacturing, use, sale, or importation by the infringer.¹¹

The traditional legal emphasis on property rule protection fits well within a general tendency to equate intellectual property law with the law governing property more generally.¹² Spurred by the intellectual prominence of the ‘law and economics’ movement, concepts behind laws governing real property have firmly established the paradigm of private property rights in intellectual property.¹² The underlying concepts in the economic theory of real property justify granting strong rights to intellectual property owners in order to internalise positive externalities and prevent free riding.

Leading commentators have argued that patent law is better suited as a property rule regime than a liability rule system.¹³ Strong remedial protection promotes *ex ante* incentives for innovators and enables patent holders to license their patent to users and follow-up innovators. Arguing from the assumption that patent rights are relatively well defined, law and economics scholars have generally operated on the expectation that patent holders and follow-up innovators will have little trouble negotiating licenses against the backdrop of an injunction. By contrast, judicially determined damage remedies (such as *ex post* compulsory licenses) may misjudge the value of the intellectual property or the injuries caused by a patent infringement. Specifically, the objection to liability rule protection is that courts will not only inaccurately identify damages, but that the deviation will

¹⁰ Patent right is the right to exclude others from using your patented innovation. See J. Bessen and M. Meurer, *Patent Failure* (Princeton: Princeton University Press 2008).

¹¹ R.P. Merges, ‘Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents’ (1994) 62 *Tennessee Law Review* 75 at 77: ‘The basic rule [in patent law] is that the rightholder has an almost absolute right to obtain an injunctive remedy against the infringer.’ See also *Smith Int’l, Inc. v. Hughes Tool Co.*, 718 F.2d 1573, 1578 (Fed. Cir.), *cert. denied*, 464 U.S. 996 (1983) (‘[W]ithout the right to obtain an injunction, the right to exclude granted to the patentee would have only a fraction of the value it was intended to have, and would no longer be as great an incentive to engage in the toils of scientific and technological research’).

¹² This is not met with unequivocal approval. Some commentators argue that information goods should not a priori be reward absolute exclusion rights; for Congress awards only so much protection as to ensure ‘the progress of the Arts and Sciences’. See M.A. Lemley, ‘Property, Intellectual Property and Free Riding’ (2005) 83 *Texas Law Review* 1031.

¹³ See R.D. Blair and T.F. Cotter, ‘An Economic Analysis of Damages Rules in Intellectual Property Law’ (1998) 39 *William and Mary Law Review* 1585; R.P. Merges, and J. Duffy, *Patent Law and Policy* (San Francisco: Matthew Bender 2002).

lead to a systematic undervaluation of innovation.¹⁴ Patent owners, on the other hand, are acutely aware of what it will take to recoup their initial investments through licensing revenues. Also, by satisfying the non-obvious requirement of patent law,¹⁵ a patent holder demonstrates ingenuity and a unique expertise regarding the technology. This places him or her in the best position to evaluate the contribution and decide the appropriate price for using the patent in a follow-up innovation.¹⁶

To summarise, by emphasizing the *ex ante* incentive for the innovator and the reliance on private bargaining, law and economics scholarship operates on the presumption that property rules (injunctions) may be preferred in the field of patents.

3 The liability rule shift in patent law

Recently a new paradox has emerged, alongside the scholarly trend of conceiving intellectual property as real property. As the property right paradigm gains ground in scholarly commentary, recent judicial developments in patent law have begun to cast doubt upon the quintessential stick in a property owner's bundle of rights: the right to exclude by way of injunction.¹⁷ In *eBay v. MercExchange*, the United States Supreme Court vacated the Federal Circuit's long-standing policy of automatically enjoining infringing defendants in patent cases.¹⁸ In effect, the Court abrogated the well-established property rule entitling a patent holder to an absolute right to exclude and replaced it with a conditional property rule, which awards protection for patents based on the outcome of a balancing test completed at trial. In the underlying dispute, MercExchange owned a patent for a business model which allowed private buyers and sellers to transact via an online market place that is regulated by 'a central authority to promote trust among participants.'¹⁹ MercExchange attempted to license its patent to Ebay, the renowned Internet auction site; however, no deal was subsequently reached.

