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Analyze This: A Law and Economics Agenda for the Patent System

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Analyze This: A Law and Economics Agenda for the Patent System

*Rebecca S. Eisenberg**

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Patent law as a field of academic study has benefited enormously from the attention of economists. Indeed, law professors are relative newcomers to the academic patent field, trickling in behind the economists in small but growing numbers as patent law evolves from an arcane, practitioner-taught specialty to a less marginal role in law school curriculums.¹ Yet considering the prominence of economists in academic discourse about the patent system, they have had relatively little impact on patent law and policy. One reason for this disparity between the role of economists in the academy and in policy arenas may be the indeterminacy of economic analysis

* Robert & Barbara Luciano Professor of Law, University of Michigan Law School. © Rebecca S. Eisenberg 2000. I am grateful to Ronald Mann and workshop participants at Vanderbilt Law School for helpful comments on earlier versions of this Article.

1. The number of full-time law school faculty members who teach and write in the patent field has increased significantly in the past twenty years. Notable examples of legal scholars writing in the field prior to that time include Martin Adelman, Donald Chisum, James Gambrell, Edmund Kitch, and John Stedman.

in evaluating the patent system.² Another reason may be a failure on the part of some economists to focus their analysis on the kinds of decisions that courts and policy-makers confront in the course of administering and fine-tuning the patent system.

This is a missed opportunity of more than academic significance. The pros and cons of the patent system are getting more attention right now than they have in many years. By some measures, the patent system appears to be in ascendancy, expanding into previously hostile regions of the world,³ previously patent-free fields of endeavor,⁴ and previously nonproprietary research settings.⁵ Yet the patent system is provoking controversy along the way, as skeptics question whether these patents are on balance promoting technological progress or retarding it.⁶ Interest in pat-

2. See generally WESLEY M. COHEN ET AL., PROTECTING THEIR INTELLECTUAL ASSETS: APPROPRIABILITY CONDITIONS & WHY U.S. MANUFACTURING FIRMS PATENT (OR NOT), (National Bureau of Econ. Research Working Paper No. 7552, 2000) (concluding on basis of survey results that "patents are used in substantially different ways across different technologies, suggesting that policy and court decisions affecting the breadth of claims, applicable nonobviousness standards, likelihood of being upheld in court and other features of patents will likely have different impacts on invention and competition in different industries"); ADAM B. JAFFE, THE U.S. PATENT SYSTEM IN TRANSITION: POLICY INNOVATION AND THE INNOVATION PROCESS (National Bureau of Econ. Research Working Paper No. 7280, 1999) (reviewing economics literature on recent trends in patent law and concluding that "robust conclusions regarding the empirical consequences for technological innovation of changes in patent policy are few").

3. See generally Martin J. Adelman & Sonia Balda, *Prospects and Limits of the Patent Provision in the TRIPS Agreement: The Case of India*, 29 VAND. J. TRANSNAT'L L. 507 (1996) (providing an appraisal of India's patent law).

4. See generally Symposium, *Intellectual Property Rights in Methods of Doing Business*, 10 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 1 (1999) (considering the extent to which business methods should be protected by intellectual property laws); SAMUEL KORTUM & JOSH LERNER, STRONGER PROTECTION OR TECHNOLOGICAL REVOLUTION: WHAT IS BEHIND THE RECENT SURGE IN PATENTING? (National Bureau of Econ. Research Working Paper No. 6204, 1997) (examining possible causes of recent surge in U.S. patenting); JOSH LERNER, WHERE DOES STATE STREET LEAD? A FIRST LOOK AT FINANCE PATENTS, 1971-2000 (National Bureau of Econ. Research Working Paper No. W7918, 2000) (documenting increase in patenting of financial formulas and methods).

5. See generally Rebecca S. Eisenberg, *Public Research and Private Development: Patents and Technology Transfer in Government-Sponsored Research*, 82 VA. L. REV. 1663 (1996) (reviewing history of federal policy concerning intellectual property rights in the results of government-sponsored research); REBECCA HENDERSON ET AL., UNIVERSITIES AS A SOURCE OF COMMERCIAL TECHNOLOGY: A DETAILED ANALYSIS OF UNIVERSITY PATENTING, 1965-1988 (National Bureau of Econ. Research Working Paper No. 5068, 1995) (discussing the "explosion in university patenting"); ADAM B. JAFFE & JOSH LERNER, PRIVATIZING R&D: PATENT POLICY AND THE COMMERCIALIZATION OF NATIONAL LABORATORY TECHNOLOGIES (National Bureau of Econ. Research Working Paper No. 7064, 1999) (examining impact of changes in U.S. law on patenting at national laboratories funded by U.S. Department of Energy).

6. See, e.g., Rechelle Cooper Dreyfuss, *Are Business Method Patents Bad for Business?*, 16 SANTA CLARA COMPUTER & HIGH TECH. L.J. 263, 265 (2000); Jon F. Merz et al., *Disease Gene Patenting Is a Bad Innovation*, 2 MOLECULAR DIAGNOSIS 299 (1997); Pamela Samuelson, Benson

ents has become sufficiently widespread to command the attention of busy world leaders,⁷ as well as prominent treatment in the popular press.⁸ In this environment, policy-makers are particularly likely to be receptive to scholarly input aimed at ensuring that the patent system does less harm than good.

