POST-GRANT REVIEWS IN THE U.S. PATENT SYSTEM–DESIGN CHOICES AND EXPECTED IMPACT

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ABSTRACT

Several policy review boards have advocated the introduction of post-grant patent review mechanisms in the U.S patent system. We discuss to what extent "patent quality" has been deteriorating in the U.S. patent system and then consider the expected impact of post-grant review mechanisms as advocated by the policy review boards. We take a detailed look at the experience with the opposition mechanism at the European Patent Office. Our results indicate that a properly designed U.S. post-grant review could generate high welfare gains. We discuss the design choices faced by policy-makers in the United States and provide recommendations.

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I. INTRODUCTION

The past two decades have seen unprecedented growth in patenting in the United States and the rest of the world, coupled with increased interest on the part of many firms in acquiring, using, and enforcing patents. At the

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same time, the types of subject matter that may be patented have expanded, both through invention and through a series of court decisions. Not surprisingly these changes have led to tensions in the system, some of which have manifested themselves in increased litigation and some in a decline in the average quality of patents issued. Several governmental and quasi-governmental bodies have called for reforms of various types. One measure that has received considerable support is the strengthening of the current *inter partes* reexamination system into a full post-grant open review system that would have features in common with the European Patent Office (EPO) opposition system.

This Article explores this policy option more thoroughly. In Part II, we define patent quality and discuss the welfare implications of having too many low quality patents, while in Part III, we provide evidence that standards have fallen with some of the patents issued under the current system. Next, in Part IV, we present the options for strengthened reexamination or open review systems that have been recommended in recent reports by the U.S. Patent and Trademark Office (USPTO) itself,[1] the Federal Trade Commission (FTC),[2] and the National Academy of Sciences (NAS).[3] Finally, in Parts V and VI, respectively, we review what is known about the functioning and effectiveness of the European opposition system to draw some lessons for the design of a similar system in the United States.[4]

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1. USPTO, THE 21ST CENTURY STRATEGIC PLAN (Feb. 3, 2003) [hereinafter USPTO PLAN], *at* http://www.uspto.gov/web/offices/com/strat21/stratplan_03feb2003.pdf.

2. FTC, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY (2003) [hereinafter FTC REPORT], *at* http://www.ftc.gov/os/2003/10/innovationrpt.pdf.

3. NAT'L ACAD. OF SCI., A PATENT SYSTEM FOR THE 21ST CENTURY (Stephen A. Merrill et al. eds., 2004) [hereinafter NAS STUDY], *available at* http://www.nap.edu/books/0309089107/html.

4. In writing this Article, we have drawn heavily on our joint work with Stuart Graham and David Mowery. *See* Stuart J.H. Graham et al., *Patent Quality Control: A Comparison of U.S. Patent Reexaminations and European Patent Oppositions*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY 74 (Wesley M. Cohen & Stephen A. Merrill eds., 2003); Bronwyn H. Hall et al., *Prospects for Improving U.S. Patent Quality via Postgrant Opposition*, *in* INNOVATION POLICY AND THE ECONOMY 4, 115 (Adam B. Jaffe et al. eds., 2004). We are extremely grateful to them for their contributions. We also appreciate comments by Richard Nelson who encouraged us to define the term "patent quality" in more detail than in previous work.

II. "PATENT QUALITY"[5]

A. Defining "Patent Quality"

Before discussing some of the problems that have emerged recently, it is useful to define what we mean in this Article by the term "patent quality," a concept that is subject to multiple interpretations. The statutory definition of a patentable invention is that it be novel, non-obvious, and useful.[6] Economists define a desirable patent as one that covers an invention that would not otherwise be made or one that ensures that a good idea is commercialized by providing a temporary monopoly to the patent holder. Both the economic and legal views suggest that high quality patents describe inventions that are truly new, rather than inventions that are already in widespread use but not yet patented.[7] Achieving this goal requires that examiners have low-cost access to searchable information about the state of the prior art in a particular technological area.

Besides these three legal requirements, a fourth statutory criterion for granting a patent on an invention is that the patent application must disclose sufficient details about the invention.[8] These disclosures in the published patent facilitate knowledge spillovers to others who might use or improve upon the invention. Therefore, a high quality patent must enable those "skilled in the art"[9] to comprehend the invention well enough to use the patent document to implement the described invention. Satisfying this criterion also helps to achieve the first three requirements, since it facilitates the search portion of the examination process.

Finally, from a social welfare perspective, a high quality patent should have little uncertainty over its validity and the breadth of its claims. The specific features of the claimed technical advance should be clearly defined, and the claims should likely be upheld in subsequent legal proceedings. Uncertainty about the validity and breadth of a patent has several potential costs: such uncertainty may cause the patent holder to under-invest in the technology, reduce investment by potential competitors in competing technical advances, and lead to costly litigation after both the patent holder and potential competitors have sunk sizable investments. Some un-

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5. Parts of this section of the paper are drawn from Hall et al., *supra* note 4, and Bronwyn H. Hall, Business Method Patents, Innovation, and Policy (Apr. 2003), *at* http://www.frbatlanta.org/news/conferen/fm2003/hall.pdf.

6. 35 U.S.C. §§ 101-103 (2000).

7. Presumably, if the invention has already been reduced to practice by others, the potential gain from offering an inventor incentive to invent is zero, leaving only the deadweight loss from monopoly.

8. 35 U.S.C. § 112.

9. *Id.* § 112.

certainty over validity and breadth is inevitable, but resolving it sooner rather than later is a desirable feature of any patent system.

Our notion of patent quality refers both to the standard, set by the law and the courts, against which patent applications are being evaluated, and to the less than perfect handling of the examination process. The first idea describes the degree to which the patent standard deviates from that which would maximize economic welfare, while the second idea describes the way in which the standard is applied, which is inevitably at times in at variance with the intent of the law. Both ideas measure deviations from a welfare-maximizing delineation of patents. In that sense, the ideas both imply low patent quality.

B. Consequences of Low Patent Quality

Although Lemley has argued that the costs of having higher quality patents may exceed the benefits,[10] recent experience suggests that the issuance of low quality patents has unintended negative consequences in the form of increasing complexity of using the patent system and of feedback effects on the behavior of potential applicants. In this Section, we review these arguments, which include entry deterrence of would-be innovators, a slower pace of innovation, and increases in patent application activity that are costly both to the firms and to society.

Low quality patents can create considerable uncertainty among inventors or would-be commercializers of inventions, and which in turn can slow either the pace of innovation or investment in the commercialization of new technologies. Lerner has shown that fear of litigation may cause smaller entrant firms to avoid areas where incumbents hold large numbers of patents.[11] Testimony from the biotechnology community to the 2002 Federal Trade Commission-Department of Justice hearings on innovation and competition policy confirms this view.[12] Such entry-avoidance may be rational and even welfare-enhancing if the incumbents' patents are known for certain to be valid, but low quality patents held by incumbents may also deter entry into a technological area if the cost of invalidating the patents is too high. In these circumstances, technological alternatives may not be commercialized and consumer welfare suffers.

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10. Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW U. L. REV. 1495 (2001).

