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19 Critical analysis: property rules, liability rules and molecular futures

Bargaining in the shadow of the cathedral

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19.1 Introduction

The chapters in this volume on pharmaceutical development and on the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPRGFA) are oriented toward the use of liability rules to promote innovation. Each describes an attempt to re-align the incentives of innovators by structuring a set of contractual options that will overcome the barriers to investment. In response to the formidable barriers to development of viable pharmaceuticals from private libraries of receptors and ligands, Rai et al. propose the creation of a private molecular “semi-commons” of pooled molecules from which promising drug targets could be tested, and for which a contributor would be paid if a viable product resulted.¹ In a similar vein, Henson-Apollonio reports on the structure of the ITPRGFA, which allows use of genetic resources with the guarantee of a royalty if a contributor’s variety is used.²

A common feature of these systems is a type of conscription mechanism that permits a participant in the system to use intellectual property (IP) without a direct negotiation with the IP owner. Users of an asset are required to pay for their use of the asset; they cannot be refused use of that asset but they control the decision whether to take the asset or not. In other words, owners of the asset have a right to payment, but not a right to exclude. Following the nomenclature developed in the famous Calabresi and Melamed article on ‘Property Rules, Liability Rules, and Inalienability: One View of the Cathedral’, we dub such

¹ Rai, A.K., Reichman, J.H., Uhlir, P.F. and Crossman, C., ‘Pathways across the valley of death: novel intellectual property strategies for accelerated drug discovery’, Chapter 17 of this volume.

² Henson-Apollonio, V., ‘Case 10. The International Treaty on Plant Genetic Resources for Food and Agriculture: the Standard Material Transfer Agreement as implementation of a limited compensatory liability regime’, Chapter 18 of this volume.

payment regimes as ‘liability rules’ as opposed to regimes of exclusivity, or ‘property rules’.³

Yet the incentive structure of these systems employs liability rules with a particular structure, in very particular circumstances. The Rai et al. proposal contemplates a two-stage process of agreement to testing, then the option of payment or further collaboration, depending upon the outcome of such testing. In describing the proposal of Rai and her co-authors, I use the term *option* advisedly, indeed deliberately, as it has economic meaning beyond its colloquial usage to designate a particular type of contract employed in futures markets. One might say that the proposal attempts to construct a type of futures market in molecular options, facilitating trading under the scientific uncertainty of matches between receptors and ligands. And although it may not be immediately obvious, the liability rules schema of the ITPRGFA shares the same features of institutional design.

In this comment, I shall attempt to set in context the characteristics of such liability regimes, particularly the incentive choices that might guide us to choose them or to reject them. In that effort, I draw heavily upon the recent literature analyzing property and liability rules from the standpoint of options and information theory. I begin by briefly reviewing the structure of liability rules and their relationship to the property rules that typically characterize the IP regime. I then turn to the literature analyzing asset entitlements as options, including the very nascent literature on IP and real options. I conclude with some observations regarding the allocative choices that we might make in a proposal like that of Rai et al., including some possibilities not considered in their paper. My goal in all of this is to situate the ITPRGFA and the Rai et al. proposal within both the landscape of property theory and the existing literature.

19.2 Liability in the cathedral

Although we commonly use the term “property” to refer to intellectual and tangible assets, it is exceptionally rare in practice to find a pure property regime in the sense of exclusivity. Property rules are typically subject to a host of exceptions. Easements, takings, compulsory licenses of various sorts tend to overlay and modify property rights, whether in real or IP.⁴ Similarly, pure liability regimes are exceptionally rare;

³ Calabresi, G. and Melamed, A.D., ‘Property Rules, Liability Rules, and Inalienability: One View of the Cathedral’, 85 *Harvard Law Review*, 1972, 1089.

⁴ Burk, D., ‘Muddy Rules for Cyberspace’, 21 *Cardozo Law Review*, 1999, 121.

non-consensual uses are typically limited in time or space, triggered by certain events, subject to some type of reservation or control by the holder of the asset. Property owners typically have the right to exclude all but certain defined classes of users under particular circumstances. Asset owners seldom have complete control over the disposal of the asset, but compulsory licensees seldom have complete freedom as to use.

