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4

Prospects for Improving U.S. Patent Quality via Postgrant Opposition

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Executive Summary

The recent surge in U.S. patenting and the expansion of patentable subject matter has increased patent office backlogs and raised concerns that, in some cases, patents of insufficient quality or with inadequate search of prior art are being issued. At the same time, patent litigation and its costs are rising. This paper explores the potential of a postgrant review process modeled on the European opposition system to improve patent quality, reveal overlooked prior art, and reduce subsequent litigation. We argue that the welfare gains to such a system may be substantial.

This is an agency in crisis, and it's going to get worse if we don't change our dynamic. It doesn't do me any good to pretend there's not a problem when there is.
—James E. Rogan, appointed director of the U.S. Patent and Trademark Office in December 2001, as quoted in the *Los Angeles Times*, February 7, 2003.

I. Introduction

Beginning in the 1980s, a series of administrative, judicial, and legislative actions strengthened the economic value of U.S. patents and extended their coverage in areas such as computer software and business methods. Partly as a result of these changes, patent applications in the United States continue to grow (see figure 4.1), and the resources available to the patent office have not kept pace. The fraction of patents granted within two years of application has fallen from 85 percent in the early 1990s to about 70 percent in the late 1990s. At the April 2002 hearings before the House Subcommittee on Courts, the Internet and Intellectual Property, Commissioner Rogan stated, "Average pendency surpassed 24 months in 1999, and we expect it to average 26.5 months this year" (Rogan 2002).

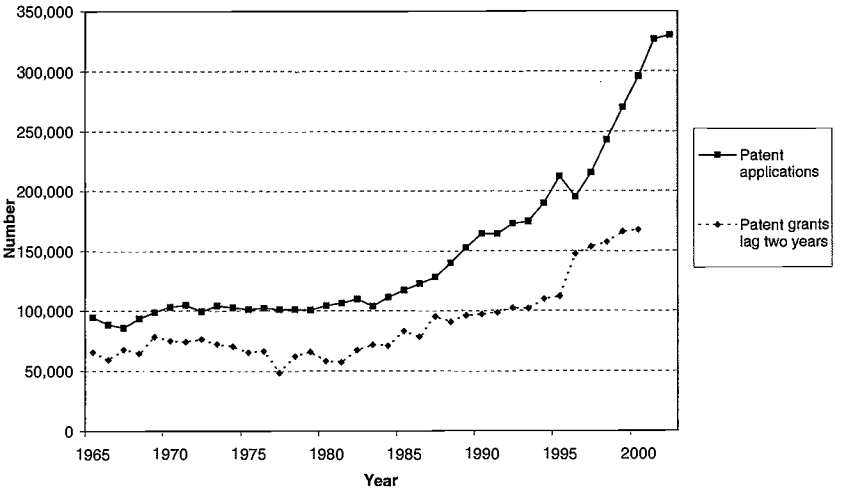

Figure 4.1
USPTO utility patents 1965–2002.

A second consequence of these changes has been an increase in patent litigation and a more recent increase in patent litigation rates. In a study of patent litigation between 1978 and 1995, Lanjouw and Schankerman (2002) found that the rate of litigation rose only slightly between the 1978–1984 and 1991–1995 periods, from nineteen to twenty-one suits per thousand patents, with some variation across technology areas. Somaya (2002) suggests that this rate rose again in the late 1990s. In a new and comprehensive study of patent litigation focusing on cases that terminated in 1998–2000, Allison et al. (2003) report a litigation rate of approximately thirty-two suits per thousand patents. Whether or not litigation per patent issued has increased substantially, the fact remains that the absolute amount of litigation has grown enormously, increasing both the private and public costs of the system as a whole.

Although many of the administrative, legal, and judicial changes in policy affecting patent validity, examination, and value were undertaken at the behest of the U.S. business community, concerns have been raised about the potential economic burdens of low-quality patents in an environment of greater deference to the rights of the patent holder (Merges 1999, Barton 2000, Kingston 2001). 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 nonpatent prior art, resulting in the issuing of patents of considerable breadth and insufficient quality, and that this problem has worsened in recent years. Many of these critics advocate the reform or extension of procedures that would enable interested parties other than U.S. Patent and Trademark Office (USPTO) examiners to bring relevant information to bear on this process either before or shortly after the issue of a patent.

The present paper reviews the prospects for improving the operation of the patent system and lowering its cost by changing the administrative process at the USPTO. At present, the primary administrative procedure for a challenge to the validity of a U.S. patent is the re-examination proceeding, which may be initiated by any party during the life of the patent. A more elaborate and adversarial procedure for challenging the validity of patents in the immediate aftermath of their issue is the opposition proceeding used by the European Patent Office (EPO). Several scholars, both legal and economic, have advocated the introduction of such a system in the United States or a strengthening of the re-examination system to improve the quality of patents and to increase the likelihood that relevant prior art is brought to bear, especially in new subject matter areas. (See Hall 2003 for a summary of these views.) In this paper, we consider the likely effects of introducing such a postgrant review process in the U.S. patent system, focusing in particular on the ability of such a process to improve the quality of patents and reduce the length of time that the current reliance on litigation requires to ascertain the validity of the relatively valuable patents contested in court. Our assessment of the benefits and costs of a U.S. postgrant patent review system draws on our previous work (Graham et al. 2003), as well as that of Janis (1997) on alternatives to the re-examination procedures and Levin and Levin (2002) for models of strategic litigation and opposition behavior.

We begin by reviewing the current causes of concern about the operation of the U.S. patent system, focusing on the patent quality issues that such a system might be designed to improve. We then describe the institutional background and administrative structure of the U.S. and European patent systems. Readers who are already familiar with the patent system or who are not interested in the institutional detail may wish to skip this section. The final sections of the paper compare the operation of the two patent systems and then present a simple welfare analysis of the expected costs and benefits of introducing a more adversarial administrative challenge system.

