Disharmony in International Patent Office Decisions

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Introduction

There is much debate about the merits of harmonizing international patent laws.[1] Bilateral and multilateral trade agreements and treaties such as the Agreement on Trade Related Aspects of Intellectual Property (TRIPS),[2] which promote consensus on issues such as copyright term extension and patent coverage, have flourished.[3] Moreover, it is a condition of TRIPS that all sig-

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[1] *See, e.g.*, John H. Barton, *Issues Posed by a World Patent System*, 7 J. Int'l Econ. L. 341, 341–42 (2004); John F. Duffy, *Harmony and Diversity in Global Patent Law*, 17 Berkeley Tech. L.J. 685, 685–87, 691 (2002); Gerald J. Mossinghoff & Vivian S. Kuo, *World Patent System Circa 20XX, A.D.*, 80 J. Pat. & Trademark Off. Soc'y 523, 524–25 (1998).

[2] Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, 33 I.L.M. 1197, 1869 U.N.T.S. 299 [hereinafter TRIPS].

[3] For example, the United States has signed numerous bilateral free trade agreements—with Australia, Chile, Singapore, and others—in recent years that have reinforced (and in some cases, extended) the obligations contained in TRIPS. *See, e.g.*, Office of the United States Trade Representative, Bilateral Trade Agreements, http://www.ustr.gov/Trade_Agreements/Section_Index.html.

natories to the agreement apply the same criteria—novelty, non-obviousness and utility—to determine whether an invention is eligible to be protected by a patent.[4] Despite this, there are substantial procedural differences in the ways in which different patent offices search for prior art and interpret non-obviousness. The Trilateral Patent Offices—the United States Patent Office (USPTO), the Japanese Patent Office (JPO) and the European Patent Office (EPO)—have recognized the importance of consensus in patent examination procedures and have considered ways in which these differences can be attenuated.[5]

In this Article, we analyze one aspect of the patent harmonization debate: whether there are systematic differences in patent application outcomes—which we define as withdrawn, pending, rejected or granted—across the trilateral patent offices. Recent evidence suggests that despite the fact that all three offices have been working towards a consistent interpretation of patentability thresholds, disharmony in patent application outcomes may exist. For example, a recent study compared the aggregate grant rates in the USPTO, the EPO, and the JPO and found that the proportion of original patent applications that are approved as patents varies between 64% (JPO) and 95–97% (USPTO).[6] However, this comparison is based on aggregate statistics from each of the offices and therefore it is not possible to determine whether the difference in observed granting rates is caused by the quality of the patent application or differences in the outcomes of the examination process. To determine how

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[4] *See* TRIPS, *supra* note 2, art. 27.

[5] The Trilateral Offices agreed to enhance their cooperation by further streamlining their procedures and common technical tools, signing a Memorandum of Understanding that aims to increase the efficiency of the patenting process and better exploit the work performed by each office using common technical tools and harmonized procedures. *See* Press Release, United States Patent and Trademark Office, Leaders of the Worlds' Three Major Patent Offices Sign Memorandum of Understanding (Nov. 19, 2004), http://www.uspto.gov/web/offices/com/speeches/04-31.htm; Trilateral Co-operation, Summary of 23rd Trilateral Conference (2005), http://www.trilateral.net/conf_sum/mou2005.pdf. The Trilateral Cooperation states that "[t]hrough harmonisation and development of industrial property administration and protection of industrial property rights, the Trilateral Offices strive to contribute to an increasingly efficient worldwide patent system in the 21st century." Trilateral Co-operation, http://www.trilateral.net (last visited Apr. 10, 2006).

[6] *See* Cecil D. Quillen, Jr. & Ogden H. Webster, *Continuing Patent Applications and Performance of the U.S. Patent and Trademark Office*, 11 Fed. Cir. B.J. 1, 3 (2001) [hereinafter Quillen & Webster, *2001 Study*]; Cecil D. Quillen, Jr., Ogden H. Webster & Richard Eichmann, *Continuing Patent Applications and Performance of the U.S. Patent and Trademark Office—Extended*, 12 Fed. Cir. B.J. 35, 36 (2002); Cecil D. Quillen, Jr. & Ogden H. Webster, *Continuing Patent Applications and the U.S. Patent and Trademark Office—Updated*, 15 Fed. Cir. B.J. ___, *3–5 (2006).

much disharmony exists, we need to determine whether the patent offices make consistent decisions *for a given invention*.