11. Josh Lerner, *Patenting in the Shadow of Competitors*, 38 J.L. & ECON. 463 (1995).

12. FTC, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY, EXECUTIVE SUMMARY 5 n.17 (2003) [hereinafter FTC EXECUTIVE SUMMARY], *at* http://www.ftc.gov/opa/2003/10/cpreport.htm.

On the incumbent side, problems may also arise if a proliferation of patents with dubious validity or uncertain breadth are granted because incumbents with sunk investments, especially investments involving technological standards, are highly vulnerable to hold-up or patent predation by firms who have not sunk investments. The assertion of patents by non-producers against established firms may be valid in some cases. But resolution of the non-producer's claims is clearly more costly when the validity and breadth of the asserted patent can only be determined via expensive litigation. In that instance, paying licensing fees may be cheaper than going to court, even if the patent in question is viewed as low quality by the accused infringer. Such patent predation is of particular concern to large firms in the information and communication technologies ("ICT") and semiconductor industries.[13]

The lack of rapid processes for resolving patent validity and ensuring higher patent quality also may slow the pace of invention in fields characterized by cumulative invention, in which one inventor's efforts rely on previous technical advances or advances in complementary technologies. If these previous technical advances are covered by patents of dubious validity or uncertain breadth, the costs to inventors of pursuing the inventions that rely on them may be so high as to discourage such cumulative invention. Alternatively, large numbers of low quality patents may dramatically increase the level of fragmentation of property rights covering prior-generation or complementary technologies, raising the transaction costs for inventors to license these technologies. Finally, the issue of a large number of low quality patents will increase uncertainty among inventors concerning the level of protection enjoyed by these related inventions, which in turn will make it more costly and difficult for inventors to build on these related inventions in their own technical advances.

The issuance of low quality patents is also likely to spur significant increases in patent applications, further straining the already overburdened examination processes of the USPTO. A vicious circle may result, in which cursory examinations of patent applications result in the issue of low quality patents, which triggers rapid growth in applications, further taxing the limited resources of the USPTO, further limiting the examination of individual applications, and further degrading the quality of patents. Anecdotal and statistical evidence suggests that increases in patenting in information and communication technologies have been driven by

13. FTC REPORT, *supra* note 2, chs. 3 ("The Computer Hardware Industries, Including Semiconductors"), 44 ("The Software and Internet Industries"); Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995*, 32 RAND J. ECON. 101 (2001).

this process. Hall shows that although the growth in U.S. patenting since 1985 has been spread throughout different technology classes, it is largely accounted for by the growth in patenting by U.S. corporations in the computing and electronics sector of the economy.[14] One does not have to look far for the reason: Ziedonis and Hall describe the conscious accumulation of patents in the semiconductor industry solely for the purposes of the cross-licensing negotiations that are necessary in a complex products industry.[15] A number of participants in the broader ICT sector have confirmed that this motive is behind the increase in patenting in this sector and indicated that they view most of this activity simply as a cost of doing business rather than as a benefit for their firms.[16]

Lemley's argument would lead one to believe that a registration system with fast and inexpensive court proceedings available for resolving the inevitable conflicts would be the best patent system.[17] Given the above arguments, we do not follow that conclusion. We argue that a mixture of reasonably thorough examination using a high standard of patentability combined with a post-grant review mechanism and subsequent court proceedings will work best to sustain strong innovation incentives. However, in the United States, neither our preferred design nor Lemley's alternative is available at this point. We study some of the problems of the U.S. patent system in the next part.

III. PROBLEMS IN THE U.S. PATENT SYSTEM

In this Part, we review some of the problems that have recently been identified in the operation of the U.S. patent system. These problems include a rapid and sustained increase in patent applications, leading to a greater workload for each examiner in spite of efforts to increase the examination corps. Because there are more patents, there has also been an increase in patent litigation, both in absolute numbers of suits and in the

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14. Bronwyn H. Hall, Exploring the Patent Explosion (Mar. 14, 2003), *at* http://emlab.berkeley.edu/users/bhhall/papers/BHH%20Mannheim03.pdf.

15. Rosemarie Ham Ziedonis & Bronwyn H. Hall, *The Effects of Strengthening Patent Rights on Firms Engaged in Cumulative Innovation: Insights from the Semiconductor Industry*, *in* ENTREPRENEURIAL INPUTS AND OUTCOMES: NEW STUDIES OF ENTREPRENEURSHIP IN THE UNITED STATES 133 (Gary D. Libecap ed., 2001). For additional evidence that the computing manufacturing sector including semiconductors is the force behind the increase in software patenting, rather than the software sector itself, see JAMES BESSEN & ROBERT M. HUNT, AN EMPIRICAL LOOK AT SOFTWARE PATENTS (Fed. Reserve Bank of Philadelphia, Working Paper No. 03-17/R, 2004).

16. FTC EXECUTIVE SUMMARY, *supra* note 12, at 6-7.

17. *See* Lemley, *supra* note 10.

rate per patent. Finally, criticisms that the patentability standard has declined are supported by evidence based on European patent examination.

Since the mid-1980s, utility patent applications to the USPTO have grown at an average rate of five percent per year, rising from approximately 100,000 per year in 1970-1984 to about 330,000 per year in 2001.[18] Obviously, this increase has led to an increase in patent office workload, especially since resources at the patent office have not kept pace.[19] Patent pendency has risen from an average of 18 months in 1990 to 24 months in 2002.[20] There is evidence that patent grant rates have also risen, suggesting that time pressures have led to less scrutiny of each individual application.[21] These are signs of a system under stress. James Rogan, the former Director of the USPTO, said in February of 2003, "This is an agency in crisis, and it's going to get worse if we don't change our dy-

18. Authors' computation from USPTO data at USPTO, *U.S. Patent Statistics, Calendar Years 1963-2001*, *at* http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.pdf (last visited Aug. 10, 2004).

19. During the past five years, the number of applications filed per annum and per examiner has risen from 90 to 110, according to authors' computations from USPTO Annual Reports. *See* USPTO, ANNUAL REPORT (1999), *at* http://www.uspto.gov/web/offices/com/annual; USPTO, PERFORMANCE AND ACCOUNTABILITY REPORT (2003), *at* http://www.uspto.gov/web/offices/com/annual. Since about 1984, the length and complexity of patent applications has also been increasing, so that the number of claims filed per examiner has gone up even faster, according to data compiled from the NBER patent database. *See* NAT'L BUREAU OF ECON. RESEARCH, U.S. PATENT CITATIONS DATA FILE (2003), *at* http://www.nber.org/patents; *see also* BRONWYN H. HALL ET AL., THE NBER PATENT CITATIONS DATA FILE: LESSONS, INSIGHTS AND METHODOLOGICAL TOOLS 23-24 (Nat'l Bureau of Econ. Research, Working Paper No. 8498, 2001), *at* http://papers.nber.org/papers/w8498.pdf; John R. Allison & Mark A. Lemley, *The Growing Complexity of the United States Patent System*, 82 B.U. L. REV. 77, 103 (2002).