Legal scholars and economists might enhance the value and impact of their work by making more effective use of each other's knowledge and capabilities. Legal scholars can offer a more nuanced understanding of the legal rules that underlie the patent system and the doctrinal levers that might be manipulated in furtherance of public policy goals. Economists bring to bear a set of analytical and methodological tools that could shed considerable light on what these doctrinal levers are doing and which of them we ought to be manipulating. Together, we have a better chance of asking the right questions and thinking about them in a useful way.

Towards that end, this Essay provides an overview of issues of patent doctrine that might be illuminated by good work in law and economics. It is important not only to identify the levers in the patent system that are available for manipulation, but also to understand which policy choices are best addressed through the manipulation of each of these levers. Economic analysis that is grounded in a better understanding of patent doctrine can better inform us about the most effective use of the levers that control the operation of the patent system.

I. SUBJECT MATTER BOUNDARIES

A much-noted dimension of the apparent expansion of the patent system in recent years has been the range of patent-eligible subject matter. Once confined to traditional fields of applied technology such as mechanics and chemicals, the patent system has

Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions, 39 EMORY L.J. 1025, 1029-30 (1990).

7. See e.g., President Bill Clinton & Prime Minister Tony Blair, Joint Statement (March 14, 2000), available at <http://www.pub.whitehouse.gov/uri-res/12R?urn:pd:oma.eop.gov.us/2000-3/14/7.text.1> ("To realize the full promise of this research, raw fundamental data on the human genome, including the human DNA sequence and its variations, should be made freely available to scientists everywhere."); Asako Saegusa, *Japan May Place Gene Research on Summit Agenda*, 404 NATURE 324 (2000).

8. See e.g., James Gleick, *Patently Absurd*, N.Y. TIMES, Mar. 12, 2000, § 6 (Magazine), at 44.

moved into agriculture,⁹ medical procedures,¹⁰ computer software,¹¹ and business methods.¹² The expansion has occurred largely through judicial decisions and administrative practice, with changes in statutory language typically following, rather than leading, the way.¹³ As commentators have questioned whether living things, computer algorithms, and business methods are appropriate subject matter for patents, the courts in these and other areas have seen no reason to limit the patent system's realm.

Why does the patent system need subject matter boundaries? What light can economics shed on the risks of the expansion of patent-eligible subject matter that seems to be underway? Perhaps subject matter boundaries preserve the integrity of patent law as a one-size-fits-all system, ensuring that the kinds of innovations the law protects are similar enough that a single set of rules is a reasonable approximation of how best to promote progress throughout its domain. Yet economists have demonstrated empirically that the role of patents varies greatly from one industry to another.¹⁴ A set of rules that works tolerably well for machines or drugs may not work as well for information products, business methods, and dis-

9. See generally *Ex parte* Hibberd, 227 U.S.P.Q. (BNA) 443 (1985) (considering a matter "relat[ing] to maize plant technologies").

10. See generally *Allergan Sales, Inc. v. Pharmacia & Upjohn, Inc.*, 41 U.S.P.Q.2d (BNA) 1283 (S.D. Cal. 1996) (reviewing a claim of infringement for a patent that "include[d] a method of implantation of an artificial intraocular lens having a deformable optic zone portion with prescribed memory characteristics").

11. See generally *AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352 (Fed. Cir. 1999) ("[I]t is now clear that computer-based programming constitutes patentable subject matter so long as the basic requirements of [35 U.S.C.] § 101 are met."); *In re Alappat*, 33 F.3d 1526 (Fed. Cir. 1994) (concluding that a programmed computer could be entitled to patent protection).

12. See generally *State Street Bank & Trust Co. v. Signature Fin. Group Inc.*, 149 F.3d 1368 (Fed. Cir. 1998) (extending patent protection to a business method).

13. The patent statute has defined patent-eligible subject matter in the same terms (process, machine, manufacture, or composition of matter) for many years. Nonetheless, when the U.S. Patent and Trademark Office ("PTO") and the courts have permitted patenting of inventions in areas that previous case law had seemed to exclude from patent protection, Congress has sometimes responded by adding statutory provisions that are addressed specifically to these new fields, arguably endorsing the judicial expansion. For example, controversy over the patenting of medical and surgical methods led Congress to enact new legislation specifying that the remedies for patent infringement shall not apply to medical practitioners and related health entities for performance of a medical activity. See Pub. L. No. 104-208, § 101(a), 110 Stat. 3009-16 (codified at 35 U.S.C. § 287(c) (1994 & Supp. IV)). More recently, Congress responded to controversy over the patenting of business methods by enacting new legislation that provides a defense to infringement of business method patents for prior users of those methods. See Pub. L. No. 106-113, § 1000(a)(9), 113 Stat. 1536 (codified at 35 U.S.C. § 273 (1994)).

14. See Richard Levin et al., *Appropriating the Returns from Industrial R&D*, in 3 BROOKINGS PAPERS ON ECON. ACTIVITY 783 (Martin Neil Baily & Clifford Winston eds., 1987); Edwin Mansfield, *Patents and Innovation: An Empirical Study*, 32 MANAGEMENT SCIENCE 173 (1986); COHEN ET AL., *supra* note 2

coveries about the natural world. In the give-and-take of public policy, Congress has sometimes mediated conflicts between industries that disagree about proposed changes in patent law by carving out special rules for particular fields.¹⁵ Conflict across fields is likely to increase as the subject matter of the patent system expands.