II. The Problem

Patent Quality

What do we mean by "patent quality"? From the perspective of economic welfare, granting the property right described by a patent involves trading off the gain from providing an incentive for innovation against the deadweight loss implied by the possibility of a monopoly during the patent term. The statutory definition of a patentable invention is that it be novel and nonobvious, and that it have utility.[1] Both the economic and legal views suggest that high-quality patents describe an invention that is truly new, rather than an invention that is already in widespread use but not yet patented.[2] See table 4.1 for some examples of patents that appear to violate this definition, mostly because there is prior art that is not easily searchable in written form.

Besides the three statutory requirements, a fourth criterion for granting a patent on an invention is that the patent application must disclose sufficient details about the invention. Patents thus serve another social purpose: these disclosures in the published patent can facilitate knowledge spillovers to others who might use or improve the invention. Another criterion for a high-quality patent therefore is that it enable those skilled in the art to comprehend the invention well enough to use the patent document for implementation of the described invention. This dimension of patent quality, however, is less likely to be affected by postgrant opposition proceedings.

From a social welfare perspective, an important characteristic of a high-quality patent is that there be relatively little uncertainty over the breadth of its claims, i.e., over what specific features of a technical advance are claimed under the terms of the patent, as well as whether these claims are likely to be upheld in legal proceedings following the issue of the patent. Uncertainty about the validity of a patent has several potential costs: such uncertainty may cause the patent holder to underinvest in the technology, it could reduce investment by potential competitors in competing technical advances, and it may lead to costly litigation after both the holder and potential competitors have invested sizable amounts of money.

Consequences of Low Patent Quality

Although some scholars, notably Lemley (2001), have argued that the costs of having higher quality patents may exceed the benefits, recent

Table 4.1
Some examples of patents whose validity has been questioned

Patent number	Year granted	Assignee	Title	Description
5,241,671	1993	Encyclopaedia Britannica (Compton)	Multimedia search system using a plurality of entry paths that indicate interrelatedness of information.	Broad claims that cover a multimedia CD-ROM that searches multiple databases of text, images, and video.
5,797,127	1998	Walker Asset Management LP/ Priceline	Method, apparatus, and program for pricing, selling, and exercising options to purchase airline tickets.	An algorithm for constructing airline ticket option prices based on past demand, implemented on a computer.
5,937,468	1999	Lucent	Sine/cosine table lookup on a computer.	Use of a computer algorithm to perform the table lookup familiar from math textbooks to obtain the sine or cosine of an angle.
5,963,916	1999	Intouch Group, Inc.	Network apparatus and method for preview of music products and compilation of market data.	Patent on storing music on a server (with backup servers) and letting users listen to it by clicking on a list of the music available.
6,257,248	2001	NA	Two-hand hair-cutting method.	Cutting or styling hair using instruments such as scissors or combs in both hands.
6,368,227	2002	NA	Method of swinging on a swing.	Swinging a swing sideways or in a circular motion instead of back and forth by pulling on the chains (re-examined in 2003).

experience suggests that there are some unintended consequences, in the form of complicating property rights and feedback effects. In this section, we review the arguments for increasing patent quality.

Low-quality patents can create considerable uncertainty among inventors or would-be commercializers of inventions and slow either the pace of innovation or investment in the commercialization of new technologies. Lerner (1995) has shown that fear of litigation may cause smaller entrant firms to avoid areas where incumbents hold large numbers of patents. 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 costs of invalidating the patents are too high. In these circumstances, technological alternatives may not be commercialized, and consumer welfare suffers.

The lack of relatively rapid processes for resolving patent validity and ensuring higher patent quality may also slow the pace of invention in fields characterized by "cumulative invention," i.e., those in which one inventor's efforts rely on previous technical advances or advances in complementary technologies. But if these previous technical advances are covered by patents of dubious validity or excessive breadth, the costs to inventors of pursuing the inventions that rely on them may be so high that they discourage such cumulative invention. On the other hand, large numbers of low-quality patents may dramatically increase the level of fragmentation of property rights covering prior-generation or complementary technologies, thus raising the transaction costs for inventors obtaining access (e.g., through licenses) to 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 kind of 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, and thus further limiting the examination of individual applications, and further degrading the quality of patents.

Recent decisions by the court of appeals for the federal circuit (CAFC), the specialized appeals court for patent cases, concerning the

validity of important patents (those deemed sufficiently valuable by the patent holder or a competitor to litigate and appeal) create still another reason for serious consideration of a nonjudicial process for postissue validity challenges. For example, the CAFC ruled in 2002 that the USPTO had incorrectly rejected two applications for "obviousness," arguing that if an examiner rejects an application using "general knowledge," that knowledge "must be articulated and placed on the record."[3] According to deputy commissioner Esther Kepplinger, "[W]e can't reject something just because it's stupid."[4] This decision could significantly weaken the level of scrutiny provided by the already costly and overcrowded patent-litigation system. A system that enables 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 determination.

The U.S. patent system, no less than those of other advanced industrial economies, is very much a political creation. Its development and frequent alterations at the hands of the U.S. Congress reflect changes in the balance of political power among corporate inventors, independent inventors, the broader research community, and the general public. It is hardly an accident, after all, that the most recent series of changes in the U.S. and international patent systems were undertaken by U.S. political actors during the throes of the competitiveness crisis of the 1980s. And the increased economic stakes in intellectual property resulting from these policy changes, as well as the broader shift to a knowledge-based economy, are likely to complicate reforms of such potentially far-reaching scope as the introduction of a more elaborate system for postgrant validity challenges. Indeed, the re-examination process that we discuss below was considerably weakened during debate over its passage by the U.S. Congress. Nevertheless, consideration of any such reforms must begin with an analysis of their operation in other industrial-economy patent systems. The remainder of this paper examines the EPO opposition system and compares its operation and outcomes with those of the existing administrative process for patent-validity challenges in the United States: the "re-examination."

III. Institutional Background

The U.S. and European patent systems have similar aims and requirements for patentability, but they differ in the allowable subject matter and in their administrative procedures. As we noted earlier, the U.S. system requires that an invention (process, machine, manufacture, or

composition of matter) satisfy four requirements to be patentable: adequate disclosure, novelty, usefulness, and nonobviousness. In Europe, firms and individuals have been able since 1978 to submit a single application to the European Patent Office that specifies up to twenty-four national jurisdictions in which they desire patent protection for an invention. Under the EPO regime, the patentability requirements—adequate disclosure, novelty, industrial application, and inventive step—are broadly similar but not identical to those of the United States.

