Is the Patent Office a Rubber Stamp?[1][2]

Mark A. Lemley[3] & Bhaven Sampat[4]

A growing chorus of voices is sounding a common refrain – the U.S. Patent and Trademark Office (PTO) is issuing far too many bad patents. Look almost anywhere and you can find entertaining examples of silly patents that surely shouldn't have issued.[5] More importantly, critics complain, the PTO is so overworked, and the incentives for examiners to grant patents so great, that the PTO gives patents to the vast majority of applicants.[6] Compounding the problem, PTO rules permit applicants who do get their applications rejected to try again an unlimited number of times to get a patent using a "continuation" application.[7] As a result, some have

---

2 We thank Patrick Crosby at xblabs.com for assistance in obtaining the data used in our analyses.

3 William H. Neukom Professor, Stanford Law School; of counsel, Keker & Van Nest LLP.

4 Professor, Columbia School of Public Health.

5 Everyone has their favorite examples. *See, e.g.,* U.S. Patent 6,025,810 ("Hyper-light-speed antenna"); U.S. Patent 6,213,778 (method of painting using a baby's butt). There is even an entire book devoted to silly patents. *See* Rick Feinberg, Peculiar Patents (1994).

6 John R. Thomas, *Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties*, 2001 **U. Ill. L. Rev.** 305; Jay P. Kesan & Andres A. Gallo, *Why "Bad" Patents Survive in the Market and How Should We Change? The Private and Social Costs of Patents*, 55 **Emory L.J.** 61 (2006).

7 Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 **B.U. L. Rev.** 63 (2004).

claimed that the PTO grants patents to as many as 97% of those who seek them.[8] In this view, far from serving as an effective gatekeeper, the PTO is effectively rubber-stamping private efforts to seek immunity from competition.

These criticisms are complicated by the rather surprising fact that we don't actually know what percentage of patent applications actually issue as patents. Patent applications have historically been kept secret unless and until they issued as patents, meaning that applications that are abandoned and applications or continuations that are still pending were never disclosed. The result has been significant controversy over both the nature and use of continuation applications and the underlying question of what percentage of applications actually issue as patents.

Because of recent changes in the law regarding publication and PTO administrative procedure, we are now able for the first time to track what happens to the vast majority of patent applications during prosecution. Significantly, we also have access for the first time to patent applications that are abandoned without a continuation. This allows us to estimate the actual grant rate in the PTO.[9] It also allows us to learn some significant things about how issued patents differ from rejected patents – by examiner, by industry area, and by prosecution behavior. We also evaluate the use of continuation applications.

---

[8] *See* Cecil D. Quillen Jr. & Ogden H. Webster, *Continuing Patent Applications and the Performance of the U.S. Patent and Trademark Office*, 11 **Fed. Cir. B.J.** 1 (2002). Quillen and Webster did subsequent work that caused them to revise that number downward, however. *See* Cecil D. Quillen Jr., Ogden H. Webster, & Richard Eichmann, *Continuing Patent Applications and the Performance of the U.S. Patent and Trademark Office*, 12 **Fed. Cir. B.J.** 35 (2002).

[9] Because an unknown number of unpublished applications may have been abandoned without ever being published, we can't identify a definitive grant rate for unpublished applications. Oddly, the PTO doesn't give applications entirely sequential numbers, so we can't make inferences from the application numbers.

We find that the PTO rejects a surprisingly high percentage of patents. While more than two-thirds of all applications result in at least one patent, a significant number of applications are rejected and then finally abandoned by the applicant. We also find that the likelihood of obtaining a patent varies significantly by industry in surprising ways. For example, patents are much more likely to be granted in the chemical and pharmaceutical industries than in software and computer fields, despite the fact that most of the complaints about bad patents show up in the IT industries.

Finally, despite a variety of reforms that might be thought to reduce the use and abuse of continuation applications, we find a high use of continuation applications of various types. The extent and nature of the use casts significant light on the purposes of continuation applications, suggesting that different industries use continuations for different purposes. Even given the existence of a new and quicker procedure for continuing to fight with the examiner, many applicants persist in using the older continuation procedure in order to delay issuance of their patens or because they are seeking to construct a multi-patent fence.

In Part I, we describe existing uncertainty about various aspects of patent practice and grant rates and explain the data we have collected. Part II presents our basic findings about grant rates. In Part III, we examine the extent to which continuation applications affect grant rates, and also explore motivations for engaging in continuation practice. In Part IV, we examine prosecution practice. In Part V we explore the significant industry-specific differences in patent numbers, patent prosecution process, and grant rates. Finally, in Part VI we discuss the implications of our findings, both for patent policy disputes over the value of the work the PTO does and for efforts to reform and rationalize patent prosecution.

I. The Surprisingly Difficult Question of Patent Grant Rates

A. Controversies Over Data

It seems it should be a simple matter to figure out how likely the PTO is to issue a patent. Take the number of patents issued, divide by the number of applications filed, and you'll have a grant rate. There were 164,293 utility patents issued and 356,943 utility patent applications filed in 2004,[10] so the grant rate from this simple calculation is just under 50%. But this approach is too simple, because patents take time to issue – 2.77 years on average in the late 1990s, and likely longer today -- and the number of applications filed has been increasing dramatically, roughly quadrupling over the past 30 years.[11] So a closer approximation would be the number of patents issued in, say, 2004 divided by the number of applications filed three years earlier. Quillen and Webster used such an approximation in their calculation.[12] But even this is an approximation, because 2.77 years is just an average. Some patents issue in less than a year, and others can spend over a decade in the PTO.[13]

The problem is worse than that, however, for several reasons. First, the term "patent applications" lumps together a number of different documents, only some of which are original new applications. Patent applications filed in the PTO may also include continuations,

---

[10] http://www.uspto.gov/go/taf/us_stat.htm

[11] *See* http://www.uspto.gov/go/taf/appl_yr.htm (the number of applications filed per year increased from 101,014 in 1975 to 390,733 in 2005).

[12] Quillen & Webster, *supra* note __, at __.

[13] Lemley and Moore document the time spent in the patent office for every patent issued between 1976 and 2000. Some spent a striking amount of time in the PTO – one patent spent 68 years in prosecution, another spent 64 years, and 13,282 patents spent more than ten years in prosecution. Lemley & Moore, *supra* note __, at 121-23 Appendix A.

continuations-in-part, divisionals, and PCT international priority applications. A significant percentage of these involve applications that have already been presented to the PTO once before, so that counting them in the denominator would understate the chance of at least one patent being granted on one original application. Second, because of continuations and related applications it is possible (and indeed fairly common) that more than one patent will issue based ultimately on the same original application. Counting these multiple patents in the numerator overstates the grant rate.[14] Quillen and Webster in their revised article sought to correct for these biases, but others have made the same effort and come out with very different numbers.[15]

The result of these complications is that no one can agree on how likely it is that an applicant can get a patent. The PTO says the rate historically has been about 66%,[16] and now that it is only 54%,[17] but that doesn't account for continuations. Considering continuations, Quillen and Webster estimated the rate to be as high as 97% in their original article,[18] but after revising their calculations dropped that number to 85%.[19] Others taking account of continuations with

---

14 For a nice analysis of the problem, see Bruce A. Kaser, *Patent Application Recycling: How Continuations Impact Patent Quality and What the USPTO Is Doing About It,* 88 **J. Pat. & Trademark Ofc. Soc'y** 426 (2006)

15 *See* Quillen et al, *supra* note __. *But see* Lawrence B. Ebert, *How High Are the Grant Rates at the U.S. PTO?*, 86 **J. Pat. & Trademark Ofc. Soc'y** 568 (2004) (finding a grant rate of 75%); Robert A. Clarke, U.S. Continuity Law and its Impact on the Comparative Patenting Rates of the U.S., Japan, and European Patent Office, 85 J. Pat. & Trademark Off. Soc'y [JPTOS] 335 (2003) (same).

16 *See* http://www.uspto.gov/web/offices/pac/dapp/opla/comments/fpp_continuation/quillen.pdf at 6.

17 http://www.ipfrontline.com/depts/article.asp?id=13796&deptid=5.

18 Quillen & Webster, *supra* note __, at __.

19 Quillen et al., *supra* note __, at __.

different assumptions find the number to be lower, around 75%.[20] The uncertainty and variation in numbers has led others to make wilder claims, such as that the grant rate is less than 50%.[21]

A similar problem has plagued assessment of the use of continuation applications. Using data from issued patents, Graham and Mowery documented a dramatic rise in the use of continuation applications through the 1980s and 1990s.[22] Statutory changes implemented in 1995 reduced some of the incentives to abuse continuation applications, and many have argued that continuation applications declined as a result.[23] But again there are complications. "Continuations" (which we use as a general term) before 1999 fell into three categories: ordinary refiled continuation applications, "continuations in part" (CIPs) that start with the existing application but add new material, and "divisional" applications that divide an application into multiple parts in response to a restriction requirement entered by the PTO.[24] It is not clear which of these filings should be counted as continuations voluntarily chosen by the applicant in order to extend the prosecution process or seek a "do-over" of a PTO rejection. The ordinary continuation certainly serves that purpose. CIPs and divisionals might serve that purpose, but they might also serve other purposes, particularly divisionals, which are compelled by the PTO but may be

---

[20] Ebert, *supra* note __; Clarke, *supra* note __.

[21] *See, e.g.*, Brief Amicus Curiae of Boston Patent Law Association in *Medimmune, Inc. v. Genentech, Inc.* 5 (U.S. 2006); Erik Belt *Medimmune Licensing Wars*, Bromberg & Sunstein newsletter, Spring 2007, at 1.

