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Behind the Patent's Veil: Innovators' Uses of Patent Continuation Practice, 1975-2002

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Abstract

This paper employs new data on the use by patentees of continuation applications in the United States from 1975-2002 to shed light on patentees' motivations for and actual uses of the continuation application procedure, a procedure available only in the U.S. which allows a patent applicant to voluntarily delay issue of a patent. The paper investigates the affect that continuation use has had upon patent grant lags, evaluating whether routinely used research methods that ignore continuation delays may be improved by accounting for continuations in patents' application lineage. This paper demonstrates conclusively that a sizeable share of patent applicants employs the continuation, that continuation use by patent applicants results in substantial additional delay in the time-to-grant statistics for associated issued patents, and that significant changes in the pattern of continuation use have occurred since Congress enacted legislative amendments intended to curb the procedure's use. Evidence provided in this paper supports a contention that the continuation has been economically important in shaping the environment for innovation, influencing industrial organization, and social welfare. The paper also demonstrates that continuation practice is common in overall US patenting, and that in some important sectors, including electronics, computing, pharmaceuticals, chemicals, and biotechnology, a substantial minority, and in some instances a majority of patents in recent years have issued with continuation in their application lineage. Furthermore, substantial intersectoral differences are shown in innovators' use of the continuation, as well as significant changes in the patterns of usage over time.

Keywords: Patents, Continuations, Intellectual Property Strategy

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1.1 INTRODUCTION

> This patent was applied for in 1879 and granted in 1895. [] While [Selden] withheld his patent, the public learned from independent inventors all that it could teach. [] But the patentee acted wholly within his rights. He merely took advantage of the delays which the law permitted him.[1]

When George Selden's patent for a "Road Engine" issued from the United States Patent and Trademark Office (USPTO or PTO) in 1895, vehicle manufacturers recognized it for the threat it was: Within a few years, Selden's patent was commanding royalties of 1.25% on the retail value of every automobile sold in the United States and had sparked a reorganization of the fledgling industry.[2] But Selden had not invented his "Road Engine" during the 1890s or even the 1880s. His original application to the patent office had been made in 1879. Selden had used the *continuation* procedure available to patentees in the USPTO to keep the application hidden from competitors for 16 years while the technology—and industry—developed.

The case of George Selden's patent highlights the use by U.S. patentees of procedural mechanisms to delay the issuance of patents. While the continuation used by Selden is not the only delaying mechanism—negotiation between the applicant and the patent examiner also offers an opportunity to delay the issue of a patent—continuation

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[1] Text from Judge Noyes' opinion, *Columbia Motor Car Co. vs. C.A. Duerr & Co.*, 184 Fed. 893 (2d Cir. 1911).

[2] Selden had sold his patent 549,160 in 1899 to a syndicate for $10,000 and 20% of any royalties. Early manufacturers who had originally seen the Selden patent as a threat formed a cartel around the patent, the Association of Licensed Automobile Manufacturers, which limited membership and licenses to manufacture under the Selden patent.

presents a readily observable procedural choice by the patent applicant.[3] This chapter exploits this transparency to examine the *continuation*, a procedure available under the U.S. Patent Act that allows patentees to prolong the period of non-disclosure prior to patent issue.

Given the breadth and depth of the empirical study of patents, it is noteworthy that so little attention has been given to the continuation application procedure in U.S. patenting. Historical anecdotes have drawn academic interest for years, with such infamous cases as George Selden's "Road Engine" and Jerome Lemelson's "Bar-coding" patents inviting much comment but little analysis.[4] The procedural mechanisms that allowed Selden and Lemelson to secure extended pre-issue secrecy, however, have been overlooked in the literature. While much attention has been paid to explaining the unprecedented growth in patenting in the United States over the last several decades (Kortum and Lerner, 1997; Hall and Ziedonis, 2000), the frequent use of the continuation procedure accompanying this growth has gone largely unnoticed. This chapter will remedy this oversight while demonstrating that continuation application practices characterize a significant share of granted U.S. patents. This chapter will also show that substantial changes in continuation usage patterns during the early and late 1990s suggest a phenomenon worthy of an in-depth study and analysis.

Because the effect of the continuation application is to delay the patent's issue, previous studies omitting the additional grant lag produced by applicants' continuation practice have tended to overstate the tempo of USPTO output (Griliches, 1989; Hall,

[3] Lemley and Moore (2003) suggest that the applicant receives multiple opportunities to revise the claims during each filing of an application, prior to the USPTO's "final action notice." These multiple opportunities are available regardless of whether the applicant engages in continuation practice.

Jaffe and Trajtenberg, 2001). Failure to account for the effects of continuation delay creates miscalculations that result from mistaking the dates upon which patent applications entered the Patent Office. The method leading to this miscalculation is the standard in the literature, and as a result significant additional grant lags have been ignored.

The "application date" on the face of the USPTO patent document has been used as a point of reference in a wide variety of empirical works in the economics, strategy, and organization literature. Scholarly articles ranging in topics from firm performance (Stuart, Hoang, and Hybels, 1999) to knowledge flows (Almeida, 1997; Kogut and Almeida, 1999) to innovation policy (Jaffe and Palmer, 1997; Cockburn, Kortum, and Stern, 2002) to the value of intangibles (Trajtenberg, 1990) have relied upon the patent document's "application date" to create measures in their econometric models. Much of this literature has justified using the "application date" instead of the "grant date" on the theory that employing the former would minimize data distortions caused by the vagaries of the Patent Office examination process. Furthermore, researchers have often used the "application date" to approximate the point at which a patentee's technology research bore fruit, and employ this date in an attempt match the timing of the completed research with an innovation output measure (i.e., the granted patent). Both of these justifications would be undercut, however, if the "application date" were not a meaningful indicator of the date on which the innovation entered the Patent Office. As I will show in this chapter, the assumption underlying these justifications is invalid in a number of cases, and in some important industrial sectors is invalid for the majority of issued patents.

[4] A notable exception is Lemley, M. (1994). "An Empirical Study of the Twenty Year Patent Term,"

The continuation procedure is also worthy of study because of changes in the patent regime that substantially altered the incentives to patent applicants employing the mechanism. In 1995 and again in 1999, Congress implemented statutory changes in the Patent Act, intending to remove patentees' incentives for engaging in continuation practice. The 1995 legislation altered the rules for measuring the length of the patent term and the 1999 legislation required disclosure of some patent applications after 18 months. While these changes reduced the incentives to applicants, the legislation was not sufficiently tailored and so did not completely eliminate incentives to use continuation practice. One of several questions that my dissertation seeks to address concerns the reasons for the persistent use by applicants of the continuation procedure after these legislative changes took effect.

This chapter employs data on the use by patentees of continuation applications in the United States from 1975-2002 to shed light on patentees' actual uses, as well as applicants' motivations for using, the continuation application procedure. Moreover, the chapter uses these data to investigate the affect that the continuation's use has had upon patent grant lags, evaluating whether previous research that routinely ignored continuation delays could be improved by accounting for actual continuations in patents' application lineage. Accordingly, this chapter seeks to answer these and other questions raised by the use of the continuation in U.S. patenting.

The continuation patent data I have collected comprise all continuation applications filed and reported for all patents issued during the 1975-2002 period, and as such provide a unique and comprehensive opportunity to view the uses of the

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AIPLA Quarterly Journal, 22, 369-99.

continuation procedure by U.S. patent applicants since 1975. Following this introduction, the chapter is organized as follows. Part two describes continuation practice and the 1995 and 1999 policy changes meant to reduce applicants' incentives for its use. Part three discusses the motivations for patentees' use of the procedure, while Part four presents some descriptive statistics with emphasis on the use of the continuation procedure over time, offering data on both use of the continuation and associated pre-issue application delay. Part five offers some evidence of intersectoral differences in the use of continuation practice, while Part six adds a note on continuation use in the drugs industry. Part seven concludes.

1.2 CONTINUATION PRACTICE IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the United States, inventors enter into a complex application process when seeking a patent. Procedurally, the application for a U.S. utility patent[5] must be filed in the United States Patent and Trademark Office (USPTO or "Patent Office") within one year of the invention's public use or publication[6] and must contain an adequate description with one or more claims.[7] Prior to the patent's issue, the Patent Office is charged with ensuring that the invention covers patentable subject matter,[8] is useful,[9]

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[5] While the vast majority of US patents—and the focus in this paper—are the so-called Utility patents authorized by 35 USC §101, patents are also available on Plants (35 USC §161) and Designs (35 USC §171).
[6] 35 USC §102(b).
[7] 35 USC §112, 113, 114. The "written description" requirement is intended to allow any person skilled in the art to either make or use the invention. See Permutit v. Graver Corp., 284 US 52 (1931)(finding that the absence of any writing was an insufficient description when only drawings were provided). Claims are intended to delimit the subject matter that constitutes the invention. See Flick-Reedy Corp. v. Hydro-Line Mfg., 351 F.2d 546 (7th Cir. 1965)(holding that withholding information from the claims failed to adequately describe the invention).
[8] 35 USC §101. See Diamond v. Chakrabarty, 447 US 303 (1980)(determining that man-made living micro-organisms are patentable subject-matter).

novel,[10] and not obvious.[11] The patent examiner, a Patent Office employee with specialized technical knowledge, is the first arbiter of these requirements.[12] Prosecution of the patent application has been characterized as a "give-and-take-affair," with negotiation and re-negotiation between the applicant and the patent examiner that ordinarily continues for an average of 2-3 years (Merges, et al., 1997).[13] This mean pendency statistic, however, fails to highlight some abnormally long pre-issue delays, and applicants routinely use a procedural mechanism—the continuation application—to postpone patents' issue.

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[9] 35 USC §101. See Brenner v. Manson, 383 US 519 (1966)(upholding examiner's determination that a the output of a chemical process was not useful if merely similar to a useful compound).

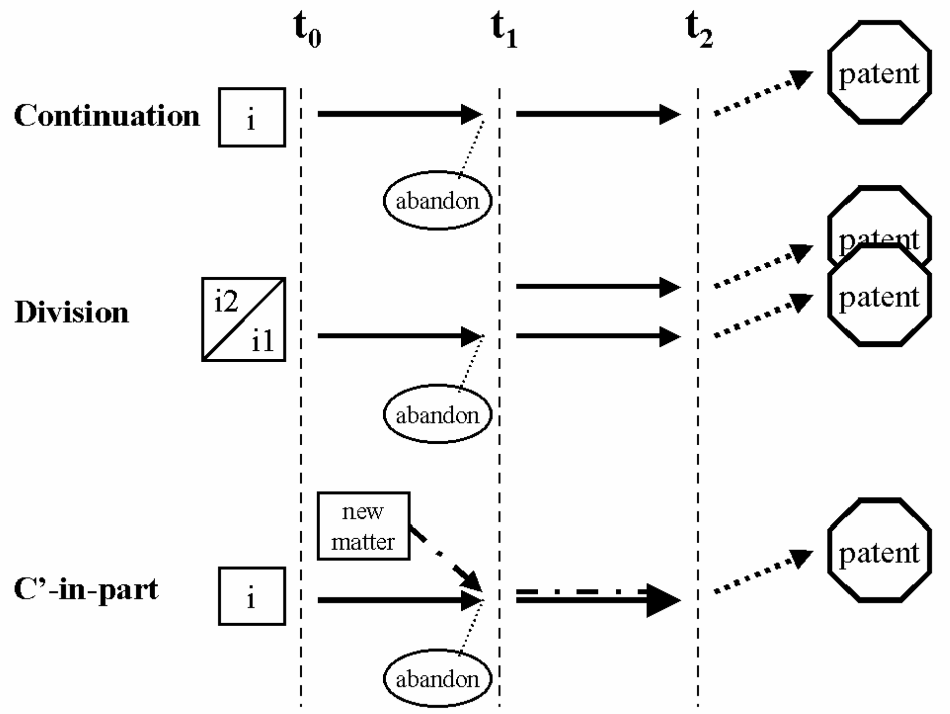
[10] 35 USC §101, 102. See Jamesbury v. Litton Industrial, 756 F.2d 1556 (CAFC 1985)(finding that an invention was "novel" when no prior art was precisely equivalent).

[11] 35 USC §103. See Graham v. John Deere Co., 383 US 1 (1966)(finding an invention invalid on grounds that the improvement would have been obvious to a person of ordinary skill in the art).

[12] Although the Patent Commissioner (in Reexamination) and the courts (through litigation) may offer a later, definitive determination as regards patentability, in practice these later determinations happen rarely and thus the patent examiner is in almost all circumstances the sole determinant of patentability.

[13] Lemley (1994) found an average length of 864 days (2.37 years) for 2,081 patents issued on December 27, 1994. There is reason to believe that patent prosecution terms may have shortened for applications made after 1994 (See Lemley, 1994), although Allison & Lemley suggests that pendency has not fallen in the years immediately following the passage of the Act (2000).

Figure 2.1: A Schematic of Continuation Practice: Continuation, Continuation-in-part, and Division



The continuing patent application permits an applicant to forestall the implementation of a patent examiner's issue decision by renewing at least some portion of the original application. As defined here, a "continuing" or "continuation" patent application may be of three types: The Continuation, the Continuation-in-part, and the Division (Figure 2.1).[14] The Continuation application discloses the identical invention claimed in the prior "parent" application, with a requirement that no extraneous matter be disclosed in the follow-up application.[15] The Continuation-in-part application allows the addition of some new matter to the original application—although priority is awarded only for the original disclosures contained in the new application. A Division may be

[14] The continuation and continuation-in-part are authorized under 35 USC § 120 "Benefit of earlier filing date in the United States." Divisions are authorized under 35 USC § 121 "Divisional applications."
[15] The fee required to request a continuing application is no higher than that for filing a first application—$710 in 2001, and $355 for small entities. 37 C.F.R. 17(e).

required under the Patent Act when the original application contains more than one independent invention. The USPTO may require that the applicant "elect" to prosecute the claims associated with a single invention of the applicant's choosing. The applicant is generally free to separately pursue the other disclosed invention(s) within the Patent Office, ordinarily later in time. So long as the later applications disclosing the non-elected inventions satisfy legal requirements, they, like the continuation and continuation-in-part applications, may benefit from the earliest filing date.[16]

Continuing applications allow the applicant to adopt the filing date of the first in the string of applications upon which the later application can trace a lineage.[17] The *sine qua non* of the continuation is that both the early and the later applications must disclose the *same* invention. Because the applicant as a matter of right may abandon earlier applications—the ancestors in the lineage—the invention can remain un-granted and hidden for extended periods of time. There is no limit to the number of times this abandonment may occur, and thus chains of continuations may develop which have the effect of postponing the patent's issue, in some cases, for decades.[18]

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[16] Continuation applications have been available to patentees in the United States at least since 1863. In Godfrey v. Eames, 68 U.S. 317 (1863), the U.S. Supreme Court interpreted the Patent Act of 1836 to allow continuation applications, in that case when the original application was abandoned on the same day that the new continued application was filed. The use of continuing applications was also upheld by the Supreme Court in Crown Cork & Seal Co. v. Gutmann Co., 304 U.S. 159 (1938) and General Talking Pictures Corp. v. Western Electric Co., 304 U.S. 175 (1938).