Recognizing that assets are almost always subject to mixed regimes of exclusive rights and compulsory licensing leads inevitably to a second insight about entitlements: that entitlements to an asset are rarely unified, complete packages; they are more often split among two or more stakeholders. Familiar divisions of entitlements include physical or temporal or situational divisions. A less immediately obvious division under liability rules is a relational division. Liability rules are by definition not exclusive; one party has a right to take, the other has the right to be paid for the taking. Such divided entitlements mean that the different stakeholders must deal with one another in some fashion; they are tied together by their shared rights to the asset.⁵

Additionally, the criteria by which either a property or a liability regime is applied to an asset may differ. The application of either property or liability regimes may be determined by clear, *ex ante* rules, or it may be determined *ex post*, after a taking, according to flexible standards.⁶ The type of legal imperative under which assets are allocated also has implications for the relationships between claimants. The more vague or muddied entitlement criteria are, the more multiple stakeholders will be required to deal with one another, as it will be less clear where one entitlement begins and another ends, or when and how new sets of entitlements might be triggered. Thus the type of legal imperative under which allocations are determined may also be considered as a partition of asset entitlements.⁷

In previous work I have attempted to map the conceptual space defined by these entitlement parameters.⁸ I have argued that a useful visualization of allocation regimes can be plotted along the dimensions of property vs. liability, divided vs. complete, and rules vs. standards entitlements. Each of these dimensions constitutes a separate continuum rather than a binary choice of entitlements, and a given property allocation will have characteristics along each of these dimensions; it may be a liability regime with clear, complete entitlements, or

⁵ Rose, C., 'The Shadow of the Cathedral', 106 *Yale Law Review*, 1997, 2175.

⁶ Rose, C., 'Crystals and Mud in Property Law', 40 *Stanford Law Review*, 1988, 577.

⁷ Johnston, J.S., Bargaining Under Rules Versus Standards, 11 *Journal of Law, Economics and Organizations*, 1995, 256.

⁸ Burk, 'Muddy Rules'.

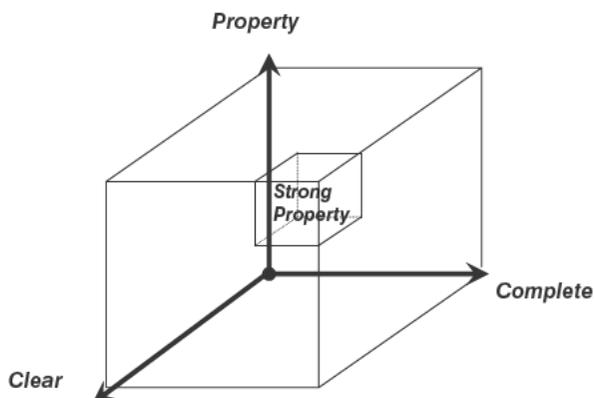


Figure 19.1 Possible entitlements in property law

an exclusive property regime with muddy, divided entitlements, or any of myriad other combinations in the three. If each of these continua is viewed as an axis in a coordinate system, a space of possible property entitlements is mapped, each point within that space representing a different combination of entitlement parameters (as shown in Figure 19.1).

The point of this illustration is that there is a broad range of possible entitlements in property law. The law and commentary on IP are filled with comparisons to the law of tangible property, and typically to the law of real property. These comparisons are frequently not merely uni-dimensional, but a-dimensional; they contemplate a single point in the property regime space that I have mapped out, ignoring the continuum of possible rules and allocations, assuming or asserting that property, by definition, can only constitute the prototypical Blackstonian “sole and despotic” control over a particular good. As I have argued elsewhere, this Blackstonian prototype is an idealized fiction, and often an ideological fiction.⁹ The law of real property in fact has never contemplated a regime of pure exclusivity, but instead incorporates a range of allocative regimes under a variety of labels: easements, takings, nuisance and so on. And indeed, there is an important additional set of dimensions to property allocations that we have not yet considered.