The trend of authority in the Court of Appeals for the Federal Circuit is to exclude from the ambit of the patent system only useless abstractions.¹⁶ Perhaps economic analysis can improve upon this approach. Economics might shed light on whether there are categories of useful discoveries that are best left outside the patent system, or clarify what differences or similarities among fields determine whether they can live together under a single legal regime. More generally, economists might illuminate the tradeoffs between the costs and benefits of applying a single set of rules across all fields of technology.

II. UTILITY

Another doctrinal lever that has received more attention in policy arenas than in academic discourse is the utility requirement. To be patentable, an invention must be useful. This requirement, which arguably follows from the constitutional limitation of patent protection to the "useful arts,"¹⁷ appears twice in the Patent Act.¹⁸

Although the utility requirement has played little role in evaluating the patentability of mechanical inventions,¹⁹ it has been more prominent in the chemical and biotechnology fields, in which new compounds are often discovered before their functions are well

15. See, e.g., Act of Nov. 1, 1995, Pub. L. No. 104-41, § 1, 109 Stat. 351 (codified at 35 U.S.C. § 103(b)(1994)) (providing that a biotechnological process using or resulting in a composition of matter that is novel and nonobvious shall be considered nonobvious); see also *supra* note 13 (noting how Congress has responded to certain controversies over patenting).

16. See *AT&T Corp.*, 172 F.3d at 1357-58.

17. U.S. CONST. art. I, § 8, cl. 8.

18. See 35 U.S.C. § 101 (1994). Section 101 of the Patent Act, in defining patent-eligible subject matter, states that "whoever invents or discovers any new *and useful* process, machine, manufacture or composition of matter . . . may obtain a patent therefor." *Id.* (emphasis added). Section 112, which sets forth the disclosure requirements for a patent application, calls for a description that is sufficient to enable others "to make *and use*" the invention. *Id.* § 112 (emphasis added).

19. For mechanical inventions, the utility requirement serves primarily as a convenient ground for rejecting claims to implausible inventions such as perpetual motion machines. See, e.g., *Newman v. Quigg*, 877 F.2d 1575, 1577-82 (Fed. Cir. 1989). It has also occasionally been invoked as a basis for excluding from patent protection inventions that are deemed immoral or fraudulent. See, e.g., *Rickard v. Du Bon*, 103 F. 868, 870-73 (2d Cir. 1900).

understood.²⁰ In the early 1990s, to the consternation of the patent-sensitive biotechnology and pharmaceutical industries, the Patent & Trademark Office ("PTO") began rejecting for lack of utility patent claims to inventions of potential therapeutic value if the patent applicant could offer no proof of clinical efficacy.²¹ This strict interpretation of the utility requirement ultimately provoked sharp rebuke from the Federal Circuit²² and led to the implementation of new utility guidelines aimed at restricting utility rejections.²³

More recently, the PTO has sought to reinvigorate the utility requirement as a ground for rejecting claims to novel DNA sequences for which the applicant has not disclosed a biological function. The PTO has issued new interim guidelines on the utility requirement²⁴ and new training materials for examiners on how to apply the requirement to biotechnology inventions.²⁵ These guidelines and training materials have been met with sharply divergent reactions among commentators²⁶ and have been addressed in congressional oversight hearings.²⁷ Plainly, the consequences of choosing a strict or loose interpretation of the utility requirement are sufficient to motivate high-level attention to the issue among policymakers. Yet it remains unclear why the patent system has a utility requirement and how we should think about what is at stake in choosing between strict or lax enforcement.

The courts treat the utility requirement as a hybrid subject matter limitation and disclosure requirement.²⁸ As a subject matter limitation, it restricts the patent system to the "useful arts"—in other words, applied technology—as distinguished from abstract

20. See e.g., *Brenner v. Manson*, 383 U.S. 519, 528-36 (1966).

21. See, e.g., *Ex parte Aggarwal*, 23 U.S.P.Q.2d (BNA) 1334, 1335-39 (Bd. Pat. App. & Interf. 1992); *Ex parte Sudilovsky*, 21 U.S.P.Q.2d (BNA) 1702, 1703-05 (Bd. Pat. App. & Interf. 1992); *Ex parte Balzarini*, 21 U.S.P.Q.2d (BNA) 1892, 1894 (Bd. Pat. App. & Interf. 1991).

22. See *In re Brana*, 51 F.3d 1560, 1565-69 (Fed. Cir. 1995).

23. See PTO, Guidelines for Examination of Applications for Compliance with the Utility Requirement, 60 Fed. Reg. 36263, 36264 (1995).

24. See PTO, Revised Interim Utility Examination Guidelines, 64 Fed. Reg. 71440, 71441 (1999), corrected 65 Fed. Reg. 3425 (2000).

25. See PTO, Revised Interim Utility Guidelines Training Materials, available at <http://www.uspto.gov/web/menu/pats.html>.

26. See PTO, Public Comments on the United States Patent and Trademark Office, "Revised Interim Utility Examination Guidelines," available at <http://www.uspto.gov/web/offices/com/sol/comments/utilguide/index.html>.

27. See *Oversight Hearing on Gene Patents and Other Genomic Inventions Before the Subcomm. on Courts and Intellectual Property of the House Comm. on the Judiciary*, 106th Cong. (2000).

28. This treatment follows the two statutory references to utility in provisions addressing subject matter and disclosure. See 35 U.S.C. §§ 101, 112 (1994).

knowledge.²⁹ As a disclosure limitation, it calls upon patent applicants to teach the public how to use their inventions as well as how to make them.