The median time between application and patent issue in the U.S. system during the 1980s and 1990s was eighteen months to two years (with a long list of patent applications with a much longer wait time), and in the EPO, it was slightly more than four years. As part of the patent system harmonization legislated in the American Inventors Protection Act of 1999, the United States instituted a policy of publication eighteen months after application in November 2000 for many patents with applications pending in jurisdictions outside the United States. In contrast, EPO applications have always been published with an eighteen-month lag time, regardless of whether the patents have been issued.

Both systems have a postgrant procedure through which the validity of the patent can be challenged by other parties, but the two patent systems' postgrant challenge procedures differ significantly. In both systems, interested parties can also bring suit in court over infringement and validity (with some restrictions on when a suit can be filed). We discuss these administrative processes for postgrant challenges in the following sections.

USPTO Examination and Re-examination Procedures

In the United States, inventors may claim a utility patent by making application to the USPTO. Before a patent is issued, the USPTO is charged with ensuring that the invention is adequately specified; covers patentable subject matter; and is useful, novel, and nonobvious. Procedurally, the application must be filed within one year of the invention's public use or publication, contain an adequate description with one or more claims, and be accompanied by the payment of a fee.

The USPTO patent examiner is the arbiter of the patentability, novelty, usefulness, and nonobviousness requirements cited above, judg-

ing these standards against the "prior art," i.e., prior inventions, in the field. Prosecution of the patent has been characterized as a give-and-take affair, with negotiation and renegotiation between the patentee and the examiner that ordinarily continues for two to three years (Merges et al. 1997). The costs of prosecuting a patent through the USPTO range from $5,000 to $100,000 (including the USPTO issue fee), depending on the nature of the technology.

Re-examination, originally envisioned as an alternative to expensive and time-consuming litigation, was created by the 1980 Bayh-Dole Act. The legislative history of this act suggests that the re-examination was intended to be a mechanism that would be less expensive and less time consuming than litigation.[5] During the legislative process, however, the act was purged of its intended adversarial characteristics, reducing the usefulness of the procedure for opponents of a given patent.

Procedurally, the re-examination proceeding permits the patent owner or any other party to notify the USPTO and request that the grounds on which the patent was originally issued be reconsidered by an examiner. Initiation of a re-examination requires that some previously undisclosed new and relevant piece of prior art be presented to the agency. Under the statute, a relevant disclosure must be printed in either a prior patent or prior publication—no other source can serve as grounds for the re-examination.

After initiation by notification and the payment of a fee to the USPTO, the re-examination goes forward only if the USPTO finds a substantial new question of patentability. Such a determination was intended by law makers to prevent the reopening of issues deemed settled in the original examination (Merges 1997). The USPTO must make this determination within three months of the request and, having made the determination, must notify the patent owner.

When the owner is not the re-examination proponent (about half the cases), the patentee is allowed to file a response to the newly discovered prior art within two months. If the owner chooses to respond, the requester is afforded an opportunity to reply within two months. By choosing not to respond, the owner can limit the requester's participation in the process. The re-examination is an ex parte proceeding between the patent owner and the USPTO that provides limited opportunities for third-party involvement.[6]

The party requesting a re-examination is entitled to notify the USPTO of the triggering prior art, to receive a copy of the patentee's reply to the re-examination (if any), and to file a response to that reply. The

owner's role in the process is much more involved: the re-examination statute contemplates a second examination, with the same type of give-and-take negotiation between owner and patent office that occurred during the initial issuance of the patent. The examiner remains the final arbiter of the process, and it is not uncommon for the original examiner to be assigned the follow-up re-examination, thus putting the question of whether prior art was overlooked in the hands of the same government official who was responsible for ensuring that no prior art was overlooked in the previous search.

Once the re-examination goes forward, however, the statute requires that the commissioner make a validity determination. The original patent is afforded no statutory presumption of validity in the proceeding, although the practice of assigning re-examinations to the original examiner may produce such a presumption. The re-examination cannot be abandoned or postponed to await the result of concurrent litigation proceedings, although it may be stayed during other USPTO proceedings, including re-issue or interferences. A re-examination may result in the cancellation of all or some of the claims in a patent or the confirmation of all or some of the claims. Nothing in the re-examination procedure can expand the scope of the original patent's claims, but claims may be amended or new claims added during the renegotiation between the patent owner and the examiner.

In summary, for parties seeking to invalidate an issued patent, the re-examination procedure involves considerable costs and risks. The filing fee for the re-examination is substantial, and practitioners estimate the average costs of a re-examination at $10,000 to $100,000, depending on the complexity of the matter. Although the costs of a re-examination are lower than those of litigation ($1 to $3 million), the third-party challenger in re-examination is denied a meaningful role in the process, and the patent holder maintains communications with the examining officer, offering amendments or adding new claims during the re-examination. Re-examination may make it more difficult for challengers to prevail in patent-validity litigation because juries tend to give added weight to re-examined patents. The court of appeals for the federal circuit has indicated that claims confirmed by the re-examining officer present added barriers to a successful contest.[7] As a result, challengers face powerful incentives to forego re-examination in favor of litigation, a process that may well be more expensive, more time consuming, and less expert in testing postissue validity.

Patent Litigation in the United States

In the United States, postissue validity can also be tested in court. Procedurally, litigation differs markedly from the re-examination procedure. Unlike the re-examination procedure, litigation is an adversarial proceeding in which the litigant may elect to have the case heard by either a judge or a jury. Because patent suits generally arise from a charge from the patent owner of infringement, the patent owner exerts considerable control over the timing of enforcement and litigation in a patent dispute.[8]

Legal standards create a relatively hostile environment in the federal courts for challengers seeking to invalidate an issued patent. Under the statute, patents are "born valid," thus enjoying a presumption of validity during the court proceedings. Furthermore, the evidentiary standard for proving that a claim is invalid is clear and convincing evidence, a standard considerably higher than the mere preponderance of proof required in the typical civil suit. Because judges and juries may have limited technical expertise, these presumptions and evidentiary barriers create high costs for challengers. The "propatent" judicial philosophy promulgated by the CAFC since its creation has compounded these barriers. According to one study, successful challenges to patent validity fell from 50 percent to 33 percent in the years after the creation of the CAFC (Lemley and Allison 1998).