20. Authors' computations from the NBER patent database. *See* NAT'L BUREAU OF ECON. RESEARCH, supra note 19.

21. Because of the existence of continuations and divisionals, the computation of the share of patent applications that are ultimately granted is somewhat difficult and subject to debate. For detailed information on this topic, see Robert A. Clarke, *U.S. Continuity Law and its Impact on the Comparative Patenting Rates of the U.S., Japan and the European Patent Office*, 85 J. PAT. & TRADEMARK OFF. SOC'Y 335 (2003); Cecil D. Quillen, Jr. et al., *Continuing Patent Applications and Performance of the U.S. Patent and Trademark Office—Extended*, 12 FED. CIR. B.J. 35 (2002). Using numbers based simply on raw USPTO data on granted patents and their reported application dates, the grant rate has risen since 1995 from about 62% for patents applied for in 1993 to around 78% for patents applied for in 1998. *See* NAT'L BUREAU OF ECON. RESEARCH, supra note 19. Both rates underestimate the true grant rate once continuations and divisionals are accounted for.

namic. It doesn't do me any good to pretend there's not a problem when there is."[22]

At the same time, patent litigation has increased, as have patent litigation rates more recently. In a study of patent litigation between 1978 and 1995, Lanjouw and Schankerman found that the rate of litigation rose only slightly between the 1978-84 and the 1991-95 periods, from nineteen suits per thousand patents in the first period to twenty-one suits per thousand patents in the second, with some variation across technology areas.[23] Somaya suggests that this rate rose again in the late 1990s.[24] In a new and comprehensive study of patent litigation focusing on cases that terminated in 1998-2000, Allison et al. reported a litigation rate of approximately thirty-two suits per thousand patents.[25] Whether or not litigation per patent issued has increased substantially, the absolute amount of litigation has grown, increasing both the private and public costs of the system as a whole. This increase in litigation suggests that the number of valuable patents is increasing and that there is greater uncertainty about their validity.

It is therefore not surprising that a number of experts have suggested that the U.S. patent examination system does not currently impose a sufficiently rigorous review of patent and non-patent prior art, resulting in the issuing of patents of excessive breadth and insufficient quality, and that this problem has worsened in recent years. There is some consensus among legal scholars and other researchers that the average standard being applied during the past decade is too low,[26] especially in newer technology

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22. David Streitfeld, *Note: This Headline is Patented*, L.A. TIMES, Feb. 7, 2003, at 1.

23. JEAN O. LANJOUW & MARK SCHANKERMAN, ENFORCING INTELLECTUAL PROPERTY RIGHTS 30 tbl.2 (London Sch. of Econ. & Political Sci. Toyota Ctr., Working Paper No. EI/30, 2001), *at* http://sticerd.lse.ac.uk/dps/ei/ei30.pdf.

24. Deepak Somaya, Patent Strategy Viewed Through the Lens of Patent Litigation 107-08, 140 fig.1 (2002) (unpublished Ph.D. dissertation, University of California, Berkeley) (on file with the University of California, Berkeley Library).

25. John R. Allison et al., *Valuable Patents* app. at 57 fig.1 (2003), *at* http://papers.ssrn.com/abstract=426020.

26. For a critique of the standard in general, see John H. Barton, *Non-obviousness*, 43 IDEA 475 (2003); John H. Barton, *Reforming the Patent System*, 287 SCIENCE 1933 (2000); Mark D. Janis, *Rethinking Reexamination: Toward a Viable Administrative Revocation System for U.S. Patent Law*, 11 HARV. J.L. & TECH. 1 (1997); William Kingston, *Innovation Needs Patents Reform*, 30 RES. POL'Y 403 (2001); Cecil D. Quillen, Jr., The U.S. Patent System: Is It Broke? And Who Can Fix It If It Is?, Address at the Spring Meeting of the Association of General Counsel (May 11, 2001), *at* http://www.ftc.gov/os/comments/intelpropertycomments/quillenattachments/isitbrokewhocanfixit.pdf.

areas like software and business methods.[27] Quantitative evidence that the problem of lowered standards affects the system as a whole rather than simply these relatively small (in terms of patenting) new technological areas has been more difficult to find, but we can offer two pieces of suggestive evidence based on comparisons with the European Patent System.

The first is to compare the EPO experience of patents originating from the United States versus patents originating from other parts of the world. Our proxy for the patent's origin is the priority-date country named in the patent. Most U.S. origin patent filings have a U.S. priority date and most non-U.S. filings have a non-U.S. priority date. Figure 1 shows the result: the difference in grant rates for patent applications from the two jurisdictions has risen from 0% to about 16% during the past twenty years, in spite of the fact that U.S. priority patents represent only those U.S. inventions thought to be valuable enough to be worth patent protection in a foreign jurisdiction.[28] The fact that U.S. priority applications are now less likely to receive patent protection suggests a decline in the standard of U.S. applications. We have verified that the difference in grant rates is not due to differences in subject matter coverage, such as software and business methods, which are generally patentable in the United States, but not in Europe. Although slightly higher in electrical, chemical, and construction technologies, the differences exist in all technologies.

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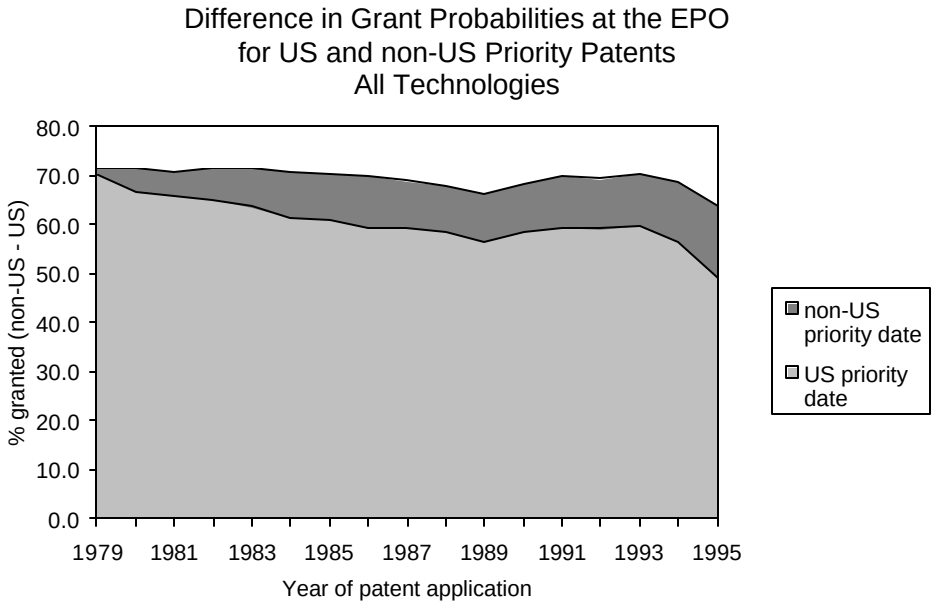
27. On software and business method patents, see JOHN KASDAN, FASCINATIN' ALGORITHM: PATENT PROTECTION FOR COMPUTER PROGRAMS (Columbia Law Sch. Ctr. for Law and Econ. Studies, Working Paper No. 94, 1994), *at* http://www.law.columbia.edu/center_program/law_economics/wp_listing_1/wp_author#83129; Rochelle Cooper Dreyfuss, *Are Business Method Patents Bad for Business?*, 16 SANTA CLARA COMPUTER & HIGH TECH. L.J. 263 (2000); Glynn S. Lunney, Jr., *E-Obviousness*, 7 MICH. TELECOMM. & TECH. L. REV. 363 (2001); Michael J. Meurer, *Business Method Patents and Patent Floods*, 8 WASH. U. J.L. & POL'Y 309 (2002).