¹⁴ R.A. Epstein, 'A Clear View of the Cathedral: The Dominance of Property Rules' (1997) 106 *Yale Law Journal* 2091 (would-be purchasers of a property right invariably prefer liability rules).

¹⁵ 35 U.S.C. § 103.

¹⁶ Along these lines, the veto right of patent holders in future innovation has been compared to a mining right in innovation. See E.W. Kitch, 'The nature and function of the patent system' (1977) 20 *The Journal of Law and Economics* 265.

¹⁷ See in the context of takings law, R.A. Epstein, 'Takings, Exclusivity and Speech: The Legacy of *PruneYard v. Robins*' (1997) 64 *University of Chicago Law Review* 21 at 22 ('[I]t is difficult to conceive of any property as private if the right to exclude is rejected').

¹⁸ 547 U.S. 388 (2006).

¹⁹ *Id.* at 390.

MercExchange filed suit against Ebay, claiming Ebay had infringed upon its patent. Instead of continuing the long tradition of using property rules to regulate patent law, the Supreme Court determined MercExchange did not have an absolute right to enjoin Ebay from using patented innovation without a license. The court held that: ‘The decision to grant or deny permanent injunctive relief is an act of equitable discretion by the district court’²⁰ Justice Thomas, writing for the majority, reasoned that: ‘The Patent Act itself indicates that patents shall have the attributes of personal property ... including, presumably, the provision that injunctive relief “may” issue only “in accordance with the principles of equity.”’²¹ Specifically, the Court provided a discretionary, four-prong test for lower courts to apply.

Thus, following this decision, a plaintiff seeking a permanent injunction must establish that he or she can meet all four requirements set forth by the test before a court may grant such relief. A plaintiff must demonstrate that: (1) he has suffered an irreparable injury; (2) remedies available at law, such as monetary damages, are inadequate to compensate for that injury; (3) considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and (4) the public interest will not be disserved by a permanent injunction.²² On remand, the District Court completed the four-part analysis and held, *inter alia*, that the harm caused to MercExchange was not irreparable, money damages could justly compensate for the wilful infringement, the ‘balance of hardships favoured neither patent owner nor competitor,’ and that the public interest was slightly disfavoured by a permanent injunction.²³ The absence of injunctive relief that may result from the application of this four-part test creates, in effect, a compulsory licensing regime based on a liability rule, under which infringement is permitted at a price determined by a court.²⁴

Since the decision in *Ebay*, several district courts have denied requests for permanent injunctions where a patent holder has failed to meet all four prongs of the test. A prominent example of such a denied request can be seen in *z4 Technologies v. Microsoft*,²⁵ in which plaintiff z4 owned the

²⁰ *Id.* at 391.

²¹ *Id.* at 392 (quoting 35 U.S.C. §283).

²² *Id.* at 390.

²³ *MercExchange, L.L.C. v. eBay, Inc.*, 500 F. Supp. 2d 556 (E.D. Va. 2007).

²⁴ G.D. George, ‘What is hiding in the Bushes? Ebay’s Effect on Holdout Behavior in Patent Thickets’ (2007) 13 *Michigan Telecommunications and Technology Law Review* 557.

²⁵ 434 F. Supp. 2d 438, 439 (E.D. Tex. 2006); See also *Voda v. Cordis Corp.*, No. CIV-03-1512-L, 2006 WL 2570614 (W.D. Okla. Sept. 5, 2006) (denied plaintiff’s motion for permanent injunction where a plaintiff introduced evidence that the defendant’s infringement caused harm to a third-party exclusive licensee. The Court held that the evidence proffered failed to meet the irreparable harm component of the test because a plaintiff must show he, himself, was harmed.); See G. Barten,

patent for software used by Microsoft in Office and Windows. While a jury verdict found that Microsoft had infringed upon z4's patent, the court denied the plaintiff's motion for permanent injunction, reasoning that monetary damages serve as adequate compensation where the protected property is only a small part of the defendant's product.