Direct costs in litigation are also high compared with those of re-examination. Estimates of legal costs in patent litigation run from $500,000 to $3 million per suit, depending on the amount at risk (AIPLA 2001) or to $500,000 per claim at issue, per side (Barton 2000). One important driver of these costs is the extensive use of pretrial discovery. The lag between filing a patent suit and reaching a resolution can also be considerable. One study estimates the average length of a district court patent suit at thirty-one months (Magrab 1993).

But, in fact, very few patent suits actually go to trial, as reported in Lanjouw and Schankerman (2002), who find that approximately 95 percent of all patent suits settle either before or during trial: 78 percent settle even before the pretrial hearing, an additional 16 percent settle before trial, and 1 percent settle during trial. The median length of time to settlement is eight months, sixteen months, and twenty-five months, respectively, implying that the average or median time to a litigation outcome is somewhat less than the thirty-one months reported by

Magrab. This does not mean that litigation is inexpensive. According to the surveys conducted by the AIPLA, about half of the estimated legal costs of litigation are incurred before the end of the discovery phase (AIPLA 2001). It also does not mean that the social costs of a patent are avoided because settlement before trial is likely to lead to a collusive outcome.

EPO Examination and Opposition Procedures

Patent protection for European signatories to the European Patent Convention (EPC) can be obtained by filing several national applications at the respective national patent offices or by filing one EPO patent application at the European Patent Office. The EPO application designates the EPC member states for which patent protection is requested.[9] The total cost of a European patent amounts to approximately €29,800, roughly three times as much as a typical national application.[10] Thus, if patent protection is sought for more than three designated states, the application for a European patent is less expensive than independent applications in several jurisdictions. This cost advantage has made the European filing path particularly attractive for applicants selling goods and services in multiple European markets. Increases in the number of patent applications and grants have given the EPO a level of economic importance that now resembles that of the USPTO.

EPO patent grants are issued for inventions that are novel, mark an inventive step, are commercially applicable, and are not excluded from patentability for other reasons. After the filing of an EPO application, The Hague EPO office produces a search report for the applicant. The search report describes the state of prior art regarded as relevant according to EPO guidelines for the patentability of the invention, i.e., it contains a list of references to prior patents and/or nonpatent sources. Unlike the procedure in the U.S. system, applicants at the EPO are not required to supply a full list of prior art (see Michel and Bettels 2001, p. 191ff). Within six months after the announcement of the publication of the search report in the EP bulletin, applicants can request the examination of their application. This request is a compulsory prerequisite for the patent grant. If examination is not requested, the patent application is deemed to be withdrawn. Eighteen months after the priority date, the patent application is published. At this point, the application is normally under examination; thus, the patent owner is generally required to reveal some information about his or her in-

vention before the grant of the patent and even if no patent is ever issued.

After examination (if requested) has been performed, the EPO either informs the applicant that the patent will be granted as specified in the original application or requires the applicant to agree to changes in the application that are necessary for the patent grant. In the latter case, a negotiation process similar to that in the U.S. system follows. Once the applicant and the EPO have agreed on the scope of the allowable subject matter, the patent is issued for the designated states and is translated into the relevant national languages. If the EPO declines to grant a patent, the applicant may file an appeal. Within nine months after the patent has been granted, any third party can oppose the European patent centrally at the EPO by filing an opposition against the granting decision. The outcome of the opposition procedure is binding for all designated states. If opposition is not filed within nine months after the grant, the patent's validity can be challenged only under the legal rules of the respective designated countries. The EPO opposition procedure is thus the only centralized challenge process for European patents.

An EPO patent opponent must file an opposition with the EPO and present evidence that the prerequisites for patentability were not fulfilled; i.e., the opponent must show that the invention lacked novelty and/or an inventive step or that the disclosure was poor or insufficient. At the EPO, an opposition division determines the outcome. The examiner who granted the patent is a member of the three-person opposition chamber but may not be the chairperson. The opposition procedure can have one of three outcomes: the patent may be upheld without amendments, it may be amended, or it may be revoked. Data on opposition outcomes reported in Graham et al. (2003) indicate that revocation occurs in about one-third of all opposition cases.

Another interesting aspect of the opposition procedure concerns the restrictions imposed by this process on the opponent's ability to settle out of court. Once an opposition is filed, the EPO can choose to pursue the case on its own, even if the opposition is withdrawn. Thus, the opponent and patent holder may not be free to settle their case outside the EPO opposition process once the opposition is filed. This provision of the opposition proceeding may discourage its use by opponents seeking to force patent holders to license their patents.

Both the patent holder(s) and the opponent(s) may appeal the outcome of the opposition procedure. The appeal must be filed within two months after receipt of the decision of the opposition division, and it

must be substantiated within an additional two months. The board of appeal affords the final opportunity at the EPO to test the validity of the contested European patent. Both parties can bring expert witnesses to the proceedings, and various options are available for extending deadlines. Graham et al. (2003) report that the median duration of the challenge procedures (opposition and any appeal) is about three years, although there is considerable variation in the duration of individual cases (the interquartile range is also about three years).

The official fee for filing an opposition is €613; for filing an appeal against the outcome of opposition, the fee is €1,022. However, the total costs to an opponent or the patent holder are much higher. Estimates by patent attorneys of the costs of an opposition range between €15,000 and €25,000 for each party. Patent attorneys we interviewed agreed that opponents have limited ability to drive up the patent holders' costs by filing an opposition (in contrast to litigation in the United States), because attorney fees are regulated in most European countries, including Germany, where many patent lawyers who have the required EPO registration reside.