28. Authors' own computations based on data from the EPO's website at http://www.epoline.org. To compute the results referenced here and in the remainder of the Article, we used a complete list of EPO applications numbers supplied by the EPO and extracted procedural data on all EPO patent applications filed between the inception of the EPO and Dec. 31, 2002 from the EPOLINE database. The data allow us to consider the timing of applications and grants by major technical fields. Furthermore, we can identify all opposition and appeal cases and their outcomes from this source, again by technical field.

Figure 1



The second piece of evidence is drawn from a recent Organisation for Economic Co-Operation and Development (OECD) study that compares the grant rates for U.S. priority patent equivalents at the EPO and the USPTO.[29] Equivalents are filings on the same invention in different patent offices. In this case the inventor, who may or may not be U.S. based, has filed for protection in both Europe and the United States. He may or may not be successful in both places, depending on the standards of patentability applied. The OECD study shows that the difference in grant rates for equivalent filings at the two patent offices has grown from 18% to 40% during the past twenty years, again suggesting a decline in the standards being applied at the USPTO, or an increase in the standards applied at the EPO.[30]

What are the causes of the apparent decline in scrutiny indicated by these numbers? We have already suggested that rapid increases in patent applications have overburdened the patent office. The patent office has introduced a number of changes intended to help the situation. For example, between 1997 and 2000, the number of examiners in class 705, the class to which many business method patents are assigned, approximately quadrupled, and the number with advanced training in business also in-

29. ORG. FOR ECON. CO-OPERATION & DEV., PATENTS AND INNOVATION: TRENDS AND POLICY CHALLENGES (2004), *at* http://www.oecd.org/dataoecd/48/12/24508541.pdf.

30. *Id.* at 19 fig.7.

creased.[31] A program of improving prior art availability in this area was undertaken.[32] In 2001, a "second pair of eyes" was introduced for patents in class 705[33] and the grant rate in that class fell as a result. It is now only 17%.[34] The USPTO counts this program a success and has recommended that it be used in other technological areas.[35]

A recent decision by the Court of Appeals for the Federal Circuit (CAFC) creates still another reason for serious consideration of a nonjudicial process for post-issue validity challenges. In 2002, the CAFC ruled that the USPTO had incorrectly rejected an application for obviousness, arguing that if an examiner rejects an application using "general knowledge," that knowledge "must be articulated and placed on the record."[36] According to deputy commissioner Esther Kepplinger, this ruling means, "we can't reject something just because it's stupid."[37] This decision could significantly weaken the level of scrutiny provided by the already costly and overcrowded patent-examination system. A system that enabled third parties, including competitors, to bring such knowledge in the form of written prior art to bear on the patent could help in making an obviousness or novelty determination. This idea is discussed further in the next part of this Article.

IV. REFORM PROPOSALS AND THE PROMISE OF POST-GRANT REVIEW MECHANISMS

Not surprisingly, the increase in the USPTO's workload, the increase in litigation, and the decrease in patent quality have not gone unnoticed in

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31. USPTO, AUTOMATED FINANCIAL OR MANAGEMENT DATA PROCESSING METHODS (BUSINESS METHODS) 8, 10 (2000), *at* http://www.uspto.gov/web/menu/busmethp/whitepaper.pdf.

32. *Id.* at 11.

33. Commissioner for Patents Nicholas Godici, Remarks at the Patent Public Advisory Committee Meeting 21-22 (Aug. 23, 2000), *at* http://www.uspto.gov/web/offices/com/advisory/notices/ppacmeet0008.html.

34. Q. Todd Dickinson, Address at the Berkeley Center for Law and Technology Conference on Patent Reform (Apr. 16, 2004).

35. USPTO PLAN, *supra* note 1, at 9.

36. *In re* Lee, 277 F.3d 1338 (Fed. Cir. 2002). This decisions presumably makes it more difficult to reject such patents as U.S. Patent No. 6,368,227 (issued Apr. 9, 2002), the patent on a swinging method that uses a technique known by children for years, but not placed "on the record." This particular patent has been subject to a reexamination request of the U.S. Patent Commissioner, probably because of the publicity it received. NAS STUDY, *supra* note 3, at 39. The problem with patents like U.S. Patent No. 6,368,227 is not necessarily that they are enforceable in the courts, but that they clog the system and raise its total cost.

37. Streitfeld, *supra* note 22.

the business and policy communities. Three organizations have instituted studies of the operation of the patent system and produced a set of recommendations. These studies are the USPTO's proposed *21st Century Strategic Plan*,[38] a FTC Report that focuses on the competition policy-innovation policy nexus,[39] and a study by the NAS in which one of the authors of this Article participated.[40] We review these proposals here, and conclude that they have the potential to move U.S. post-grant patent review closer to the European patent opposition system, whose performance we then take a closer look at in the subsequent part of the Article.

The USPTO has proposed a proceeding "that would allow the public to petition the USPTO to cancel one or more claims in a patent within one year of its issue date. And it allows anyone who is threatened with a patent infringement suit to petition for review within four months of being threatened."[41] The proposal envisions a streamlined proceeding conducted by Administrative Patent Judges of the Board of Patent Appeals and Interferences and "designed to be concluded within a year, in which direct cases could be presented by documents, and live cross-examination allowed where necessary."[42] As a consequence, the USPTO proposes eliminating the *inter partes* reexamination to "alleviate the burden on the examiners of having to examine complex and lengthy reexamination proceedings, and thus free examiners to examine applications and reduce pendency."[43] In the proposed proceeding, the third party would develop and present the evidence, which would save resources that the USPTO currently expends to determine patentability. The merit of this proposal is that it comes from the USPTO and therefore presumably reflects the realities of the resource constraints the agency faces.

The FTC Report on *Innovation and Competition Policy* makes a similar recommendation for the creation of "a new administrative procedure to allow post-grant review of and opposition to patents."[44] The report recommends that challengers "be able to raise issues of novelty, nonobviousness, written description, enablement, and utility."[45] The FTC Report also recommends that the process be presided over by an administrative patent

38. USPTO PLAN, *supra* note 1.

39. FTC REPORT , *supra* note 2.

40. NAS STUDY , *supra* note 3.

41. USPTO, POST-GRANT REVIEW OF PATENT CLAIMS, *at* http://www.PTO.gov/web/offices/com/strat21/action/sr2.htm (last visited July 16, 2004).

42. *Id*.

43. *Id*.