[22] *See* Stuart J.H. Graham & David C. Mowery, Submarines in Software? Continuations in U.S. Software Patenting in the 1980s and 1990s, 13 ECON. INNOVATION & NEW TECH. 443 (2004).

[23] cite claims. Graham and Mowery found a spike in continuations before implementation of the new law, and a drop immediately thereafter. Graham & Mowery, *supra* note __, at __.

[24] *See* 35 U.S.C. § 120 (continuations), § 121 (divisionals).

provoked by intentionally broad applications.[25] Further complicating the issue, the PTO adopted new means for continuations starting in the late 1990s – the short-lived "continued prosecution application" (CPA) and then the "request for continued examination" (RCE). CPAs and RCEs are, like ordinary continuations, efforts to get the examiner to reconsider a rejection, and so they should count as continuations for policy purposes. Unlike continuations, CIPs, and divisionals, however, they aren't counted as new applications in the PTO statistics. As a result, measurements of continuation applications today that don't include RCEs will understate the actual use of continuations.

B. Why It Matters

Both the PTO grant rate and the use of continuation applications are at the heart of raging controversies over patent reform today. The unprecedented modern Supreme Court interest in patent cases[26] and Congressional interest in patent reform[27] are both driven in significant part by the widespread perception that the PTO is acting as a rubber stamp, regularly issuing bad patents that wind up imposing costs on others. That has in turn produced proposals to spend more time and money in the PTO weeding out bad patents,[28] to establish post-grant opposition systems to

[25] *See* Graham & Mowery, *supra* note __ (providing evidence that patent applicants provoke restriction requirements in the pharmaceutical and biotechnology industries); Lemley & Moore, *supra* note __ (explaining the problem). For a discussion of issues that arise in the categorization of CIPs, see, e.g., Hal Milton & James P. Bonnamy, *CIP Practice Under and Beyond the Proposed Rule Changes for Continuations*, 88 **J. Pat. & Trademark Ofc. Soc'y** 801 (2006).

[26] The Supreme Court heard, decided, or granted certiorari in six patent cases in 2006, more than in any year since 1965.

[27] *See, e.g.,* Patent Reform Act of 2007, H.R. 1908, 110th Cong., 1st Sess. (2007).

[28] Complaints are legion. *See, e.g.,* Jeff Bezos, *An Open Letter on the Subject of Patents*,

allow administrative challenges to bad patents,[29] to create a two-tiered patent system in which patentees can opt into a more rigorous examination for important applications,[30] and proposals to eliminate the clear and convincing evidence presumption as unwarranted.[31] All these proposals are based on the assumption that the PTO is not doing a good job now of weeding out bad patents.

Continuation applications are also the subject of continued policy controversy. Congress passed a number of changes in 1994, and some more in 1999, to deal with abuse of continuation practice by "submarine patentees." The PTO is currently considering significant further

---

http://www.amazon.com/exec.obidos/subst/misc/patents.html; Julie E. Cohen, *Reverse Engineering and the Rise of Electornic Vigilantism: Intellectual Property Implications of "Lock-Out" Programs*, 68 **S. Cal. L. Rev.** 1091, 1177-80 (1995); Simson Garfinkel, *Patently Absurd,* **Wired**, July 1994, at 104; Lawrence Lessig, *The Problem With Patents,* http://www.thestandard.com/article/display/0,1151,4296,00.html (April 23, 1999); Robert P. Merges, *As Many As Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 **Berkeley Tech. L.J.** 577 (1999); John R. Thomas, *Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties*, 2001 **U. Ill. L. Rev.** 305; Shubha Ghosh & Jay Kesan, *What Do Patents Purchase? In Search of Optimal Ignorance at the Patent Office*, 40 **Hous. L. Rev.** 1219 (2004); James Gleick, *Patently Absurd,* **N.Y. Times**, Mar. 12, 2000, S 6 (Magazine), at 44.

[29] H.R. 1908, *supra*. For discussion of post-grant review proposals, see, e.g., Mark D. Janis, "Rethinking Reexamination: Toward a Viable Administrative Revocation System for U.S. Patent Law," 11 *Harvard Journal of Law and Technology* 1 (1997); Robert P. Merges, "As Many as Six Impossible Patents before Breakfast: Property Rights for Business Concepts and Patent System Reform," 14 *Berkeley Technology Law Journal* 577 (1999); Craig A. Nard, "Certainty, Fence Building, and the Useful Arts," 74 *Indiana Law Journal* 759 (1999); J. H. Reichman, "From Free Riders to Fair Followers: Global Competition under the TRIPS Agreement," 29 *NYU Journal of International Law & Policy* 11 (1997); John R. Thomas, "Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties," 2001 *University of Illinois Law Review* 305 (2001).

[30] *See* Mark A. Lemley et al., *What To Do About Bad Patents*, **Regulation**, Winter 2005/06, at 10; Doug Lichtman & Mark A. Lemley, *Presumptions of Validity: A Proposal for Patent Reform*, 60 **Stan. L. Rev. __** (forthcoming 2007).

[31] *See, e.g.,* Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 **Nw. U. L. Rev.** 1495 (2001).

restrictions on continuation practice to deal with remaining abuses of continuation practice.[32] In response, patent applicants and lawyers have claimed that problems with continuations were solved in the 1990s and that further reform is unnecessary. Resolving this issue requires a full understanding of the extent and if possible the purpose of continuation practice.

C. Our Data

We take a novel approach to collecting data on both of these issues. Rather than looking at overall filings and issued patents in the aggregate and trying to measure ratios, we identify a group of patent applications and follow them through the process. Specifically, we collected every original utility patent application filed in the month of January 2001 that was published by April 2006. After eliminating plant, design, and reissue patents, PCT applications directed at foreign filing, and continuations, divisionals, and CIPs based on earlier applications, we were left with 9,960 applications. We then collected every "transaction" for each of these patent applications – every filing or act by the patentee and every action by the PTO – from the PTO's PAIR database as of April 2006.

Our approach has the advantage that for those applications it can give us accurate, verifiable data on the questions that have vexed patent lawyers and policy-makers. Until 1999, our approach was impossible, because patent applications were not published unless and until they issued as patents. But beginning with applications filed this millennium, the vast majority of patent applications are published 18 months after they are filed, and most of the rest 60 months

[32] US Department of Commerce, Patent and Trademark Office, "Changes to Practice for Continuing Applications, Requests for Continued Examination Practice, and Applications Containing Patentably Indistinct Claims," 71 *Federal Register* 48 (Jan. 3, 2006).

after filing.[33] For each of these applications, we can determine whether a continuation of any type was filed, and whether the patent and any of its continuation "children" was ultimately patented, was abandoned without any continuation being filed,[34] or whether the application or its children were still pending more than five years after the original application was filed.

Our use of PAIR data has other significant advantages as well. Because we collect all the transaction data, we can report a wealth of data about the way the PTO treats applications – how many receive first-action allowances, how many allow patents after rejection, how many require appeals, and so forth. We can also track the significant differences in the treatment of applications by area of technology.

While our approach has a number of advantages, one significant disadvantage is that we sample only published applications. If the characteristics of published applications are systematically different than those of unpublished applications, this would limit our ability to make inferences from our sample to the broader population. One issue is that applications granted or abandoned before 18 months do not appear in our analyses unless the applicant affirmatively chooses to ask for early publication. Data from granted patents suggests that about 17 percent of patents are granted before 18 months; of these, about half (46 percent) are published pre-grant. It is likely that some applications are finally abandoned before 18 months have passed, and never show up either in the dataset or as issued patents.

[33] 35 U.S.C. § 122(b) (setting out the rule and describing the exceptions, chiefly for applicants who agree not file counterpart applications abroad).

[34] There is no actual way for the PTO to finally reject a patent. *See* Lemley & Moore, *supra* note __, at 63. We consider a patent application to have been finally abandoned if the applicant has filed a notice of abandonment or has not responded to a PTO rejection for over six months and has not filed an appeal or any form of continuation.

A more serious issue is that even applications pending more than 18 months can "opt-out" of publication if they don't have corresponding foreign applications, or if they have corresponding foreign applications but also have priority dates pre-dating the effective date of the AIPA.[35] To the extent such opt-out is systematically related to characteristics of interest, our conclusions, e.g., those about the grant rate, would be biased. Accordingly, in Appendix B we examine opt-out patterns in detail. We show that while opt-out of publication is non-randomly distributed across applications, our main conclusions do not change if we context on the subsample of applications for which opt-out was not possible.

II. Grant Rates

We begin with our results on grant rates. As we noted above, this is not a simple matter of measuring grant versus rejection. The PTO has no power to finally reject a patent; the applicant can always come back and argue that the examiner should change her mind. Further, even five and a half years after the applications in our cohort were filed, there are a number of applications that are still pending. We therefore can establish, not a grant rate, but a grant *range*, bounded on the lower end by the percentage of original applications that have already received a patent, and on the upper end by the percentage of applications that have been abandoned. The first-order results, not including the effect of continuations, are presented in Table 1.

%

[35] *See* 35 U.S.C. § 122(b)(2)(B) (opt out for U.S.-only applications); American Inventors Protection Act of 1999, Pub. L. No. 106-113 (transition period implementing publication for applications with priority dates after November 2000).