To achieve this end, we analyzed patent applications that have been submitted to all three offices and have a single common priority application—and should therefore cover the same invention specifications.[7] We constructed a dataset consisting of the population of 70,000 non-Patent Cooperation Treaty (PCT),[8] single, common priority patent applications (unit records) with priority years inclusive of the period 1990 through 1995.[9] Data on applications from the United States are not available for this period, so our dataset consists of all USPTO-granted patents that were also the subject of patent applications in the EPO and the JPO. Because estimates of the grant rates at the USPTO based on original applications are as high as 95–97%,[10] the degree of bias caused by omitting rejected USPTO applications in our dataset should be small. We analyzed the pattern of patent application outcomes in each patent office over time and across a number of variables. The results suggest that much disharmony exists: of those patents granted by the USPTO, only 37.7% were also granted by the EPO and the JPO.

This Article is structured as follows. In Part I, we consider some background to the patent harmonization debate, compare the differences in patent law (and patent examination processes) across jurisdictions and consider what

[7] Given that there is considerable interaction between the applicant and the office during the course of the examination process, it is possible that patents with common single priority dates do not have identical claims (and therefore the scope of the patent is different). *See, e.g.*, U.S. Patent & Trademark Office, U.S. Dep't of Commerce, Manual of Patent Examining Procedure § 714 (8th ed., rev. 4 2005). However, we cannot compare the details of the claims in each patent office as they are not directly observable from the data sources we used.

[8] A PCT application is a patent application filed through the Patent Cooperation Treaty, June 19, 1970, 28 U.S.T. 7645, 1160 U.N.T.S. 231 [hereinafter PCT]. The PCT provides for the filing of a single patent application having effect in designated PCT member countries, either by filing an application with the national patent office of the Contracting State (and designating it a PCT application), or at the applicant's option, filing an application with the International Bureau of WIPO in Geneva. *See id.*; 1 World Intellectual Prop. Org., PCT Applicant's Guide ¶¶ 11–13, 25 (2005), http://www.wipo.int/pct/guide/en/gdvol1/pdf/gdvol1.pdf [hereinafter PCT Applicant's Guide]. The PCT provides a convenient system for international applications; applicants may still choose to file individual applications in each country where they seek protection. *See* PCT Applicant's Guide, *supra*, at ¶ 11.

[9] Non-PCT applications were chosen because of the ease in downloading unit records. In the future, we will construct a comparable dataset using PCT applications, which requires the Japanese applications to be translated into English. We discuss possible selection biases that might arise from our use of non-PCT applications later in this Article.

[10] Quillen & Webster, *2001 Study*, *supra* note 6, at 3.

factors might affect the decision to grant a patent in one jurisdiction but not another. In Part II, we provide information on the construction of the patent dataset, and in Part III, we provide some descriptive analysis on the characteristics of international patent application outcomes. In Part IV, we analyze the characteristics of those patents where the trilateral offices are in disharmony with regard to the patent application outcomes. Finally, we draw some conclusions and implications for the patent harmonization debate.

I. Background

The current state of play with regard to international patenting is that an inventor who wants legal protection in different countries must apply for a patent in each jurisdiction.[11] Once a patent application has been lodged at the relevant patent offices, each office undertakes its own examination of the application.[12] Although similar patentability thresholds apply, each office conducts its own search for prior art and uses different tests to examine the size of the inventive step involved in the invention.[13] Thus, it is possible that a single invention that results in patent applications in multiple jurisdictions will be granted a patent by one office and rejected by others.[14]

There are several apparent problems with the existing state of affairs; problems at the center of the push for harmonizing international patent procedures.[15] First, the fact that an invention could be granted protection in one market but denied protection in others creates uncertainty for firms interested in launching new products in multiple markets. From a welfare

[11] BitLaw, PCT Patents and Other International Patents, http://www.bitlaw.com/patent/international.html (last visited Apr. 10, 2006).