Similarly, many post-*eBay* district court decisions have denied injunctions in patent infringement cases in favour of awarding damages, thus making it appear that patents will now be increasingly governed by liability rules.²⁶ While the critical examination of *Ebay* is underway,²⁷ this article attempts to explain the weakened link between patent rights and property rule protection. As I argue in more detail below, the shift to a liability rule system in patents is best understood when one considers the relative impact of property and liability rules on the access to innovation and the cumulative effect of patent rights on follow-up innovation.

4 Patent market failure

Commentators in the field of intellectual property rights now fully recognize that innovation is characterised by an increasing degree of composite innovation. Seen from this viewpoint, the progress of science depends on every innovator standing on the shoulders of his or her predecessors.

However, in order to make use of patented innovations, a patent license must be obtained. Each patent provides an inventor with the

'Permanent Injunctions: A Discretionary Remedy for Patent Infringement in the Aftermath of the *Ebay* Decision' (2007) 16 *University of Miami Business Law Review* 1.

²⁶ Of course, by now means does this trend signify an exclusive shift to liability rules. Many permanent injunction motions in patent infringement claims continue to pass muster under the four factor test. See for example, *Transocean Offshore Deepwater Drilling, Inc. v. GlobalSantaFe Corp.*, 2006 WL 3813778 (S.D. Tex. Dec. 27, 2006). Also, even though courts now unanimously apply the four-part test from *Ebay* to motions for permanent injunctions, courts are 'split as to whether the presumption of irreparable harm applies in motions for preliminary injunctions.' *Hologic, Inc. v. Senorx, Inc.*, 2008 WL 1860035 at 14 (N.D. Cal. Apr. 25, 2008).

²⁷ See for example, Kozinski and Newman, above n. 3 at 525-527 (Arguing that both injunctive relief and fair use should be rejected and copyright owners should be entitled only to actual damages.); See also M.A. Lemley and P.J. Weiser, 'Should Property or Liability Rules Govern Information?' (2007) 85 *Texas Law Review* 783 (identifying situations where property rule protection invariably enjoins the underlying right as well as noninfringing conduct). But see P.M. Schoenhard, 'Who Took My IP?—Defending the Availability of Injunctive Relief for Patent Owners' (2008) 16 *Texas Intellectual Property Law Journal* 187.

exclusive right against all unauthorized uses of the patented product.²⁸ Non-patent holders are constrained not only from manufacturing, but also from using, selling, or importing the resource without prior consent from the patent holder.²⁹ A patentee's exclusive right extends to identical inventions, regardless whether these inventions were copied from the patent and irrespective of any good faith intentions on the part of the patent infringer. In addition, the doctrine of 'equivalent patents' extends the control rights of the patentee beyond the terms of the patent description. Under this doctrine, the holder may exclude the development of all subsequent, similar, non-identical, useful inventions. In effect, a property rule creates a setting where any subsequent innovator is at risk of being enjoined from using already patented innovations.

As discussed above, property-rights oriented scholars have traditionally presumed that the transaction costs involved in patent license negotiations are negligible compared with the information costs involved when courts apply compulsory licenses (liability rule protection) to patents. Accordingly, property rules provide better footing for consensual agreements in the area of patents, without having courts impose prices on innovation. This conventional wisdom is outdated. Firstly, a number of recent articles have discovered ways in which liability rules do indeed enhance negotiations.³⁰ Others have explored ingenious modifications to liability rule regimes that improve the effectiveness of bargaining under liability rule protection.³¹ Secondly, as I argue in more detail in this part, transaction costs in private bargaining are higher than regularly assumed. Properly conceived, successful patent license negotiations depend on an accurate assessment of (1) the value of innovation, (2) the boundaries of patents on the underlying innovations, and (3) externalities involved in patent license agreements.

²⁸ See generally M. Adelman and others, *Cases and Materials on Patent Law* (St. Paul: West Group 2002).