⁹ Burk, D., ‘Legal Consequences of the Cyberspatial Metaphor’ in Consalvo, M., et al. (eds.) *Internet Research Annual Volume 1: Selected Papers From the Association of Internet Researchers Conferences 2000–2002*, New York, Peter Lang.

19.3 Real options in the cathedral

I have so far said little about the placement of allocations between different claimants to the asset. And it is this question of vesting, even more than the nomenclature of liability and property, to which the Calabresi and Melamed article owes its fame. The prototypical negotiation or dispute over an asset contemplates at least two parties to a transfer, although there could well be more. But no matter the absolute number of claimants, there will be at least two classes of claimants to the asset, one of which will hold the entitlement in a given instance and one of which will not. Calabresi and Melamed recognized that as between the two classes of claimants, entitlements may be reciprocal.

A given entitlement can be assigned to either of the classes of claimants. An exclusive entitlement, a property right, could be vested in either of the claimants to an asset – in the case of judicial remedies, issuing an injunction effectively allows the asset owner to exclude others from the asset, while denying the injunction effectively allows the user to take control of the asset. Similarly, a liability rule, a right to be paid, could be vested in either claimant. The asset user might be allowed to take the asset in return for payment to the asset owner, or the asset owner might be allowed to reclaim the asset upon payment to the user for the value of the asset. This reciprocity produces a set of four possible rules, allocating the rights in the asset either exclusively to one party or the other, or under a liability regime to one party or the other.

But the four reciprocal possibilities of the Calabresi/Melamed schema do not define the entire universe of rights assignments. Commentators relatively quickly realized that the incentive structure of liability rules is equivalent to that of a “call” option in futures markets.¹⁰ In the language of options contracts, a call is the right to purchase an asset at a pre-defined price. The contractual price set for the transfer is known as the exercise price. Liability rules, like call options, obligate the owner of the asset to a transfer of all or part of the rights in an asset for a pre-determined price. At the time the transfer is required, neither the price nor the transfer may necessarily be desired by the asset owner, but the transfer is imposed anyway. In the case of bargained-for options, the transfer occurs due to an earlier agreement; in the case of liability rules,

¹⁰ Morris, M., ‘The Structure of Entitlements’, 78 *Cornell Law Review*, 1993, 440; Krier, J. and Schawb, S., ‘Property Rules and Liability Rules: The Cathedral in Another Light’, 70 *NYU Law Review*, 1995, 440.

the transfer may occur due to an agreement or due to the operation of other law, such as a statute.

Liability regimes are of particular use in situations of bilateral monopoly, that is, where the parties can only deal with one another. In the presence of property rules, such situations are expected to produce “holdout” problems, where each party acts strategically to capture all or most of the value of an exchange. Because of the exclusive nature of the property regime, the rights holder can prevent any beneficial use of an asset except on his terms, but the other party may refuse those terms. This may result in a bargaining impasse, where no exchange occurs. The impasse may be especially acute where the valuations of the parties create a large bargaining range, making agreement on a price for exchange prohibitively difficult. The asset goes inefficiently unused as a result.

Liability rules break the impasse by allowing one of the parties to take the asset without the permission of the other party. But of course such a taking will occur only if the party taking the asset is willing to pay the royalty set for the asset. Analyzed under option theory, we may say that the option holder will only exercise the option when his private valuation is higher than the strike price. On average, this is expected to produce efficient returns.¹¹ Importantly, this occurs because the liability structure harnesses the parties’ private information about valuation. It may be difficult to get parties who are behaving strategically to reveal their private valuations, but they can be prompted to act on those valuations under a liability system.

The recognition that liability rules operate as call options raises the possibility that another type of option, the put option, may also be present in the cathedral of asset allocations.¹² A “put” is the right to sell an asset at a pre-defined price. Each type of option contemplates an asset transfer, the terms of which were agreed upon and memorialized in the contract at some previous time. The party subject to the call or the put may no longer necessarily desire the transaction, or may no longer desire the transaction at the exercise price, but is contractually obligated to the transfer anyway. Thus, call options effectively confer the right to force a sale to the option holder; put options effectively confer the right to force a purchase from the option holder.