[17] The application must meet certain conditions. Under 35 USC § 120, a patent application is entitled to adopt the filing date of a "parent" application when (1) both applications disclose the same invention; (2) both applications are filed by the same inventor; (3) both applications are simultaneously co-pending; (4) the earlier application meets the disclosure requirements of 35 USC § 112; and (5) the later application contains a specific reference to the earlier application. Sampson v. Ampex Corp. (1971, DC NY), 333 F. Supp. 59, aff'd. (2nd Cir. NY) 463 F2d 1042. The language of 35 USC § 120 was initially adopted in the Patent Act of 1952, and legislative history suggests that the section was intended to write existing legal practice on the issue into the statute. In re Henriksen, 55 C.C.P.A. 1384 (1968).

[18] See, for instance, Jerome Lemelson's U.S. patent 5,283,641, Apparatus and methods for automated analysis, issued February 1, 1994. The priority date of this patent was December 24, 1954, and there were no fewer than eleven continuations and divisions in this patent's chain while it languished in the patent office for 39 years.

Patents that issue after extended periods of continuation secrecy are often labeled "submarine" patents. The term *submarine* is generally applied as a pejorative term to a patent, like George Selden's, that combines extended non-disclosure with economic hold-up, thus like the naval submarine combining both stealth and threat. The archetypical example of the "hold-up submarine" patent is one that, after having languished in the patent office for many years, is released into a marketplace in which competitors are extensively using the patented technology. Afforded additional delay, the applicant has had the opportunity to observe the technology develop over time and to use the continuation process to alter the scope of the pending application to fit the advancing technology. When the applicant ultimately allows the submarine patent to surface, competitors may be held hostage to the owner of the fresh property right. Competitors using the technology may be willing to settle even in the face of a patentee's questionable claims to invention: The cost of extended legal battles and the risk of an injunction shuttering operations may justify a competitor settling, regardless of the merit of the patentee's claim.

To understand the submarine strategy, consider a timeline in which $t_0 < t_1 < t_2 < t_3$. Assume a patent applicant applies for the patent at time t_0 and thereafter takes advantage of allowable delay (read the continuation application process) to keep the patent application secret while a "user" adopts the technology at time t_1, unaware of the pending and secret application. Because the continuation may be used to update the claims, the applicant may capture the precise uses to which she observes the "user" putting the adopted technology in the marketplace. During the period after t_1 but prior to the patent's issue at some future time t_2, the "user" may develop valuable follow-on technologies or deploy complementary assets alongside the adopted technology, thus making specific investments that open the "user" to economic hold-up by the patentee. These hold-up opportunities would attach to the patentee when she allows the patent to finally issue, thereafter securing the right under law to exclude all subsequent uses by "user" or any other infringer throughout the patent term until the patent expires at t_3.[19] This situation is modeled after a real-world example of this type of submarine strategy: Bar-coding patents that lay submerged for decades were used by patentee Jerome Lemelson to collect royalties from both semiconductor and automobile manufacturers in much the same manner as Selden had done with his "Road Engine" a century earlier.[20]

While "submarine" patenting has been examined in the literature, little effort has been directed toward understanding the effects that the availability and use of continuation applications has had upon patterns in U.S. patenting, or the environment for technological innovation more generally. While patentees using continuations to delay the granting of their patents is inconsistent with the faster-is-preferable thrust of patent race literature (Loury, 1979; Dasgupta and Stiglitz, 1980) as antithetical to patentee self interest, other theories have attempted to rationalize its use. Quillen and Webster (2002) advance the theory that applicants use the continuation procedure to increase the likelihood of earning a patent, taking advantage of a incentives in the Patent Office that

[19] The institutional set-up dictating the rules of the game to the adopters prior to the issue of a patent are important to consider. The uses of the patented technology prior to t_3 are "free" to user 1 and user 2 because at t_3 the patentee is precluded from collecting rents from uses prior to the issue of the property right. Furthermore, in the event that an adoption later than t_0 but prior to t_3 is accompanied by an application for patent by user 1 or user 2, an attentive Patent Office is likely to adjudicate the dispute over priority and rights to the patent on the innovation in an "interference" proceeding. The "interference" would give both parties notice of the other applicant's disclosure, with the result being a conclusion that one of the applicants has actual priority-in-time and, thus, is entitled to the patent. In practice, however, interferences are rare.

may reward examiners for granting patents when the technology disclosures in the application fail to meet objective standards of patentablility. I develop a complementarity theory in chapter two of this dissertation, offering theory and evidence to demonstrate how innovators may use patenting and secrecy as complementary appropriability mechanisms, and I employ the continuation patent data as an empirical lever to uncover this relationship.

Moreover, intellectual property experts in the drugs industry contend that patentees in the pharmaceutical sector have employed the continuation to maximize revenues, opting to delay the issue of the patent to coincide with the emergence of a patented product from the U.S. government's lengthy new drug approval process. While changes in the patent laws effective in 1995 appear to have blunted the incentives for patentees taking advantage of this "fitting" strategy, my data analysis demonstrates an ongoing use of continuation patenting after 1995 by pharmaceutical and biotechnology patentees alike. The explanation for this persistent use is one of several puzzles upon which my dissertation seeks to shed light.

Unpacking these several competing—and in some manner inconsistent—explanations for continuation use demands a more nuanced discussion of the continuation procedure's characteristics. Given the structure of the patent laws, non-disclosure in and of itself cannot fully explain strategic uses of the continuation. Absent other benefits, a rational applicant motivated by a desire for secrecy would have no incentive to seek to protect secrecy through continuation. Without accompanying benefit, the added secrecy

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[20] Bar coding appears to have been patented prior to Lemelson's application entering the USPTO, in 1949 by Norman Woodland and Berny Silver. Soon, T.J. (2001). "An Introduction to Barcoding." *Synthesis: The Journal of the ITSC,* 1-10. My thanks to Wesley Cohen for pointing me to this historical fact.

afforded by the continuation appears to offer no advantage over extended and exclusive trade secret protection. If secrecy were the only benefit that continuation provided, an applicant would realize that benefit by simply delaying the application filing.[21] By delaying filing, the applicant could thus avoid the costs of early payment of fees and expenditures for application prosecution, also avoiding the added risks of knowledge spillover from the Patent Office to competitors.

But the patent applicant does receive a significant benefit from a chain of continuations: A protected early filing date. In the U.S. "first to invent" patent system, the filing of a patent application gives the applicant a government-sanctioned presumption that the invention was reduced to practice by that filing date. Competitors claiming earlier invention dates must show why they themselves were not diligent in reducing the invention to practice or can otherwise justify delaying the filing of an application.[22] Additional benefit is offered to the applicant through a legally recognized protection of the common law rights to trade secret protection during pendency of the application.[23] In practice, this government presumption afforded to the first mover poses significant barriers to the second and subsequent applicants. The institutional rules at the USPTO create an opportunity for the patent applicant to retain private knowledge over

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[21] This delay of filing would be predicated upon the inventor keeping the technology active and in-house, thus not running afoul of the provisions of 35 USC § 102(b) (loss of right to patent due to publication, sale, or use prior to one year before application date) or 35 USC § 102(c) (loss of right to patent due to abandonment).

[22] "Public policy favors the early disclosure of inventions. This underlies the requirement for "reasonable diligence" in reducing an invention to practice, not unlike the requirement that, to avoid a holding of suppression of concealment, there be no unreasonable delay in filing an application once there has been a reduction to practice. *Naber v. Cricchi,* 567 F.2d 382 (CCPA, 1977), quoted in *Griffith v. Kanamaru*, 816 F.2d 624 (CAFC, 1987).

[23] The applicant is "promised that merely by soliciting, before the Patent Office, [patent protection for his secret invention] he is not giving up his common-law rights. Though the Patent Office may refuse to issue a patent, it must do nothing to jeopardize even an unsuccessful applicant's common-law rights." *Irons & Steel v. Dann,* 606 F.2d 1215 (D.C. Cir. 1979).

the technology disclosure: When coupled with the protected priority date, a more valuable secrecy is created.

The patent regime in place prior to 1995 enabled the applicant to extend this period of secrecy virtually without limit. Prior to 1995, the patent term was 17-years-after-issue with no requirement that applications be published, therefore allowing a patentee to protect the original priority-date for many years before beginning the patent's monopoly protection. Because continuations are new applications based upon their predecessor "parent" or "grandparent" applications, they may incorporate amended claims while retaining priority-in-time for the core technologies disclosed in the initial application. Furthermore, the first application can be abandoned in order to avoid the patent issuing, thus allowing the applicant to avoid disclosing the existence of the application, and the technology itself, to the public and real or potential competitors.

In 1995, Congress changed the method for measuring the term of patent protection, intending with the legislation to alter the incentives for applicants to use continuations. Enacted as part of a series of statutory modifications meant to harmonize U.S. law with its international trading partners, the new law[24] increased the patent term from seventeen to twenty years. Intended to eliminate incentives for using submarine strategies (Lemley, 1994), the Act offered patentees some additional *de jure* length, but required that the longer patent term be measured from the application-date instead of the issue-date. In practice, this change reduced the patent term for applications pending in the USPTO for greater than three years. The Act's legislative history demonstrates that

[24] The legislation was offered and passed in 1994 as part of the fast-track vote on the Uruguay Round of the General Agreement on Tariffs and Trade (GATT). The law's provisions did not take effect until 1995 so it will be termed the "1995 Act."

the amendment was intended to eliminate submarine patent incentives by forcing the patentee to "trade off" *ex ante* secrecy for *ex post* protection.[25]

While the 1995 change reduced an applicant's incentives to engage in continuation practice, it nevertheless did not entirely eliminate these incentives. The statute was engineered to reduce submarine incentives while also offering a longer patent term, by granting each patentee a maximum 20-year window in which to both prosecute an application and enjoy the benefits of patent protection. So long as patent prosecution lasted less than 3 years, a patentee could enjoy an added benefit—a longer patent term than had been available under the 17-year term provided by the previous law. For inventors considering a continuation strategy, the legislation required that the applicant weigh the present value of early priority, coupled with extended *ex ante* non-disclosure, against added patent protection at the end of the patent term. Patentees whose value in early priority and a period of relatively lengthy pre-issue secrecy outweighed that of late term patent protection retained an incentive under the new statutory scheme to resort to continuation practice.

The menu of disincentives to applicants using the continuation was increased in 1999 with the passage of the American Inventors Protection Act.[26] This amendment to the patent laws requires that applications be published after 18-months, thus bringing the U.S. law into harmony with the patent laws of most of the major patenting jurisdictions.[27] Effective lobbying by independent inventors, however, resulted in one important

[25] The impact upon continuation applications is provided in 35 USC 154(c). For patents in force on or with application dates prior to June 8, 1995, the patent term is the longer of 20 or 17 years as calculated under their respective regimes. Therefore, only patent applications made after June 8, 1995 will be subject to the limitations of the new law.
[26] Pub. L. No. 106-113, 1000(a)(9), 113 Stat. 1501, 36.

loophole: Patent applications made in the United States, but not also in another country requiring 18-month publication, are exempted from the U.S. publication requirements. Therefore, although the 1999 publication requirement may prove a substantial disincentive for the continuation applicant motivated to capture a longer period of non-disclosure, a class of applicants is exempted from the requirements of the law.

While USPTO reporting on the number on exempted patents is scant,[28] preliminary statistics suggest that the use by applicants of the exemption is not isolated. The USPTO reported that 326,508 applications entered the system during calendar year 2001 (USPTO, 2002c), yet the USPTO publication database shows only 213,826 applications with year 2001 application dates have been published through November 2003. Thus, according to USPTO reports and databases, only 65.5% of applications filed in 2001 have been published, although a minimum of 23 months have elapsed since the patents entered the USPTO. While the 1999 "publication" law may be causing behavioral changes, and the strategic implications will ultimately hinge upon interpretations of the Act by agencies and courts in the years to come, these preliminary data suggest that a substantial share of patents enjoys extended secrecy even after the 1999 amendments have taken effect.

1.3 INNOVATORS' USES OF CONTINUATION APPLICATIONS

In order to unpack the motivations for innovators' use of the continuation application, the decisions and options available to applicants and examiners during the patent negotiation process are presented in Figure 2.2. In this stylized representation,

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[27] Japan and the signatory nations to the European Patent Convention, including the Germany, France, and Great Britain, abide by an 18-month application publication rule.

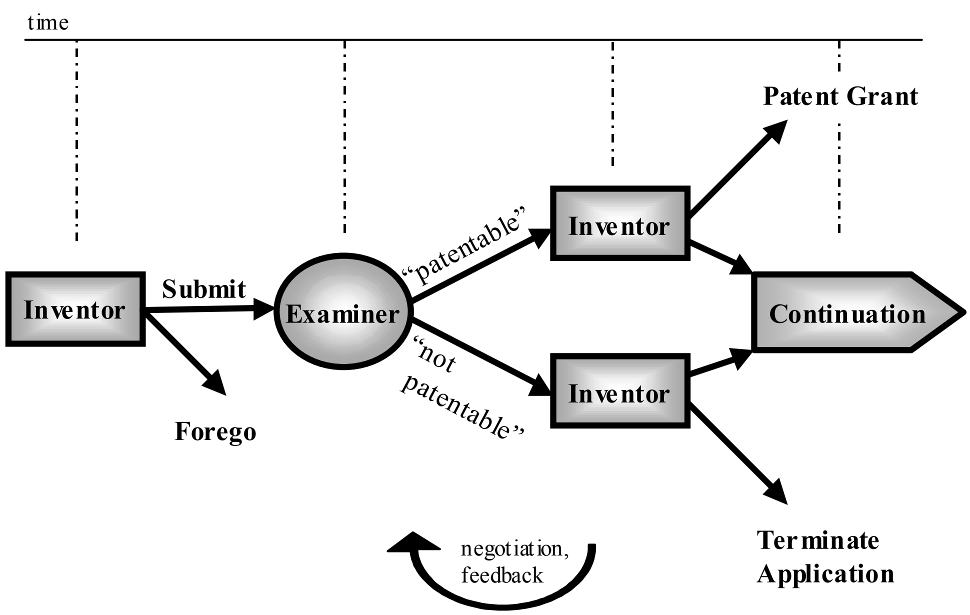
discovery of a technological advance presents the inventor with two options: To patent or not to patent. The decision to forego a patent likely indicates that the property right is a costly or uncertain option compared to alternatives, or presents fewer benefits when compared to alternative appropriability options. In the event that an inventor makes an application for a patent, the examiner has two options: To declare the invention either patentable or unpatentable. Although this latter decision is presented in the figure as a simple choice, the examiner's decision is ordinarily made after extensive communication and negotiation with the applicant over a number of months, if not years.