Patent Litigation in Europe

One desirable feature of the EPO opposition system is its centralized structure within the fragmented European legal system for patent challenges. As we noted earlier, patent litigation affecting EPO patents is conducted at the national level. The centralized nature of the EPO opposition process thus arguably is more important in this context than in the United States, where the federal courts operate as a more unified system. Nonetheless, a full evaluation of the effects of the EPO opposition system requires some consideration of the possibilities for litigation, which are not precluded by the opposition proceeding.

There have been few systematic studies of patent litigation within the various European nations, and we therefore confine ourselves to a brief review of the few known facts. Outcomes in the local litigation processes involving EPO patents are restricted to the "local" level; for example, the patent may be invalidated in Spain, but this finding does not affect its validity in Italy. During the past decade, national patent courts have increasingly taken evidence and decisions from litigation in other European nations into account, but no systematic study has analyzed such legal spillover effects (Stauder 1996, Stauder et al. 1999).

Table 4.2
Estimated patent costs in the United States and Europe[a]

	United States	Europe
Application	$34,000	$22,903
Fees[b]	$4,000	$4,624
Legal costs	$30,000	$5,914
Translation	NA	$12,366
Renewal (10 years)	$6,000	$9,140
Re-examination/opposition		
Fees	$2,520	$1,075
Legal costs	$10,000–$100,000	$21,505
Litigation	$0.5M–$3M	$54K–$540K

[a]Numbers are in 2002 dollars using an exchange rate of 0.93 euros to the dollar. Figures are approximate.
[b]These fees are for an entity that is not small.

The differences among national jurisdictions within Europe are enormous, requiring substantial investments in each national suit and driving up the costs of challenging the national patents emerging from an EPO grant in several of the designated states. The costs of litigation in any national court have been estimated to be between €50,000 and €500,000, depending on the complexity of the case. This cost structure makes an attack at the European level with the opposition procedure particularly attractive for a current or potential competitor of the patent holder. The litigation rate (computed as the number of cases for which a suit is filed divided by the number of patents) in most European countries is roughly 1 percent, slightly lower than the 1.9 percent reported for the United States (Stauder 1996, 1989; Lanjouw and Schankerman 2001). However, recent estimates by Cremers (2003) suggest that the litigation rate may be as high in Germany as in the United States, on the order of 2.1 percent.[11] At this juncture, all that can be said is that the quantitative evidence is too sparse to conclude from these figures that the existence of the opposition mechanism leads to a reduction in litigation or in litigation cost. Table 4.2 summarizes the costs associated with each system.

IV. Comparing the Two Systems

In Graham et al. (2003), we compared the operation of the postissue re-examination and opposition systems for challenging patent validity in the United States and drew some conclusions about the differences

between an ex parte system like the current U.S. system and the inter partes system used in Europe. First, the U.S. re-examination procedure differs dramatically from the EPO opposition procedure in almost all its features. The two most important are that re-examinations are much less common, with an overall average rate of 0.2 percent, in contrast to the European opposition rate of about 8 percent, and that the identity of the party requesting a re-examination in the U.S. system is the patent owner in at least 44 percent of the cases, lowering the effective rate even more. This characteristic of re-examination hardly qualifies it as the sort of adversarial procedure that EPO oppositions represent.

We also found that EPO oppositions resolved validity challenges more slowly than USPTO re-examination proceedings. Indeed, opposition proceedings in some cases (and almost certainly in important, complex cases with numerous opponents, appeals, etc.) may well take as much time to be resolved as with litigation in the U.S. system. Nonetheless, the higher frequency of EPO opposition compared to U.S. re-examination or litigation is at least consistent with the hypothesis that the opposition process handles many more legal disputes over patent validity than are addressed by the U.S. re-examination process and at a lower cost than the U.S. litigation process.[12]

Our analysis of the outcomes of the re-examination and opposition system outcomes confirmed that the adversarial nature of the opposition system was more likely to lead to outcomes unfavorable to the patent holder. In table 4.3, we show the distribution of outcomes for all re-examinations and all oppositions of patents over the past twenty years. It is clear from the table that patent revocation is much more likely when a patent is opposed in Europe (one in three is revoked) than when a patent is re-examined in the United States (only one in ten is revoked). Combined with the lower probability of re-examination, the overall probability that a patent is revoked via a postgrant administrative challenge is 3 percent in Europe and essentially zero (0.02 percent) in the United States. Conversely, re-examination is more likely than opposition to lead to amendment of the patent, whether or not the patent owner initiated the process.

Our analysis also indicated that patent amendment, rather than revocation, is more likely for oppositions in relatively new fields of inventive activity, for more complex patents, or for oppositions in which numerous opponents participate. Because we lack evidence on the

Table 4.3
Outcomes from oppositions (EPO) and re-examinations (USPTO)

	Opposition[a]		Re-examination[b]		Re-examination, excluding owner-requested re-examinations[b]	
Outcome	Total number	Total share	Total number	Total share	Total number	Total share
No change to patent	5,590	22.4%	716	23.9%	476	25.9%
Patent amended	6,466	33.0%	1,993	66.4%	1,151	62.7%
Patent revoked	6,655	35.1%	291	9.7%	209	11.4%
Closed / no outcome	1,753	9.6%	0	0.0%	0	0.0%
Total with an outcome	**20,464**	**100.0%**	**3,000**	**100.0%**	**1,836**	**100.0%**
Pending	3,221	22.4%	902	23.1%	472	20.5%
Total	**23,685**		**3,902**		**2,308**	

[a]Opposition outcomes are for all patents granted by the EPO 1980–1999, oppositions filed 1980 to September 2000.
[b]Re-examination outcomes are for all re-examinations filed between 1981 and 1998.
Each re-examination appears only once. In the cases where there is more than one re-examination request, the outcomes have been combined.

extent to which oppositions are followed by litigation in the European patent system, we were unable to determine whether the lack of any speed advantage for oppositions in resolving patent disputes quickly is offset by a reduction of litigation rates associated with oppositions. The EPO system may offer few advantages over the U.S. system for postissue patent challenges, but we cannot address this issue without analyzing litigation data for both the U.S. and European systems. Any truly comprehensive assessment of the social costs and benefits of the two challenge systems requires that we consider both patent office processes of postgrant challenge (opposition or re-examination) and legal system litigation. Nevertheless, we present a simple version of such an analysis in the next section of the paper.