Table 1: Status of applications in sample

Status	*N*	*Share of Total*
Abandoned	2446	24.6%
Patented	6666	66.9%
Pending	848	8.5%
Total	**9960**	**100%**

These results generally track the PTO's estimate of about a 2/3 grant rate, but several issues complicate making an inference about the overall grant rate from these figures. First, it is important to emphasize that a 24.6% abandonment rate is not necessarily evidence that the PTO rejects 24.6% of all patent applications. Some of these abandonments presumably reflect business decisions by the applicant not to pursue the application, either because they company as a whole went out of business or because the company's plans or interests changed. We explore some data that might suggest what caused abandonment in Part III.A. Second, the data in Table 1

don't take into account the possibility of applicants filing continuations and obtaining patents on those continuations. We examine this in the next section.

III. Continuations

Continuation applications are today at the heart of a firestorm of controversy. To critics, continuation applications are strategies for delay, for "wearing down" the PTO by returning to argue the same case an unlimited number of times, and for modifying patent claims to track developments made by others in the industry.[36] To proponents, the ability to file an unlimited number of continuations is a legal right to try to get the strongest possible patent protection for their clients, and a necessity given that examiners may want to provoke continuations for bureaucratic reasons.[37] Further, proponents respond to the concerns about continuation abuse by arguing that 1990s reforms have solved the problem, presumably reducing the desirability of continuation applications if they were filed primarily for abusive reasons. Based on data from applications that resulted in issued patents, Graham and Mowery found that the number of continuation applications spiked just before the 1995 rule changes at just over 30%, and dropped into the mid-20% range by the late 1990s. One possible interpretation of this data is that some, but not most, continuation applicants were used for abusive purposes before that time. In this part, we evaluate how continuations affect the grant range, the relative use of statutory continuations and RCEs, and the light the use of those different tools can shed on the reasons applicants use continuations.

A. The Impact of Continuations on the Grant Rate

The grant ranges we have reported don't take into account the possibility of applicants filing continuations and obtaining patents on those continuations. This could cause the lower

36 *See* Lemley & Moore, *supra* note __, at __.

37 cite some proponents

bound of the grant range to increase, because some applications that were either abandoned or pending might have continuations that have themselves resulted in a patent. Five and a half years after the roughly 10,000 applications in our study were filed, those applicants have filed 2,016 distinct "children" – ordinary continuations, CIPs, or divisionals based ultimately on those original applications. Table Two shows that roughly 1/3 of those children are "ordinary" continuations, and slightly less than 40 percent are divisionals, with the remainder being continuations in part (CIPs) or applications for which we could not determine continuation type:

Table 2: Distribution of Continuation Types

Continuation Type	*N*	*Share of Total*
Continuation	608	30.16
Continuation in Part	422	20.96
Divisional	770	38.19
Unknown/ Not determinable	216	10.71
Total	**2016**	**100.00**

Table 3 shows that nearly half these children have themselves already issued as patents, though not surprisingly (given their later filing date) a large percentage of these continuation applications are still pending.

Table 3: Status of Child Applications

Continuation Type	*N*	*Share Abandoned*	*Share Patented*	*Share Pending*
Continuation	608	11.5%	43.9%	44.6%
Continuation in part	422	18.5%	55.2%	26.3%
Divisional	770	10.8%	57.0%	32.2%

How do continuations affect the overall grant rate numbers cited above? In part, this depends on the status of the original applications on which they were based. Table Four shows the share of applications with a continuation (of any of the types above) by application status.

Table 4: Share of parent applications with continuations, by status of parent

Status of parent application	*Share with any continuation*
Abandoned	13%
Patented	16%
Pending	7%
Total	**14%**

About 7 percent of pending applications had continuations; to these extent that these continuation applications were patented this would raise the lower bound of the grant rate. Further, 13 percent of the applications that have been abandoned have continuation applications. Patenting these continuations should raise the upper bound of the grant range, because some patents classified as finally abandoned (i.e. rejected) in fact still have continuation applications pending. Table 5 shows the share of applications with at least one child pending, by status of the original application:

Table 5: Parent applications with and without children pending, by status of parent

	No Children Pending *N* *Row%* *Column%*	*>=1 Child Pending* *N* *Row%* *Column%*	*Total* *N* *Row%* *Column%*
Abandoned	2,328 95.18% 24.93%	118 4.82% 18.97%	2,446 100.0% 24.56%
Patented	6,207 93.11% 66.47%	459 6.89% 73.79%	6,666 100.0% 66.93%
Pending	803 94.69% 8.60%	45 5.31% 7.23%	848 100.0% 8.51%
Total	**9,338** **93.76%** **100.0%**	**622** **6.24%** **100.0%**	**9,960** **100.0%** **100.0%**

If we treat abandoned applications with pending continuations as "pending" the percentage of applications pending increases from 8.5 percent to 9.7%. Similarly, we can examine the share of continuations that are patented by the status of the original application:

Table 6: Parent applications with and without children patented, by status of parent

	No Children Patented *N* *Row%* *Column%*	*>=1 Child Patented* *N* *Row%* *Column%*	*Total* *N* *Row%* *Column%*
Abandoned	2313 94.56% 25.16%	133 5.44% 17.34%	2446 100.0% 24.56%
Patented	6047 90.71% 65.78%	619 9.29% 80.70%	6666 100.0% 66.93%
Pending	833 98.23% 9.06%	15 1.77% 1.96%	848 100.0% 8.51%
Total	**9193** **92.30%** **100.0%**	**767** **7.70%** **100.0%**	**9960** **100.0%** **100.0%**

About 5 percent of abandoned applications and 2 percent of pending applications have children that are patented, compared to 9 percent of patented applications. The bulk of applications with at least one child patented-——over 80%--were themselves patented. As a result, continuations have a more modest effect on the grant rate than their overall numbers might suggest. Once we take continuations into account, the share of the January 2001 original applications which themselves resulted in patented or which had children resulting in patents is 68.4%, and the percentage of applications or continuations pending increases to 9.7%, so the grant range runs from a lower bound to 68.4% to an upper bound of 78.1%. This is higher than the PTO's estimate, but it is significantly lower than the Quillen-Webster estimates and the fears of many advocates of patent reform. And while the numbers are higher than from foreign patent offices,[38] they are not radically different. Even after accounting for continuations, the odds of an applicant getting a patent are pretty good, but it is an exaggeration to say that the PTO is a rubber stamp.

Some of the abandonments occur for business reasons, rather than because the PTO refused to issue the patent. To test the magnitude of this effect, we identified the last transaction before abandonment for all applications abandoned and not refiled. There were 2,444 applications that were finally abandoned, and 2,127 of those had no continuations filed. For each of those 2,127, we classified the last transaction record in PAIR other than an express abandonment. Of those 2,127, 1,470, or 69.1%, were abandoned after a substantive office action or appeal or petition decision. Presumably, most (though probably not all) of these abandonments reflected a decision by the applicant that the PTO would not grant a patent. By

---

[38] *See* Quillen et al., *supra* note __, at 47-48 & fig.9 (concluding that the European Patent Office and the Japanese Patent Office had grant rates 25-30% less than the U.S. PTO).

contrast, the remaining 30.9% of abandonments came after non-substantive office communications, or even after notices of allowance, suggesting that these abandonments were entered for business reasons rather than because of a substantive decision by the PTO. As a result, while fewer applications make it through the PTO than some critics fear, the share of applications actually rejected on the merits by the PTO – what one might call its examination rigor – is rather lower than the grant range suggests. Applications abandoned without continuations represent 21.4% of all applications filed. But since at most only 69.1% of those represented abandonment due to a substantive rejection, the PTO has so far actually managed to reject on the merits only 14.8% of the applications before it. Another 9.7% of applications are pending, so the substantive rejection rate will doubtless rise somewhat, but it will never be as high as 25%.

B. RCEs and the Total Number of Continuations Filed

If these numbers represented the full extent of continuation practice, we could conclude that continuations now were less important than they were in the 1990s, at least in comparison to the Graham-Mowery statistics based on granted patents. We cannot draw that conclusion, however, for two reasons. First, 8.5% of the original applications are still pending, and some others were recently patented. Those applicants could file new continuation applications in the future. Thus, as with grant rate we can identify only a continuation range rather than an absolute number of continuations. Second, and more significant, the PTO has a new alternative procedure for filing continuations – the RCE.

The addition of the RCE raises the numbers of total continuations filed substantially. As discussed above, 14.4% of all applications have children – ordinary continuations, CIPs, or divisionals. But an additional 15.9% of all applications have RCEs.[39] The total number of applications with any sort of continuations is not just the sum of these numbers, because some applications have both a child and an RCE. Rather, the total number of continuations is 27.3%, a number nearly as high as the 1995 spike seen in the Graham-Mowery analysis. And that's a floor, not the final number – other applicants may still file continuations or RCEs.

Table 7: Share of Applications With Continuations and/or RCEs, by Status of Parent

Status of parent application	*Share with continuation*	*Share with RCE*	*Share with either continuations or RCE*
Abandoned	13%	7%	18%
Patented	16%	14%	26%
Pending	7%	57%	60%
Total	**14%**	**16%**	**27%**

[39] Because the RCE is treated by the PTO as continued prosecution of the original application, rather than a new application, RCE data is already built into the data on pending applications, and therefore doesn't need to be taken into account separately in determining the grant rate.