As I have suggested above, liability rules or call options are well known in the law of real property and chattels, in the form of easements,

¹¹ Kaplow, L. and Shavell, S., ‘Property Rules Versus Liability Rules: An Economic Analysis’, 109 *Harvard Law Review*, 1996, 713.

¹² Ayres, I. ‘Protecting Property with Puts’, 32 *Valparaiso University Law Review*, 1998, 793.

claims of nuisance, and so on. Put options are somewhat more rare in the law, but allocations of rights with the features of a put do occur. Ayres has identified a number of situation in which judicial remedies provide for put-type property allocations.¹³ Typically these involve an election of remedies by the asset owner, either to recover taken property or to be paid the value of the asset. These remedies parallel put options in that the asset owner, rather than the taker, has the election whether to be paid for the taken asset – in effect, to force a sale of the asset whether or not the taker would prefer that outcome to returning the asset. The striking feature of such put options is that they not only create a divided entitlement that will harness the private information of the parties, as a call option would do, but they provide the entitlement holder with more than the value of the asset. The holder of the put is entitled to the value of the asset plus the value of the put, which has an independent worth.

The independent value of the put derives from value of flexibility under future uncertainty. A critical feature of both types of options is the allocation of choice. The choice as to whether the transfer will occur lies with the option holder. Thus options will have a two-stage allocative and temporal structure. In the first stage, the option holder is given, or decides whether to acquire the option. In the second, later stage, the option holder decides whether to exercise the option. The second-stage, future choice to give up an asset and require payment for an asset, or to take an asset and pay for it at the exercise price, has present value, quite literally the value of keeping one's options open until the future situation becomes more certain.

19.4 Options in IP law

I have argued that if one is to make analogies between IP and tangible property, then the full range of allocative systems in tangible property ought to be part of such an analogy, not the idealized view of exclusivity that some commentators would selectively import into the consideration of IP. Options analysis has become well established in the law of real property and chattels, and so by my argument deserves consideration in regard to IP as well. Do such options exist in the law of IP? In particular, given the theme of this volume, do they exist in patents and related systems of proprietary rights? And if they do not, should they?

¹³ Ayres, 'Protecting Property', 800.

The first place to look for options, particularly call options, in IP, is where there are functioning liability rules, as we have seen that liability rules function like call options. Liability rules in IP are most often associated with copyright: for example with the compulsory licensing schemes for music, or with user privileges and exceptions like fair use, that are essentially a compulsory license at a zero royalty.¹⁴

But in the US, patents are largely devoid of formal liability rules. Compulsory licenses in the US statute itself are quite rare, limited to a handful of provisions governing civilian nuclear technology, certain particulate emissions technologies, or medical procedures.¹⁵ In other countries, compulsory licensing for many types of patentable subject matter were fairly common, but such liability systems have been limited by the requirements of the WTO TRIPs Agreement. Prior user rights, which are available in many countries but are limited in the US, are also effectively a type of compulsory license at a zero royalty.

But the fact that liability rules act as “call” options does not mean that all call options are liability rules. Carroll has noted that the patent system effectively includes call-type options in the maintenance fees required to keep a patent in force. Patents lapse without payment of these fees.¹⁶ Patent holders have in essence an option to buy the next increment of patent protection, at a set price, by paying the fee.

Call options on patents can also be created by courts. In the US, liability regimes are occasionally created as judge-made law, in the context of remedies to infringement suits. Courts have in a very few instances denied injunctive relief to patent holders in favor of monetary damages, effectively creating a compulsory license for that patent, at a royalty determined by the court.¹⁷ Such cases have typically involved patents drawn to essential technologies – such as municipal sewage treatment – that would precipitate a public health crisis if enjoined. Preliminary injunctive relief requires such consideration of the public interest, and the Supreme Court has recently re-emphasized that permanent injunctions are subject to equitable considerations.¹⁸ So the door remains open for purely monetary remedies, but denying a patent holder the right to exclude will likely remain unusual.