Although an EPO opposition must be filed within nine months of patent issue, it does not reach a conclusion more rapidly than the U.S. re-examination procedure if we estimate the total time lag as the length of time from patent application date to final resolution. The average lag time between application date and the initiation of a challenge is substantially greater within the U.S. re-examination system than in the EPO opposition system, but this difference reflects the different time limits on the initiation of such proceedings. Should we conclude from these comparative data that the longer lag times in the EPO opposition system imply a lengthier period of uncertainty and legal expense, and therefore a higher welfare burden within the innovation systems of these economies? Such a conclusion is unfounded because it relies on a characterization of the re-examination and opposition proceedings as analogous in their characteristics, rigor, and outcomes. The data presented above on the identity of the parties initiating re-examinations, as well as the abundant evidence discussed earlier of significant procedural differences between the re-examination and opposition processes, should invalidate any such analogies. Any such comparison of challenges must incorporate data on the next stages of these challenges, which in both Europe and the United States involve litigation.

One of the concerns often raised about both litigation and postgrant administrative challenges is that they may be used by firms with deep pockets to harass smaller firms and independent inventors.[13] Although re-examination requests are slightly more likely if the patent is held by an independent inventor, there is little if any evidence that independent-inventor patents are significantly more prone to EPO oppositions than other patents, which means that the opposition system

in Europe is not being used by large players to harass small inventors. Nevertheless, the possibility of some strategic use of the system by competing firms cannot be ruled out. For example, Harhoff and Hall (2002) find in the hair care industry that German firms systematically oppose the patents of their multinational competitors and are not opposed in turn. Whether this finding is due to greater expertise and knowledge of the prior art or to greater familiarity with the use of the opposition system as a weapon is not clear.

V. Welfare Gains from Improved Postgrant Review

Would introducing an adversarial challenge system simply add another level of costly litigation to what already exists? Or does it have the potential to reduce the subsequent litigation? Answering these questions is a complex task, given the difficulty of predicting the responses of firms and individuals to a rather radical change in the administration of the patent system. Nevertheless, it is possible to perform some simple welfare computations based on plausible assumptions about the value of patent validity and the known costs of both the European and U.S. patent systems. As Levin and Levin (2002) argue in their discussion of the same issue, successful patent opposition is likely to reduce subsequent patent litigation substantially, thus increasing social welfare, but opposition itself brings forward cases that would not have gone to litigation and affects the terms on which firms are able to license the technology embedded in patents. They conclude that, on balance, substantial welfare gains are likely from the introduction of an opposition system. In this section of the paper, we present our own analysis of the consequences of this change and reach a similar conclusion.

Successful opposition should reduce litigation because invalid patents could not then be litigated, although this might require a somewhat circumscribed appeals process that does not allow recourse to the courts. Unsuccessful opposition may still lead to litigation later and, unless barred by statute, successful opposition might also lead to later litigation on the part of the former patent holder. The net result of this scenario is fewer suits filed, and possibly fewer collusive settlements based on the threat of a suit, although there might be an increase in collusive settlements based on the threat of opposition.

The computation shown below makes these ideas more precise. We compute the social benefits and costs of introducing an opposition

system under a few simple stylized assumptions. Although the precise numbers should be viewed somewhat sceptically, the order of magnitudes are such that substantial social gains may accrue from such a system. The total cost of the system per year is assumed to be given by

$$C = c_o \phi N$$

where c_o is the cost of an opposition, ϕ is the rate of opposition, and N is the total number of patents issued in a year. We assume a range of costs between $100,000 per opposition (the European estimate) and $500,000 (the cost assumed by Levin and Levin [2002]), and a range of opposition rates between 2 percent (very conservative) and 10 percent, which is approximately the rate in Europe.

Computing the benefit of the system requires some assumptions about the effects of opposition outcomes on the costs associated with avoiding litigation, collusive presuit settlements, and the exercise of monopoly power. We write the benefit as

$$B = b_o \phi N$$

where b_o is the cost avoided by each opposition, ϕ is the rate of opposition, and N is the total number of patents issued in a year. The variable b_o has three components, corresponding to the three possible outcomes of the opposition: and N revocation, amendment, or rejection. To estimate these components, we assume that the opposition and appeals boards make the correct decision when they revoke or amend a patent or when they reject an opposition.

In the case of revocation, we can assume that the patent should never have been granted and that its existence may create excessive market power. Suppose that in litigation, the same correct outcome would be obtained; i.e., the patent right would be destroyed. As long as the respective case would have ended up in litigation, the opposition will simply pre-empt later litigation. The welfare effect is then to reduce the number of cases in litigation, at the cost of an opposition proceeding. We assign an average social value of $2 million to avoided litigation, based on the estimates provided by AIPLA (2001) for legal costs plus an addition for the direct costs to the firms involved and the cost of court services.

The parties may have an incentive to settle; thus, not all cases will actually be litigated (Lanjouw and Schankerman 2002). But in this case, if the correct outcome would have been a revocation, a settlement be-

tween the parties will be socially inefficient because it typically maintains the patent for the proprietor and allows the other party in litigation to have an exclusive license. This situation amounts to a case in which the two parties collusively maintain patent protection, which may impose considerable welfare costs on society.[14] The welfare costs of such an agreement depend on the value of the patent right and demand conditions. As our base case, we assume that high-value patents that are attacked in the opposition procedure have an average value of $4 million and therefore a monopoly welfare loss of $2 million.[15] For example, Harhoff, Scherer, and Vopel (2003) compute an average value of about (1977) DM 400,000 for patents of German proprietors. They also estimate regressions indicating that opposed patents that survived opposition are worth about ten times this amount. We assume that patents that were opposed but did not survive opposition would generate the same level of profits as patents that withstood opposition. In 2003 terms (assuming a 4 percent growth rate), the average value of an attacked patent would then be roughly 5.76 million euros [$= (1.04^{27}400{,}000)/2$]. A conservative estimate of the value of the attacked patent is therefore $4 million on average, with welfare losses in the monopoly case of $2 million.