44. FTC EXECUTIVE SUMMARY, *supra* note 12, at 7.

45. *Id*. at 8 n.26.

judge and that discovery be carefully circumscribed. The USPTO's conclusions would receive deference in the appellate court; such a feature may help to reduce the uncertainty over the validity of a patent by resolving the question sooner.[46]

The NAS Study recommends both that the nonobviousness standard be reinvigorated and that an open review proceeding of the type contemplated by the USPTO be instituted. With respect to the first recommendation, the study comments particularly on business methods, "where the common general knowledge of practitioners is not fully described in published literature likely to be consulted by patent examiners, [and] another method of determining the state of knowledge needs to be employed,"[47] and on gene sequence patents where "a Federal Circuit ruling [holds] that with this technology obviousness is not relevant to patentability."[48] An open review proceeding would help to avoid such problems in the future by allowing prior art to be brought forward by those most knowledgeable about the area—the competitors of the patentholder—and by giving deference to the USPTO in determining questions of patentability.

With respect to open review itself, the NAS Study recommends that Congress pass legislation "creating a procedure for third parties to challenge patents after their issuance in a proceeding before administrative patent judges of the USPTO."[49] Like the FTC, the NAS wants the grounds for a challenge to be "any of the statutory standards—novelty, utility, nonobviousness, disclosure, or enablement."[50] The NAS Study also anticipates that federal district courts would be able to refer validity questions to an open review proceeding within the USPTO, leaving them free to concentrate on the infringement part of the case.[51] This reform would have the added benefit of more rapid feedback of information, such as the existence of prior art, from opposition or litigation to the prosecution of patents within the USPTO itself.

Summing up, all these proposals both broaden the number of issues than can be raised and increase the ability of the requestor to engage with the patent-holder and the USPTO. In these respects, the open review systems contemplated by these proposals resemble the opposition system that currently exists at the EPO. Therefore, in the next part, we look at the ex-

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46. *Id.* at 8.
47. NAS STUDY, *supra* note 3, at 5.
48. *Id.* (referring to *In re* Bell, 991 F.2d 781 (Fed. Cir. 1993)).
49. *Id.*
50. *Id.*
51. *Id.*

perience with the European system and what it might tell us about the design parameters for a similar system in the United States.

V. A LOOK AT THE EUROPEAN EXPERIENCE

The opposition and appeal institutions at the EPO provide us with an interesting laboratory for analyzing the workings of a particular post-grant system. The legal framework governing application, examination and opposition processes at the EPO is the European Patent Convention (EPC). Part V of the EPC (Articles 99 to 105) provides the foundations for the opposition procedure; Part VI (Articles 106 to 112) describes the appeal process.[52] Any third party may file an opposition against the patent grant within nine months after the grant of a patent by the EPO.[53] The decision regarding the opposition has force in all designated EPC countries, and the opponent is involved in the proceedings as an *inter partes* participant. The European scope of an opposition's effect and the participation of the opponent as an adversary make the European opposition mechanism quite attractive for any potential challenger. Article 100 lists the admissible reasons for an opposition: 1) that the subject matter is not patentable because the EPO's three examination criteria of novelty, inventive step, and commercial applicability have not been met; 2) that disclosure of the invention is not sufficient to enable somebody skilled in the art to practice the invention; or 3) that the scope of the patent as granted exceeds the scope of the original patent application.[54] The opposition proceeding has three potential outcomes: the patent may be revoked, the opposition may be rejected, or the patent may be narrowed.[55] In the third case, a modified patent grant will be published by the EPO. The costs of opposition and appeal are born by each party; however, the Opposition Division may deviate from this cost allocation if it wishes to do so.[56] This option to assign costs is rarely used, so that typically, the costs are born by each of the parties themselves.[57]

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52. Convention on the Grant of European Patents, Oct. 5, 1973, arts. 99-112 [hereinafter EPC], *at* http://www.european-patent-office.org/legal/epc. Part VI of the EPC deals with appeals at the EPO in general, i.e., with appeals against the examiner's decision to refuse a patent grant and any other decision, such as the ruling of the opposition boards.

53. *Id*. art. 99.

54. *Id*. art. 100.

55. *Id*. art. 102.

56. *Id*. art. 104.

57. An exact assessment of the number of cases in which the actual cost allocation deviates from the rule laid down in Article 104(1) is difficult as the EPO does not publish statistics on cost allocation in opposition proceedings. For the decisions of the Boards of

The Opposition Division responsible for hearing the opposition case consists of three technical examiners, at least two of whom have not taken part in the examination.[58] The respective patent examiner may not be the chairman of the division. The Opposition Division may conduct oral proceedings, and it can be enlarged, if necessary, by a legally qualified examiner who has not taken part in the proceedings for grant of the patent. Additional procedural details are described in the Implementing Regulations to the Convention on the Grant of European Patents which accompanies the European Patent Convention.[59] Notably, the settlement options between the opponent and the patent holder are seriously restricted once the opposition case has been filed. The EPO may pursue an opposition case of its own motion if the opposition has been withdrawn by the opponent or if the opponent has been legally incapacitated.[60]

We now turn to our empirical data on opposition.[61] In Table 1, we document the frequency of opposition for all patent grants occurring between 1980 and 1995.[62] A total of 7.9% of all patents granted between 1980 and 1995 were opposed, and roughly one third of these opposition cases were then appealed. The median duration is about 1.9 years for opposition[63] and 2.1 years for appeal cases. Getting to legal certainty for patents filed at the EPO is therefore a lengthy process: the average duration of examination is 4.3 years,[64] and for contested patents, another 4.0 years are needed to sort out the opposition and appeal cases. Across technology areas, there is little variation in opposition and appeal rates; moreover, the median durations do not vary strongly, with the exception of cases involv-

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Appeal, an estimate of how frequently cost allocation is an issue can be derived from a search of the Boards of Appeal decisions published at http://legal.european-patent-office.org/dg3/search_dg3.htm. Article 104 is mentioned only in 209 out of 18148 appeals cases (date of search: Aug. 4, 2004). This result confirms our subjective assessment that a cost allocation deviating from Article 104(1) is a rare event.

58. EPC, *supra* note 52, art. 19(2).

59. Implementing Regulations to the Convention on the Grant of European Patents, Oct. 5, 1973 [hereinafter EPC Implementing Regulations], *at* http://www.european-patent-office.org/legal/epc.

60. *Id.* R.60(2).

61. See *supra* note 28 for details on the data source used to compute the results summarized in Table 1 and Table 2.

62. The nine month period during which opposition can be filed is not included in the duration of opposition. The incidence of appeal is computed as a share of all opposed patents.

63. Again, this duration does not include the nine-month opposition period.

64. *See* Dietmar Harhoff & Stefan Wagner, Modeling the Duration of Patent Examination at the European Patent Office 11 (Nov. 12, 2003), *at* www.vwl.uni-mannheim.de/stahl/io_ausschuss/paper/04_harhoff.pdf.

ing chemistry patents for which the appeal stage takes somewhat longer (2.6 years at the median) than in other technology areas.