²⁹ See 35 U.S.C. §§ 154(a), 271(a) (1994 & Supp. III 1997). This stands in contrast to most other areas of intellectual property law, where only some unauthorized uses are prohibited. Consider for instance the exceptions in copyright law, such as the fair use and first-sale doctrines, 17 U.S.C. §§ 107-12. Also, wrongful intent is not a condition for infringement.

³⁰ L. Kaplow and S. Shavell, 'Property Rules Versus Liability Rules: An Economic Analysis' (1996) 109 *Harvard Law Review* 713 (providing importance nuances to the claimed bargaining advantage of property rules).

³¹ I. Ayres and E. Talley, 'Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade' (1995) 104 *Yale Law Journal* 1027 at 1031-1033 (arguing that liability rules make possible credible signaling among entitlement holders); A. Bell and G. Parchomovsky, 'A Theory of Property' (2005) 90 *Cornell Law Review* 531 (suggesting that liability rules may be helpful in overcoming strategic obstacles to successful negotiations).

Together, these factors significantly increase the probability of patent market failure.

4.1 Innovation uncertainty

In the particular case of patent licenses, there are several factors that complicate the licensing process between a patent holder and an improver or follow-up inventor. These stem from the problem of assessing the value of any given innovation, the level of product complexity, the difficulty of sharing information regarding the innovation at the pre-patent stage, and from cognitive limitations.

Firstly, research into patentable inventions entails a significant degree of *ex ante* uncertainty.³² It is unduly hard to predict inventions or estimate their value with any degree of success.³³ A historic example that demonstrates the difficulty of obtaining an accurate estimation of the expected value of a present invention is IBM's underestimation of the future market for home computers.³⁴ Such uncertainty increases the reluctance of a follow-up innovator to license the follow-up invention. The uncertainty over the value of any given innovation may extend to both the original innovation that is the subject of a potential license by a follow-up innovator and the licensor's follow-up invention. The uniqueness of each respective invention prevents parties from accurately estimating the value of both a license and

³² What I mean when referring to uncertainty is the difficulty of perfectly predicting *ex ante* how whether any given innovative activity will be successful *ex post*.

³³ M.A. Lemley, 'The Economics of Improvement in Intellectual Property Law' (1997) 75 *Texas Law Review* 989 at 1049 and n. 280 (referring to the literature that illustrates the computational problems firms have in the management of intra-firm inventions: S.A. Lippman and others, '*Heterogeneity Under Competition*' (1991) 29 *Economic Inquiry* 774; M.E. Porter, 'The Structure Within Industries and Companies' Performance' (1979) 61 *The Review of Economics and Statistics* 214; D.J. Teece, 'Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy' (1986) 15 *Research Policy* 285).

³⁴ Merges, above n. 11 at 86 n. 41, *citing* N. Rosenberg, *Exploring the Black Box: Technology, Economics and History* 220 (1994): 'The computer was regarded by its inventors as a purely scientific device' (*quoting* B.G. Katz and A. Phillips, 'The Computer Industry' in R.R. Nelson, *Government and Technical Progress* (New York: Pergamon Press 1982) 162, 171). See also J. Elster, *Explaining Technical Change* (Cambridge: Cambridge University Press 1983) at 111; J. Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress* (New York: Oxford University Press 1990) at 154; C. Freeman, *The Economics of Industrial Innovation* (London: Frances Pinter 1982, 2nd ed.) at 75.

the follow-up innovator's innovation.³⁵ The reasons for this are that it is often hard to place separate values on relative contributions of the pioneer and improver, and that there is a high degree of uncertainty regarding the likely profitability of the overall combined technology.³⁶

Secondly, these high levels of uncertainty regarding the value of a patent make a prospective licensee more cautious and less generous when negotiating a price for a patent license. When both parties' expectations diverge too widely, no licensing agreement will be reached.³⁷ Also, as experimental research has demonstrated, uncertainty has a magnifying effect on the price asked for a good or service.³⁸ Moreover, the bargaining range in patent license negotiations is further reduced by the general tendency of researchers, commonly referred to as attribution bias, to overvalue the contribution of their own research compared to that of others.³⁹

Finally, the information problem is even more complex in the course of license negotiations that involve potential rather than actual improvers.⁴⁰ In such a context, parties face what is known as Arrow's information

³⁵ Highly detailed contracts might ameliorate the problem, but integrating all possible contingencies into contracts is costly and not all eventualities are foreseeable.