Another possible way of understanding the utility requirement is as a timing device, helping to identify when an invention is ripe for patent protection. This understanding finds support in language from the last Supreme Court case to address the utility requirement, *Brenner v. Manson*.³⁰ In that case the Court affirmed a rejection of a patent claim for a method of synthesizing a novel steroid on the ground that the patent applicant had failed to disclose a practical utility for the steroid. Conceding that further research might reveal such a utility, the Court observed that "a patent is not a hunting license . . . it is not a reward for the search, but compensation for its successful conclusion."³¹ More recent decisions of the Federal Circuit suggest a willingness to issue patents at an earlier stage in the research process. For example, in *In re Brana* the Federal Circuit reversed a rejection of claims to novel compounds that were structurally similar to other compounds displaying antitumor activity in mice.³² While recognizing that further research would be necessary before the compounds could be administered to humans, the court held that "[u]sefulness in patent law, and in particular in the context of pharmaceutical inventions, necessarily includes the expectation of further research and development."³³ The Federal Circuit did not cite the Supreme Court's decision in *Brenner v. Manson*, and it is not obvious how the two cases can be reconciled.

Economic analysis could illuminate what is at stake in this debate by clarifying the implications of granting or withholding patent protection in early stages of research. Some years ago, Edmund Kitch offered an intriguing account of the function of patents that contrasted sharply with the Supreme Court's vision in *Brenner v. Manson*.³⁴ Kitch argued that granting broad patent rights in the early stages of innovation promotes efficiency in the further development of promising technological prospects, much like the award of exclusive mineral claims promotes efficiency in the exploration of

29. See generally *In re Ruschig*, 343 F.2d 965, 970 (1965) (asserting "that a patent system must be related to the world of commerce rather than to the realm of philosophy").

30. *Brenner v. Manson*, 383 U.S. 519 (1966).

31. *Id.* at 536.

32. *In re Brana*, 51 F.3d 1560 (1995).

33. *Id.* at 1565-69.

34. See Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977).

natural resources. Economists were skeptical of his arguments at the time he published them.³⁵ Meanwhile, the PTO has alternated between very strict and very lax enforcement of the utility standard, with no clear policy basis for choosing one approach over another. The choice makes a big difference to universities and some private firms that specialize in "upstream" research that is removed from end product development. Perhaps it is time for economists to revisit the question of when discoveries are ripe for patent protection.

III. NOVELTY

Perhaps the most basic limitation on access to the patent system is that one may only patent something that is new. This is so easily justified in intuitive economic terms that it might seem hardly to merit the attention of anyone with sophisticated training in economics. Granting patents on technologies that are not new would impose the social costs of monopolies without the countervailing benefits of promoting development and introduction of welfare-enhancing inventions. Why, then, is the novelty standard a worthy topic for economic analysis?

What is "new" or "novel" for patent purposes is a function of how patent law defines the content of the "prior art." The categories of references that count as prior art are set forth in section 102 of the Patent Act, a Byzantine set of rules at the core of the patent system that economists have largely neglected. The most important sources of prior art are those that are readily accessible to patent examiners, primarily prior patents and printed publications.³⁶ Other statutory categories of prior art, including technologies that were previously invented,³⁷ known, or used by others,³⁸ are less likely to come to the attention of the PTO at the time of examination, but may be invoked in challenging the validity of an issued

35. See, e.g., F.M. SCHERER, *THE ECONOMIC EFFECTS OF COMPULSORY PATENT LICENSING* 9-10 (1977).

36. See 35 U.S.C. §§ 102(a), 102(b) (1994).

37. Under § 102(g) of the Patent Act, an invention fails the test of novelty if "before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it." *Id.* § 102(g).

38. Section 102(a) provides that an invention fails the test of novelty if "the invention was known or used by others in this country . . . before the invention thereof by the applicant for patent." *Id.* § 102(a). Section 102(b) bars issuance of a valid patent if "the invention was . . . in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States." *Id.* § 102(b).

patent years later in an infringement action.³⁹ In order to defeat a patent for lack of novelty, it is necessary to find every element of the claimed invention present in a single reference.⁴⁰ If it is necessary to combine the disclosures of multiple references to find all of the elements of the invention, the basis for challenging the patent is not lack of novelty but rather "obviousness,"⁴¹ and further limitations apply.⁴²

These basic rules are now quite old, but one might nevertheless ask whether this approach makes sense. One set of questions worth exploring is how a proliferation of information in digital form might alter the inquiry into what is new. For example, is the "all elements rule" outmoded in the modern information environment, with search engines to facilitate the rapid consolidation of information from multiple sources?⁴³ Another promising line of inquiry would focus on the allocation of responsibility and opportunity for identifying patent-defeating prior art between the PTO and the public. Currently, before a patent is issued we rely on PTO examiners to identify relevant prior art, aided only by the disclosures of patent applicants, in the course of confidential ex parte patent examinations.⁴⁴ Once a patent has been issued, any person may cite prior art references to the PTO that may have a bearing on patentability and ask that the claims be reexamined.⁴⁵ A defendant in an infringement action may also challenge the patentability of the in-

39. An issued patent enjoys a presumption of validity. See 35 U.S.C. § 282 (1994 & Supp. IV 1998). This presumption, however, may be overcome by clear and convincing evidence. See *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1565 (Fed. Cir. 1987).