In addition, Hausman et al. have employed the methodology of options analysis in critiquing the effects of certain patent infringement

¹⁴ 17 USC §§ 107, 110, 115. ¹⁵ 35 USC §§ 287, 2183; 42 USC § 7608.

¹⁶ Carroll, M., ‘One for All: The Problem of Uniformity Cost in Intellectual Property Law’, Villanova Law/Public Policy Research Paper No. 2005–17, October 11, 2005, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=820308

¹⁷ *City of Milwaukee v. Activated Sludge*, 69 F.2d 577 (7th Cir. 1934).

¹⁸ *eBay, Inc. v. MercExchange, L.L.C.*, 126 S. Ct. 733 (2005).

decisions by the US Court of Appeals for the Federal Circuit regarding lost profit damages.¹⁹ In recent cases, the Federal Circuit has held that if a non-infringing technology was hypothetically available to an accused infringer, then lost profit damages are unavailable to the patent holder, because the infringer could have substituted the non-infringing technology, sold the same output, and reaped the same profits. This holding effectively confers on the alleged infringer an option on patent damages in situations where a substitute to the patented technology was hypothetically available. If the alleged infringer chooses to use the patented technology, and the patent is held valid or unenforced in an enforcement action, then the alleged infringer pays nothing. If the patent is found to be valid and infringed, the infringing company can switch to a non-infringing technology and pay damages equal to a reasonable royalty, essentially what the infringer would have paid for a license initially.

This approach to patent damages shows how the decision whether to infringe or not can be modelled in the familiar two-stage option. The alleged infringer initially decides in the first stage whether to use the patented technology; if a lawsuit ensues and the patent is held valid, then the accused infringer can switch to the substitute technology and pay a reasonable royalty. This means the accused infringer can effectively defer the costs of adopting the substitute technology until after the patent validity has been litigated – after uncertainties have been resolved. The option to wait and decide whether to adopt the substitute technology after uncertainties are resolved has value that accrues to the infringer since the cost of acquiring the option is no more than the infringer would have paid for a license to the patented technology anyway.

Despite the movement toward analysis of call options in patent law, virtually nothing has been said to date about put options in patent law. If call options are rare in the patent system, put options are even rarer – although this should come as no surprise, given that they are relatively rare in the law of real property and chattels as well. But the US patent system does include at least one put mechanism, in the form of the Statutory Invention Registration (SIR), which allows inventors to publish enabling descriptions of an invention without receiving a patent, placing the invention into the public domain.²⁰ This is effectively a put

¹⁹ Hausman, J., et. al. 'Patent Damages and Real Options: How Judicial Characterization of Non-Infringing Alternatives Reduces Incentives to Innovate', 22 *Berkeley Technology Law Journal*, 2007, 825.

²⁰ 35 USC § 157.

at an exercise price of zero – the holder of the technology can essentially require the public to take the invention, electing not to hold it as a trade secret or pursue a patent.

19.5 Contracting into options

Although recognizable liability rules may be sparse in the law of IP, the kind of analyses performed by Carroll and by Hausman et al. demonstrates how options theory may be useful in assessing legal incentives to innovation. The liability systems considered here require us to go a step further, as they contemplate arrangements beyond existing statutes or judicial remedies. Both the ITPRGFA as described by Henson-Appollonio and the “semi-commons” pooling arrangement proposed by Rai et al. may be viewed as attempts to set up an exchange, in the institutional sense of that word. We are familiar with other more obvious exchange institutions; with securities exchanges directed toward the trading of stocks and other financial instruments; or with commodities exchanges, directed toward the trading of food-stuffs or raw materials. Such exchanges set the rules and parameters for trade between parties that ostensibly wish to exchange real or financial assets.

But it is critical to understand that such institutions are in fact contract exchanges, where the primary goods traded are promises to deliver certain properties at a certain price. Such promises may be current, intended for immediate execution, or they may be options intended for execution at some later date. It is not in fact securities or commodities that change hands in such exchanges; they are the basis for the promises, but it is the exchange of promises that is the point of the institution. Moreover, the exchange of contracts is subject to contract; traders in a given exchange contractually agree to certain rules governing buying and selling within the exchange. These contracts structure the transaction environment; in effect they lower the transaction costs for trading, and create a contractually defined marketplace.