³⁶ Merges, above n. 11.

³⁷ On the dynamics of bargaining breakdown, see generally R. Cooter, 'The cost of Coase' (1982) 11 *Journal of Legal Studies* 1; R. Cooter and others, 'Bargaining in the Shadow of Law: A Testable Model of Strategic Behavior' (1982) 11 *Journal of Legal Studies* 225.

³⁸ In fact, in cases of uncertainty, the anticommons pricing effect is amplified. The results in Depoorter & Vanneste suggest that licensors ignore the expected value of the licensee's project, and instead focus on the upper range of profitability of surplus. Willingness to accept seems to be anchored to a proportion of the maximum profitability, rather than a proportion of the expected benefits of the project. In one particular experiment the total uncoordinated reservation price of all licensors was seven times above the expected value of the project. In the experiment this created a serious gap between the amount licensors' holders were asking, on the one hand, and what a third-party entrepreneur could reasonably offer, on the other hand. See B. Depoorter and S. Vanneste, 'Putting Humpty Dumpty Back Together: Pricing in Anticommons Property Arrangements' (2007) 13 *Journal of Law, Economics and Public Policy* 59.

³⁹ See M.A. Heller and R. Eisenberg, 'Can Patents Deter Innovation? The Anticommons in Biomedical Research' (1998) 280 *Science* 698 at 698.

⁴⁰ Lemley, above n. 33 at 1051. On the interaction between initial inventors and improvers in science, see, e.g., S. Scotchmer and J.R. Green, 'Novelty and Disclosure in Patent Law' (1990) 21 *RAND Journal of Economics* 131; S. Scotchmer, 'Standing on the Shoulders of Giants: Cumulative Research and the Patent Law' (1991) 5 *Journal of Economic Perspectives* 29; J.R. Green and S. Scotchmer, 'On the division of Profit in Sequential Innovation' (1995) 26 *RAND Journal of Economics* 20.

paradox.⁴¹ The actual improver possesses valuable information that he would like to disclose to the patent owner in exchange for money.⁴² However, the exchange cannot occur before the original owner is in a position to evaluate the information. At the same time, however, under prospect theory,⁴³ the patent owner will be free to use the patented information once he finds out what the improvement consists of.⁴⁴

4.2 Uncertain patent boundaries

The real property-property rule analogy to patents, as described above, operates based on the assumption that patent rights are relatively well defined. As recent scholarship has illuminated, this assumption does not hold true. In this respect, a patent is very different from a parcel of land. While the extent of a parcel of land can be surveyed with relative ease, ascertaining the boundaries of a patent is much more demanding. That is because the boundaries of a patent are determined by individual patent right holders' exclusionary rights as described-claimed in a patent application.

⁴¹ K.J. Arrow, *Collected Papers of Kenneth H. Arrow: The economics of information vol. IV* (Cambridge: Belknap Press 1984) at 222-224. Arrow's paradox encapsulates the notion that imperfect information of another's utility function inhibits the ideal Coasian bargaining model.

⁴² Merges, above n. 11 at 81. Arrow's paradox also provides a case for the existence of blocking patents.

⁴³ Under prospect theory, the patent system provides incentives but is based on the ability of intellectual property ownership to drive the efficient use of inventions and creations through licensing. The patent system rewards not future investors but instead insures 'further commercialization and efficient use of as yet unrealized ideas by patenting them, just as privatizing land will encourage the owner to make efficient use of it.' See Lemley, above n. 33 at 1046.