40. See e.g., *In re Donohue*, 766 F.2d 531, 534 (Fed. Cir. 1985).

41. Section 103(a) of the Patent Act provides:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole *would have been obvious* at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

35 U.S.C. § 103(a) (1994 & Supp. IV 1998) (emphasis added).

42. The technological scope of the prior art for purposes of an obviousness challenge is limited to the field of the invention and analogous fields. See *Litton Sys. Inc. v. Honeywell*, 87 F.3d 1559, 1567-68 (Fed. Cir. 1996). Moreover, if it is necessary to combine references to make the invention obvious, the challenger must show that the prior art suggests combining the teachings of the different references. See *In re Geiger*, 815 F.2d 686, 688 (Fed. Cir. 1987).

43. A related question is whether the limitations on the pertinent art for purposes of an obviousness challenge still make sense as information technology makes it easier to search for references in unrelated fields.

44. See 35 U.S.C. § 131 (1994) (providing that "[t]he Director shall cause an examination to be made of the application and the alleged new invention; and if on such examination it appears that the applicant is entitled to a patent under the law, the Director shall issue a patent therefor").

45. See 35 U.S.C. §§ 301-07 (1994 & Supp. IV 1998).

vention by asserting invalidity as a defense.⁴⁶ The perception of many patent lawyers is that it would be a poor strategic move for a potential infringement defendant to show its cards to the patent holder by seeking reexamination of a patent rather than waiting to litigate the issue in an infringement action.⁴⁷ As a result, costly litigation is typically necessary to get rid of erroneously issued patents. Robert Merges has recently argued that we might be better served by permitting pre-issuance opposition to patents that would bring the full range of prior art to the attention of the PTO in a timely fashion.⁴⁸ This issue might be illuminated by good empirical research, perhaps comparing the U.S. reexamination system to foreign opposition systems.

Recent experience suggests that the rules for determining prior art are less effective when the patent system enters a new arena, such as information technology or business methods. Because advances in these areas have only recently been considered eligible for patent protection, traditional sources of prior art, especially prior patents and publications, are less reliable as indicators of the state of the art. Prior innovators, believing that their achievements were categorically excluded from the patent system, had little incentive to file patent applications that would document their achievements, and might also have refrained from publishing their work to avoid forfeiting their next best strategy for protection, trade secrecy. As a result, patent examiners have limited sources of prior art to consider in examining patent applications in these fields.

Another aspect of the current prior art rules that legal scholars are exploring with economic analysis is strategic prior art creation to defeat the patent claims of rivals.⁴⁹ Do current rules

46. See 35 U.S.C. § 282 (1994 & Supp. IV 1998).

47. One reason for this is that the reexamination is generally conducted by the patent examiner who conducted the original examination, who may be difficult to persuade that his own prior decision to award the patent was wrong. Another limitation of reexamination is that it may only be used to call attention to prior patents or printed publications and not to bring forward less conspicuous categories of prior art (such as prior knowledge or use by others) that are more likely to have escaped the attention of the examiner. See generally 35 U.S.C. § 301 (1994) (governing citations of prior art); 35 U.S.C. § 302 (1994) (regulating requests for reexaminations).

48. See Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577, 610-15 (1999).

49. See generally Douglas Lichtman et al., *Strategic Disclosure in the Patent System*, 53 VAND. L. REV. 2175 (2000); Gideon Parchomovsky, *Publish or Perish*, 98 MICH. L. REV. 926 (2000) (exploring "the strategy of preemptive publication in patent races and evaluat[ing] its welfare implications").

make it strategically advantageous to create patent-defeating prior art? Is anyone responding to these incentives? Is this good or bad? This promising line of economic analysis would benefit from careful grounding in legal doctrine and observed practice.⁵⁰

Another Byzantine set of rules that plays a more conspicuous role in patent practice than it does in scholarly debates is the U.S. "first-to-invent" system for resolving priority disputes.⁵¹ This unique feature of the U.S. patent system contrasts with the "first-to-file" rule for awarding patent priority in every other major patent system in the world.⁵² It has been a prominent focus of trade negotiations in the past and may reappear on the patent policy scene, although it has been quiescent in recent years. Patent practitioners who have urged that the first-to-invent rule be retained have generally advanced arguments about fairness.⁵³ Economists might play a useful role in evaluating the system from the perspective of efficiency. This might also be a fruitful direction for empirical research, comparing U.S. and foreign patent systems.

IV. NONOBVIOUSNESS

In order to be patentable, an invention must be nonobvious to a person of ordinary skill in light of the prior art. Originally a judicial creation,⁵⁴ this requirement is now codified at section 103 of the Patent Act.⁵⁵ The meaning of this standard has been much contested in the patent system over time.⁵⁶ The courts have elaborated

50. See Rebecca S. Eisenberg, *The Promise and Perils of Strategic Prior Art Creation Through Publication: A Response to Professor Parchomovsky*, 98 MICH. L. REV. (forthcoming 2000).

51. See 35 U.S.C. §§ 102(g), 104 (1994).

52. In fact, the U.S. patent system looks to both the application filing date and the invention date in determining the content of the prior art. Compare 35 U.S.C. §§ 102(a), 102(e), 102(g) (1994) (calling for determination of prior art as of invention date) with 35 U.S.C. §§ 102(b), 102(d) (1994) (calling for determination of prior art as of one year prior to application filing date). See generally MARTIN J. ADELMAN ET AL., CASES AND MATERIALS ON PATENT LAW 203-07 (1998) (describing relationship between the "novelty" and "statutory bar" subsections of § 102).