In the case of amendment (where claims are usually narrowed), a similar argument holds, although the avoided litigation cost is likely to be much smaller. The results from opposition rejection are more ambiguous. It may reduce uncertainty about the patent validity and therefore reduce subsequent litigation, but this is by no means certain. In our base case, we assume no effect, and we also evaluate a variant where there is increased social cost due to an increase in litigation probability when opposition is rejected.

In table 4.4, we show the cost-benefit computation under different scenarios. Three panels are shown in the table, each corresponding to a set of assumptions about outcome probabilities. The first uses the probability that a U.S. patent is found valid during litigation, as reported by Allison and Lemley (2002). The second uses the observed opposition outcome probabilities for the EPO system, and the third uses the observed re-examination outcome probabilities of the USPTO system, both given in table 4.2. The latter choice is very conservative, and an opposition system is unlikely to lead to patent revocation probabilities as low as 11 percent. For each of these three outcome scenarios, we report five computations, three using a (comparatively) low opposition cost and two using the higher estimate of $500,000 that was used

Table 4.4
Welfare computation under different scenarios

Scenario	Cost of an opposition per patent (thousands)	Outcome probabilities			Benefits (avoided cost)			Total benefit per patent (thousands)	Cost-benefit ratio
		Revocation (probability)	Amendment (probability)	Rejection (probability)	Revocation (thousands)	Amendment (thousands)	Rejection (thousands)		
Validity probability from Allison and Lemley 2002; low cost.	$100	0.450	0.300	0.250	$2,000	$0	$0	$900	9.0
Validity probability from Allison and Lemley 2002; low cost.	$100	0.450	0.300	0.250	$2,000	$300	$0	$990	9.9
Validity probability from Allison and Lemley 2002; high cost.	$500	0.450	0.300	0.250	$2,000	$0	$0	$900	1.8
Validity probability from Allison and Lemley 2002; low cost; rejection raises cost.	$100	0.450	0.300	0.250	$2,000	$0	−$200	$850	8.5
Validity probability from Allison and Lemley 2002; high cost; rejection raises cost.	$500	0.450	0.300	0.250	$2,000	$0	−$200	$850	1.7
Opposition outcome probabilities; low cost.	$100	0.350	0.330	0.320	$2,000	$0	$0	$700	7.0
Opposition outcome probabilities; low cost.	$100	0.350	0.330	0.320	$2,000	$300	$0	$799	8.0

Table 4.4
(continued)

Scenario	Cost of an opposition per patent (thousands)	Outcome probabilities			Benefits (avoided cost)			Total benefit per patent (thousands)	Cost-benefit ratio
		Revocation (probability)	Amendment (probability)	Rejection (probability)	Revocation (thousands)	Amendment (thousands)	Rejection (thousands)		
Opposition outcome probabilities; high cost.	$500	0.350	0.330	0.320	$2,000	$0	$0	$700	1.4
Opposition outcome probabilities; low cost; rejection raises cost.	$100	0.350	0.330	0.320	$2,000	$0	−$200	$636	6.4
Opposition outcome probabilities; high cost; rejection raises cost.	$500	0.350	0.330	0.320	$2,000	$0	−$200	$636	1.3
Re-examination outcome probabilities; low cost.	$100	0.110	0.630	0.260	$2,000	$0	$0	$220	2.2
Re-examination outcome probabilities; low cost.	$100	0.110	0.630	0.260	$2,000	$300	$0	$409	4.1
Re-examination outcome probabilities; high cost.	$500	0.110	0.630	0.260	$2,000	$0	$0	$220	0.4
Re-examination outcome probabilities; low cost; rejection raises cost.	$100	0.110	0.630	0.260	$2,000	$0	−$200	$168	1.7
Re-examination outcome probabilities; high cost; rejection raises cost.	$500	0.110	0.630	0.260	$2,000	$0	−$200	$168	0.3

by Levin and Levin (2002). 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 the scenarios yield cost-benefit ratios well in excess of unity, with the exception of some of those that use the re-examination outcome probabilities. The lowest ratios for each panel are for the high opposition cost cases. We conclude that unless the opposition system is very expensive to operate and yields results similar to those now obtained with the re-examination system, it would be likely to generate substantial welfare gains.

VI. Conclusions and Additional Questions

The determinants and characteristics of patent challenge procedures are important issues in any assessment of intellectual property systems of the United States or other industrial economies. In a knowledge-based economy, intellectual property systems are constantly challenged by the advance of technology, a process that, among other things, creates new artifacts to which the necessarily backward-looking patent system must respond. A knowledge-based economy also is one in which the high political salience of national and global intellectual property systems means that they are the focus of political lobbying to strengthen, adapt, or weaken specific features of intellectual property regulation, administration, and law to favor particular interests. Both these forces have been at work within the U.S. intellectual property system during the past quarter-century; a period of significant strengthening of patent holder rights has triggered a debate over the appropriate level and limits of such rights. This debate has important transatlantic and global repercussions and analogues.

As the knowledge-based economy has evolved in the United States and elsewhere, it has become clear that such evolution brings with it increasing attention to the ownership of knowledge in the form of intellectual property by firms and governments. Together with the increasing importance of software in all areas, which in itself is an impetus to the growth of the knowledge-based economy, we have an expansion of the subject matter base that must be considered by patent offices everywhere. Such expansion is not a new phenomenon. It has tended to happen whenever important changes take place in technological regimes, but it does lead to two kinds of adjustment problems: first, debates over the validity of the subject matter extension, such as those

that have occurred between the United States and Europe over business method patents, and second, a concern that overly broad and invalid patents may issue early in the development of the technology because of the lack of prior art in the relevant patent office databases, even though such prior art may exist among those who practice the technology. The second problem, which may be defined broadly as the difficulty of determining the validity of a patent application in new and less well understood technologies, is the one that an inter partes postgrant review or re-examination system might be designed to address.