Table 1
Frequency and Duration of EPO Opposition and Appeal Proceedings by Technical Area (Grant Years 1980-1995)

Main Technical Area	Incidence of Opposition	Median Duration of Opposition	Incidence of Appeals	Median Duration of Appeal
Electrical Engineering	5.3%	2.1 yrs	27.0%	1.8 yrs
Instruments	7.1%	2.0 yrs	34.7%	1.9 yrs
Chemistry	9.1%	2.1 yrs	32.3%	2.6 yrs
Process Engineering	9.7%	1.7 yrs	32.5%	2.3 yrs
Mechanical Engineering	7.7%	1.7 yrs	30.5%	1.9 yrs
Consumption and Construction	7.2%	1.7 yrs	32.3%	2.0 yrs
Total	7.9%	1.9 yrs	31.7%	2.1 yrs

The opposition and appeal mechanism would not be remarkable if it did not overturn a significant percentage of the preceding examination decisions. The outcome distribution is tabulated in Table 2,[65] again by main technological area. We document here the final outcome after a possible appeal proceeding. Roughly one-third of the patents (34.7%) are revoked, and roughly another third (32.7%) are maintained in amended form with narrowed breadth. Only 27.4% of all cases lead to a rejection of the opposition. These results indicate that the EPO opposition mechanism corrects a large number of errors from earlier examination decisions.

65. The category "opposition closed" refers to cases in which either the patent holder lets the patent lapse by not paying renewal fees or the opponent drops his opposition against the grant and the EPO does not pursue the case on its own behalf.

Table 2
Outcomes of Opposition and Appeal Proceedings by Technical Area
(Grant Years 1980-1990)

Main Technical Area	Patent Revoked	Opposition Rejected	Patent Amended	Opposition Closed
Electrical Engineering	37.8%	27.4%	30.7%	4.1%
Instruments	34.8%	27.9%	32.2%	5.1%
Chemistry	36.1%	24.5%	35.2%	4.2%
Process Engineering	33.5%	28.3%	30.8%	7.4%
Mechanical Engineering	32.4%	30.3%	32.3%	5.1%
Consumption and Construction	31.0%	30.4%	31.0%	7.7%
Total	34.7%	27.4%	32.7%	5.3%

In 5.3% of all oppositions, the case is closed without yielding any of the three outcomes discussed so far. Closure can result from withdrawal of the opposition by the opponent or from the patent-holder letting the patent lapse by not paying the renewal fees. Hence, this outcome reflects both cases that were successful from the attacker's point of view, in which the patent lapsed into the public domain, and cases that were successes for the patent holder, in which the opposition was dropped. Informal agreements between opponent and patent-holder also are captured by this classification. But this implicit settlement rate is far below the settlement rate of over 90 percent in U.S. patent litigation cases.[66]

Another major difference between EPO oppositions and U.S. patent litigation concerns the costs. While there are no official statistics that capture the costs in a representative manner, several practitioners have stated cost estimates in public. According to these estimates, the average cost per instance and per side is often less than $20,000, but depends on the complexity of the case.[67] For our later welfare discussion, it is important to

66. Lanjouw & Schankerman, *supra* note 23, at 33 tbl.5.

67. Mewburn Ellis L.L.P. give ranges between $5,000 and $15,000 to prepare and file a Notice of Opposition for standard cases, and between $8,000 and $30,000 for the subsequent correspondence and oral proceeding. Mewburn Ellis L.L.P., OPPOSITIONS, *at* htpp://www.mewburn.com/meepopf.htm (last visited July 6, 2004). Markus Herzog of Weickmann & Weickmann, Munich, estimates the cost for each side to be €7,000 for the opposition and €10,000 for the appeal stage if the parties employ patent attorneys at the EPO's location (i.e., without cost of travel). E-mail from Markus Herzog, Partner, Weickmann & Weickmann, to Dietmar Harhoff, Professor of Management, Ludwig-Maximilians-University, Munich (Oct. 17, 2001) (on file with author). He also notes that the parties have virtually no way of driving up their adversary's costs. *Id.*

note that the cost of opposition is considerably lower than the cost of patent litigation in the United States.[68]

The selection of cases for opposition has been addressed in work by Harhoff,[69] Harhoff and Reitzig,[70] Graham et al.,[71] and Hall et al.[72] The overall results are summarized as follows:

- particularly valuable patents are selected with higher likelihood than less valuable ones;
- patents in fields with technical and market uncertainty are attacked more frequently than patents in more established fields;
- patents with immediate market impact are more likely to be attacked;
- patents of independent inventors are attacked *less*, not more frequently than corporate patent applicants.

The first result confirms that opposition at the EPO has a screening property: particularly valuable patents are more likely to be opposed than low value ones. If we assume that the potential welfare losses due to invalid patents are particularly large in the case of valuable patents, this empirical result is very reassuring. The last result is especially important given that the U.S. independent inventor lobby has voiced concerns that a post-grant mechanism may threaten financially weaker patent holders. The EPO opposition mechanism clearly does not present such a threat.

Ideally, the existence of an opposition system with a high revocation rate will have considerable benefits if the revoked patents would have led to costly litigation in a patent system without a post-grant review. In other words, a working opposition system should reduce the rate of litigation. It is difficult to show this reduction directly for EPC countries, since we do not have access to a suitable experiment. However, a comparison of the German and U.S. systems shows a remarkable difference in litigation ac-

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68. Litigation costs for the U.S. are estimated to range between $0.5 and 4 million per side, without appeal. NAS STUDY, supra note 3, at 31; *see also* AM. INTELLECTUAL PROP. LAW ASS'N, REPORT OF ECONOMIC SURVEY 84-85 (2001).

69. Dietmar Harhoff, Incidence, Duration and Outcomes of Opposition and Appeal Cases at the European Patent Office (July 12, 2004), *at* http://www.inno-tec.bwl.uni-muenchen.de/forschung/harhoff/index.html.

70. Dietmar Harhoff & Markus Reitzig, *Determinants of Opposition Against EPO Patent Grants—The Case of Biotechnology and Pharmaceuticals*, 22 INT'L J. INDUS. ORG. 443 (2004).

71. Graham et al., *supra* note 4.

72. Hall et al., *supra* note 4.

tivity. For EPO granted patents in Germany, the patent litigation filing rate can be estimated to be about 0.9%.[73] This rate compares quite favorably to the overall filing rate of 1.9% in the United States as computed by Lanjouw and Schankerman.[74] The difference between the German and the U.S. litigation rate is all the more remarkable, since there are a number of factors that would lead to a relatively high estimate for Germany. For example, the calculation just described only concerns EPO granted patents, which are typically more valuable than patents granted by the German Patent Office and are thus more likely to be attacked. Moreover, litigation in Germany is considerably less expensive than in the United States, and the cases are resolved more quickly.[75] Hence, the low German filing rates are all the more surprising.

We can employ our data and these estimates to conduct a simple thought-experiment. Suppose that only 20% of the patents revoked in EPO oppositions and appeals would lead to patent infringement litigation in Germany.[76] According to Tables 1 and 2, the share of revoked patents among all patents is 2.7%.[77] Thus, if 20% of the revoked patents would have caused litigation without an opposition system, the German litigation rate would have increased by 0.55%, more than half of its current level of 0.9%. While we cannot show a direct causal impact of opposition on litigation, these calculations, taken together with the remarkably low litigation activity in Germany, support our view that a well-functioning opposition system will create considerable benefits for an economy. Based on this scenario and additional assumptions, we consider the expected impact of a post-grant review system in the following section.