C. What Can We Learn About Motivations for Continuations?

RCEs have somewhat different characteristics and uses than ordinary continuations. They are examined almost immediately, rather than going into the general application hopper, so they aren't particularly good tools if the patentee's interest is delay. And unlike ordinary continuations, RCEs keep the whole case pending in the office, so they can't be used to take a patent on narrow claims and continue to fight for broad claims. Rather, RCEs are primarily useful to continue fighting with an examiner who is reluctant to grant claims.[40]

And there is evidence that this persistence seems to work. Table 8 shows that applicants who used an RCE ultimately got a patent in 59% of the cases, and have the RCE pending in 30.6% more. In only 10.4% of the cases did the RCE fail, though of course some of the pending RCEs will presumably result in abandonment rather than a patent.

Table 8: Status of Applications with RCEs

Status	*Share*
Abandoned	10.4%
Patented	59.01%
Pending	30.6%

[40] Whether this represents wearing down the PTO (hoping for an error in your favor or for a new examiner with a different view of the merits) or is instead a process pushed by examiners themselves to expand their citation counts, see Thomas, *supra* note __, is impossible to determine in a statistical sense. It would require a baseline judgment as to whether the examiner was "right" to reject the initial application.

By contrast, given the existence of the quicker and simpler RCE, ordinary continuations are primarily useful for those who want multiple patents covering similar technology or want to delay the resolution of their case, either to surprise the industry or to modify their claims to cover subsequent developments in the technology. Some evidence for this was seen in Table 3 above. Note the high percentage of ordinary continuations that are still pending – 44.6%, far more than CIPs or divisionals. If continuations were not being used in part for delay, we would expect these numbers to be roughly equal, or if anything for CIPs to be more likely to be pending, since those applications have added new material to the patent.

More direct evidence of these motivations for using old-style continuations comes from looking at the data in Tables 5 and 7 which show that continuations came disproportionately from the group of applicants who actually obtained a patent on their original application. The percentage of applications with a child pending where the parent is patented is 73.8%, greater than the overall ratio. Further, Table 6 showed that those children are more likely to be patented if the parents are also patented. Of patented children, 80.7% stem from patented parents, compared with 17.3% stemming from abandoned parents and 2.0% from pending applications. The number of patented children that come from patented parents far exceeds the proportion of patented parents in the overall population.

What does all this mean? Continuations are flourishing. They have broken into two roughly equal groups, with different uses. Many applicants are using RCEs to keep fighting for claims that the examiner wasn't willing to give them. To a critic, this is a classic example of "wearing down" the PTO. Wearing down works as follows. The fact that examiners can never actually finally reject applications, but can allow them, means that error costs are asymmetric –

when the PTO wrongly rejects an application, the applicant will file an RCE to correct that error, but when the PTO wrongly approves an application, no one will object. Assuming that examiners make mistakes in a certain percentage of cases, the more bites at the apple the applicant has, the more likely those errors are to result in a wrongly issued patent.

A proponent of continuations might respond by saying that the examiner wants to be "worn down," and that RCEs result from the way examiners are rewarded for disposing of cases. The second group is filing continuation applications rather than RCEs. They have opted for a slower process, either because they want delay or because they want multiple patents. Here, most of the applicants using continuations are not patentees seeking to wear down the examiner, but those who already have a patent and are seeking a second one. Whether either strategy is something the law should support is a policy issue on which reasonable minds can differ. But in evaluating continuation policy, it is worth knowing that continuations are alive and well.

IV. Prosecution Practice

The transaction data from the PAIR records gives us a window on the patent prosecution process. Prosecution is an ex parte negotiation between the applicant and the examiner. The applicant files an application. The examiner can either grant the patent or reject it. If the examiner rejects it, the applicant can either "traverse" the rejection – arguing against it – or amend the claims to seek a patent on a generally narrower variation of the original claims. The examiner can again either allow the claim or reject it. That second rejection is typically called a "final" rejection, but in fact the applicant then has an opportunity to amend the claims again, to seek an interview to try to persuade the examiner in person, to file a continuation, or to appeal.

Overwhelmingly, the first reaction a patent examiner has to an application is a non-final rejection. As Table 9 shows, 86.5% of the PTO's first office actions are non-final rejections. Only a tiny percentage (0.04%) began with final rejections, and 13.5% granted patents on the first office action without any argument or negotiation.

Table 9: Distribution of First Office Actions

First Office Action	*Number of Applications*	*Share of Applications*
Final Rejection	4	0.04%
Mail Notice of Allowance	1324	13.46%
Non-Final Rejection	8511	86.5%
Total	9839[41]	100.0%

But the second time appears to be a charm. After that initial, non-final rejection, a significant number of applications result in patents. As we have seen, over 2/3 of applications ultimately issue as patents. Table 10 demonstrates that almost three-fourths of the applications that do issue do so without ever receiving a "final" rejection.

Table 10: Relationship between notice of allowance and final rejections:

Received a Final	*No Notice of*	*Notice of Allowance*	*Total*

[41] This number differs from the total number of applications above because a small number of applications never received a first office action at all, generally because they were abandoned before any action by the PTO.

Rejection	*Allowance* *N* *Column %*	 *N* *Column %*	 *N* *Column %*
No	1463 48.3%	4980 73.2%	6443 65.5%
Yes	1559 51.7%	1827 26.8%	3396 34.5%
Total	**3302** **100.0%**	**6807** **100.0%**	**9839** **100.0%**

When do patents result from applications which did receive "final" rejections? Sometimes this change of outcome reflects a change of heart – the applicant has persuaded the PTO to issue the same claims they initially rejected. Other times, it is because the patentee has amended the claims, generally but not necessarily to narrow them to avoid prior art. Many of these applications were amended after the initial rejection, so the PTO process may have the effect of narrowing unduly broad claims. Nonetheless, it is notable that quite a few patents – significantly more than half of those issued– issued without any amendment, as Table 11 shows:

Table 11: Status of applications, by whether they were ever amended

Status	*Never Amended* *N* *Row %*	*At Least One Amendment* *N* *Row %*	*Total* *N* *Row %*

Abandoned	1808 73.98%	636 26.02%	244 100.0%
Patented	3780 56.74%	2882 43.26%	6662 100.0%
Pending	290 34.24%	557 65.76%	847 100.0%
Total	**5878** **59.06%**	**4075** **40.94%**	**9953** **100.0%**

Table 12 shows that, after a final rejection, patents are much more likely to be rejected if the applicant won't amend (13.6% abandoned if the applicant amended versus 50.0% abandoned if they didn't amend). The difference does not reflect significant differences in pendency of applications with and without amendments after final rejections, but rather differences in the propensity of such applications to be patented: 66.1 percent of those which were amended after a final rejection are patented, versus 29.0 percent of those that were not amended:

Table 12: Status of Applications with "final rejections", by whether amended after final rejection

Status	No Amendments After Final Rejection N Column %	Amended After Final Rejection N Column %	Total N Column %
Abandoned	601	299	900

	50.0%	13.6%	26.5%
Patented	348 29.0%	1450 66.1%	1798 52.9%
Pending	252 21.0%	446 20.3%	698 20.6%

Despite the widespread allowance in the second office action, there are still a significant number of applications – almost 2,000 – that ultimately are allowed by the PTO but were at one point "finally" rejected, strongly suggesting that the term "final rejection" is "a classic legal misnomer."[42] Indeed, as Table 13 demonstrates, more than half of those applications that received a final rejection have ultimately resulted in a patent, and another 20% are still pending.

Table 13: Status of applications with "final" rejections

Status	*Number* *Column %*
Abandoned	900

[42] Robert P. Merges et al., Intellectual Property in the New Technological Age 161 (4th ed. 2006).

	26.5%
Patented	1798[43] 52.9%
Pending	698 20.6%
Total	**3396** **100.0%**

To see the significance of these numbers, consider that the chance of having your patent application finally abandoned is only slightly greater for those applications that got a final rejection than those that didn't (26.5% for those with a final rejection compared to 24.6% in the overall sample). And 18 percent of applications with final rejections have continuation applications pending so they may also result in one or more patents despite the final rejection.

Finally, the PTO backlog has been so great in this millennium that there are some patent applications that simply haven't been resolved. As noted above, 848 original applications were still pending five and a half years after they were filed. Some of those are still pending because the applicant is taking actions that extend prosecution – filing a continuation, or a CPA or RCE, or a notice of appeal. Nonetheless, there are 229 applications in our study that are still pending in the PTO despite the fact that the applicant hasn't done any of these things. That's a small

43 This number differs slightly from the number receiving a Notice of Allowance above because some applications have been allowed but not yet issued as patents.

percentage – only 2.3% -- but the fact that there are any such applications at all is somewhat disturbing, given that every additional year in the patent office is a year less of patent term.[44]

V. Industry-Specific Differences

There is a growing body of economic evidence suggesting that different industries experience the patent system in very different ways.[45] A great deal of work has focused on the proposed polar opposition between the biopharmaceutical industries, where patents are extremely important and generally considered a positive force, and the information technology industries, where patents are often viewed as interfering with rather than promoting innovation. Our data provides strong support for the proposition that there are significant industry-specific differences in patent prosecution, though the *ways* in which they differ will surprise many.

A. Patent Applications By Industry

We begin with use of the patent system by different industries more generally. Table 14 reports on the number of applications in our study by art unit. Art units are coarse and imperfect measures of technology class or industry, but they give a general sense of technological differences.[46]

---

[44] A few might be subject to government secrecy orders that require delay in prosecution for national security reasons. 35 U.S.C. § 181.

[45] *See, e.g.,* John R. Allison & Mark A. Lemley, *The Growing Complexity of the U.S. Patent System*, 82 **B.U. L. Rev**. 77 (2002); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 **Va. L. Rev.** 1575 (2003).