To understand how such a system might work, the analysis in this paper highlights several interesting features of the patent challenge systems of the U.S. and EPO systems. First, the current U.S. re-examination procedure differs dramatically from the EPO opposition procedure in almost all its features, of which the most significant are the identity of the party requesting a re-examination (the patent owner in more than 40 percent of the cases) and the outcomes (which rarely include revocation of the patent). These characteristics of re-examination hardly qualify it as the sort of adversarial procedure that EPO oppositions represent, but they are not surprising when we consider the differences in structure between the two procedures: (1) a three-examiner panel including the original examiner, but not as chair, in the EPO versus a single examiner, often the same as the original examiner, in the USPTO; (2) the prohibition in later litigation of questions that could have been raised in a re-examination in the United States; and (3) the inter partes nature of the proceeding at the EPO versus the ex parte nature of the proceeding at the USPTO.

Keeping in mind the significant differences between the re-examination and opposition processes, our comparative analysis suggests that EPO oppositions are not significantly swifter in resolving challenges than the USPTO re-examination proceedings, as might be expected given their more adversarial nature. Indeed, opposition proceedings in some cases (and almost certainly in important, complex cases with numerous opponents, appeals, etc.) may well take as much time to be resolved as does litigation in the U.S. system. Nonetheless, the higher frequency of opposition (which is presumably due to the lower cost associated with opposition compared to the cost of litigation in the United States) within the EPO system suggests that this process handles many more legal disputes over patent validity than are addressed by the U.S. re-examination process.

Our analysis also indicates that patent amendment, rather than revocation, is more likely for oppositions in relatively new fields of inventive activity, for more complex patents, or for oppositions in which numerous opponents participate. We lack evidence on the extent to which oppositions are followed by litigation in the European patent system, so we cannot determine whether the lack of any advantage for oppositions in resolving patent disputes quickly is offset by a reduction of litigation rates associated with oppositions. The EPO system may offer few advantages over the U.S. system for postissue patent challenges, but we cannot address this issue without analyzing litigation data for both the U.S. and European systems. Any comprehensive assessment of the social costs and benefits of the two challenge systems requires a consideration of both the patent office processes of postgrant challenge (opposition or re-examination) and legal system litigation. Nevertheless, the preliminary computations presented here suggest that the social gains from such a system might be substantial.

Notes

We appreciate the extremely helpful comments on an earlier draft by the editors of this journal, Adam Jaffe and Josh Lerner.

1. See Lunney (2001) for an argument that the nonobviousness test has been weakened since the creation of the Federal Circuit Court of Appeals in 1982.

2. Presumably, if the invention has already been reduced to practice by others, the potential gain from incenting an inventor is zero, so we are left only with the deadweight loss from monopoly.

3. This decision presumably made it more difficult to reject patents such as U.S. 6368227, the patent on a swinging method that uses a technique known by children for decades but not placed on the record. Note that this particular patent has been subject to a reexamination request by the U.S. patent commissioner because of the publicity it received. The problem with patents like this one is not necessarily that they are enforceable in the courts but that they clog the system and raise its total cost.

4. As quoted in the *Los Angeles Times*, February 7, 2003.

5. Our evidence (Graham et al. 2003) suggests that the average reexamination takes less than two years, slightly shorter than the average duration of a patent lawsuit (thirty-one months), but this difference is not large (especially in view of the high variance of the "average duration" estimate for a trial). Some observers have criticized the reexamination system for not providing a fast and cheap alternative to trial.

6. An alternative re-examination procedure, the inter partes re-examination, was enacted by the U.S. Congress in 1999 (see the American Inventors Protection Act, codified in 35 USC 311-318. Several commentators have questioned the efficacy of the inter partes re-examination on the grounds that it allows the third-party requestor limited opportuni-

ties of involvement; prevents any adverse findings of the USPTO from being appealed to the courts; and also precludes the raising of any questions of validity on grounds that were, or may have been, raised during the inter partes re-examination from being litigated in the courts (Neifeld 2000). The USPTO reports no inter partes re-examination requests in 2000 and one in 2001, suggesting that the procedure has been little used.

7. *Kaufman Company v. Lantech, Inc.*, 807 F.2d 970 (CAFC 1986), suggesting that evidentiary burdens are likely higher for challengers after re-examination.

8. This owner initiation occurs in many cases in which declaratory validity determinations are being sought by a challenger third party. These suits, which make the patentee the defendant, are often initiated only after a demand by the patent holder that the challenger stop infringing on the patent, thus putting the initial move in the hands of the patent holder.

9. The Convention on the Grant of European Patents, also referred to here as the European Patent Convention (EPC) was enacted in October 1973. It is the legal foundation for the establishment of the EPO. The full text of the convention is available at http://www3.european-patent-office.org/dwld/epc/epc_2000.pdf.

10. At the time of writing, the exchange rate was approximately 0.93 euros per dollar. As in other patent systems, the official patent office fees are a relatively small part of the costs (in this case, €4,300. Professional representation before the EPO amounts to €5,500 on average, whereas translation into the languages of eight contracting states requires €11,500. Renewal fees for a patent maintained for ten years amount to roughly €8,500. See "Cost of an average European patent as of 1.7.99," http://www.european-patent-office.org/epo/new/kosten_e.pdf (accessed January 14, 2002).

11. Using data from court filings in Mannheim and Duesseldorf, Cremers (2003) identifies 715 patent infringement cases involving 905 patents during the 1993–1995 period. These courts account for about 55 to 60 percent of all cases filed in Germany. The three-year average of EPO patents issued since 1980, which included Germany as one of the covered regions, is about 71,000. This figure is for a litigation probability of about 2.1 percent (assuming that the process is stationary).

12. The latter statement is premised on the argument that more oppositions than suits are filed partly because they are lower cost.

13. In fact, according to data reported by Lanjouw and Schankerman (2002), it is the other way around in the United States: small firms and independent inventors are far more likely to file infringement suits than are larger firms.

14. This is the reason why the European Patent Office is entitled to pursue opposition cases, even if the two parties wish to settle the case. Thus, this feature of an opposition system can be expected to increase social welfare.

15. With linear demand, the welfare loss from monopoly will be one-half the monopoly rents.

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