53. See, e.g., Coe A. Bloomberg, *In Defense of the First-to-Invent Rule*, 21 AIPLA Q.J. 255, 260-63 (1993); George E. Frost, *The 1967 Patent Law Debate—First-to-Invent vs. First-to-File*, 1967 DUKE L.J. 923 (1967); Charles R.B. Macedo, *First-to-File: Is American Adoption of the International Standard in Patent Law Worth the Price?*, 1988 COLUM. BUS. L. REV. 543, 576-80 (1990).

54. See *Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248, 266 (1850).

55. 35 U.S.C. § 103 (1994), amended by 35 U.S.C. § 103 (Supp. IV 1998); see *supra* note 41.

56. See generally P.J. Federico, *Origins of Section 103*, 5 APLA Q.J. 87 (1977); Edmund Kitch, *Graham v. John Deere: New Standards for Patents*, 1966 SUP. CT. REV. 293 (1966) (discussing the Supreme Court's treatment of § 103 and potential improvements made by the Court's

upon it in formulaic rules that shed little light on the underlying policy considerations at stake.⁵⁷

What is the function of the nonobviousness requirement in patent law? How well formulated is the requirement to perform this function?⁵⁸ In a formulation that has resonated with the courts, the nonobviousness standard distinguishes the unpatentable work of the "ordinary mechanic" from the patentable advances of more insightful inventors. One way of understanding this distinction is that patents are unnecessary to bring about mundane improvements that are within easy reach of those working in the field, but may be needed to motivate inventors to pursue the nonobvious advances that require something beyond routine work. This suggests that the nature of the inventive effort leading up to the invention may have a bearing on its patentability. But the drafters of the 1952 Patent Act, who were unhappy with prior judicial efforts to distinguish between patentable and unpatentable results in terms of the nature of the inventive work,⁵⁹ added to their definition of nonobviousness the following sentence: "Patentability shall not be negated by the manner in which the invention was made."⁶⁰ This language arguably excludes the obviousness of the inquiry that led to a discovery from consideration in assessing the obviousness of the resulting discovery. One context in which this approach seems to call for issuance of patents on routine, mechanical work is the result of high-throughput DNA sequencing.

If the function of the nonobviousness standard is to limit the issuance of patents to circumstances in which patent incentives are necessary, it is questionable whether it makes sense to exclude from consideration the obviousness of the method by which a discovery is made. Economic analysis might help clarify whether the patent system should reward "sweat of the brow" research efforts, or whether it should limit patent protection to advances that require greater insight. A related issue is whether the costs of making

holding in *Deere*); Giles Rich, *Why and How § 103 Came to Be*, in *NONOBVIOUSNESS—THE ULTIMATE CONDITION OF PATENTABILITY* (J. Witherspoon ed., 1980).

57. See, e.g., *In re Deuel*, 51 F.3d 1552, 1559 (Fed. Cir. 1995); *In re Dillon*, 919 F.2d 688, 692-93 (Fed. Cir. 1990).

58. Robert Merges offered a critical analysis some years ago that focused on so-called "secondary considerations," such as commercial success, in evaluating the nonobviousness of an invention. Robert P. Merges, *Commercial Economic Perspectives on Innovation*, 76 CAL. L. REV. 803, 816 (1988).

59. Some judicial decisions had interpreted the standard as calling for an extraordinary inventive process that reveals "the flash of creative genius, not merely the skill of the calling." *Cuno Eng'g Corp. v. Automatic Devices Corp.*, 314 U.S. 84, 91 (1941).

60. 35 U.S.C. § 103(c) (1994 & Supp. IV 1998).

a discovery should matter in assessing its patentability. Nothing in the current legal rules explicitly directs the attention of the PTO and the courts to R&D costs in determining patentability. Economic analysis might help evaluate this approach.⁶¹

V. DISCLOSURE

In order to get a patent, an inventor must provide a written description of the invention, an enabling disclosure of how to make and use the invention, and disclosure of the best mode contemplated by the inventor of making the invention.⁶² Applicants may not make substantive changes to their disclosures after filing their patent applications without losing the benefit of their original filing dates (and thereby risking loss of rights if intervening prior art has a bearing on patentability).⁶³ This disclosure becomes freely available to the public upon issuance of the patent, or earlier if there is a corresponding foreign filing.⁶⁴

Courts sometimes tout the disclosure as the *quid pro quo* for the patent monopoly,⁶⁵ as if the reason we offer patents is to get disclosures of technologies that would otherwise be kept secret rather than simply to promote research and development. But this claim cries out for closer scrutiny. Apart from informing the public, patent disclosures also demonstrate to the PTO what the applicant has done that might justify issuance of a patent.⁶⁶ Controversies over whether U.S. patent applications should be disclosed 18 months after their filing dates, like patent applications filed in most of the world, highlight the importance of rules governing patent disclosure.

One useful contribution that empirical economists might make is to gather data on how patent disclosures are actually used.

61. One possibility is that if monopoly rewards are offered for "sweat of the brow" activities that, although costly, are foreseeable and accessible to anyone of ordinary skill in the field, the result will be wasteful rent-dissipating patent races. Perhaps patent rewards that are available only for nonobvious inventions are less likely to have this effect because they are less likely to occur to multiple rent-seekers at the same time. See Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation* 78 VA. L. REV. 305, 322-38 (1992) (seeking to explain various features of patent law as reflecting a policy of minimizing rent dissipation).