If the examiner determines that the application does not describe a patentable invention, the applicant is presented with two options: To abandon the application, or to file a continuation application. While abandonment ends the process ("Terminate Application" in Figure 2.2), an applicant's continuation choice keeps the application alive, allowing the applicant to force another action from the patent examiner. When faced with this forced choice, the examiner must again declare the application patentable or unpatentable, after another period of costly communication with the applicant and information gathering. The continuation application thus offers the applicant the opportunity to win an issued patent on her invention despite being declared initially "unpatentable," and to force costs upon the patent examiner. Although failure to secure a patent ("Terminate Application") may occur either prior to or during the continuation process, a failure is *always* at the discretion of the applicant, and in practice such failure

[28] In fact, as of December 2003, the USPTO has yet to publish complete statistics on patenting for 2001, and has published none for 2002.

may occur infrequently. In fact, the Quillen and Webster study (2001) suggests that failure to secure a patent occurs in as few as 1 in 20 patent applications.[29]

FIGURE 2.2: The Continuation Patenting Process



Patentees prior to 1995 were not necessarily motivated by classic "submarining" incentives: A less nefarious strategic motivation for the use of the continuation process may have been straightforward profit maximizing. Because the patent term is limited in years, a delaying mechanism can offer a benefit to an innovator of a patented product with late arriving profits to capture a greater portion of those profits so long as the patent term can be shifted forward in time. Because products produced in different sectors—and even within sectors—have varying life cycles with profits that arrive with different timing, continuation applications may have created a strategic opportunity to profit maximize. Because the Food and Drug Administration's regulatory process has been

[29] The USPTO suggests that exit occurs much more frequently, in as many as 1 in 4 applications. Clarke, R. (2003). "U.S. Continuity Law and its Impact on the Comparative Patenting Rates of the US, Japan, and

estimated to last on average in excess of ten years, delaying a pharmaceutical patent's issue to ensure the maximum patent term can allow the firm to capture additional rents.[30]

Experts in the pharmaceutical industry note that, by taking advantage of continuation application delay, pharmaceutical patentees maximized returns from the exclusive patent right. The continuation was employed to ensure that the maximum patent term was available for the drug product, a particularly valuable goal due to pharmaceutical products generally being characterized by long product cycles and late arriving returns.[31] "Fitting" the patent term to the patented product's period of maximum returns is valuable in the pharmaceutical sector, and likely in other sectors with product market characteristics similar to that of the drugs industry.

Changes in the U.S. patent laws made this "delay" strategy more valuable to pharmaceutical firms before 1995. Prior to that date, the law mandated that the patent term began at date of issue, thus affording the pharmaceutical patentee 17-years of protection from the date that the applicant chose to end the continuation process by allowing the patent to grant. After 1995, the patent term became 20-years, but the term begins running on the date of first application. Results of my analysis of the continuation data in pharmaceutical patenting support the contention that pharmaceutical firms used

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the European Patent Office" *Journal of the Patent and Trademark Office Society.*

[30] J.A. Dimasi's analysis shows that new drug approval in the U.S. took on average 15-years in the 1990s. Testimony of Joseph A. Dimasi, Director of Economic Analysis, Tufts University Center for the Study of Drug Development, before the U.S. House of Representatives Subcommittee on Health and the Environment, Committee on Commerce Hearings, April 23, 1997. Alliance Pharmaceutical Corp. and Avanir Pharmaceuticals report a 12-year mean based on a study completed by D. Wierenga and C.R. Eaton, "The Drug Development and Approval Process," Office of Research and Development, Pharmaceutical Manufacturers Association (1993).

[31] In fact, significant returns are often available in pharmaceutical products beyond the expiry of the 20-year patent term, a fact that helps explain the aggressive lobbying, legal, and litigation stance of the large drugs firms in the face of generic competition.

the continuation procedure routinely prior to, and that use curtailed after, the 1995 regime change.

Longer periods of pre-issue examination, coupled with an early and protected priority date for the invention, offered benefits to patentees who, like the pharmaceutical firms, realized strategic advantage from delaying the beginning of the 17-year patent term prior to 1995. One set of motivations for such a strategy can be found chiefly in patentees deriving benefit from added time prior to the commercial use of the patented technology. Shortening "dead time" in the beginning of the patent term can protect economic rents. "Dead time"—a period of patent protection without the ability to earn revenues—may result from a time-consuming development process for complementary technologies necessary to bring the patented technology to market, postponement while required complementary assets are deployed, or any other institutionalized delays, such as those experienced by drugs firms during the regulatory approval process mandated for pharmaceutical products by the Food and Drug Administration.

Because the 1995 amendments to patent laws restrict the patent term to 20 years after the date of the first patent application, the effective use of continuation as a "fitting" strategy has been blunted. If continuation practice is being used with "serial patenting," however, patentees may be taking advantage of some form of "fitting" even in the wake of the 1995 legislative changes. Patentees' use of continuation applications in conjunction with a series of overlapping, time-delayed patents filed on a stream of innovations may still give effect to the "fitting" strategy. Merges (1999) suggests that serial patenting is particularly common strategy in drugs patents, and interviews I have conducted with intellectual property attorneys reveal that pharmaceutical and biotechnology firms are engaging in this specialized continuation practice in their post-1995 patenting.

The fact that drugs patents are less likely to be continued post-1995, however, suggests that the disincentives of the Act have had some effect. The removal of legal incentives to engage in "fitting" has uncertain welfare consequences. This feature of the U.S. patent laws may have had beneficial welfare effects for certain products that require substantial up-front investments but for which profits are expected to arrive over a long time horizon. Absent the delays afforded by the continuation process, returns may not be sufficient to encourage innovators to bring new and potentially beneficial products to market. Certain pharmaceuticals may fit this definition, and evidence demonstrates that the drug companies have been among the most active users of the continuation process in their corporate patenting.

Another strategic option derives from the manner in which continuations allow an innovator using secrecy to "hedge" against independent invention. An innovator developing a technology that is most valuable when protected by secrecy is supported by the intellectual property institution of trade secrecy, a legal protection that offers no safeguard against independent invention of the identical technology by another inventor. In the pre-1995 era, when continuations could be used to protect early priority dates indefinitely without disclosure, these innovators could gain a strategic advantage. Under circumstances in which the valuable technical knowledge was independently discovered by another, the launching of a patent from the continuation process would allow the first inventor to prevent the second inventor from using the technology, which could have the effect of protecting some of the lost value from the now disclosed technology.[32] If no second inventor materialized, the applicant would have the option of abandoning the application ("Terminate Application") as depicted in Figure 2.2. Discussions with practitioners suggest, however, that this hedging strategy was rarely used, and Quillen and Webster's (2001) study, if accurate, suggests that the "abandonment" could at most comprise 5% of all patent applications.[33]

After the 1995 legislative changes took effect, the strategic landscape shifted. While non-strategic motives remained unaltered, the new rules reduced incentives and changed the option set, both for "submarining" and other strategic actors alike. The new law, forcing a 20-year limit on the time taken for both patent prosecution and protection, necessarily limited the submarine strategy. The result of the law may have made a submarine strategy less viable, although because extended secrecy was protected by the continuation at least until the 1999 amendments to the Patent Act, the trade-off may have had a more complex result. In fact, for technologies with short lives, the disincentives intended by the 1995 changes may have come at modest cost to the patentee, and may have had a limited effect on applicants' behaviors.

For "submarine" strategies that seek to hide the invention within the Patent Office, the new law forced the patentee to make a more explicit choice between an extended period of secrecy and a lengthy patent term. While the old law allowed a

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[32] One can imagine, however, a situation in which it would be more valuable to the first inventor to allow the second inventor to use the technology—producing a duopoly—if there was some indication that secrecy would be maintained, thus avoiding a full disclosure which an issued patent would inevitably bring.

[33] The 5% termination rate discovered by Quillen and Webster must necessarily constitute all patent application abandoned, for whatever reason. If the USPTO's study (Clarke, 2003) is accurate, however, upwards of 25% of applications are being terminated, thus allowing for a greater number of terminations of all motivations.

patent's issue to be delayed while value-adding complementary assets were deployed, the new 20-year rule disadvantages strategic users of continuations in industries built upon long-lived technologies. An applicant is thus forced, once the priority date has been protected through filing, to choose between more early secrecy and less late patent protection. This decision is made more complicated by the "lumpiness" of the issue decision at the Patent Office—an applicant considering whether to postpone the issue of a patent may be dissuaded from using the continuation by an inability to perfectly control the length of time that the grant will be delayed. While it is clear that the 1995 legislative changes altered the environment in the U.S. for innovation, it is less clear what effect this change has had upon the use of continuation applications, and upon innovation strategies more generally.

The enactment of the maximum 20-year window to both examine and protect a patent created two sets of strategic opportunities, one set for applications entering the Patent Office prior to the 1995 amendments, and another for applications filed after these changes. Prior to 1995, liberal continuation rules made "submarining" a viable option, and applicants like George Selden could utilize the continuation to keep individual claims, or entire applications, secret for extended periods of time. This former type of "submarining" was relatively inexpensive: The only benefit forgone by the applicant was early patent protection.

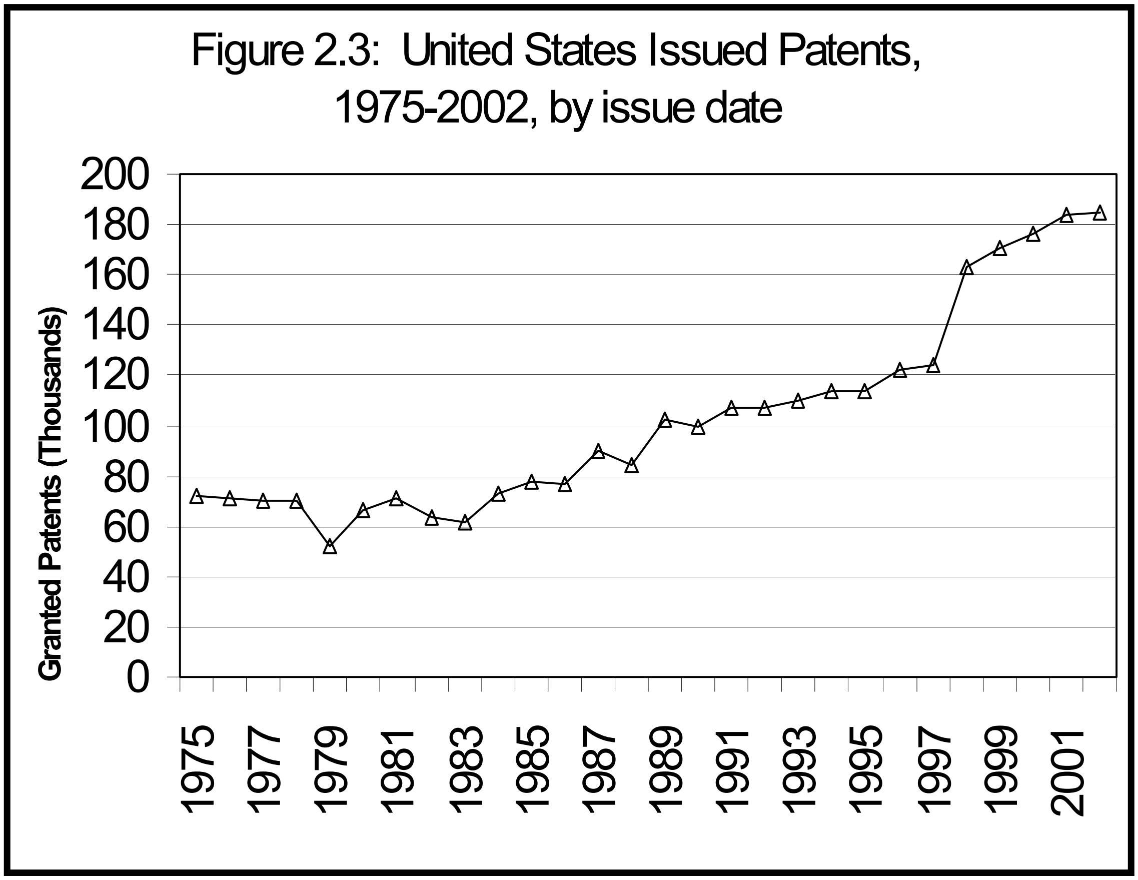
Pre-1995 continuation practice was comparatively inexpensive overall. For patentees like drugs firms seeking to maximize profits by "fitting" the patent term to the greatest return available given the patented product's life-cycle, the continuation delay would require the patentee to forego early sub-optimal returns in exchange for later, greater profits. Furthermore, all applicants with patents issued prior to1995 enjoyed not only an early priority date, but also extended secrecy and full control over the start-date of a 17-year patent term undiminished by the time spent in examination.

While in the wake of the 1995 and 1999 legislative changes some patentees have lost the extended secrecy, and all patentees have lost control over the start-date of a full 17-year patent term, these costs do not fall on all patentees equally. For industries relying on technologies that lose revenue-generating potential reasonably quickly, the 1995 law may offer few disincentives to the strategic use of continuations. Moreover, patentees with technology interests that are geographically insulated in the United States—or can be organized to be—may be protected from the costs associated with the 1999 publication requirements by the U.S.-only loophole. Strategic applicants in industries or firms with these characteristics may protect priority while extending early secrecy without any loss of value in what may be relatively invaluable late years of a 20-year patent term.

1.4 CONTINUATION SHARES AND DELAYS, 1975-2002

These motivations for innovators' uses of the continuation procedure, both before and after the 1995 and 1999 regime changes, beg a host of questions. First, what are the determinants of continuation practice by patentees? Second, why did patentees begin to use the continuation process in greater numbers during the 1980s through the time when the 1995 Act was passed? Third, what effects have the legislative changes had on the use by patentees of the continuation procedure? Fourth, are there significant differences in the incidence of continuation practice by industry or technology sector and, if so, have these differences persisted in light of incentive changes produced by the amendments in the Patent Act? And fifth, are there differences in the characteristics of patentees using the continuation procedure, and, if so, how was the use of the procedure by these firms affected by the regime changes in 1995 and 1999?