The ITPRGFA and small-molecule proposal contemplate the same arrangement: defining a marketplace according to certain contractually agreed upon rules, in order to lower the transaction costs for trades. This is especially striking in the case of the Rai et al. proposal: it is not merely information about biological and chemical molecules that is exchanged within their contractual marketplace, it is a set of promises, as to what may be done, what price will be paid and under what conditions, that is exchanged within their pooling arrangement. The standardized exchange structure is necessary due to the high transaction

costs first, of bargaining under uncertainty regarding the receptor/ligand combinations tested; and second, strategic behaviours of the parties who hold physical title to the molecular pairs.

Additionally, the agreements within the shelter of the exchange structure are drafted under uncertainty, contemplating different outcomes depending on the results of testing. Uncertainty dictates the contingent nature of such promises; the parties may or may not exercise their contractual options depending on the outcome of test results that cannot be known at the time the contract is drafted. We have seen that options are desirable to harness the private information of parties to a bargain. The proposal of Rai et al. facilitates information exchange in the physical sense that certain molecules will be found to react optimally with certain targets. But this is intertwined with information forcing regarding the parties' valuation of the asset, or their willingness to pay for the asset. Private valuation is of course profoundly affected by information about the asset, in this case chemical and physiological information that is privately held by each of the parties and unavailable to the other.

Call options are well suited to such bargaining under future uncertainty, but we have seen that they are not the only tool available to facilitate innovative exchange where the parties stand in bilateral monopoly, and bilateral monopolies characterize the small molecule market place – one party holds materials, and information about materials, that will physically interact with materials held by the other. The possibility of adding put options to the suite of property entitlements in this situation is particularly interesting for the Rai et al. pharmaceutical research proposal. Ayres has noted that under *ex ante* conditions, put options can increase a rights holder's expected payoff from bargaining above that which would be expected under a pure property regime, without reducing what the other party to the bargain would expect.²¹ That is to say, when assessing the parties' expected payoff before they acquire information about the value of the resource they hold, puts can raise the level of payoff a party expects from an exchange.

This means that put options may be an attractive mechanism to employ where it is desirable to encourage investment in the resource held by the rights holder. If at the time of investing, the holder of a put option does not know her expected value, she does know that the put will have at least the value of the property. And, because the put gives the holder the entitlement plus the value of the put, the holder should be willing to invest up to the level of the larger expected payoff. Given

²¹ Ayres, 'Protecting Property', 805.

that the problem Rai et al. address is precisely a problem about *ex ante* investment, about deciding what to invest before the value of a small molecule compound is known, puts may be appropriate to consider.

19.6 Conclusion

I have argued that the liability systems found in the ITPRGFA and the pharmaceutical testing proposal of Rai et al. can be viewed as establishing essentially a type of commodities exchange, which in turn suggests that these systems may be fruitfully analyzed by application of option analysis. The chapters to which this comment is directed contemplate liability regimes for IP exchange, but the place of liability rules in the cathedral of asset entitlements can only be understood by reference to the place of other regimes in the cathedral. Option analysis provides an excellent window through which to view these relationships. While there has been to date relatively little application of option analysis to IP, the sizeable body of literature applying option analysis to real property suggests the range of entitlement allocations that might be contemplated. In the present context, option analysis clarifies the structure of the liability regimes discussed in the previous chapters, and suggests additional arrangements, such as “put” rules, that might be worth exploring.