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73. Harhoff, *supra* note 69. These computations supersede and correct earlier estimates in Hall et al., *supra* note 4, at 141 n.11.

74. Lanjouw & Schankerman, *supra* note 23, at 30 tbl.2.

75. See Klaus-Jürgen Michaeli, *Patent Litigation in Germany*, *in* BUTTERWORTHS PATENT LITIGATION: ENFORCING A GLOBAL PATENT PORTFOLIO 79 (Gary M. Ropski ed., 1995). Michaeli gives a range of $100,000 to $320,000 for patent litigation costs in Germany in 1995. *Id.* at 86. If a case goes through all instances, it may last between three and five years. *Id.* at 85. The first instance typically takes less than two years, and frequently as little as seven to nine months. *Id.* at 81-84, 86.

76. Of all EPO patent grants, 97.88% designate Germany. EUROPEAN PATENT OFFICE, ANNUAL REPORT 86 tbl.7.4 (2003), *at* http://annual-report.european-patent-office.org/2003. Thus, in first approximation we can work with the grant and opposition estimates displayed in Table 1 although these refer to the population of all EPO patent grants.

77. Calculated by multiplying the total incidence of opposition (7.9%) by the percentage of patents revoked (34.7%).

VI. KEY DESIGN CHOICES AND EXPECTED IMPACT

A. Design Choices

The design of a post-grant review mechanism is by no means an easy task. A number of key design parameters have to be set appropriately, and the underlying economic structure has to be well-understood by policy-makers. Misjudging the motivation of the parties and the impact of costs and of institutional settings could render the institution nonfunctional. The design of the USPTO reexamination system is a telling example. Graham et al. argue that the decision to make reexamination an *ex parte* institution has weakened this mechanism because of the lack of involvement of the challenger.[78] In the following paragraphs we consider a few crucial design parameters: the time limits on opposition; the role of settlements; the parties allowed to file a review motion; the cost of the procedure; the availability of appeal; the validity of the patent during review; and the permissible outcomes.[79]

The time period during which a post-grant review can be initiated must be specified. At the EPO, the opposition period lasts for nine months. More than 97% of all EPO opposition cases are filed within five days of that deadline.[80] While a longer opposition period may allow for better preparation of cases, it also allows the parties to engage in negotiations. As pointed out before, settlements at this stage have the potential to be made at the cost of society at large. The opponent and the patent holder may have strong incentives to settle, since a cozy duopoly is much better than a market with free entry resulting from the patent being revoked. Hence, a long post-grant review period does not serve the purpose of the patent system well. We suggest limiting the opposition period to nine months or fewer.

A related issue concerns the question of whether settlements between the parties should be allowed once the post-grant review has been initiated. In EPO opposition proceedings, an opponent may drop her case, but the EPO retains the right to examine the validity of the patent on its own motion.[81] This right is a powerful threat against settlements, and there is

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78. Graham et al., *supra* note 4, at 83-85.

79. Another design parameter on which we do not comment due to lack of evidence is the question of whether the original examiner should be included in the review process, as is sometimes the case at the EPO. *See* EPC, *supra* note 52, art. 19(2). The effect of this choice on the outcome of the opposition has not yet been studied, although work to do this is underway.

80. Based on author's own computations. *See supra* note 28.

81. EPC Implementing Regulations, *supra* note 59, R.60(2).

little reason to encourage the use of settlements in a dispute that focuses on the *validity* of a patent. The public, a silent participant in the process, is unlikely to benefit from the settlement outcome. Given the public's interest in avoiding collusive settlements, we argue against the admission of settlements during the post-grant review process.

Any third party could conceivably have information about the subject matter of the patent, its novelty, and other aspects bearing on its validity. As a direct implication, there should be no restrictions on the type of opponent admitted to the procedure. This rule will allow public-interest groups and non-governmental organizations to participate in these proceedings, enlarging the set of parties that may provide information for the review decision.

Another important design parameter of a post-grant review system concerns the cost of the proceedings. Keeping the opponent's costs low will increase the likelihood of post-grant reviews, but it will also increase the number of cases. A post-grant review system that involves costly discovery is likely to achieve the opposite result, and it may make the new institution a battleground for cash-rich players. Moreover, the inherent danger of post-grant reviews becoming a strategic instrument to harass small firms and independent inventors would increase. The empirical results discussed above are reassuring: the EPO institutional design shields independent inventors from strategic abuse by means of the opposition mechanism. On balance we favor a low cost system, in particular, the inclusion of mechanisms that guard against the raising of rivals' costs via discovery.

The EPO experience also shows that an appeal mechanism should be in place to correct potential errors of the post-grant review board: about one third of the opposition cases at the EPO lead to an appeal (see Table 1). In Europe, the appeal is heard by the Technical Appeal Boards of the EPO.[82] Currently, the Appeal Boards form part of the EPO, but some efforts are under way to turn them into a formally independent institution. To give challengers and patent-owners access to a full-fledged court hearing, we advocate letting the CAFC decide about appeals arising from the post-grant review process.

The patent's validity should be maintained while it is under review. Otherwise, there would be strong incentives to initiate patent reviews merely to render the patent invalid for some time. Once a first-instance review has revoked the patent, however, the presumption of validity should be discontinued. The intensive scrutiny of the post-grant review

82. EPC, *supra* note 52, art. 19.

deserves greater weight than the initial patent examination, which takes place under strict resource constraints.

Post-grant review should not be used to broaden a granted patent. This asymmetry in favor of the opponent, or society, simply provides a balance to the initial asymmetry in favor of the applicant. While the applicant will use all of its information to its own advantage during the negotiations with the examiner, the scope of information available to the examiner may be seriously restricted. Thus, the examiner's error distribution will favor the applicant. Given this bias, a broadening of the patent should not be allowed in the review round.

Finally, one of the shortcomings of the European opposition system is the excessive duration of opposition and appeal cases. As we show in Table 1, it can take 4 years at the median to resolve an opposition case with subsequent appeal. Opposition and appeal last longer than 6.2 years for one quarter of all cases.[83] The introduction of a post-grant review system may require shifting resources from examination to post-grant reviews if the introduction of the new institution is not accompanied by the provision of additional capacity. Even in this scenario, we view the introduction of a post-grant review positively because post-grant reviews target socially important patent rights. One resource unit can be employed to considerably expedite the opposition process, which largely concerns valuable patents, while taking the same resource unit away from examination would lead to a small delay of the average duration of examination, where only a small share of patent applications are valuable.

In conclusion, we recommend a post-grant review system that is inexpensive both to opponents and patent holders, that limits the parties' incentives to settle at the expense of society, that permits both parties to appeal, that leads to swift decisions, and that allows for a narrowing, but not a broadening, reissue of patents.

B. Expected Impact

Given the experience with post-grant reviews at the EPO, what is the likely welfare impact of the introduction of a post-grant challenge mechanism in the United States? In another publication, with our two co-authors, Stuart Graham and David Mowery, we conclude that post-grant review will generate substantial welfare gains as long as the system yields a reasonable percentage of revocations and is not too expensive.[84] We reach this conclusion by considering a variety of scenarios. These are replicated

83. *Id.*

84. Graham et al., *supra* note 4.

in Table 3 and Figure 2, which show the benefit-cost ratio under a variety of different scenarios.