The continuation viewed as an empirical phenomenon also poses several related and important questions for researchers. First, what are the lag and delay effects of continuation applications, and what implication do these effects have for grant lag statistics reported in the prior literature? Second, are there differences in these effects according to the timing of patent practice, the patent's underlying technology, or patentee characteristics? Third, do these lag and delay effects suggest that researchers should modify their approach to doing empirical patent research, and if so under what circumstances? Fourth, in light of the legislative changes enacted in 1995 and 1999, are these effects relevant for researchers studying patenting subsequent to these changes?



1.4.1 Continuation Shares and Grant Lags

To shed light upon these two sets of questions, I present analyses of the continuation-patenting data for the years 1975-2002. The data source I use to identify patents issued at the end of a chain of continuation applications is the Micropatent Database purchased and maintained at the Walter A. Haas School of Business.[34] Information regarding a patent's continuation applications is collected from the face of the patent document under a sub-heading styled "Related Patent Data" by the USPTO. I have defined a "continuation" patent as any patent containing the term "continuation" or

[34] Although I maintained the database during the years 1999-2003, I am very thankful for the original work of Dr. Michael Barnes and Dr. Arvids Ziedonis, and the ongoing efforts of Dr. Ziedonis in supplementing the database.

"division" in this sub-heading.[35] Other information beyond the scope of the statutorily defined terms continuation and division is not contained in the "Related Patent Data" section of the patent document. Other data on a range of characteristics for both continued and non-continued patents was collected from the Micropatent Database, the NBER patent database (Hall, Jaffe, and Trajtenberg, 2001), Derwent Information, and the United States Patent and Trademark Office. Data are generally available on the range of patent-based measures beginning in 1975. My data includes 2,500,811 issued U.S. patents during the period January 1, 1975 to December 31, 2001, of which 566,767 (22.7%) show a continuation application lineage.

In order to frame continuation use in the larger context of overall U.S. patenting, a plot of annual United States granted patents during the 1975-2002 time period is presented in Figure 2.3. Several studies have examined the motivations for increased patenting in the US after the mid-1980s (Kortum and Lerner, 1999; Hall and Ziedonis, 2001; USPTO, 2002b), with suggestions by some that growth in "junk" patenting has played a significant role, particularly in new technologies (Aharonian, 2000). According to Quillen and Webster (2001), the continuation application allows the applicant to increase the likelihood of patent issue by "forcing" costs onto the examiner. If confirmed, such a benefit to the patentee would have implications for firms seeking to increase patent stocks for strategic purposes, for instance in cross-licensing strategies to manage the design and competitive challenges created by patent thickets (Hall and Ziedonis, 2001; Shapiro, 2001; Hunt and Bessen, 2003). If Quillen and Webster's

[35] By including the term "continuation," "continuation-in-part" patents were also captured.

hypothesis is sustainable, some of the overall increase in patenting may be the result of "junk" patents issued as a result of strategic continuation practice.

Illustrating the overall use of continuations, Figure 2.4 plots the fraction of patents issued that had at least one continuation[36] in their application lineage, annually 1975-2002. These data thus represent only the terminal patent emerging at the end of a chain of continuations. Because early applications are routinely abandoned, this terminal patent may offer the only evidence of the existence of a continuation chain. The data in Figure 2.4 are calculated using the issue-date instead of the application-date because, under continuation practice, the application-date recorded on the face of the patent document reflects simply the "last" application in a chain of continuations. This last "application" date is, therefore, a substantially biased measure of an innovation's entry into the Patent Office when the patentee has used continuation application practice. In cases that the patent shows a continuation application lineage, the issue date may be a more meaningful metric of the use by patentees of the procedure, because the issue date is one over which the applicant exercises greater control than in the "normal" single-application patent case, and gives an indication of when, within a certain distribution, the patentee chose the period of pre-issue delay to end.[37]

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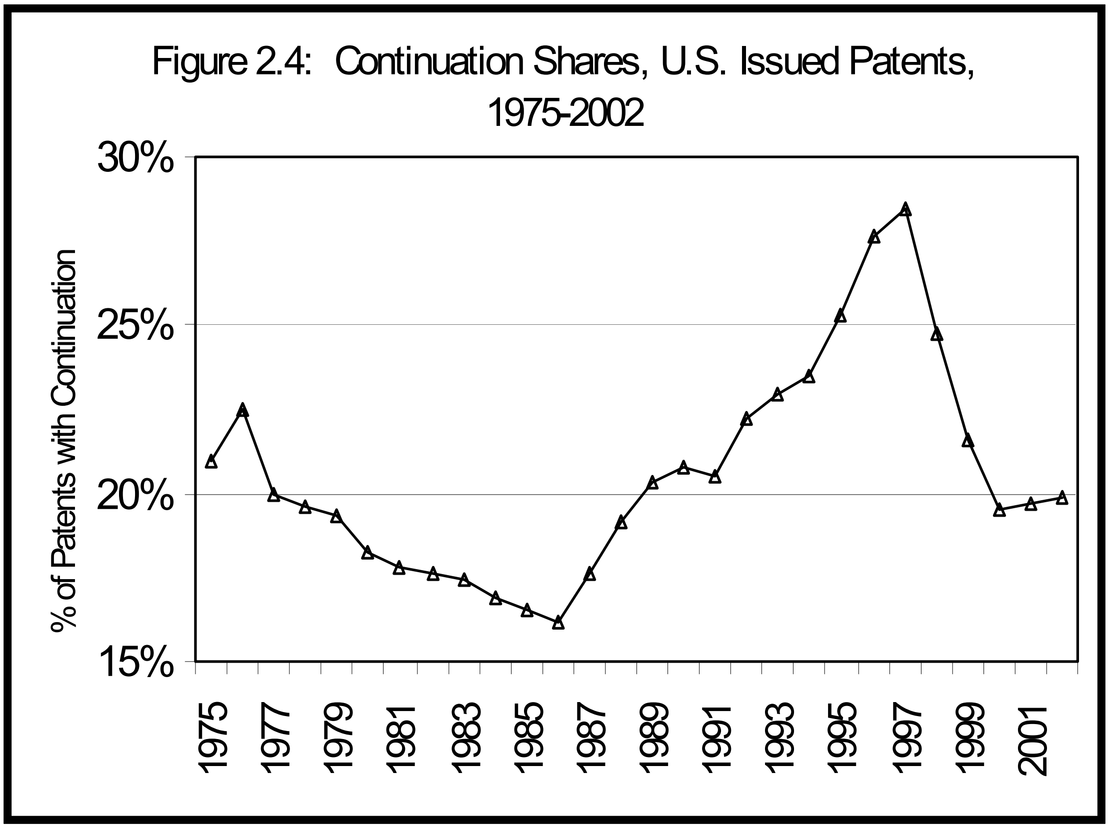
[36] The use here of "continuation" includes also the "continuation-in-part" process by which particular claims or groups of claims can be continued as opposed to an entire application and all disclosures therein. Because the use of the continuation-in-part process to shroud certain critical claims under a veil of secrecy is, in effect, virtually identical to secreting the entire application, both are considered "continuations" for this analysis. Divisions, which have the same effect as continuations, are considered here also.

[37] There will always be a certain amount of uncertainty about the date of issue, although the patentee can minimize this uncertainty through the negotiation process with the USPTO examiner and the deft use of the continuation process itself.



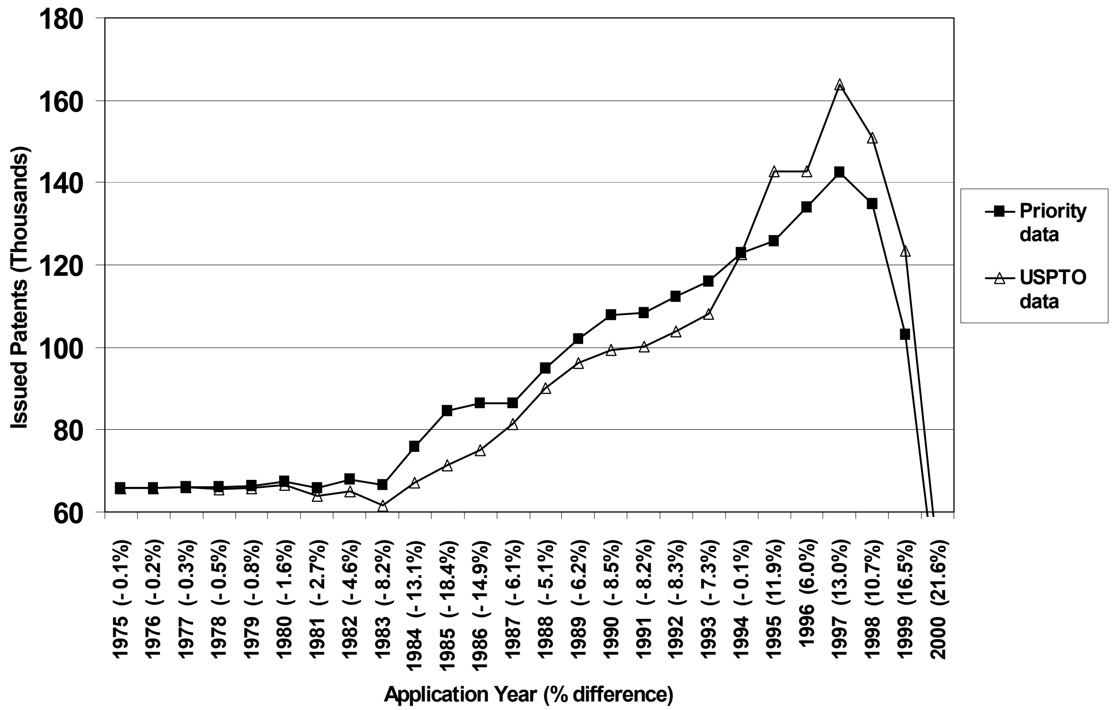
The numbers presented in Figure 2.4 suggest that the continuation may be an important economic phenomenon: The practice can be found in the applications of at least 17% and as much as 28% of annual aggregate issued patents throughout the 1975-2002 period. Patents issuing after some continuation practice account for a large share of patenting before 1995, and their use remains significant after Congress' amendments to the patent laws. The downward trend after 1997 may be an indication that the disincentives intended in the 1995 Act have had an impact on behavior, when one corrects for some identifiable lag in the prosecution of patents already in the system. For these overall data, continuation practice has fallen from a high of 28% in 1997 to 19% in 2000, nearly returning in the last years to the level of continuation use that had been the norm in the 1970s and early 1980s.

Compounding the difficulty in interpreting the trend after 1999 is the existence of a second temporal "shock:" Congress inserted the 18-month publication requirement to the Patent Act effective in 1999. Although Congress had intended this second statutory revision as another disincentive to further curb the use by patent applicants of the continuation procedure, continuation shares appear to have reached a plateau after 1999. Across all patent classes, continuation use has apparently stabilized, with approximately 20% of all patents issued during the 2000-2002 period showing some continuation application lineage. In fact, continuation shares have increased, albeit modestly, from 2000-2002.

The substantially increased incidence of granted continuation patents shown in the 1986-1996 period reflects in fact applications filed several years earlier. While non-continuation applications pend inside the USPTO for 2-3 years, continuation applications unsurprisingly pend on average for a longer time. For instance, the continuation "priority dates" (the date upon which the first in the chain of continuation applications for a patent entered the Patent Office) for continuation patents issued in 1987 and 1988 occur a mean of 3.9 years before issue, placing the mean first-filing date for this subset of issued patents at 1983 and 1984, respectively. In fact, 52% of all patents issued in 1987 had a first continuation filing date during 1983-84, as did 33% of all patents issued in 1988. Thus, more frequent use of continuation applications by patentees began prior to the inflection in the plot of patent grants demonstrated in Figure 2.4, and appears to correspond in time to the founding of the Court of Appeals for the Federal Circuit (CAFC) in 1983 and the U.S. "pro-patent" regime that that court ushered in (Merges, 1996). Whether the increase in the returns to patenting suggested as one possible outcome of the founding of the CAFC (Hall and Ziedonis, 2001) also led to a concomitant change in the returns to using the continuation procedure in patenting is left to future research.

To further investigate the timing of patent applications entering the Patent Office when continuation applications are involved, all issued patents 1975-2001 are plotted in Figure 2.5 by application year (data for 2002 falls out due to right censoring). The two plots represent different definitions of the timing of a patent's entry into the patent system, hence Figure 2.5 compares (1) the method used by the USPTO, assigning the "application date" found on the first page of the patent document (USPTO, 2002a), with what I contend is a more meaningful measure, (2) assigning to continuation patents the "priority date" associated with the earliest continuation application filed in that patent's application lineage. Figure 2.5 demonstrates that, regardless of the definition used, the growth in patent applications changed its trajectory after 1983, consistent with changes heralded at the founding of the "pro-patent" regime. The trajectory is inclined more steeply, however, after 1983 when one takes account of continuation-patent "priority" dates. Also significant in the trends is the precipitous drop in the share of continuation application after 1997, corresponding to the effective date of the first relevant amendment to the Patent Act. A share, but not the entirety, of this plunge in application numbers after 1995 is an artifact of right side censoring.

Figure 2.5: Issued Patents by Application Year, 1975-2001
(comparing USPTO application data and Continuation "priority" data)



A comparison of the two plots in Figure 2.5, moreover, reveals that the USPTO's method employed to report "incoming applications" results in distorted statistics. For instance, in 1984, 1985, and 1986, the USPTO figures undercount the number of patent applications entering the system that ultimately exit as patents by 13.1%, 18.4%, and 14.9% respectively. The substantial additional delay that continuation practice can add to an application's pendency correspondingly skews the reported figures in more recent years: In 1995, 1996, and 1997, USPTO statistics over count the number of patent applications that enter the system and ultimately exit as patents in those years by 11.9%, 6.0%, and 13.0% respectively. The result of the USPTO neglecting to employ the continuation data—data to which the agency has historically had better access than the public at large—is to undercount patent applications entering in past years and to over count them in recent years. While this over count in recent years is not a double-count of patent applications, it is a real temporal distortion: Patents that were actually filed in earlier years are being counted, and reported, as being filed in later years. The question of double-counting is a very real concern, however, because in the case of the "division" continuation application, multiple patents may be granted from a common application. But this dimension of continuation counts awaits future research.