I have directed my comments to discussion of the ITPRGFA and the pharmaceutical development proposal, but of course a similar view could be taken of virtually all the species of “clearinghouse” mechanisms reviewed in this volume. Virtually all of them attempt to create exchange environments via contractual structures aimed at lowering transaction costs. Previous commentary on patent pools, performance societies and the other mechanisms in this volume have suggested that if property rights are granted, clearinghouse mechanisms through a process of “contracting into liability rules”.²² Yet the transaction costs of such contracts may be substantial, deterring such exchanges from forming. Transactions costs of contracting can be significantly lowered by the availability of standardized contracts, which is in essence what institutional exchanges provide.²³ Such a “nexus of contracts” has been identified as providing a lower cost transaction environment than

²² Merges, R., ‘Contracting Into Liability Rules: Intellectual Property Rights and Collective Rights Organizations,’ 84 *California Law Review*, 1996, 1293.

²³ Hillman, R. and Rachlinsky, J., ‘Standard-Form Contracting in the Electronic Age’, 77 *NYU Law Review*, 2002, 429.

open market transactions.²⁴ Once established, the rules of institutional exchanges may in essence allow asset owners to “contract into contracting into liability rules”. And once within the shelter of an institutional structure, the diversity of possible rights allocations provides a rich diversity of option structures to prompt investment and exchange.

REFERENCES

- Ayres, I. ‘Protecting Property with Puts’, *32 Valparaiso University Law Review*, 1998, 793.
- Burk, D., ‘Muddy Rules for Cyberspace’, *21 Cardozo Law Review*, 1999, 121.
- Burk, D., ‘Legal Consequences of the Cyberspatial Metaphor’, in Consalvo, M., et al. (eds.) *Internet Research Annual Volume 1: Selected Papers From the Association of Internet Researchers Conferences 2000–2002*, New York, Peter Lang.
- Burk, D. and McDonnell, B., ‘The Goldilocks Hypothesis: Balancing Intellectual Property Rights at the Boundary of the Firm’, *2006 University of Illinois Law Review*, 2006, 275.
- Calabresi, G. and Melamed, A. D., ‘Property Rules, Liability Rules, and Inalienability: One View of the Cathedral’, *85 Harvard Law Review*, 1972, 1089.
- Carroll, M., ‘One for All: The Problem of Uniformity Cost in Intellectual Property Law’, Villanova Law/Public Policy Research Paper No. 2005–17, October 11, 2005, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=820308
- Hauseman, J. et. al., ‘Patent Damages and Real Options: How Judicial Characterization of Non-Infringing Alternatives Reduces Incentives to Innovate’, *22 Berkeley Technology Law Journal*, 2007, 825.
- Henson-Apollonio, V., ‘Case 10. The International Treaty on Plant Genetic Resources for Food and Agriculture: the Standard Material Transfer Agreement as implementation of a limited compensatory liability regime’, Chapter 18 of this volume
- Hillman, R. and Rachlinsky, J., ‘Standard-Form Contracting in the Electronic Age’, *77 NYU Law Review*, 2002, 429.
- Johnston, J. S., ‘Bargaining Under Rules Versus Standards’, *11 Journal of Law, Economics and Organizations*, 1995, 256.
- Kaplow, L. and Shavell, S., ‘Property Rules Versus Liability Rules: An Economic Analysis’, *109 Harvard Law Review*, 1996, 713.
- Krier, J. and Schwab, S., ‘Property Rules and Liability Rules: The Cathedral in Another Light’, *70 NYU Law Review*, 1995, 440.
- Merges, R., ‘Contracting Into Liability Rules: Intellectual Property Rights and Collective Rights Organizations’, *84 California Law Review*, 1996, 1293.

²⁴ Burk, D. and McDonnell, B., ‘The Goldilocks Hypothesis: Balancing Intellectual Property Rights at the Boundary of the Firm’, *2006 University of Illinois Law Review*, 2006, 275.

- Morris, M., 'The Structure of Entitlements', **78** *Cornell Law Review*, 1993, 440.
- Rai, A. K., Reichman, J. H., Uhler, P. F. and Crossman, C., 'Pathways across the valley of death: novel intellectual property strategies for accelerated drug discovery', Chapter 17 of this volume
- Rose, C., 'The Shadow of the Cathedral', **106** *Yale Law Review*, 1997, 2175.
- 'Crystals and Mud in Property Law', **40** *Stanford Law Review*, 1988, 577