[46] On the many problems with PTO classification systems, see Allison & Lemley, *Who's*

Table 14: Distribution of January 2001 applications by USPTO art unit

Art Unit	N	Share of Applications
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	425	4.3%
1700 Chemical and Materials Engineering (Art Units 1700-1775)	1407	14.1%
2100 Computer Architecture, Software, & Information Security (Art Units 2100-2195)	1074	10.8%
2600 Communications (Art Units 2600-2697)	1541	15.5%
2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	2508	25.2%
3600 Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review (Art Units 3610-3683)	1553	15.6%
3700 Mechanical Engineering, Manufacturing, and Products (Art Units 3700-3767)	1452	14.6%

What is interesting about this data is the predominance of what are broadly defined as the IT industries – computer hardware, software, communications, semiconductors, and electronics. Together, these applications account for more than 50% of all published patent applications, a number far in excess of their proportion of issued patents in the 1970s or even in the 1990s.[47]

Patenting What, *supra* note __, at 2114.

[47] Allison and Lemley found that 24.2% of patents issued between 1996 and 1998 were computer-related inventions (including both hardware and software), 7.7% were electronics, and another 9.3% were semiconductor inventions. Even if we include the 4.1% that were communications related, not all of which involved information technology, that totals only 45.3%. Further, in the 1970s the numbers were much smaller – 7.4% computer related, 2.3%

Appendix A breaks the industry character down further, identifying the 50 largest patent classes in our study.[48] Those data may tell us more about the breadth of individual PTO classes than the popularity of technologies, but it is notable that the single largest class was class 705, covering business method and financial services patents.[49]

B. Grant Rates By Industry

The most dramatic industry-specific differences are in grant rates. Table 15 reports the status of applications by art unit:

Table 15: Status of January 2001 applications by USPTO art unit

Art Unit	Share Abandoned	Share Patented	Share Pending
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	31.5	58.1	10.4
1700 Chemical and Materials Engineering (Art Units 1700-1775)	24.2	73.3	2.5
2100 Computer Architecture, Software, & Information Security (Art Units 2100-2195)	27.2	46.7	26.1
2600 Communications (Art Units 2600-2697)	22.6	59.6	17.7

semiconductors, 18.3% in electronics, and 3.3% communications, for a total of 31.3%. Allison & Lemley, *Growing Complexity, supra* note __, at 93 Tbl 1. Allison and Lemley's numbers aren't strictly comparable to ours, because they involve issued patents rather than applications, but they are broadly indicative of a difference between the past and today.

48 Classes, too, are notoriously imprecise measures of technology area. For examples, see Allison & Lemley, *Who's Patenting What, supra* note __, at 2114.

49 *See* John R. Allison & Emerson H. Tiller, *The Business Method Patent Myth,* 18 **Berkeley Tech. L.J.** 987 (2003) (documenting how class 705 understates the number of business method patents because applicants characterize their inventions to avoid the second level of scrutiny applied to this class).

2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	16.8	81.8	1.4
3600 Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review (Art Units 3610-3683)	33.3	57	9.7
3700 Mechanical Engineering, Manufacturing, and Products (Art Units 3700-3767)	26.9	71	2.1

Clearly the chance of getting a patent differs significantly by industry. Patented applications – the lower end of the grant range -- vary from a low of 46.7% in computer hardware and software to a high of 81.8% in semiconductors and electronics. Some of this variation is a function of differences in pending applications, and therefore presumably of industry-specific differences in the speed with which the PTO processes applications. Indeed, this is clearly true of the outlier groups just identified – semiconductors have only 1.4% of applications still pending, while 26.1% of computer applications are still pending. The number of finally abandoned applications – the high end of the grant range -- also differs significantly by art unit, from a low of 16.8% in semiconductors to a high of 33.3% in the transportation industries.

Table 16 shows that the cross-field differences in grant rates are similar after adjusting for grants to children:

Table 16: Share of January 2001 applications patented, with and without adjustment for grants to child applications, by USPTO art unit

Art Unit	Share of applications patented	Share patented, after accounting for grants to children
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	58%	60%
1700 Chemical and Materials Engineering (Art Units 1700-1775)	73%	76%
2100 Computer Architecture, Software, & Information Security (Art Units 2100-2195)	47%	47%
2600 Communications (Art Units 2600-2697)	60%	60%
2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	82%	83%
3600 Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review (Art Units 3610-3683)	57%	58%
3700 Mechanical Engineering, Manufacturing, and Products (Art Units 3700-3767)	71%	73%

These cross-field differences are also seen in the grant rates of individual patent classes reported in Appendix A. Here the ranges are much wider, as one might expect. Patented applications – the lower end of the grant range – vary from a low of only 4.0% in business methods to a high of 96.0% in class 365, covering “static information storage and retrieval.” The high end of the range – abandoned applications – also vary from a low of 5.0% in class 365 to a high of 51.6% in business methods.

While much of the academic and policy discussion about patent policy focuses on differences across industries—primarily IT versus biomedical inventions-- Appendix A also shows significant differences *within* broad technological categories. For example, the various “data processing” classes the share of patented applications ranges from 3 percent to 89 percent.

Similarly, grant rates in "surgery" (78 percent) are significantly higher than those for "drugs" (53 percent) and "molecular biology" (45 percent).

Finally, given the recent academic and policy controversies relating to patenting software, we examined this field in particular. Though defining "software" patents is notoriously difficult, we used the Graham-Mowery U.S. patent class based definition of software patents to create a measure of software patent grant rates across classes.[50] Table 17 reports the results:eeeeeeeeee

Table 17: Status of "Software" and other patent applications

	Share Abandoned	Share Patented	Share Pending
Non-software (N=8,806)	24.7%	69.0%	6.4%
Software (N=1,154)	23.7%	51.4%	24.9%

Overall, about 13 percent of the applications in our sample are "software." The odds that a software patent is finally abandoned are virtually the same as those for a non-software patent – 23.7% of software patents, and 24.7% of non-software patents, were finally abandoned. The number of patents that are still pending is significantly different – 24.9% of software patents

[50] Stuart Graham & David C. Mowery, *Intellectual Property Protection in the U.S. Software Industry*, in **Patents in the Knowledge-Based Economy** (Cohen & Merrill eds. 2003). For other definitions, see Hall & McGarvie, http://elsa.berkeley.edu/~bhhall/papers/HallMacGarvie_Sept06.pdf; Bessen & Hunt, http://www.researchoninnovation.org/swpat.pdf.

versus 6.4% of non-software patents. But strikingly, grant rates in software are lower than overall grant rates: 51 percent versus 69 percent.[51]

While few should be surprised at the existence of industry-specific differences in patent grants, many people should be surprised –as indeed we are – at *which* industries have the highest grant rates. The received wisdom is that the problem of bad patents "rubber-stamped" by the PTO is largely confined to the IT industries. In fact, however, what we find is rather more complex. IT is hardly monolithic, and indeed includes the art units with both the highest and the lowest grant rates. The industry in which the grant rate is *lowest* is the computer industry, the very one in which many people would have said bad patents were most common. Similarly, the PTO rejects the highest share of applications in the field of business methods, from which a disproportionate number of complaints about the patent system arise.[52]

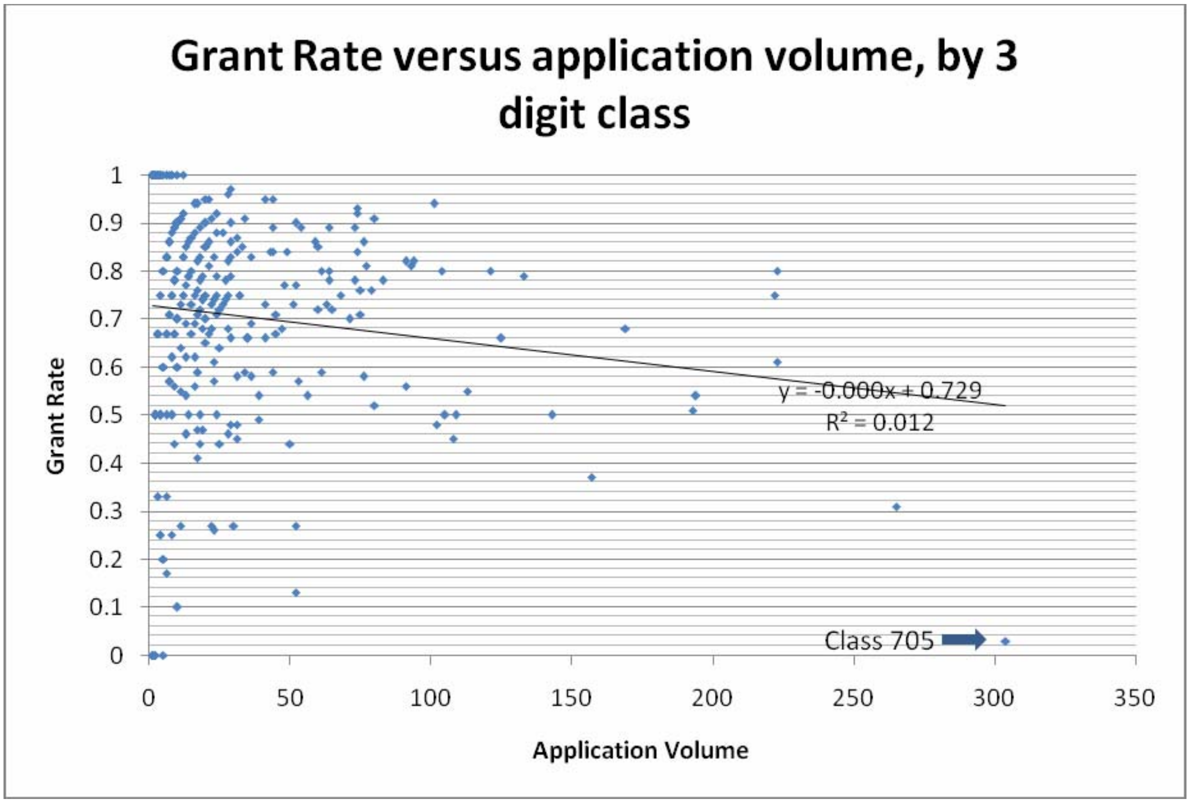
Grant rate data can't provide a complete picture of the rigor of patent prosecution across fields, since this rigor could feed back to the quality of applications submitted. That is, a tough examination could deter frivolous filings, while a lax examination encourages them, with the result that the tougher groups end up having fewer bad applications to reject and the laxer groups have more.[53] It is difficult to test this, since under this scenario application volume, quality, and the rigor of examination would not be independent. But note that the data in Table 15 showed

[51] The grant rate for software patents versus other patents do not change much after adjusting for whether any child applications result in patents, increasing to 52 percent and 71 percent respectively.