The USPTO's persistent failure to account for the continuation application not only distorts the agency's reporting of overall patent statistics, it in fact also distorts the more focused USPTO reports of geographical and patentee identity statistics used by policymakers and researchers alike. The biased statistics can be demonstrated by comparing (1) the USPTO's report on "Organizational Patenting" detailing "patents by year of application" for large patenting organizations 1988-2001 (USPTO, 2002a), with (2) annual counts that I generated by instead assigning to continuation patents the "priority date" associated with the earliest continuation application filed in that patent's application lineage. I compare in Table 2.1 the patenting for the entity leading the list of the USPTO reported "large patenting organizations," International Business Machine, that the USPTO reports as having held 28,608 patents through the end of 2001.[38]

The bias in the USPTO's reporting is palpable. The USPTO method tends to undercount IBM's patent applications significantly in past years (28%, 21%, 17% and 20% in 1989, 1990, 1991, and 1992, respectively) and over count them substantially in recent years (16%, 12% and 10% in 1995, 1996, and 1997, respectively). These distorted

[38] It seems clear that the USPTO defines an "International Business Machine" patent as one with an assignee that begins either with the text "International Business Machine" or "IBM." This definition almost certainly is failing to capture the patenting by IBM subsidiaries and partners, but I follow the USPTO's method so as to compare like with like in this count analysis.

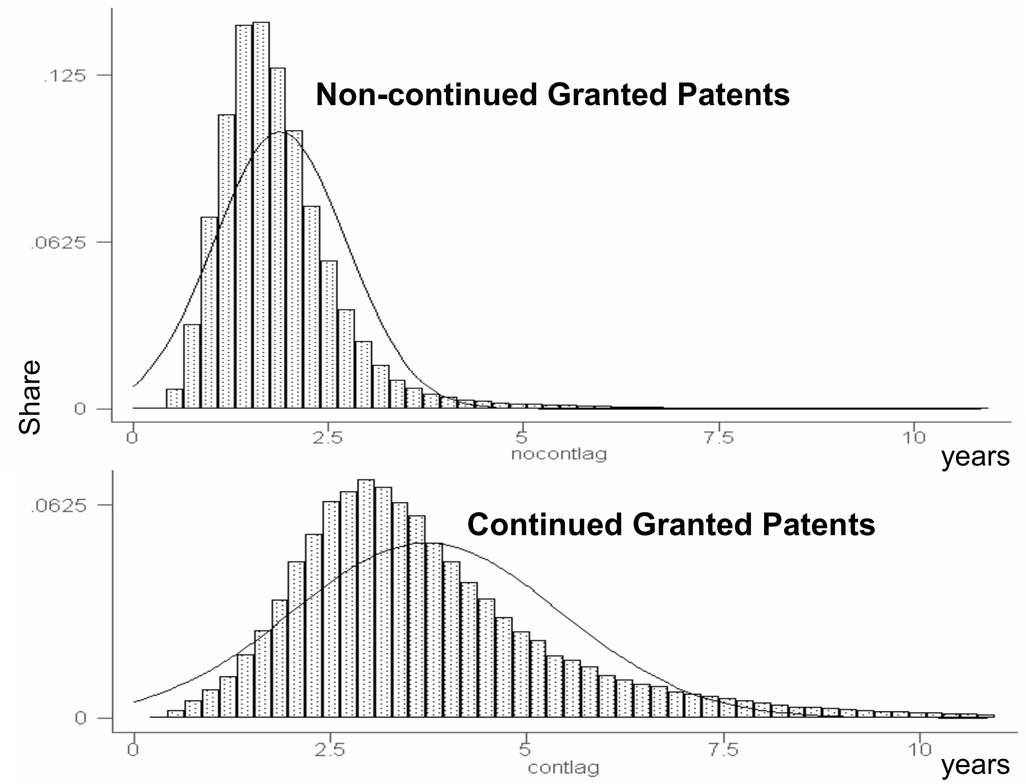
figures are not isolated to IBM as an organization: Distortions in USPTO patent counts can be seen in the figures for other large patenting organizations, including General Electric, Bayer Aktiengesellschaft, and E.I. DuPont De Nemours, among others.

Table 2.1: International Business Machine patenting, by grant year (based on figures from USPTO Table B-2 (2002))

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Patents by Application Year (USPTO)	658	743	932	1265	1548	1305	1909	2560	2694	3379	2937	1429	361
Patents by Application Year (“priority date”)	735	896	1193	1479	1858	1522	2054	2156	2360	3053	2694	1139	219
USPTO Under-/ Over-count	**-12%**	**-21%**	**-28%**	**-17%**	**-20%**	**-17%**	**-8%**	**16%**	**12%**	**10%**	**8%**	**20%**	**39%**

The distortions created by employing the “application date” appearing on the front of the U.S. patent document to the exclusion of continuation application data have also affected empirical patent studies reporting application-to-grant lag statistics. Griliches (1989) reports a distribution of U.S. patent grants by year of application, and calculates time from application to grant for patents issued 1966-1982 using USPTO data and methods. While the shares of patents issuing within three years of application dates[39] in 1975-1979 is reported in Griliches (1989) to be 89%, 91%, 84%, 82%, and 82% respectively, recalculating using the “priority date” method transforms these statistics. Accounting for continuation applications shows that the shares of patents issuing in the identical time window for the same application years is 79%, 81%, 77%, 76% and 76% respectively, thus demonstrating that Griliches (1989) overestimated the share of U.S. patents granted within the defined 3-year window in the years 1975-1979 by 10%, 10%, 7%, 6%, and 6%, respectively. As a result, USPTO examiners were not as "timely" in their patent granting as Griliches (1989) had suggested. Hall, Jaffe, and Trajtenberg (2001) also rely on the USPTO "application date" method to report on grant lag statistics, and as such their findings also fail to take account of the substantial delay that continuation applications can introduce.

Figure 2.6: Grant lags, Non-continued and Continued patents, 1975-1994



1.4.2 The Effects of Patentees' Continuation Use on Grant Lags

The distortions described in the last section beg the question: What is the temporal effect of the continuation? Data analysis indicates that the consequence of using the continuation application is to delay the issue of the patent. Figure 2.6 compares

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[39] It appears that rounding may have led Griliches (1989) to report shares of annual patents granted within 2.5 years instead of the stated 3.0 years, but lack of access to the original data make such a claim only informed conjecture.

two cohorts of issued continuation patents, those having at least one continuation in their application lineage and those issued showing no continuation history. The calculations are based upon the lags of all patents issued from 1975-1994, inclusive, with patents issued after 1994 dropped to reduce lag-issue and regime-change effects. While non-continuation patents pend for an average of 1.89 years in the Patent Office, those with at least one continuation in their lineage pend for an average of 3.94 years—about 750 days, or 2.1 years, longer.[40] The longer periods of pendency exhibited by continuation patents do not appear to be due overwhelmingly to multiple-continuation applications: Restricting the sample to patents with only one continuation in their application lineage yields a mean pendency of 3.38 years—about 550 days or 1.5 years longer than non-continued patents. Thus, the effect of the applicant's continuation choice is in virtually all circumstances to purchase delay.[41] Not surprisingly, it is this additional delay caused by continuation practice that is at the heart of the data distortions outlined in the last section.

Table 2.2: Continuation Rates and Composition,
By Technology Grouping and Ownership Characteristics
<u>Panel A: Continued Patents, 1975-79</u>

1975-79	Overall	Domestic	Foreign	Entities	Independent
Drugs & Heath	33.6%	34.7%	31.9%	38.3%	19.0%
Chemical	33.6%	38.7%	26.8%	33.9%	28.9%
Electronics	14.6%	16.0%	12.2%	14.3%	16.2%
Mechanical	18.0%	20.0%	14.6%	18.4%	17.0%
Other	22.1%	22.8%	20.5%	25.9%	14.5%

[40] These longer periods of pendency do not appear to be due overwhelmingly to multiple-continuation applications. Restricting the sample to patents with only one continuation in their application lineage yields a mean pendency of 1230 days—542 days, or 1.5 years, longer than non-continued patents.

[41] In a mere 0.01% of cases is the application date listed on the face of the patent the same date as the earliest "continuation" date.

Table 2.2: Continuation Rates and Composition,
By Technology Grouping and Ownership Characteristics (continued)
Panel B: Continued Patents, 1990-94

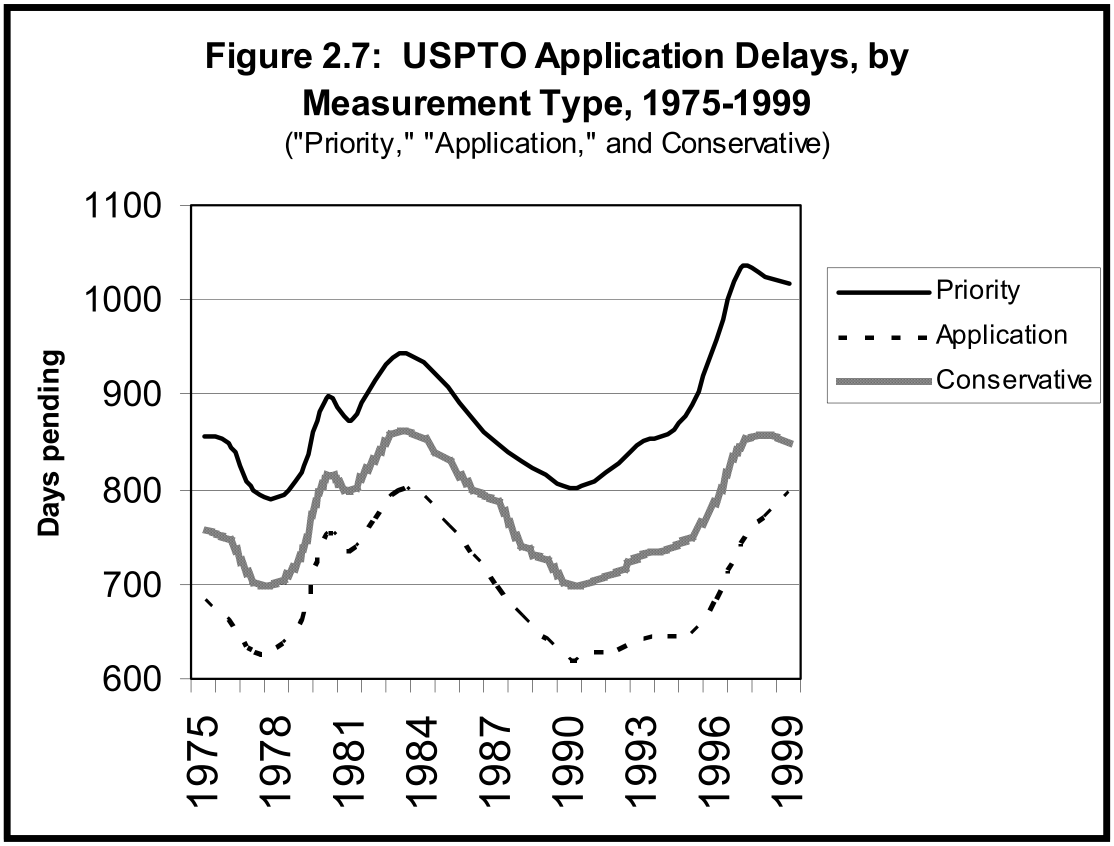
1990-94	Overal l	Domestic	Foreign	Entities	Independen t
Drugs & Heath	34.3%	36.9%	29.8%	36.7%	26.6%
Chemical	34.2%	39.5%	30.0%	34.3%	32.4%
Electronics	19.9%	21.8%	18.2%	20.0%	19.4%
Mechanical	19.6%	22.0%	16.3%	20.3%	17.0%
Other	25.7%	27.5%	22.5%	29.2%	18.5%

Panel C: Continued Patents, 1995-99

1995-99	Overal l	Domestic	Foreign	Entities	Independen t
Drugs & Heath	41.0%	45.7%	31.6%	43.4%	31.0%
Chemical	39.4%	47.5%	30.4%	39.8%	33.7%
Electronics	25.1%	27.9%	22.3%	25.2%	23.5%
Mechanical	21.6%	25.6%	16.7%	22.8%	17.5%
Other	30.9%	34.5%	23.7%	35.8%	20.2%

Table 2.2 summarizes the mean pendency period for patents having at least one continuation in their application lineage compared with those patents issued after no continuation practice. Table 2.2 offers statistics for the entire population of over 1.5 million patents issued from 1975-1995 for which data are available, with patents issued after 1995 dropped to reduce lag issue effects. Inspecting the annual continuation shares (shown in Figure 2.3) during this period suggest two eras defined by the trend's inflection: One prior to the change in continuation patents' growth trajectory (1975-1986) and another thereafter, during the increasing use by patentees (1987-94). The lag effects for these two cohorts of patents shows the same pattern: Employing the continuation procedure purchases for the average applicant substantial delay (over 24 months), and a significant share of this delay is available on average for the first

continuation filed (over 18 months). Evidence suggests differences between the two eras, however: The table demonstrates that the length of application pendency inside the USPTO, for both continued and non-continued patents, has fallen over time, consistent with Griliches' findings (1989; 1990), while continuation practice itself has become more commonplace.



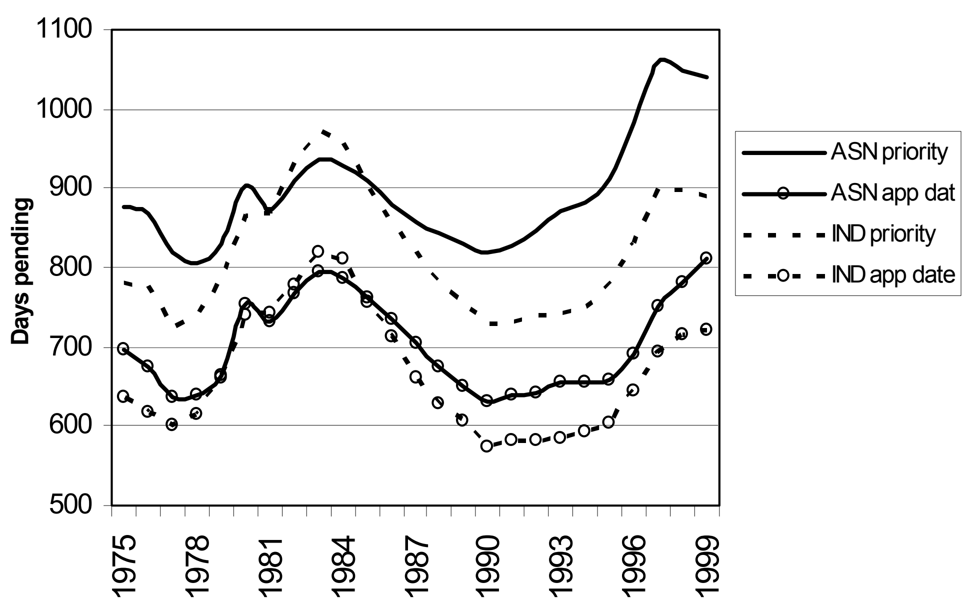
Furthermore, the additional pendency afforded to patentees from employing the continuation procedure is significant and persistent over time, both before and after the 1995 regime change. Figure 2.7 plots USPTO pendency year-on-year for continuation applications using three different definitions for the date upon which pendency begins: (1) "Application date;" (2) "priority date;" and (3) an intermediate, conservative measure described below. The pendency measured from "application date" uses the application date listed on the face of the patent, and so is identical to the method used by the USPTO, in Griliches (1989) and Hall, Jaffe, and Trajtenberg (2002). The pendency calculated using this measure is significantly below the "priority date" measure in all years. The "priority date" measure calculates pendency from the date upon which the first continuation application entered the Patent Office ("priority date"), as disclosed on the patent document. The difference in pendency resulting from the application of these two different measurement methods is significant: The "priority date" method results in an increase in pendency over the "application date" method of 20 weeks in the early 1980s and over 40 weeks by the late 1990s.