[12] 2 World Intellectual Prop. Org., PCT Applicant's Guide, ¶ 7 (2004), http://www.wipo.int/pct/guide/en/gdvol2/pdf/gdvol2.pdf [hereinafter 2 PCT Applicant's Guide]. Even in instances where an applicant files a PCT application, the patent will still be examined separately in each jurisdiction. PCT, *supra* note 8, arts. 25, 27.

[13] *See generally* Melanie J. Howlett & Andrew F. Christie, *An Analysis of the Approach of the European, Japanese and United States Patent Offices to Patenting Partial DNA Sequences (ESTs)*, 34 Int'l Rev. Indus. Prop. & Copyright L. 581 (2003), *available at* http://ssrn.com/abstract=573184 (describing a project in which the Trilateral Offices examined several identical, hypothetical claims according to the offices' own internal standards and finding significant differences across the three offices). The Howlett & Christie article provides insight into the causes of the differences observable from the grounds for rejecting the patent application (non-obviousness, lack of utility, etc.). *See id.* In this Article, however, we observe only the application outcome and not the reasons for a particular decision.

[14] *See id.* at 600.

[15] We are only concerned here with application and examination aspects of patent harmonization. We ignore issues such as differences in legal rules relating to legislation or the enforcement of patents in court.

perspective, either it attenuates the ex ante incentive to invest in innovation by permitting copying in one jurisdiction, or it implies an unwarranted grant of a monopoly patent right in the other jurisdiction.[16] Second, the existence of independent patent examinations in each patent office is inefficient. The duplication of examination costs has been conservatively estimated to be US$150 million for filing a patent in two jurisdictions.[17] This estimate is conservative as it does not include translation costs—which are substantial, for example, when applying for a Japanese patent in English—or additional legal fees associated with patent application; it merely accounts for the additional filing fees incurred when applying for a patent in two jurisdictions.

While there are strong a priori reasons for arguing that patent harmonization—at least of the examination process—will eliminate the inefficiency and uncertainty created by the existing system, the case for harmonization is tempered by the fact that it is unclear which country's patenting standard should be adopted. If the lowest common denominator became the universal standard, there might be adverse consequences for future innovation investment because a low inventive step threshold may induce patent thickets and other anticompetitive effects.[18] In addition, a world patent system would prevent sovereign nations from making unilateral changes to national legislation in the event of unforeseen future events. Such a system may impose deadweight losses on developing countries that are signatories to the PCT or the Paris

[16] Assuming that patents are intended to act as an incentive to invest in innovation, a patent granted in one country but not another means that either: (a) the incentive is necessary, but reduced by the grant in one country and not another; or (b) the incentive is not necessary and hence the monopoly represents a simple deadweight loss. *See generally* William M. Landes & Richard A. Posner, The Economic Structure of Intellectual Property Law 294–333 (2003) (discussing the law and economics of patents and patent grants and their roles as incentives to investment).

[17] Barton, *supra* note 1, at 345.

[18] Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard-Setting*, *in* 1 Innovation Policy and the Economy, 119 (Adam B. Jaffe et al. eds., 2001), Joseph Farrell & Robert P. Merges, *Incentives to Challenge and Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors and Why Administrative Patent Review Might Help*, 19 Berkeley Tech. L.J. 943, 944–46 (2004); Paul H. Jensen & Elizabeth Webster, *Achieving the Optimal Power of Patent Rights*, 34 Austl. Econ. Rev. 419, 419 (2004); 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, 588, 596–600 (1999).

Convention,[19] without inducing any economic benefit from additional investment in research and development.[20]

This Article, however, is not about the welfare effects of patent harmonization. Rather, it is concerned with a simpler set of issues: how much disharmony in patent application outcomes currently exists across the major patent offices in the world? Does the observed disharmony vary across variables such as the area of technology and the priority country? To address these questions, we considered what factors may affect the outcome of the patent application process in the different patent offices.