62. See 35 U.S.C. § 112 (1994).

63. See 35 U.S.C. §§ 132, 305 (1994).

64. See 35 U.S.C. §§ 122, 153, 154 (1994 & Supp. IV 1998).

65. See, e.g., *Grant v. Raymond*, 31 U.S. (6 Pet.) 218, 247 (1832) (holding that "a correct specification and description of the thing discovered . . . is necessary in order to give the public, after the [monopoly] privilege shall expire, the advantage for which the privilege is allowed").

66. See *In re Argoudelis*, 434 F.2d 1390, 1394-96 (C.C.P.A. 1970).

Who reads patent disclosures, and why? Do they serve primarily as guides to pending or outstanding patent claims, or are they useful for the scientific information they contain? How do patent disclosures relate to other disclosures of scientific information, such as publications? How valuable are the spillovers that patent disclosures create? What impact does patent disclosure have on the value of patents and on the appropriability of the underlying technology? Do the current rules make sense?

VI. INFRINGEMENT AND CLAIM SCOPE

A number of economists have analyzed the issue of patent claim scope.⁶⁷ Additional work would be useful to situate this analysis within evolving patent doctrine. Determinations of patent scope turn on multiple, interrelated legal issues that often have been blurred or overlooked in the economics literature. As a result, the literature sometimes seems to miss the import of developments in doctrine and to offer limited guidance for fine-tuning the system to achieve optimal results.

Patent scope turns on legal rulings made at two separate stages in the life of a patent: prosecution and infringement litigation. At the prosecution stage, the PTO decides whether to allow or reject the applicant's suggested claim language depending on how the claims compare to the prior art⁶⁸ and how the breadth of the claims compares to the breadth of disclosure.⁶⁹ These two determinants of allowable claim scope—prior art and disclosure—are in tension with each other. In a new field, the prior art sets relatively few constraints on the scope of patent claims, permitting broad patent protection for pioneering inventions. On the other hand, the

67. See, e.g., Howard F. Chang, *Patent Scope, Antitrust Policy, and Cumulative Innovation*, 26 RAND J. ECON. 34, 36 (1995); Richard Gilbert & Carl Shapiro, *Optimum Patent Length and Breadth*, 21 RAND J. ECON. 106, 108-11 (1990); Jerry Green & Suzanne Scotchmer, *On the Division of Profit in Sequential Innovation*, 26 RAND J. ECON. 20, 25-27 (1995); Paul Klemperer, *How Broad Should the Scope of Patent Protection Be?*, 21 RAND J. ECON. 113 (1990); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 884-908 (1990); Ted O'Donoghue, *A Patentability Requirement for Sequential Innovation*, 29 RAND J. ECON. 654, 656-58 (1998); Michael Waterson, *The Economics of Product Patents*, 80 AM. ECON. REV. 860, 868-69 (1990).

68. Claim language that is so broad as to cover technology that has been disclosed in a prior art reference will be rejected (or subsequently held invalid) for lack of novelty. See *Titanium Metals Corp. of Am. v. Banner*, 778 F.2d 775, 780-83 (Fed. Cir. 1985).

69. The disclosure must be sufficient to enable someone of ordinary skill in the field of the invention to make and use the invention across the full breadth of the claim without engaging in undue experimentation. See *In re Goodman*, 11 F.3d 1046, 1050 (Fed. Cir. 1993).

primitive state of the art in such a new field may limit the extent to which the patent disclosure enables other practitioners to make and use variations on the invention without having to engage in undue experimentation. As knowledge in the field progresses, it becomes easier to make an enabling disclosure that will support a broad claim, but the more extensive prior art available in a mature field has a countervailing tendency to narrow the scope of allowable claims.

After a patent has issued, a trial court may revisit the question of its scope in infringement litigation. There are several determinations that might have the effect of changing the apparent scope of a claim at this stage. First, a trial court might decide that a broad claim is invalid and should not have been allowed under proper application of the rules discussed in the preceding paragraph concerning prior art and scope of disclosure. The claims of an issued patent enjoy a presumption of validity, but a defendant may overcome this presumption with clear and convincing evidence. Second, the trial court must construe the claim language in order to determine whether infringement has occurred, and often the meaning of the claim is susceptible to multiple interpretations. The specific interpretive issue before the trial court (for example, whether the claim covers a variation on the invention that takes advantage of new technology not yet known at the time of prosecution) will often be something that no one thought about when the claim language was drafted, creating ample opportunity for disagreement and uncertainty. Third, even if the claim language does not cover the defendant's variation, the judge or jury might still conclude that there is infringement under the doctrine of equivalents. This doctrine, which the Supreme Court recently affirmed, permits a finding of infringement when the defendant's product or process, although not within the literal scope of the plaintiff's claim, is substantially equivalent to the claimed invention.⁷⁰

70. See *e.g.*, *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 24-29 (1997); *Graver Tank & Mfg. Co. v. Linde*, 339 U.S. 605, 608-09 (1950). Far fewer cases have recognized a so-called "reverse doctrine of equivalents," excusing a defendant from liability for what would otherwise be literal infringement of a patent if the defendant's product is so far changed from the patented invention that it performs the function of the claimed invention in a substantially different way. See *e.g.*, *Boyden Power-Brake Co. v. Westinghouse*, 170 U.S. 537, 568 (1898); *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 1122-25 (Fed. Cir. 1985). Although rarely invoked and more rarely successful, the reverse doctrine of equivalents features prominently in academic commentary, perhaps inspired by the intriguing analysis by Professor Merges. 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).