[52] As the data in Appendix B show, these differences persist if we examine the subset of applications where "opting-out" of publication was not possible.

[53] See **Adam Jaffe & Josh Lerner, Innovation and Its** Discontents (2004) (discussing this possibility).

little systematic relationship between grant rates and grant probabilities across art units, suggesting that examination rigor and application volume are not strongly related. We also examine this at a more disaggregated level in Figure 1, which shows a scatterplot of grant rates versus application volume by 3-digit patent class, with each point representing a specific class:



The data shows some a negative and statistically significant relationship between the two, potentially suggesting that a feedback effect is at work – applicants in a few classes are flooding the PTO with frivolous claims that the PTO is rejecting. But the result is driven by one particular class: class 705, for business methods, and becomes statistically insignificant when this class is excluded. Class 705 is interesting not only because it is the leading class in terms of application volume and has the lowest grant rate, but also because the USPTO initiated a specific "quality control" measure in this class in 1999, the "second pair of eyes" review, where applications were subjected to mandatory assessment by more than one examiner. One possible explanation for the low grant rate in this class is that the second pair of eyes is working, and the grant rate reflects better rigor rather than application volume.[54]

After excluding class 705, there is little relationship across classes between application volume and grant rates. While it is impossible to know this for sure absent some evidence on application quality (as opposed to simply volume) by class, these data undercut the notion that "flooding the patent office" alone explains the patterns of cross-field differences in grant rates we highlighted above.

C. Continuations By Industry

Both the frequency with which patent applicants use continuations and the type of continuation they use also differ significantly by industry. We report the share of applications in each art unit that rely on continuations in Table 18.

Table 18: Share of applications with continuations and RCEs, by Art Unit

Art Unit	Share with	Share with RCE	Share with either a

[54] Given the timing of the applications, shortly before the "dot com" bust, it is also possible that the abandonments in this class reflect business closings rather than rejections by examiners. To examine this, we analyzed the last transaction before abandonments in this class, and found that 75 percent of these were substantive office actions by the USPTO, significantly higher than the analogous share for abandoned patents in other classes reported above. That is, the bulk of abandonments do not appear to be due to applicants' exit from the industry, but rather to USPTO scrutiny. While this requires more research, it is consistent with the argument that the second pair of eyes review is working.

	Continuations		continuation or RCE
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	27%	22%	43%
1700 Chemical and Materials Engineering (Art Units 1700-1775)	20%	15%	30%
2100 Computer Architecture, Software, & Information Security (Art Units 2100-2195)	10%	27%	35%
2600 Communications (Art Units 2600-2697)	11%	19%	28%
2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	15%	14%	25%
3600 Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review (Art Units 3610-3683)	10%	11%	20%
3700 Mechanical Engineering, Manufacturing, and Products (Art Units 3700-3767)	17%	11%	25%

The use of continuations of any type, displayed in the last column, varies from a low of 19.9% of applications in the transportation industry to a high of 42.6% in biotechnology. What is notable here is not only the variation across fields– the highest mean is more than twice the lowest – but that even the industries with relatively little use of continuations use them as much or more than the average industry did 15 years ago, based on data from patent grants.[55]

[55] *See* Graham & Mowery, *supra* note __, at __ (reporting that approximately 20% of applicants across all industries used continuations in 1990).

The industries that use traditional continuations generally track our expectations – they are most common in the chemical and biotechnological industries, where obtaining patent protection quickly is less important. By contrast, RCEs are more common in the computer and communications industries, where applicants are two to three times more likely to use RCEs than to use continuations, perhaps reflecting their "need for speed" given shorter product life-cycles.[56]

We also see cross-field differences in the types of traditional continuations used, in Table 19:

Table 19: Share of applications with continuations, CIPs, and Divisionals, By USPTO Art Unit

Art Unit	Share with Continuations	Share with CIPs	Share with divisionals
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	10.4%	5.4%	12.2%
1700 Chemical and Materials Engineering (Art Units 1700-1775)	5.3%	4.6%	11.1%
2100 Computer Architecture, Software, & Information Security (Art Units 2100-2195)	5.1%	2.1%	2.1%
2600 Communications (Art Units 2600-2697)	4.2%	2.3%	2.9%
2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	4.8%	2.2%	8.7%
3600 Transportation, Construction, Electronic Commerce, Agriculture,	3.5%	3.1%	3.0%

[56] It is worth noting, however, that the biotechnology industry was also one of the largest users of RCEs.

National Security and License and Review (Art Units 3610-3683)			
3700 Mechanical Engineering, Manufacturing, and Products (Art Units 3700-3767)	5.6%	5.9%	6.6%

The differences here are dramatic – biotechnology and chemical applicants are far more likely to file divisionals than are companies in any other industry. This is consistent with anecdotal evidence suggesting that the PTO is imposing restriction requirements with abandon in those industries, forcing applicants to divide their patent applications multiple ways.[57]

Recall our conclusions above on the reasons applicants might use one form of continuation or another. It is reasonable to conclude that in the computer and communications industries, applicants are using continuations to continue the fight with the examiner. In the life sciences industries, continuations are more likely to serve the purpose of obtaining multiple patents and particularly allowing the applicant to delay the writing of claims to track subsequent developments in the industry.

VI. Implications

The PTO today is doing a better job than many people seem to think. While it grants patents to more than two-thirds of those who apply, the PTO is not a rubber stamp. It rejects a

[57] *See, e.g.,* Teresa J. Welch, *When One Patent Application Begets 10,* **Intell. Prop. Strategist,** Jan. 2004, at 1 ("In recent years, hyperproliferation of restriction requirements, especially in the biotechnology, chemical and software arts, has occurred.

small but non-trivial percentage of applications (15-20%), and more applications are abandoned for business reasons. While the rejection percentage may seem low, it is worth remembering that the PTO has no power ever to finally reject a determined applicant. The fact that it nonetheless succeeds in doing so in a non-trivial number of cases is notable. So is the fact that a second pair of eyes seems correlated with a significant increase in actual rejections.[58] Further, in a significant number of cases – around 40% of those that issue – the prosecution process requires the applicant to amend her claims, presumably generally to make them narrower. Requiring an applicant to narrow a patent provides a useful social function akin to weeding out bad patents. We can think of it as weeding out bad (overbroad) claims in otherwise good patents.

At the same time, while many suggested that continuations would wither after the mid-1990s patent reforms, in fact they are alive and well. Our data allows us to identify two rather different motivations for continuations. Many applicants use continuations to persevere – to persuade an examiner to grant claims that have been "finally" rejected. Many others use continuations for other reasons – perhaps to build a multi-patent fence around the same invention, perhaps to delay the final issuance of the patent. Applicants in turn likely want delay in order to change their claims to track developments in the industry; while delay has in the past been used to surprise an industry, that is much less likely after the 1999 changes in publication rules.[59] It is not clear that the reasons applicants use statutory continuations – to obtain multiple patents on the same invention, or to delay issuance in order to change the application to capture

[58] We emphasize that we cannot demonstrate that the second pair of eyes review in class 705 is responsible for the much higher rate of rejection in that class. We can confirm that the abandonments in that class were not business decisions. But an alternate explanation is that applications in that class were of abnormally low quality.

[59] 35 U.S.C. § 122(b).

later developments – make much sense as a policy matter. RCEs are a more complex issue. They do permit "wearing down" the PTO by trying many times to get an erroneous allowance, but they also permit the correction of erroneous rejections. And examiners have bureaucratic incentives to provoke RCEs before allowing an application, because doing so allows them to receive additional "points" for having processed both the initial application and the RCE. While there are plausible arguments for limiting continuations of all types, the arguments against statutory continuations seem stronger than those against RCEs.

Finally, our data underscore the dramatic differences between industries in how they experience the patent prosecution process. They do so, however, in a surprising way. There is no monolithic "IT versus pharma" divide in the treatment of patent applications. Rather, semiconductor patents and software patents look very different, with biotechnology and pharmaceuticals falling somewhere in between.[60] But overall, those industries that are most identified with bad patents (computer software, hardware, and business methods) turn out to be those with the lowest grant rates. This could suggest that the conventional wisdom about cross-field differences in examination rigor is incorrect, or that more rigorous patent examination may not improve patent quality. As noted above, we cannot make these claims definitively absent more information about the underlying quality of applications submitted. But our findings certainly suggest that that debates about patent system reform need to move beyond a narrow focus on the grant rate. They also suggest that published patent application data and PAIR

[60] And even at the more fine-grained patent class level, there is considerable within-industry variation (as reported in Appendix A).

transaction/status data are a rich and unexplored source of information for examining the law and economics of the patent system, and firm and industry level patent strategies.