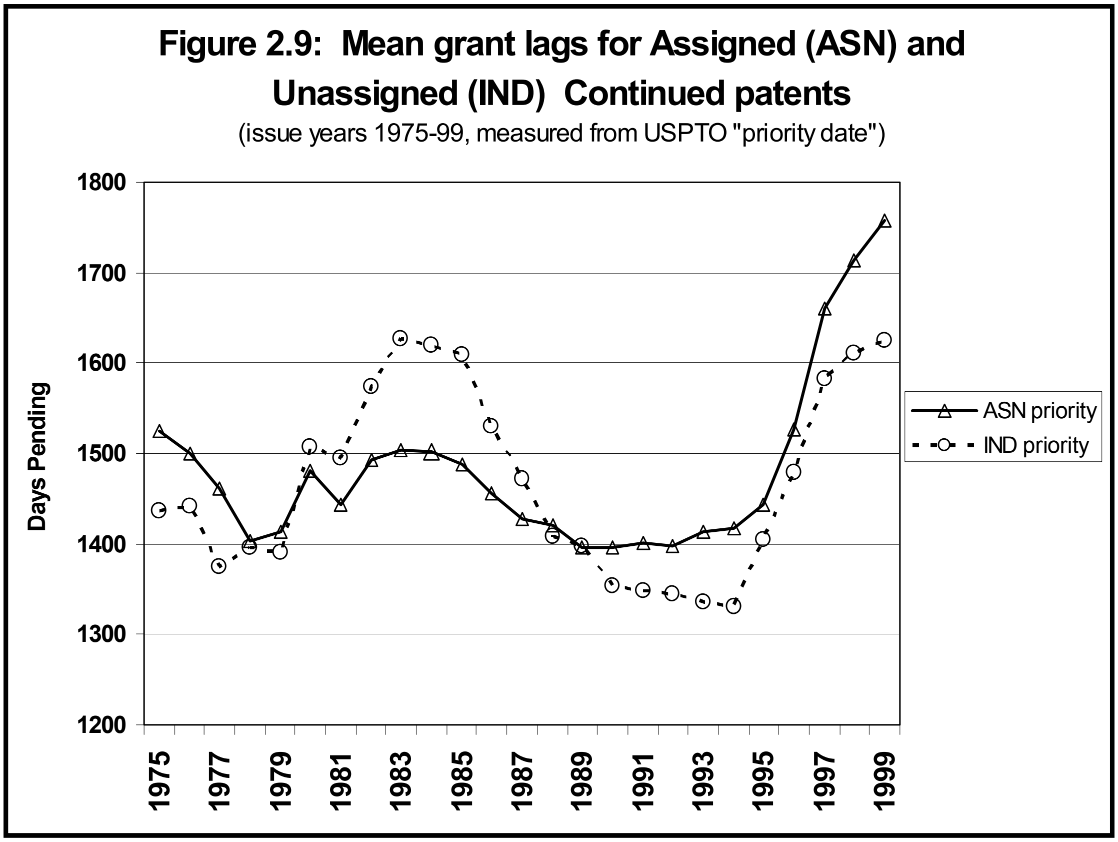
Figure 2.7 also plots a more conservative, intermediate measure. This third grant-lag measure is calculated using the "application date" method favored in the prior literature unless all continuation applications were both "continued" and "abandoned," in which case the continuation "priority date" is used. This measure (3), while showing pendency shorter than the "all priority date" measure (2), is nevertheless substantially longer than the measures based upon the "application date" method (1), with inconsistencies of 9 weeks in the early 1980s and 15 weeks by the late 1990s. Conducting the measurement using this third, conservative method gives an intermediate result, yet may be a more accurate and defensible measure under certain circumstances. For a granted patent showing a continuation lineage, the simple "application date" method (1) assigns only the last in a series of continuation application dates to measure pendency, thus ignoring any previous continuation process. Conversely, by assigning to all continuation patents the "priority date" measure (2), a researcher would be presenting statistics as if, for all granted patents showing a continuation lineage, all the technology disclosures were pending at the original filing date, thus ignoring any subsequent disclosures made. These two methods may be taken as polar extremes in terms of measurement, and each can be shown to be objectively inaccurate, the former because it assigns too late a starting date to some patent disclosures that were previously pending inside the USPTO, and the latter because it assigns too early a starting date to some patent disclosures that have been added only after the continuation process has begun. While the conservative, intermediate measure surely contains inaccuracies in the measurement of individual patent grant lags, it benefits from correcting some of the clearly flawed results of using either the "application date" or "priority date" method exclusively. The conservative method selectively uses these two methods of measurement, making use of the "application date" as a default measure and assigning the "priority date" to a patent only when the patent (a) shows a continuation lineage and (b) all the continuation events are both (i) "continued" and thus identical in terms of technological disclosures and (ii) "abandoned." The conservative measure thus ensures that early dates are applied to measure patent pendency only when the applicant objectively acts (by both choosing to "continue" and also abandoning all applications except for the terminal application), and when the disclosure is objectively the same invention (by definition, the statutory "continuation"). This third method may be a better reflection of application-to-grant lags, and may reflect a truer measure of the application pendency for patents inside the Patent Office.

Because "submarining" motivations are often associated with independent inventors, I investigate whether ownership features of the patent have a bearing on the delay I have shown in the pendency of the grant process. Figure 2.8 compares the application-to-grant delay measured alternatively by the "application date" (1) and first priority date (2) methods for both assigned (all entities) and unassigned continuation patents. The patent characteristic "assigned" or "non-assigned" has been used frequently as a means of distinguishing between made-for-hire firm patents and inventor-owned patents, respectively (Hall, Jaffe, and Trajtenberg, 2002). Two interesting patterns in the data emerge. First, application lags are significantly longer when measured from priority date as compared to application date regardless of ownership, although delay for assigned patents at its apex in the late 1990s is significantly longer than that for unassigned patents (44 weeks for assigned patents as compared to 29 weeks for unassigned patents). Also, during the late 1970s to the mid-1980s, application-to-grant lags for unassigned patents were longer than those for assigned patents, regardless of the applicant's ownership category.

Figure 2.8: USPTO Application Delays, by Identity and Applicatiion Process, 1975-1999

(Independents and Assignees - Application date and Priority date)





This latter pattern is displayed in Figure 2.9 by plotting only continuation patent grant lags, comparing the lags of assigned and unassigned issued patents that had some continuation application practice in their lineage. Analysis of this restricted (to only continuation patents) sample suggests that, during the issue years 1980-1988, independent inventors were using the continuation application and reaping a greater pre-issue delay than were patenting entities, and that this characteristic began to abate after 1983. This date is noteworthy because, as this chapter discussed when other 1983 inflections were shown both in overall patenting and in continuation patterns, the date corresponds to the founding of the CAFC and the strengthening of the U.S. patent right. It is conceivable that the launch of the "pro-patent" regime altered the returns to continuation for individuals or entities, but further research is needed to uncover a proof-positive relationship.

1.4.3 Continuation Usage in Discrete Sectors

While the trend presented in Figure 2.4 demonstrates that the use of continuation is widespread across all patenting through the period 1975-2002, the prospect of significant intersectoral differences make an examination of less aggregated descriptive statistics desirable. Following the technology groupings from Lanjouw and Schankerman (1997), Table 2.2 presents the mean incidence of continuation lineage in issued patents across different technology areas and ownership characteristics for three samples, issued patents 1975-79, 1990-94, and 1995-99. These three periods were chosen on grounds that the first period, 1975-79, predated the pro-patent regime ushered in at the founding of the CAFC (Merges, 1997), the second period, 1990-94, coincides with the era of considerable growth in the use of the continuations across many sectors, while the 1995-99 period corresponds to the period immediately after the first relevant amendment to the Patent Act. The technology groupings indexed in the table include "Drug and Health," "Chemical," "Electronics," "Mechanical," and all "Others."

The data show that patentees in the Drug/Heath (DH) and Chemical (CH) technologies have employed the continuation application more than patentees in other areas, and that this significantly greater incidence persists over time. Particularly strong growth in the use of the continuation application can be detected in Electronics (EL) patenting since the mid 1970s. Showing a comparatively low usage rate in the early years, electronics patentees' use of the continuation application is significantly more likely to be evidenced in 1995-99 issued patents than in those issued during 1975-79.

Mechanical patents appear to show the most consistent continuation rates over time, fluctuating in a comparatively narrow range between 15-25% for all categories in all periods.

Because ownership characteristics are likely to play a role in the use of the continuation procedure, whether due to familiarity with and ability to use the procedure, access to necessary time and resources, scale and scope advantages in framing an overall technology strategy, or incentives and motivations, Table 2.2 also presents several geographic and entity-ownership characteristics. Domestic and foreign-owned patents are determined by reference to the country of first inventor disclosed on the face of the patent document. The data suggest that domestically-owned patents are significantly more likely to be continued than are their foreign-owned counterparts, and that this difference persists over time. Comparisons of the 1995-99 statistics with those from 1990-94 suggest that much of the increased use in the continuation in the latter years was due to significant increases in domestic US users. Furthermore, this increased domestic participation over time holds across all technology groupings. The increased usage rate after 1994 may be an effect of the operation of the regime change and, as Figures 3 and 4 suggest, significant changes in usage occurred during the 1995-99 period.

To gain some insights into the use of continuation patents by entity ownership, organizational patents are defined as those "assigned" to an entity, while independently-owned patents are defined as those that were not assigned from inventor to another entity on the face of the patent document. Over 96% of these "assigned" patents are assigned to non-governmental organizations, mostly corporations (Hall, et al. 2002). In general, the data demonstrate that independents use the continuation application significantly less in all technology except for in the electronics sector. In electronics, independent inventors' usage rates were actually higher than assigned entities during the early years of the study, and continued to keep pace with increased usage by entities into and throughout the 1990s.

Data analysis reveals the relationship between independent (unassigned) patentees in electronics and their uses of the continuation application. Restricting the sample of issued patents to those issued in the "H" primary international patent classification ("electricity") allows me to demonstrate that independent "electronics" patentees are much more likely to file continuations than patentees in other technology sectors. This pattern can be contrasted with patentees in all other technology sectors, in which continuations are comparatively more likely to be filed by entities, not independents. While independents filing continuation applications during 1975-99 file a roughly equal number of multiple continuations (1.54 filings per patent for independent electronics patentees, 1.51 filings per patent for independent patentees in all other technologies), this equality does not hold for patenting entities. In fact, entities filing continuation applications 1975-99 file significantly unequal[42] numbers of multiple continuations (1.42 filings per patent for entity electronics patentees, 1.57 filings per patent for entity patentees in all other technologies).

These figures are noteworthy because entities in electronics are shown to file more continuations per patent than independent electronics patentees, while entities in all other technologies are filing fewer continuations per patent than independent patentees in all other technologies. Thus, this chapter's earlier finding that unassigned patents that are