Table 3

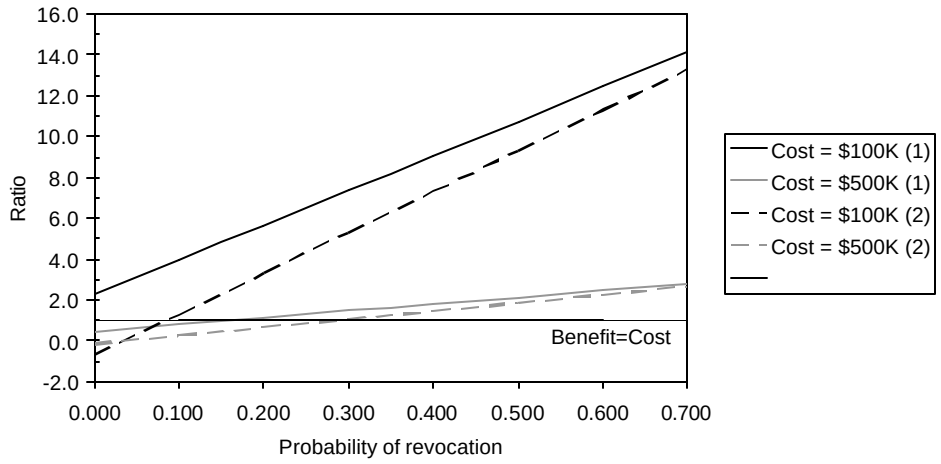
Welfare Computation for Post-Grant Review Systems under Different Scenarios

		Outcome Probabilities			Benefits (avoided cost)				
Scenario	Cost of review case (per patent) thousands	Revocation probability	Amendment probability	Rejection probability	Revocation thousands	Amendment thousands	Rejection thousands	Total benefit (per patent) thousands	Benefit/ Cost Ratio
Validity prob from Allison & Lemley; low cost	$100	0.45	0.30	0.25	$2.000	$0	$0	$900	9.0
Validity prob from Allison & Lemley; low cost	$100	0.45	0.30	0.25	$2.000	$300	$0	$990	9.9
Validity prob from Allison & Lemley; high cost	$500	0.45	0.30	0.25	$2.000	$0	$0	$900	1.8
Validity prob from Allison & Lemley; low cost; rejection raises cost	$100	0.45	0.30	0.25	$2.000	$0	-$200	$850	8.5
Validity prob from Allison & Lemley; high cost; rejection raises cost.	$500	0.45	0.30	0.25	$2.000	$0	-$200	$850	1.7
Opp. Outcome probabilities; low cost	$100	0.35	0.33	0.32	$2.000	$0	$0	$700	7.0
Opp. Outcome probabilities; low cost	$100	0.35	0.33	0.32	$2.000	$300	$0	$799	8.0
Opp. Outcome probabilities; high cost	$500	0.35	0.33	0.32	$2.000	$0	$0	$700	1.4
Opp. Outcome probabilities; low cost; rejection raises cost	$100	0.35	0.33	0.32	$2.000	$0	-$200	$636	6.4
Opp. Outcome probabilities; high; rejection raises cost	$500	0.35	0.33	0.32	$2.000	$0	-$200	$636	1.3

Re-exam outcome probabilities; low cost	$100	0.11	0.63	0.26	$2.000	$0	$0	$220	2.2
Re-exam outcome probabilities; low cost	$100	0.11	0.63	0.26	$2.000	$300	$0	$409	4.1
Re-exam outcome probabilities; high cost	$500	0.11	0.63	0.26	$2.000	$0	$0	$220	0.4
Re-exam outcome probabilities; low cost; rejection raises cost	$100	0.11	0.63	0.26	$2.000	$0	-$200	$168	1.7
Re-exam outcome probabilities; high cost; rejection raises cost	$500	0.11	0.63	0.26	$2.000	$0	-$200	$168	0.3

Table 3 has three panels, each corresponding to a set of assumptions about outcome probabilities. The first panel uses the probability that a U.S. patent is found valid during litigation reported by Allison and Lemley.[85] The second panel uses the observed opposition outcome probabilities for the EPO system given in Table 2. The third panel uses the observed reexamination outcome probabilities of the USPTO system, given in Hall et al.[86] The third choice is very conservative; an opposition system is unlikely to lead to patent revocation probabilities as low as 11%. For each of these three outcome scenarios, we report five computations, three using a low opposition cost of $100,000 and two using the higher estimate of $500,000 that was used by Levin and Levin.[87] We also experiment with assuming a social cost for rejection and an avoided cost for patent amendment as well as for patent revocation. Almost all of the scenarios yield benefit-cost ratios well in excess of unity, with the exception of some scenarios that use the USPTO reexamination outcome probabilities. The lowest ratios for each panel are for the high opposition cost cases. Hall et al. conclude that unless the opposition system is very expensive to operate and yields results similar to those now obtained with the USPTO reexamination system, it would generate substantial welfare gains.[88]

Figure 2
Benefit-cost ratio versus the probability the patent is revoked



85. John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 205-06 (1998).

86. Hall et al., *supra* note 4, at 131 tbl.4.3.

87. Jonathan Levin & Richard Levin, *Benefits and Costs of an Opposition Process*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY, *supra* note 4, at 120, 137-38.

88. Hall et al., *supra* note 4, at 138.

Figure 2 gives a graphical illustration of the results of our computations under a number of different scenarios. This figure plots the computed benefit-cost ratio versus the assumed probability that a patent will be revoked. We consider four scenarios: two with an opposition cost of $100,000 and two with a cost of $500,000. For each cost assumption, the first case has an avoided cost for patent revocation of two million dollars, an avoided cost for patent amendment of $300,000, and a rejection probability of 25%, while the second less favorable case has the same avoided cost for patent revocation, but a social cost for the rejection of opposition of $200,000, and a rejection probability of 35%. In all cases, the amendment probability is simply one minus the revocation and rejection probabilities. We also show the unit line where benefits equal costs to assist in interpretation. Costs exceed benefits only when the revocation probability is extremely low, except for the situation where the cost of an opposition is $500,000 and rejection of an opposition leads to *increased* litigation costs rather than leaving them unchanged.

VII. CONCLUSION

Patent offices are not perfect data-processing machines and patent examiners are not perfect assessors of patent applications. Patent examiners' tasks are particularly challenging if the technological or scientific frontier is moving fast, and if relevant information has not yet been included fully in the written material that patent examiners use to understand the state of the art. In such a context, the parties with the most salient and relevant knowledge for the process of examining or reexamining a patent are informed third parties, and in particular the patent applicant's competitors. Our inspection of the EPO opposition system shows that post-grant review mechanisms can provide proper incentives for these parties to supply valuable information to the patent office. A properly designed post-grant review mechanism, similar to the one broadly described in Part VI, should generate considerable welfare gains for the intellectual property system. Given the current state of the U.S. patent system, the introduction of such a mechanism, possibly in conjunction with other reforms such as an increase in the nonobviousness standard, would improve its efficiency and lower the burden from litigation.