APPENDIX A: STATUS OF APPLICATIONS BY 3-DIGIT USPTO CLASS, TOP 50 CLASSES BY VOLUME

CLASS	CLASSNAME	N	ABANDONED	PENDING	PATENTED	PARENT OR CHILD PATENTED
705	Data Processing: Financia	304	52.0%	45.0%	3.0%	4.0%
709	Electrical Computers and	265	29.0%	40.0%	31.0%	31.0%
257	Active Solid-State Device	223	17.0%	3.0%	80.0%	82.0%
370	Multiplex Communications	223	17.0%	22.0%	61.0%	61.0%
438	Semiconductor Device Manu	222	24.0%	1.0%	75.0%	76.0%
345	Computer Graphics Process	194	28.0%	18.0%	54.0%	54.0%
455	Telecommunications	193	30.0%	20.0%	51.0%	51.0%
428	Stock Material or Miscell	169	27.0%	5.0%	68.0%	74.0%
707	Data Processing: Databas	157	33.0%	30.0%	37.0%	38.0%
713	Electrical Computers and	143	20.0%	30.0%	50.0%	52.0%
359	Optics: Systems (Includi	133	17.0%	4.0%	79.0%	83.0%
375	Pulse or Digital Communic	125	15.0%	18.0%	66.0%	66.0%
385	Optical Waveguides	121	20.0%	0.0%	80.0%	80.0%
348	Television	113	21.0%	24.0%	55.0%	55.0%
424	Drug, Bio-Affecting and B	109	37.0%	13.0%	50.0%	53.0%
435	Chemistry: Molecular Biol	108	41.0%	14.0%	45.0%	45.0%
280	Land Vehicles	105	49.0%	1.0%	50.0%	51.0%
382	Image Analysis	104	12.0%	9.0%	80.0%	80.0%
358	Facsimile and Static Pres	102	16.0%	36.0%	48.0%	48.0%
365	Static Information Storag	101	5.0%	1.0%	94.0%	96.0%
324	Electricity: Measuring a	94	18.0%	0.0%	82.0%	82.0%
439	Electrical Connectors	93	19.0%	0.0%	81.0%	82.0%
361	Electricity: Electrical	91	18.0%	0.0%	82.0%	84.0%
514	Drug, Bio-Affecting and B	91	33.0%	11.0%	56.0%	60.0%
73	Measuring and Testing	83	22.0%	0.0%	78.0%	80.0%
347	Incremental Printing of S	80	6.0%	3.0%	91.0%	94.0%
379	Telephonic Communications	80	38.0%	10.0%	52.0%	52.0%
714	Error Detection/Correctio	79	19.0%	5.0%	76.0%	77.0%
250	Radiant Energy	77	19.0%	0.0%	81.0%	83.0%
430	Radiation Imagery Chemist	76	13.0%	1.0%	86.0%	89.0%
704	Data Processing: Speech S	76	34.0%	8.0%	58.0%	58.0%
340	Communications: Electric	75	24.0%	5.0%	71.0%	72.0%
600	Surgery	75	21.0%	3.0%	76.0%	80.0%
123	Internal-Combustion Engin	74	8.0%	0.0%	92.0%	92.0%

360	Dynamic Magnetic Informat	74	12.0%	4.0%	84.0%	86.0%
399	Electrophotography	74	7.0%	0.0%	93.0%	95.0%
369	Dynamic Information Stora	73	18.0%	4.0%	78.0%	78.0%
701	Data Processing: Vehicles	73	11.0%	0.0%	89.0%	89.0%
362	Illumination	71	30.0%	0.0%	70.0%	70.0%
310	Electrical Generator or M	68	25.0%	0.0%	75.0%	78.0%
429	Chemistry: Electrical Cu	65	23.0%	5.0%	72.0%	74.0%
156	Adhesive Bonding and Misc	64	20.0%	2.0%	78.0%	81.0%
327	Miscellaneous Active Elec	64	9.0%	2.0%	89.0%	91.0%
604	Surgery	64	14.0%	6.0%	80.0%	83.0%
710	Electrical Computers and	63	16.0%	11.0%	73.0%	73.0%
349	Liquid Crystal Cells, Ele	61	8.0%	11.0%	80.0%	80.0%
700	Data Processing: Generic	61	30.0%	11.0%	59.0%	59.0%
264	Plastic and Nonmetallic A	60	28.0%	0.0%	72.0%	73.0%
313	Electric Lamp and Dischar	60	15.0%	0.0%	85.0%	87.0%
711	Electrical Computers and	59	10.0%	3.0%	86.0%	86.0%

APPENDIX B: AN ANALYSIS OF NON-PUBLISHED APPLICATIONS

As discussed in the introduction, in this study we sampled on published applications. Our ability to make broader inferences about the population of patent applications would be limited if these were systematically different from the entire population of applications.

While we cannot directly examine these differences for unpublished applications that are not granted, we can examine the share of patents that are granted that stem from published versus unpublished applications. To do so, we collected information from *Delphion* on all patents issued by April 2006 that resulted from original January 2001 applications, i.e. applications with no U.S. parents. Of these 9931 patents, 7,067 (about 71 percent) were published before issue.[61] However, there are significant differences by technological field, as Table B1 shows, using the patent class-field concordance developed by researchers at the National Bureau of Economic Research:[62]

Technology Category	Share published
Chemical	64%
Computers and Communication	80%
Drugs and Medical	57%
Electrical and Electronic	75%
Mechanical	72%

[61] Separate analyses show that the publication rate has been increasing over time. For all patents granted by the end of 2006, the publication rate was 76 percent for those filed in 2001, 83 percent for those filed in 2002, and 86 percent for those filed in both 2002 and 2004. The figures increase over time since increasingly fewer patents are based on foreign applications with pre-November 2000 priority, which allows applicants to opt-out of pre-grant publication. For other applications, the only applications that can opt-out are those with no related foreign applications, or those which have foreign counterparts but issue or are abandoned before 18 months.

[62] Hall, Jaffe, and Trajtenberg. *Patents, Citations, and Innovation*. MIT Press, 2004.

Other	67%
Total	71%

In particular, the share of patents resulting from published applications is significantly lower in the biomedical and chemical arenas than other fields.

What are the sources of these differences? The AIPA mandates publication at 18 months from the filing date of an application, or 18 months from the filing date of any U.S. or foreign priority application, of any application where foreign patent protection is (or will be) sought.[63] For our January 2001 sample, which by construction excludes applications with earlier U.S. priority, applications can result in patents without pre-grant publication under several scenarios. The first is if there are no counterpart foreign applications. The second is if there are foreign applications, but the U.S. patent issues or the application is abandoned in less than eighteen months from filing. The third is if there are foreign applications, but the foreign priority date preceded the effective date of the AIPA, November 29, 2000.[64]

The lower tendency of biomedical and chemical patents to be published pre-grant must reflect differences in the share of patents subject to one of these exemptions, or the propensity of applicants to exercise their right to "opt-out" in these circumstances. We examine this in Table B2, collapsing the "Drugs and Medical" and "Chemical" categories into a single "Biochemical" category for expositional convenience. (Overall, 61 percent of "Biochemical" patents are published pre-grant, compared to 74 percent of "Other" patents.)

---

[63] Specifically, applicants can avoid pre-grant publication in the U.S. by certifying that no foreign counterpart will be filed in a country or via an international agreement that requires pre-grant publication.

[64] For discussion of that transition, see http://www.ssiplaw.com/publications/pgpub.pdf

	Other	**Biomedical and Chemical**
Share of Patents That Have Foreign Counterparts	70%	82%
Share of Patents with Foreign Counterparts That Issue in <18 Months	12%	15%
Share of Patents with Foreign Counterparts That Issue in >18 Months That Have Pre-2000 Foreign Priority	44%	52%

The results show that bio-chemical patents are more likely to be filed abroad, meaning they are more, not less likely to be subject to pre-grant publication rules. While conditional on having a foreign counterpart, bio-chemical patents are slightly more likely to issue before 18 months, this difference is too small in magnitude to drive the overall difference in being "at risk" for publication. By contrast, for the biochemical patents that have foreign counterparts and take more than 18 months to issue, a significantly higher share have pre-November-2000 priority, i.e. a significantly higher share can opt-out of publication on these grounds.

Moreover, applicants in the biomedical arena are more likely to have employed this exemption to opt-out. Table B3 shows the share of patents which have foreign counterparts and were pending more than 18 months that are published, by whether they also had pre-November-2000 priority:

	Share Published	
	Other	**Biomedical and Chemical**
Pre-2000 Foreign Priority	76%	59%
No Pre-2000 Foreign Priority	91%	88%

For patents that have foreign counterparts, were pending more than 18 months, and did not have pre-2000 priority, the share published is similar (and statistically indistinguishable) for biochemical and other patents. But for the patents with pre-2000 priority, the share published is significantly lower in the biochemical fields.

Thus, not only are biochemical patents resulting from January 2001 applications more likely to have had the option to "opt out" of pre-grant publication because they had foreign priority applications predating the AIPA, but applicants in these fields were also more likely to have exercised this option, perhaps because secrecy of patent information is more important to them.