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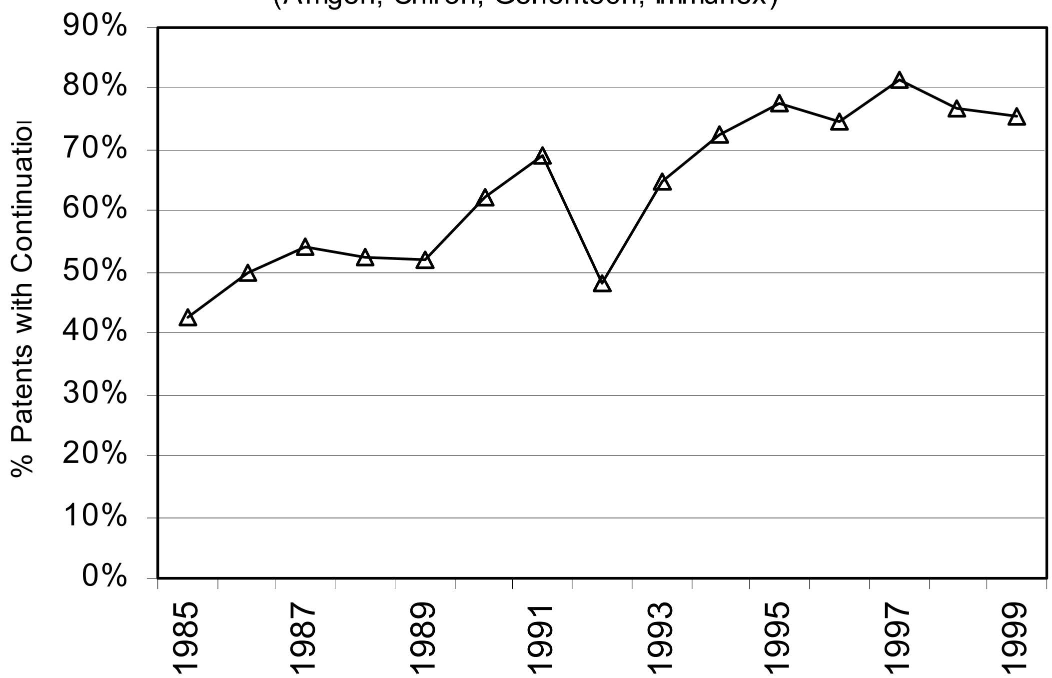
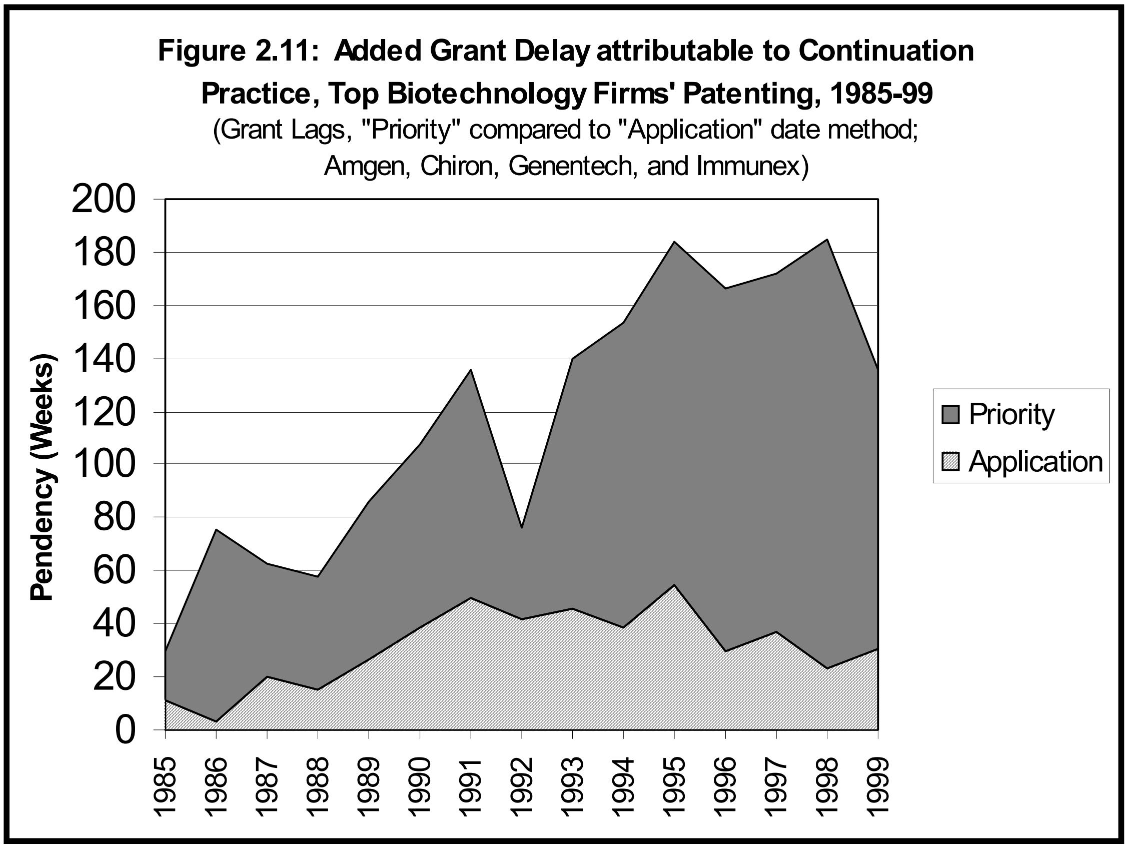
[42] Significant at the 99% confidence interval using a standard unpaired two-sample t-test.

subject to continuation tend to have a longer application-to-grant pendency finds logical support in electronics patenting, a field in which more continuation applications per patent are being filed by independents, but not in the broader population of granted patents. These distinctions in entity and independent uses of multiple continuation filings are remarkably consistent over the time period 1975-1999, and hold up even in the 1995-1999 period, although the magnitude of the number of filings is higher in all categories, suggesting that the use of multiple continuation practice may have actually increased, although this increase in numbers may be an artifact of behavioral changes attending the regime changes in 1995 and 1999.

Figure 2.10: Continuation Shares, Top Biotechnology Firms' Patents 1985-1999
(Amgen, Chiron, Genentech, Immunex)





1.4.4 Continuation Delays: Evidence from Biotechnology Patenting

Given the assumptions often used in the literature using "application date" to proxy for a technology's discovery date, the substantial continuation delays coupled with the significant use of continuations in patenting may affect researchers' measurement and create significant error. For instance, in biotechnology, a sector that has been the subject of considerable empirical studies in the strategy and organization literature, a significant portion of the patenting undertaken by leading firms shows that continuation is employed. Figure 2.10 shows the continuation shares of the top 4 U.S. biotechnology firms' patenting 1985-1999. These four top firms are selected using 1997 revenues, and include Amgen, Chiron, Genentech, and Immunex. Because of the vagaries of Patent Office classification schemes, a satisfactory patent-class method of selecting a sample of "biotechnology" patents has not been identified: I thus use a definition of "biotechnology patent" as a patent issued to a top (revenues) biotechnology firm. Figure 2.10 demonstrates that continuation use is common in top biotechnology firm patenting, growing throughout the late 1980s and 1990s. These large biotechnology firms used continuation practice in 43% of all year 1985 granted patents, the plot showing a reasonably steady growth in these firms' continuation use through the late 1990s. Over 80% of granted patents in these four firms' portfolios showed a continuation legacy in 1997 and this firm continuation activity, although decreasing slightly after 1997, remained at a 75% share in 1999.

The relatively high likelihood that issued patents in biotechnology have at least one continuation in their application history poses an empirical problem. Researchers using the "application date" as an indicator of patent entry into the USPTO may be significantly under measuring the application-to-grant lag for biotechnology firm patenting by ignoring the continuation data. Figure 2.11 plots the application lags using the three alternative lag-measurement methods outlined in Part 4.2: (1) "Application date;" (2) "priority date;" and (3) the intermediate, conservative measure. When compared to the "application date" (1) method, the conservative (3) measure yields added application-to-lag times of between a minimum of 3 additional weeks (in 1987) to a maximum of 55 additional weeks (in 1995) for these top biotechnology firms' patents. Comparing the "priority date" method (2) to the "application date" method (1), the application-to-grant lags for these same biotechnology firms' patents are between 76 additional weeks (in 1992) to as much as 185 additional weeks (in both 1995 and 1998). These results demonstrate that in biotechnology patenting, with its high incidence of continuation use and associated substantial delays, research that uses the "application date" to mark the beginning of the patent process for biotechnology inventions, and the timing of the innovation's genesis, does not reflect the true timing of entry into the patent office, and empirical analyses built upon these assumptions are prone to error. Assumptions about and measurements made upon patent “application dates” in other sectors may also be tainted with a continuation measurement problem.

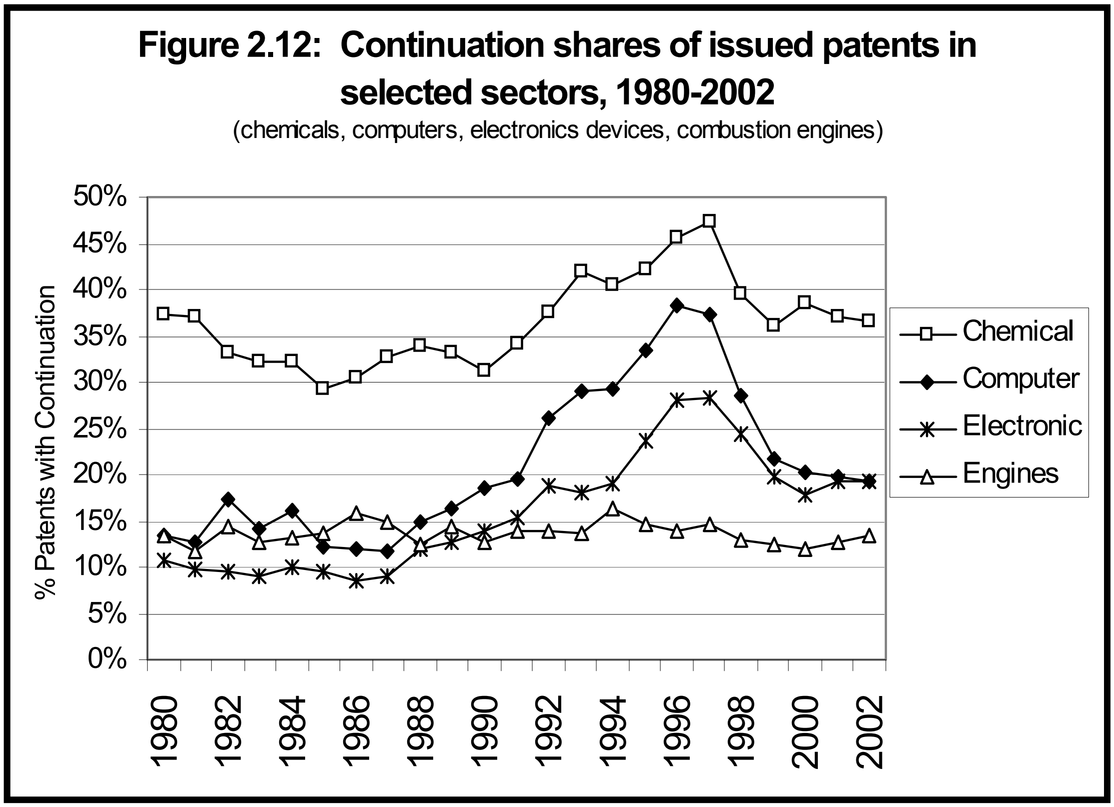
1.5 INTERSECTORAL DIFFERENCES IN THE USES OF CONTINUATIONS

While the aggregate data presented in figures 4-9 are provocative, they fail to illustrate the heterogeneity in the use of continuation practice across technologies and industries that may underlie the broader sample’s statistics. Moreover, although the aggregated technology definitions used in Table 2.2 suggest patterns, these can only be used as starting points in gaining a complete picture of the drivers of continuation usage. For instance, the grouping “Drugs and Heath” contains patents both to pharmaceuticals (molecules) and to medical devices, technologies that exhibit different characteristics on several dimensions, and that have substantially different patenting patterns. I therefore examine a number of less aggregated technology classes to provide a window into the patterns of continuation use across technologies. In order to demonstrate cross-sector differences, I introduce continuation trends for patenting in four disparate technology fields: Organic chemicals, computing, electronic communication, and combustion engines. In choosing these technologies I rely upon the dichotomous technology classification made by Kusonaki, Nonaka, and Nagata (1998) and Cohen, et al. (2001).

These papers suggest that technologies may be usefully classified as either “complex” or “discrete” types. This distinction between types of technologies is made according to the number of components required to commercialize a new product.[43] Archetypal examples of complex and discrete technology types are electronic products and chemicals, respectively. In complex-technology product industries, because many component technologies are required to commercialize a new product, firms are less likely to control all the patents covering the myriad complementary components and are accordingly more prone to cross-licensing negotiations than are firms operating in discrete-technology sectors. The discrete-type sectors are conversely characterized by one—or just a few—technologies embodied in a product, with firms accordingly more likely to exclusively control the property rights necessary to produce and market the product.

Chemical manufacturing often embodies low-cost production strategies and a drive toward process improvement, with new commercializable products protected by only a few patentable elements. Electronics industries, conversely, have been characterized as having a comparatively greater product-innovation focus, with firms more likely to pursue product differentiation strategies. Furthermore, novel electronics products are more likely to be composed of comparatively many patentable elements. In electronics product industries, many components are needed to compete and firms are less likely to control the patents covering all the complementary components, and therefore firms may be more prone to cross-licensing negotiations than are firms producing chemical products (Somaya, 2003a).

[43] These authors refer to these two categories as "complex" and "discrete" technologies, suggesting that the key distinction between these two types of technologies is whether the new commercializable product is composed of many—"complex"—or few—"discrete"—patentable elements. (Kusonaki, Nonaka, and Nagata, 1998; Cohen, et al., 2001).



To demonstrate cross-technology heterogeneity, as well as longitudinal patterns, I calculated the continuation shares of issued patents in four technology areas, defined by International Patent Classification (IPC)—organic chemicals (C07-), computing (G06-), electronic communication (H04-), and combustion engines (F02-).[44] Figure 2.12 plots these continuation shares 1975-2002. As a benchmark for comparison purposes, I use a reasonably mature technology, combustion engines (F02-). This technology class was chosen on two grounds. First, the technology is mature (Daimler and Benz produced the first working gasoline combustion engines in the mid-1880s),[45] has been progressing

[44] At this level of specification, the technology classes are only one removed from the primary levels (in this case, chemistry (C-) and electricity (H-)), and thus represent a relatively broad cross-section of chemical and electronics products, respectively. Moreover, Cohen et al. (2000) point specifically to telecommunication equipment as an example of "complex" electronics product, and H04- technologies include transmission and broadcast communication equipment.
[45] Coal gas models predated these improvements, with Lenoir and Otto early pioneers.

incrementally for over a century, and innovation is supported by a large, mature industry. The technology may thus be less likely characterized by rapid change or great uncertainty than are newer technologies.[46] Second, the International Standard Industrial Classification (ISIC) into which this technology falls, Motor/Generator, appears from the results of the CMU Survey as one in which secrecy is not an important consideration (Cohen, et al., 2001b). In fact, the technology group is characterized in the CMU Survey as having effectiveness ratings for both secrecy and patenting below the mean of all sectors, for both products and processes. Figure 2.12 shows that the use of continuations by combustion engine patentees over time is comparatively low at 12%, and does not exhibit the sharp growth in use during the 1980s nor the steep downturn after 1997 exhibited by the comparison technologies, and indeed shown in patenting overall (Figure 2.4).

Figure 2.12 shows a substantial and persistent difference in the share of patents subject to continuation practice in organic chemicals (C07-) when compared to the other three focal technology areas. Chemical patentees appear to be relying upon the procedure more than are electronic, computer, and combustion engine patentees. Continuation patenting in organic chemicals shows annual use rates between 30-48%, while the three comparison groups all demonstrate lower annual revealed rates in each studied year.