⁴⁴ To a certain extent, this dilemma is recognized in intellectual property law doctrine. The balance between the protection of the right of present innovators and future talents features strongly in the 'doctrine of improvement' of patent law. What is improvement and what is imitation? Too much freedom to improvers (imitators?) will discourage future development, while granting too much protection to the original parties may halt development of new products. *Id.* (arguing that patent doctrines of blocking-patents and the reverse doctrine of equivalents should apply equally to the realm of copyright law, because the various imperfections in the licensing markets, e.g., transaction costs and strategic behavior, will discourage copyright improvements): 'Some improvements fall within the scope of the preexisting intellectual property right, either because of an expansive definition of that right or because economic or technical necessity requires that the improver hew closely to the work of the original creator in some basic respect. Here, the improver is at the mercy of the original intellectual property owner, unless there is some separate right that expressly allows copying for the sake of improvement' (footnotes omitted). *Id.* at 991.

This process is much more elaborate than that of establishing the physical boundaries of land. There are several reasons for this. Firstly, the scope of a patent is ascertained at different stages, by different decision makers. When a patentee argues that his patent has been infringed, he or she needs to demonstrate that the infringer's patent or use falls within the boundaries of the claimant's prior, protected patent. The initial decision on patent scope is made by the patent claimant.⁴⁵ This decision is subject to the scrutiny of the Patent Office, which verifies whether the claimed invention meets the statutory requirements of novelty, non-obviousness, utility and enablement.⁴⁶ If a patent infringement is litigated, these aspects are re-evaluated by the court.

Secondly, determining the boundaries of a patent is a difficult process, which involves a mixture of difficult questions of fact and interpretations of (often vague) law. The difficulties in determining the exact scope of a patent are illustrated by the notoriously high costs of patent litigation. Moreover, the exact meaning or interpretation of the language in a claim may change over time. Thirdly, while information on land boundaries is always available in public records, patent owners can hide from the public claim language that defines the exact boundaries of a patent.⁴⁷ Finally, the sheer amount of patents complicates the establishment of patent boundaries. It is important to recognize that there is 'no simple "one-to-one" mapping of products and property rights.'⁴⁸ As Merges notes:

A commercially viable product will often be assembled from a number of components. One or more of these components may be covered by IPRs [intellectual property rights], but it is not always true that a complete product will be covered by one, and only one, comprehensive IPR. Complex, multi-component products are the

⁴⁵ Almost universally a patent claim consists of (i) a specification of the invention that describes the problem and solution-process which allows others to reproduce the invention; and (ii) the claim, which specifies the application's proposed scope of the invention and allows delineation of the invention from the existing state of the art.

⁴⁶ See, respectively, 35 U.S.C §§ 102(a), (e), (g); 103; 101; and 112. Similarly, European patent applications must meet the substantive requirements of novelty (not part of the state of the art), involve an inventive step (not obvious to a person skilled in the art), and must be susceptible to industrial application. See Convention on the Grant of European Patents, Oct. 5, 1973, art. 52, 13 I.L.M. 271. For a summary, see G. Tritton, *Intellectual Property in Europe* (London: Sweet & Maxwell 2002) 325 n.68.

⁴⁷ Bessen and Meurer, above n. 10 at 62-64.

⁴⁸ R.P. Merges, 'Intellectual Property Rights and the New Institutional Economics' (1997) 53 *Vanderbilt Law Review* 1857 at 1859 (critiquing the assumption implicit in the neo-classical economic model that 'one, and only one, property right covers the entirety of a marketable product,' *id.*, while pointing out, more generally, the important role of institutions in the coordination of intellectual property rights).

norm in many industries (e.g., autos and consumer electronics), and individual patents often cover only a single component or subcomponent ...[M]ulti-component works are far from uncommon.⁴⁹

The difficulties inherent in determining the boundaries of patents obviously drive up the costs of license negotiations. For, as Mark Lemley states: ‘[I]n order for the parties to divide the gains from trade, they must know what those gains are’.⁵⁰ Partly because of how difficult it is to establish the boundaries of what is to be purchased in a license agreement, transaction costs in technology licenses amount to 20 per cent of the total value of the underlying license.⁵¹

4.3 Patent externalities

If a subsequent innovator has to obtain several licenses, the successful negotiation of patent license agreements is further complicated by the existence of externalities among the different patent right holders. If many different prior innovations play a role, a tragedy of the ‘anticommons’⁵² may

⁴⁹ *Id.*

⁵⁰ Lemley, *Economics of Improvement*, above n. 33 at 1055.