Contrary to the apparent belief of some economists, the perception of many lawyers is that the Federal Circuit in recent years has refined the foregoing rules of law in ways that *restrict* rather than expand the scope of patents.⁷¹ This trend towards restrictive patent scope stands in marked contrast to the expansive trend within the same court in addressing issues of patentability.⁷² Important elements in the restrictive trend have been robust application of the requirements for an enabling disclosure and a written description of the invention so as to limit the breadth of claims,⁷³ as well as tighter judicial control over both claim construction⁷⁴ and application of the doctrine of equivalents.⁷⁵ By overlooking these countertrends to the widely perceived expansion of the patent system, much of the economics literature on patent scope misses its target.

Apart from analyzing the general issue of how broad patent claims should be, economists who were better versed in patent doctrine could usefully illuminate the relative merits of different procedural mechanisms for making these determinations. What determinations are best made by the PTO at the stage of patent prosecution, and what circumstances justify revisiting these determinations by trial courts at the stage of infringement litigation? One justification for the Federal Circuit's restrictive approach to claim construction and the doctrine of equivalents is to increase predictability and certainty in infringement determinations. How important

71. Cf. JAFFE, *supra* note 2, at 36 (reporting in a literature survey that "it is widely believed that patent scope has been increased in the U.S. in the last two decades as a result of more liberal application of the Doctrine of Equivalents").

72. The juxtaposition of expansive decisions relating to patentability with restrictive decisions relating to scope is summarized in the practitioner's aphorism that "the Federal Circuit will not rest until it has held every patent valid but not infringed."

73. This particular trend has been striking in the biotechnology field. See, e.g., *Genentech, Inc. v. Novo Nordisk*, 108 F.3d 1361, 1365 (Fed. Cir. 1997); *University of Cal. v. Eli Lilly & Co.*, 119 F.3d 1559, 1566 (Fed. Cir. 1997).

74. The United States Supreme Court has affirmed the Federal Circuit's holding that claim construction is a question of law to be decided by trial judges, subject to plenary review on appeal. See *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 391 (1996), *aff'g* 52 F.3d 967 (Fed. Cir. 1996). This takes the issue of claim construction away from juries and may make expansive interpretations of claim language less likely.

75. Notably, the United States Supreme Court and the Federal Circuit have both held that a finding of infringement under the doctrine of equivalents is only permissible when the defendant's product has an equivalent for every element in the patent claim. See *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 29 (1997); *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931 (Fed. Cir. 1987) (citing *Perkin-Elmer Corp. v. Westinghouse Elec. Corp.*, 822 F.2d 1528 (Fed. Cir. 1987)).

are predictability and certainty in the patent system?⁷⁶ Has the approach of the Federal Circuit, particularly the use of pre-trial *Markman* hearings to adjudicate claim construction, in fact increased predictability of outcomes in patent litigation? This question might be amenable to empirical investigation as well as to theoretical analysis of the strategic implications of different approaches.

VII. LICENSING PRACTICES

Economists have made tremendous theoretical and empirical contributions to understanding the different ways that patent owners use their rights to capture the value of innovations.⁷⁷ This work has highlighted the importance of licensing transactions in ensuring that new inventions are efficiently utilized. Further work might help resolve uncertainty in the legal literature over whether and when licensing transactions can be relied upon to make new technologies available in the face of a growing thicket of patent rights.⁷⁸ What are the limits of licensing? What safeguards are appropriate when licensing transactions are persistently costly to the point of consuming the gains from exchange? Is compulsory licensing appropriate, or is it likely to do more harm than good? What are the risks and benefits of providing safe harbors from antitrust liability for patent pooling arrangements?⁷⁹

CONCLUSION

We seem to be at the beginnings of a broader public debate about the patent system than we have seen in many years. Commentary on the patent system is extending beyond the scholarly

76. Ian Ayres and Paul Klemperer have advanced the counterintuitive thesis that unpredictability might improve the efficiency of the patent system. See Ian Ayres & Paul Klemperer, *Limiting Patentees' Market Power Without Reducing Innovation Incentives: The Perverse Benefits of Uncertainty and Non-Injunctive Remedies*, 97 MICH. L. REV. 985, 1000-05 (1999).

77. See e.g., Levin et al., *supra* note 14; Mansfield, *supra* note 14 at 180; COHEN ET AL., *supra* note 2.

78. Compare Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CALIF. L. REV. 1293 (1996) (documenting the evolution of institutions to reduce the costs of intellectual property licensing transactions in a variety of settings), with Rebecca S. Eisenberg, *Bargaining over the Transfer of Proprietary Research Tools: Is This Market Failing or Emerging?*, in EXPANDING THE BOUNDS OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY (Rochelle C. Dreyfuss et al. eds., forthcoming 2000) (documenting difficulties overcoming high transaction costs in the market for the exchange of proprietary research tools among biomedical research institutions).

79. See Bruce H. Kobayashi & Michelle Burtis, *Intellectual Property & Antitrust Limitations on Contract* (George Mason Law & Econ. Working Paper No. 00-06, 2000).

community and the bar into the popular media, suggesting growing public interest and concern. This presents an important opportunity for both legal scholars and economists to enlighten public debates. We can play a more constructive role if we help each other to ask the right questions and to figure out how best to address those questions.