What are the implications of this analysis (based on granted patents) for our main analyses using published applications? Clearly, the probability that we observe an application depends on application characteristics and applicant strategies that may vary across fields, as well as other dimensions of interest.

While we cannot control for this non-publication bias completely, in this section we reproduce all of these results from the main analysis for the subset of the applications where applicants could not have opted-out of publication, i.e. those that had foreign counterparts but no pre-2000 foreign priority. While the vast majority of applications filed today would fit this bill, less than 20 percent of the January 2001 applications were so characterized. Notably, this limitation excludes a large percentage of patent applications first filed abroad, and also excludes some lower-value patents filed only in the United States. Those effects may explain the differences in results that follow.

Rather than discuss each of the tables in detail, in the tables presented in Appendix C we highlight salient similarities and differences from the results presented in the main text. Table C1 shows that the overall grant rate and share of pending applications increase slightly when we focus on these applications, and the share of abandoned applications decreases. But these differences are slight, and are not surprising given that the application in the restricted sample were all filed abroad, and thus have higher expected value to applicants.

The strongest differences between the samples are in continuation practice. Table C2 shows that the distribution of continuation types differs in the restricted sample, with a lower share of continuations divisionals and a higher share continuations in part. The share of applications with continuations (C4), RCEs (C7) and continuations pending (C5) are significantly higher in the restricted sample, which again is not surprising given that these are likely to be more valuable applications. Similarly, Table C6 shows that the share of applications with patented children is higher in the restricted sample. Using the figures in the restricted sample, the lower bound of the grant rate (including patents on children) is 73 percent and the upper bound (assuming all pending applications and abandoned applications with continuations result in grants) is 85.6 percent. The other results on continuations (Tables C7-C8) and the results on prosecution practice (Tables C9-C13) are similar to those from the overall sample.

Given our discussion above about cross-field differences in propensity to opt-out, it is noteworthy that the distribution of the applications across art units (Table C14) is very similar in the restricted sample, as are cross-field patterns in grant rates (Tables C15-C17). Table C19 shows that applications in the biomedical and chemical are units are more likely to use CIPs in the restricted sample than the main sample.

APPENDIX C: TABLES FOR "RESTRICTED" SAMPLE OF APPLICATIONS

Restricted Sample, Table C1: Status of applications in sample

Status	*N*	*Share of Total*
Abandoned	368	20%
Patented	1285	70%
Pending	183	10%
Total	**1836**	**100%**

Restricted Sample, Table C2: Distribution of Continuation Types

Continuation Type	*N*	*Share of Total*
Continuation	219	29.44
Continuation in Part	222	29.84
Divisional	237	31.85
Unknown/ Not determinable	66	8.87
Total	**744**	**100.00**

Restricted Sample, Table C3: Status of Child Applications

Continuation Type	*N*	*Share Abandoned*	*Share Patented*	*Share Pending*
Continuation	219	10.5%	42.9%	46.6%
Continuation in part	222	15.8%	58.1%	26.1%
Divisional	237	11.8%	53.2%	35.0%

Restricted Sample, Table C4: Share of parent applications with continuations, by status of parent

Status of parent application	*Share with any continuation*
Abandoned	28%
Patented	28%
Pending	10%
Total	**27%**

Restricted Sample, Table C5: Parent applications with and without children pending, by status of parent

	No Children Pending *N* *Row%* *Column%*	*>=1 Child Pending* *N* *Row%* *Column%*	*Total* *N* *Row%* *Column%*
Abandoned	325	43	368
Patented	1111	174	1285
Pending	169	14	183
Total	**1605**	**231**	**1836**

Restricted Sample, Table C6: Parent applications with and without children patented, by status of parent

	No Children Patented *N* *Row%* *Column%*	*>=1 Child Patented* *N* *Row%* *Column%*	*Total* *N* *Row%* *Column%*
Abandoned	326	42	368
Patented	1059	226	1285
Pending	177	6	183
Total	**1562**	**274**	**1836**

Restricted Sample, Table C7: Share of Applications With Continuations and/or RCEs, by Status of Parent

Status of parent application	*Share with continuation*	*Share with RCE*	*Share with either continuations or RCE*
Abandoned	28%	11%	35%
Patented	28%	16%	38%
Pending	10%	50%	55%
Total	**27%**	**19%**	**39%**

Restricted Sample, Table C8: Status of Applications with RCEs

Status	*Share*
Abandoned	12.3%
Patented	60.7%
Pending	27.0%

Restricted Sample, Table C9: Distribution of First Office Actions

First Office Action	*Number of Applications*	*Share of Applications*
Final Rejection	0	0.0%
Mail Notice of Allowance	215	11.87%
Non-Final Rejection	1596	88.13%
Total	1811	100.0%

Restricted Sample, Table C10: Relationship between notice of allowance and final rejections:

Received a Final Rejection	*No Notice of Allowance* *N* *Column %*	*Notice of Allowance* *N* *Column %*
No	187 36.7%	915 70.3%
Yes	323 63.3%	386 29.7%

Restricted Sample, Table C11: Status of applications, by whether they were ever amended

Status	*Never Amended* *N*	*At Least One Amendment* *N*	*Total* *N*
Abandoned	263	105	368
Patented	730	553	1283
Pending	63	120	183

Restricted Sample, Table C12: Status of Applications with “final rejections”, by whether amended after final rejection

Status	No Amendments After Final Rejection N Column %	Amended After Final Rejection N Column %	Total N Column %
Abandoned	121	58	179
Patented	82	303	385
Pending	55	90	145

Restricted Sample, Table C13: Status of applications with “final” rejections

Status	*Number* *Column %*
Abandoned	179 25.2%
Patented	385 54.3%
Pending	145 20.5%
Total	**709** **100.0%**

Restricted Sample, Table C14: Distribution of January 2001 applications by USPTO art unit

Art Unit	N	Share of Applications
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	115	6.3%
1700 Chemical and Materials Engineering (Art Units 1700-1775)	310	16.9%
2100 Computer Architecture, Software, & Information Security	208	11.3%

(Art Units 2100-2195)		
2600 Communications (Art Units 2600-2697)	260	14.2%
2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	393	21.4%
3600 Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review (Art Units 3610-3683)	238	13.0%
3700 Mechanical Engineering, Manufacturing, and Products (Art Units 3700-3767)	312	17%

Restricted Sample, Table C15: Status of January 2001 applications by USPTO art unit

Art Unit	Share Abandoned	Share Patented	Share Pending
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	34.8	51.3	13.9
1700 Chemical and Materials Engineering (Art Units 1700-1775)	18.7	77.1	4.2
2100 Computer Architecture, Software, & Information Security (Art Units 2100-2195)	29.3	42.8	27.9
2600 Communications (Art Units 2600-2697)	15.8	66.2	18.1
2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	14.5	84	1.5
3600 Transportation, Construction, Electronic Commerce, Agriculture,	22.7	65.5	11.8

National Security and License and Review (Art Units 3610-3683)			
3700 Mechanical Engineering, Manufacturing, and Products (Art Units 3700-3767)	18.3	76.9	4.8

Restricted Sample, Table C16: Share of January 2001 applications patented, with and without adjustment for grants to child applications, by USPTO art unit

Art Unit	Share of applications patented	Share patented, after accounting for grants to children
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	51%	54%
1700 Chemical and Materials Engineering (Art Units 1700-1775)	77%	81%
2100 Computer Architecture, Software, & Information Security (Art Units 2100-2195)	43%	44%
2600 Communications (Art Units 2600-2697)	66%	67%
2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	84%	85%
3600 Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review (Art Units 3610-3683)	66%	68%
3700 Mechanical Engineering, Manufacturing, and Products (Art Units 3700-3767)	77%	82%

Restricted Sample, Table C17: Status of “Software” and other patent applications

	Share Abandoned	Share Patented	Share Pending
Non-software (N=1629)	19.5%	72.6%	7.9%
Software (N=207)	24.6%	49.3%	26.1%

Restricted Sample, Table C18: Share of applications with continuations and RCEs, by Art Unit

Art Unit	Share with Continuations	Share with RCE	Share with either a continuation or RCE
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	36%	29%	52%
1700 Chemical and Materials Engineering (Art Units 1700-1775)	32%	20%	44%
2100 Computer Architecture, Software, & Information Security (Art Units 2100-2195)	18%	27%	41%
2600 Communications (Art Units 2600-2697)	18%	17%	33%
2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	26%	14%	34%
3600 Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review (Art Units 3610-3683)	23%	15%	34%
3700 Mechanical Engineering, Manufacturing, and Products	35%	18%	44%

(Art Units 3700-3767)			

Restricted Sample, Table C19: Share of applications with continuations, CIPs, and Divisionals, By USPTO Art Unit

Art Unit	Share with Continuations	Share with CIPs	Share with divisionals
1600 Biotechnology and Organic Chemistry (Art Units 1600-1661)	11%	12%	15%
1700 Chemical and Materials Engineering (Art Units 1700-1775)	8%	10%	17%
2100 Computer Architecture, Software, & Information Security (Art Units 2100-2195)	10%	6%	3%
2600 Communications (Art Units 2600-2697)	7%	5%	3%
2800 Semiconductors, Electrical and Optical Systems and Components (Art Units 2800-2891)	9%	6%	12%
3600 Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review (Art Units 3610-3683)	8%	8%	8%
3700 Mechanical Engineering, Manufacturing, and Products (Art Units 3700-3767)	14%	15%	12%