⁵¹ *Id.* at 1053-1054.

⁵² Originally coined by F.I. Michelman, ‘Property, Utility and Fairness: Comments on the Ethical Foundations of “Just Compensation” Law’ (1967) 80 *Harvard Law Review* 1165, Michael Heller revitalized the concept of anticommons property. In an article on the transition to market institutions in contemporary Russia, Heller discussed the intriguing prevalence of empty storefronts. Stores in Moscow were subject to underuse because there were too many owners (local, regional and federal government agencies, Mafia, etc.) holding rights of exclusion. As employed by Heller, the definition of the anticommons as ‘a property regime in which multiple owners hold effective rights of exclusion in a scarce resource,’ provides a powerful tool for property theory. See M.A. Heller, ‘The Tragedy of the Anticommons: Property in the Transition from Marx to Markets’ (1998) 111 *Harvard Law Review* 621 at 639. For a classic treatment of the danger of over-fragmentation, see, e.g., M.A. Heller, ‘The Boundaries of Private Property’ (1999) 108 *Yale Law Journal* 1163 (recognizing a ‘boundary principle’ in property law that purports to prevent excessive fragmentation and criticizing the Supreme Court’s violation of the above principle by way of protecting increasingly minimal property fragments in a recent number of cases). See also M.A. Heller and R. Eisenberg, ‘Can Patents Deter Innovation? The Anticommons in Biomedical Research’ (1998) 280 *Science* 698 (cautioning against the stationary effects of upstream patents on downstream patent markets); D. Lichtman, ‘Property Rights in Emerging Platform Technologies’ (2000) 29 *Journal of Legal Studies* 615 (identifying externalities in emerging markets of platform technology and peripheral sellers); B. Depoorter and F. Parisi, ‘Fair Use and Copyright Protection: A Price Theory Explanation’ (2002) 21

emerge, whereby patent rights are overpriced and consequently remain underused.⁵³

Consider the following formal illustration by Schulz et al.⁵⁴ If two firms each hold a patent in a technology that requires the use of both (complementary) patents, any third party desiring use of the technology will need to obtain access to both patents. Suppose that there is a continuum of such third-party firms where each firm is characterized by its willingness (w) to pay for the use of the two patents. Let w be uniformly distributed across $[0, 1]$. Suppose the patent-holding firm 1 asks a price p_1 for a license to use its patent. Hence the price to be paid to both patent-holding firms is $p_1 + p_2$. All third party firms with a willingness to pay at least such amount will ask for a license from both firms. Given the assumption that on the distribution of the potential licensees the demand for patents is $1 - (p_1 + p_2)$, patent-holding firm 1 has a profit of $p_1 (1 - (p_1 + p_2))$.

There is an analogous expression for firm 2. The decision to set a price for an equilibrium value of both prices is $1/3$ such that both licenses cost $2/3$. Suppose now that both patents are in the hands of just one firm that demands a price of P for a license on both patents. Then the profit of this firm will be $P (1 - P)$.

This profit will be maximized at $P = 1/2$. Hence, fragmentation raises the price for both licenses. This induces some firms not to employ the technology. The result of underuse of a patent derives from a positive externality due to complementary features of the various patents. Neither of the two patent holders captures the full value of their individual decisions for the third party. As such, the various patent holders are faced with a strategic problem, given the interdependence of their decisions. These strategic costs increase the transaction costs involved in bundling the various patent rights required by law to allow the follow-up innovation to proceed. For potential

International Review of Law and Economics 453 (upholding the usefulness – from a strategic costs perspective – of fair use in copyright law in the digital era); T. J. Miceli and C.F. Sirmans, ‘Partition of Real Estate; or, Breaking Up Is (Not) Hard to Do’ (2000) 29 *Journal of Legal Studies* 783 (examining the modern statutory remedy that allows courts to order forced sale of an undivided land under joint ownership).