Moreover, comparing chemical patenting with amalgamated-product electronics patenting (H04-) reveals marked differences between the continuation-use patterns in the two technologies. Although both technology areas exhibit a substantial increase in the

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[46] Although the patterns of radical versus incremental change in technologies (Henderson and Clark, 1987)

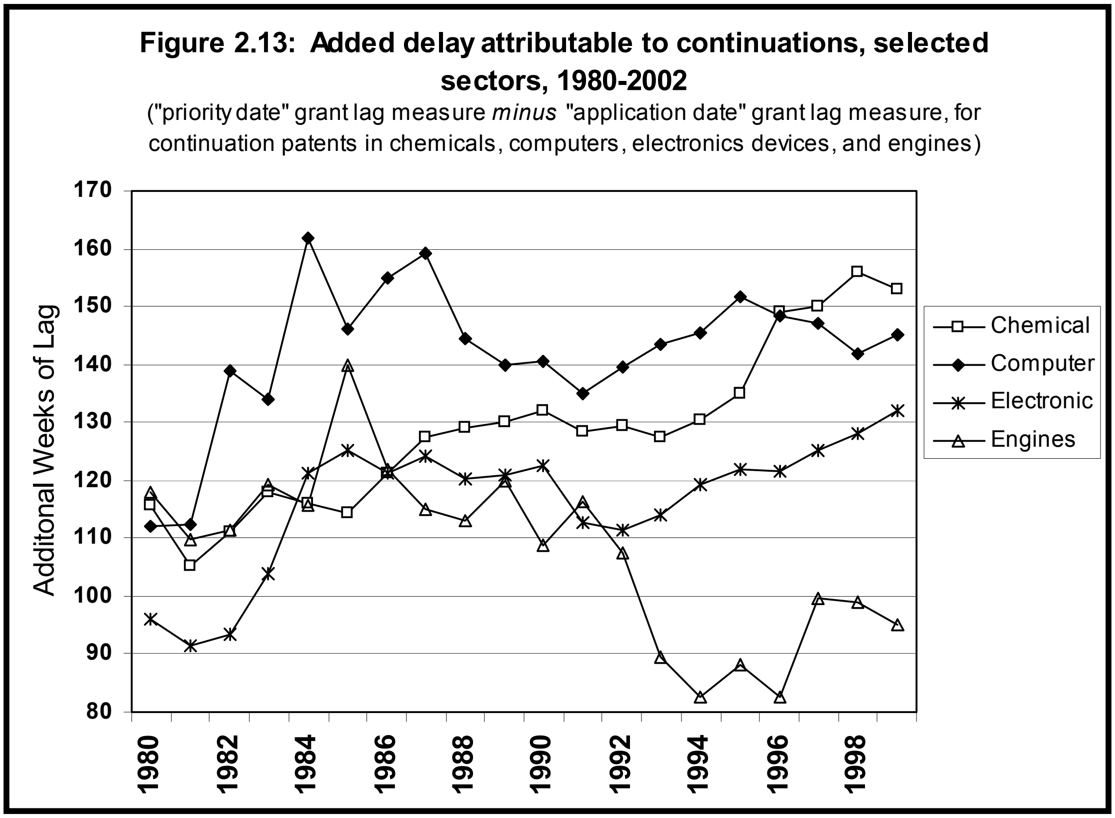
rate of continuation patenting 1987-97, the magnitude of this increase, as well as the underlying rates of continuation, are dissimilar. While organic chemical patents show as much as a 50% increase in annual continuation rates after 1985, electronics equipment patents show a continuation rate of approximately 10% through 1987. While the electronics equipment patents show an initial rate lower than the “mature” combustion engine patents, the electronics patents exhibit nearly a 3-fold increase in the revealed use of the continuation procedure during the 1990s. Both the organic chemical and electronics samples of patents do demonstrate a reduction in the share of issued continuation patents after 1997 to levels that are significantly below the 1975-2000 demonstrated sector maximum, but are nevertheless above the overall minimums. In both the “complex” and discrete” type archetypal technologies described by Cohen et al. (2001), the use of continuations appears to have been negatively impacted by the disincentives envisioned and implemented in the 1995 Act.

Computer technologies (G06-) are included as one of the newest and fastest growing patented technology areas, the patent protection on one important element—software—available widely in the U.S. only after 1981 (Graham & Mowery, 2003). Continuation use in these technologies shows a substantial decline of 20 percentage points through year 2000 from the maximum revealed 39% in 1996. Continuation use by software patentees thus fell by over one-half in the years following the 1995 Act. This contraction in use is on par with that of the electronics overall, and shows a convergence to approximately 20% use in 2000. This convergence may demonstrate that the change in the innovation environment sparked by the 1995 regime change resulted in similar

may create discontinuities in even the most mature technologies.

incentives to continuation use for both software and electronics patentees, or it may be an artifact of a merging of the innovations being assigned to these patent classes, which may be due to technological, behavioral, or administrative evolution. Further research is required to tease out the drivers of this pattern.

The use of continuations in computing reaches a high level in the late 1990s, accounting for almost 40% by 1997. The increase in the use of continuations in the computer sector is relatively delayed compared to the overall trends plotted in Figure 2.4, and shows particularly rapid growth in the period after 1993. This growth in the uses by patentees of the continuation may be a postponed reaction to the shift noted elsewhere of a move from copyright to patenting as a protection mechanism in software, which may have altered the returns to continuation in patenting for software innovators, or this pattern may simply be an artifact of the reasonably limited amount of software patenting prior to 1990 (Graham & Mowery, 2003). It may also be evidence of what has been suggested as rapid technological change, and an associated increased likelihood of uncertainty, in these technology arts. If uncertainty and rapid technological change were indeed driving the substantial increase in continuation usage in software patenting in the mid-1990s, one would have difficulty determining whether this uncertainty has persisted or has been resolved. Because the 1995 legal changes are likely the main driver of the precipitous fall in continuation usage after 1997, it is left to future research to determine whether and to what extent rapid technological change slowed abruptly after 1997, and to what degree, if at all, patentees' behavioral changes are driven by the resolution of technological and legal uncertainty over time.



The substantial heterogeneity, and high incidence, in sector-specific use by applicants of the continuation procedure suggests that measurement errors may be routine in the literature's use of the "application date" to proxy for the applicant's first use of the patent process. To examine the extent to which heterogeneity in patentees' use of the continuation by sector corresponds to additional application lags, Figure 2.13 graphs the "priority date" grant lag measure *minus* the "application date" grant lag measure for the four focal technologies, organic chemicals (C07), computing (G06), electronic communication (H04), and combustion engine (F02) by year 1980-1999. Figure 2.13 thus compares the difference between a measurement using continuation dates to calculate grant lag with a method that does not use these dates in each of these four disparate technologies. The plot shows that additional application-to-grant delays are substantial, with chemical patents showing between 105 and 156 weeks of additional delay, computing patents showing between 112 and 162 additional weeks of added delay, electronics patents showing between 91 and 132 additional weeks of added delay, and combustion engines showing between 82 and 140 weeks of additional delay. Clearly, the significant share of patents showing a continuation history, coupled with these substantial additional delays, suggest again that measurement error is likely in studies of firm patenting using the "application date" method.

1.6 A NOTE ON CONTINUATION USE IN PHARMACEUTICALS

It has been suggested that the pharmaceutical industry is demonstrably different than other industries in terms of its innovation characteristics and that, therefore, comparisons with other industries may be difficult, if not impossible. This observation offers an insight into drug patent continuation practice because, as Comanor (1986) makes clear, the pharmaceutical industry has historically used continuations to navigate the thorny problems of patenting within the Food and Drug Administration's regulatory requirements surrounding new drug applications. Thus, the pharmaceutical industry, due to its unique innovation characteristics, experienced an added and potentially dominant motivation for using the continuation strategy. Because the continuation was uniquely suited to allowing firms to maximize effective patent terms prior to the 1995 amendments to the Patent Act, it is conceivable that regulatory demands, and not information failure or the value of added secrecy, has dominated the motivations for using continuations in this industry. It may have also increased the payoff to using the continuation in other sectors, particularly to the extent that other sectors' innovation and marketing characteristics mirror those of the drugs industry.

Pharmaceuticals are an industry that has long been characterized by scholars as one in which patents are economically valuable and important in appropriating returns to innovation (Henderson and Cockburn, 1999). The drugs industry has been shown in surveys to be the sector in which patent protection is most valuable in appropriating returns from innovation (Levin, et al., 1987; Cohen, et al., 2001). Moreover, the characteristics of the industry and its products make a *long* patent term particularly valuable. Because the products emerge from regulatory procedures quite late, and because a large portion of industry revenues are generated from drugs that exhibit enormous sales well beyond the 20-year patent term, an extended patent term is more valuable in the drugs industry than in industries with reasonably quick invention-to-manufacture intervals and short product life cycles (Comanor, 1986).[47]

In light of the value of patents in this sector, and the importance that patent terms be long, the delaying continuation application may have long played a role in drugs innovation. Because it was argued that the 1962 Kefauver amendments requiring stronger proof of the "efficacy" of new pharmaceutical products shortened the patent term for pharmaceuticals by extending the period of clinical trials and regulatory approval (Grabowski, 1976), lobbying from the drugs industry[48] led to the 1984 Drug Price Competition and Patent Term Restoration Act that extended the patent term for pharmaceuticals by up to 5 years.[49] While some research conducted prior to the Act's passage suggested that the effective patent term was foreshortened by the regulatory approval process (Schwartzman, 1976; Grabowski and Vernon, 1986), the role that

[47] Lemley (1994) suggests that pharmaceutical and biotechnology patents may be more valuable at the end of their patent terms than software patents.
[48] The legislation was also motivated by a desire on the part of pro-consumer lawmakers to facilitate entry by producers of generic drugs following the expiration of pharmaceutical patents' terms.

continuations played in counter-acting this foreshortening by delaying patents' issue was underplayed in the literature and given short-shrift in the congressional debate (Comanor, 1986).

Under the pre-1995 patent regime, pharmaceutical companies routinely used continuation practice to engage in "serial prosecution."[you provide no direct evidence that continuations were used in "serial prosecutions," and the last paragraph in this section seems to conclude that term extension wasn't the key motive (something else for which no evidence beyond speculation is provided). So how do you reconcile this statement and your conclusion in this section?] Serial prosecution allowed the pharmaceutical company to patent different components of the invention—often beginning with the molecule—over a long period of time, thus extending the *de facto* patent term to much longer than the 17 years permitted under the then-existing law (Burchfiel, 1995). Firms may have also used the "dead time" purchased by pre-issue continuation applications to avoid issuing patents during their extended regulatory approval periods, thereby maximizing the patent term by launching the patent close in time to a drug's emergence from the regulatory approval process.

In order to gain some insight into the use of continuations in the pharmaceutical industry, I examined trends in the share of continuations within international patent classification A61K (excluding A617 07 cosmetics). International patent class A61K has been used to define pharmaceutical patents in several studies (Lanjouw and Schankerman, 1997; Harhoff and Reitzig, 2000; Graham, Hall, Harhoff, and Mowery, 2003). I report the results in text here.

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[49] The act also reduced entry barriers to generic drug providers.

A large percentage of issued pharmaceutical patents are the product of continuation practices, ranging from an annual low of 34% to a high of 61%, well above the share exhibited by the mature technology combustion engines. As with the broader population of patents, some downward trending is exhibited after 1997, with continuations in this sector falling by 15 percentage points through year 2000 from the 1997 high of 61%. Continuations, however, still account for almost 50% of issued patents by 2000, several years after the disincentives of the 1995 Act had been introduced.

Unlike some other sectors, the comparatively high level of continuation practice exhibited in this industry in the late1980s continues after the 1995 Act. Because the 1995 legal changes mandated the 20-year term inclusive of prosecution, absent technological and industry factors the changes may have eliminated the drugs' industry's alternative and possibly dominant motivation for pharmaceutical firms' use outlined above—maximizing the lengths of patents' terms. But the chemical technologies upon which drugs' patenting are based, and an industry dynamic that does not discourage delayed disclosure of the embodiment of the final product, permits the kind of "serial patenting" described in Merges (1999). The data thus may lend evidence supporting a role for other strategic motives, as opposed to patent-term extension, as factors increasing the likelihood of continuation practice in this sector, but the phenomenon of "serial prosecution" may have permitted patent-term extension to persist as a motivation for continuation use in the drugs industry.

1.7 CONCLUSION

This chapter has examined the “continuation” procedure available to patent applicants under the U.S. patent laws. The “continuation application” is unique in the industrialized world in allowing U.S. patentees to reset their patent applications' “clocks” during the examination process. Accordingly, the continuation affords U.S. patentees several strategic opportunities unavailable to patentees in other jurisdictions. The continuation historically preserved for U.S. patent applicants an early "priority" date for the invention, thus affording the applicant an ongoing right to amend the disclosure, and extending the period of application secrecy prior to patent issue. Because its institutional rules differ from the rest of the world in this regard, the U.S. Congress implemented changes in the patent laws in 1995 intending to reduce the incentives to patentees using the continuation procedure.

By collecting and using the complete data on continuations filed on all patents issued between 1975-2002, I am able to demonstrate conclusively in this chapter that a sizeable share of patent applicants have employed the continuation, that continuation use by patent applicants results in substantial additional delay in the time-to-grant statistics for associated issued patents, and that significant changes in the pattern of continuation use have occurred since the legislative amendments intended to curb the procedure’s use. While these findings suggest that the continuation is a phenomenon is of economic interest, its widespread use does not in and of itself establish that the economic impact of the continuation is either significant or important.

I suggest, however, that the limited evidence provided in this chapter does support a contention that the continuation has been economically important in shaping the environment for innovation, influencing industrial organization, and, possibly, welfare. The continuation's role altering the innovation environment appears strongest. Through its peculiar characteristics of allowing non-disclosure while protecting inventor priority, the evidence presented in this chapter demonstrates that the continuation embodies some unique incentives for innovators, and its wide and varied use suggests that innovators are taking advantage of these incentives. The use of continuation has also had an effect upon industrial organization: One can point both to the anecdote of George Selden and the use of his "Road Engine" continuation patent to reorganize the fledgling automobile industry in the United States, and also to the manner in which large pharmaceutical firms have used the continuation to ensure maximum patent terms. The continuation can be seen, then, as a competitive mechanism, along with litigation and marketing prowess, to keep generic competitors at bay. The link between patentees' use of continuation applications and welfare is likely the weakest—it may indeed be that the continuation has created incentives that spurred innovation that otherwise may have never been funded, by altering the returns to patenting. The converse may also be true. Further research is certainly needed.

These arguments, coupled with the substantial USPTO pendency delays that continuation practice creates, suggest that the continuation is likely to be a phenomenon of interest to management researchers and policymakers alike. Both the frequent use of the continuation and the delays that it purchases for the applicant demonstrate that Patent Office application-to-grant lags are partly endogenous, and that this endogeneity is much more common than the literature has previously noted. It may be that, in the policy arena, evidence on lengthy patent grant lags that has been used to justify special treatment or patent-term extensions, particularly in the context of pharmaceuticals, rests on a faulty empirical foundation.

This chapter has demonstrated that continuation practice is common in overall US patenting, and in some important sectors including electronics, computing, pharmaceuticals, chemicals, and biotechnology, a substantial minority, and in some instances a majority of patents in recent years have issued with at least one continuation in their lineage. Furthermore, substantial intersectoral differences are shown in innovators' use of the continuation, and significant changes in the patterns of usage over time. The next two chapters of this dissertation will address questions of complementarity and strategy that have been opened by this preliminary discussion.

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