⁵³ J. Buchanan and Y.J. Yoon, ‘Symmetric Tragedies: Commons and Anticommons’ (2000) 43 *Journal of Law & Economics* 1, demonstrating that the price charged by complementary monopolists is higher than that of a single agent monopolist); N. Schulz, F. Parisi and B. Depoorter, ‘Fragmentation in Property: Towards A General Model’ (2002) 158 *Journal of Institutional & Theoretical Economics* 594 (Proposing that the anticommons deadweight losses are an increasing function in the following three factors: (a) number of property fragments; (b) degree of complementarity of such fragments in subsequent uses; and (c) independence of the pricing of such inputs by the fragmented property owners).

⁵⁴ Schulz, Parisi and Depoorter, above n. 53, at 600-601.

improvers, the transaction costs involved may well outweigh the perceived value of obtaining a license on a prior patent or the follow-up innovation. In the advent of these transaction costs, improvers might choose to forego improvements *ex ante*.⁵⁵

To summarise: While property-rule entitlements may provide an incentive for truly alone-standing pioneering innovations, they may complicate innovations involving original combinations of existing (patented) technology. Overall, this threatens to reduce the rate of innovation.

5 Concluding remarks

As Calabresi and Melamed's classic article explains, courts should rely on property rules when transaction costs are low and parties can negotiate to reach an efficient outcome.⁵⁶ By contrast, if such bargaining is unlikely to succeed, a liability rule enables courts to attempt to achieve efficiency, even in the absence of bargaining. For example, patent market failure might be overcome by imposing compulsory licenses,⁵⁷ for instance by applying conditional property rule regimes, such as those introduced in the *Ebay* decision.

Much of the concern about under-compensation in cases of non-voluntary licensing may well be misplaced. Firstly, as several recent studies indicate, courts regularly unduly deter patent infringements by applying

⁵⁵ Lemley, above n. 33 at 1055.

⁵⁶ I. Ayres and J.M. Balkin, 'Legal Entitlements as Auctions: Property Rules, Liability Rules, and Beyond' (1996) 106 *Yale Law Journal* 703 at 706 n. 9 ('[L]egal scholars have interpreted Calabresi and Melamed to be saying that property rules are more efficient when transaction costs are low.');

J.E. Krier and S.J. Schwab, 'Property Rules and Liability Rules: The Cathedral in Another Light' (1995) 70 *New York University Law Review* 440 at 451 (deeming a 'virtual doctrine' the principle that '[w]hen transaction costs are low, use property rules; when transaction costs are high, use liability rules');

Merges, above n. 5 at 2655 ('Ever since Calabresi and Melamed, transaction costs have dominated the choice of the proper entitlement rule, with a liability rule being the entitlement of choice when transaction costs are high.').

⁵⁷ See J.H. Reichman and C. Hasenzahl, 'Non-voluntary Licensing of Patented Inventions' in UNCTAD/ICTSD, *Capacity Building Project on Intellectual Property and Sustainable Development* (2003) available at <http://www.ictsd.org/pubs/ictsd_series/iprs/CS_reichman_hasenzahl.pdf> (providing an historical perspective, reflections on the TRIPS framework, and a discussion of licensing practices in Canada and the United States).

enhanced damage awards.⁵⁸ Secondly, while it might be correct that courts are ill equipped to estimate the value of a patent license, uncertainty and information costs might similarly trouble private bargaining among patent holders and potential licensees. Finally, liability rules provide follow-up innovators access to prior patents, thereby eliminating some of the detrimental effects that anticommons tragedies have on the progress of the sciences.

⁵⁸ T.F. Cotter 'An Economic Analysis of Enhanced Damages and Attorneys' Fees for Willful Infringement' (2004) 14 *Federal Circuit Bar Journal* 291; United States Federal Trade Commission (2003), *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy*, available at: <http://www.ftc.gov/os/2003/10/innovationrpt.pdf>; K.A. Moore, 'Judges, Juries, and Patent Cases – An Empirical Peek Inside the Black Box' (2000) 99 *Michigan Law Review* 365.