There are a number of reasons why patent application outcomes for a given invention may vary across patent offices. First, there may be differences in the legislative environment governing the different offices. The few, clearly recognized differences between legislation in the trilateral jurisdictions include the first-to-invent versus the first-to-apply rule, the scope of patentable matter and the interpretation of utility in biotechnology. Such differences in interpretation over what is patentable are known to have a difference in the outcomes of the patent examination process.[21]

Second, institutional factors may affect patent application outcomes because differences in resource allocations across the offices may affect the quality of the examination—as measured either by the time spent on each application or by the caliber of the examiner.[22] For example, it is known that examiners in more specialized areas have greater latitude as there are fewer peers to provide checks and balances than other areas.[23] Moreover, the incentives provided to patent examiners may affect patent application outcomes. In the USPTO, patent examiners' pay depends on the number of applications disposed of—which may provide a perverse incentive for patent examiners

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[19] Paris Convention for the Protection of Industrial Property, as last revised at the Stockholm Revision Conference, July 14, 1967, 21 U.S.T. 1583, 828 U.N.T.S. 303.

[20] There is considerable debate about the extent to which developing countries should adopt the same international standards in intellectual property law as developed countries. *See generally* Keith E. Maskus, Intellectual Property Rights in the Global Economy (2000).

[21] *See* Howlett & Christie, *supra* note 13, at 600–02.

[22] In our dataset, the average file-to-grant times of 2.0, 4.5 and 6.7 years were recorded for the USPTO, EPO, and JPO respectively. Only application year was available for the USPTO and we assumed that each application was filed on July 1 each year. Twenty-four percent of EPO applications were, by 2004, either withdrawn or pending. The respective figure for the JPO was 40%.

[23] Iain M. Cockburn, Samuel Kortum & Scott Stern, *Are All Patent Examiners Equal? The Impact of Characteristics on Patent Statistics and Litigation Outcomes* 8–9 (Nat'l Bureau of Econ. Research, Working Paper No. 8980, 2002), *available at* http://www.nber.org/papers/w8980.

in the USPTO to grant *bad* patents because the USPTO also has a policy of granting continuations that makes it difficult for patent examiners to reject patents.[24] Offices also differ in the way in which they determine whether an invention embodies an inventive step. The EPO, for example, uses a "problem and solution approach," whereas the JPO assesses what a person skilled in the art would do after searching the prior art.[25]

Third, applicant behavior may affect the outcome of the patent application process because the decision taken in each office does not occur within a vacuum: interaction between the applicant—or its agent—and the examiner is likely to affect the final outcome in each office. Such behavior depends on the magnitude of the costs of interaction relative to the commercial benefits from selling into each national market. For example, a grant decision may be more likely if applicants are persistent and amenable to revising their applications.

Finally, patent application outcomes may vary across key characteristics such as the technology area and the priority country. In this Article, we focus on how patent application outcomes vary across these patent characteristics. Patent application outcomes may vary across technology area if the application is in an emerging technology field, or if the application of the patent law to the field is relatively new, because it may be much harder to determine whether the application meets the patentability criteria. Moreover, the interpretation of the patentability criteria may differ from office to office. Biotechnology and information technology may be examples where such difficulties arise.[26] Additionally, it may be harder to reach consistent outcomes in technologies that are less codifiable or more uncertain.

In summary, there are numerous reasons why patent application outcomes may vary with priority country status: local applicants may be more familiar with the idiosyncrasies of the local patent system, for example, or difficulties in translation—relating to both language and cultural context—may disadvantage foreign applications relative to domestic applications. While others have argued that the fact that foreign applications have a lower probability of a positive decision may be due to the inclination by patent offices to use

[24] *See* Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. Rev. 63, 74–75 (2004).

[25] Howlett & Christie, *supra* note 13, at 589–91.

[26] *See, e.g.*, Julia Alpert Gladstone, *Why Patenting Information Technology and Business Methods is Not Sound Policy: Lessons from History and Prophecies for the Future*, 25 Hamline L. Rev. 217, 225–27 (2002); Justine Pila, *Bound Futures: Patent Law and Modern Biotechnology*, 9 B.U. J. Sci. & Tech. L. 326, 370–71 (2003).

patents as a non-tariff trade barrier[27] or for xenophobic reasons,[28] we cannot untangle these effects from the possibility that the observed lower probability is simply a result of errors in translation or other non-strategic reasons. All we intend to do here is analyze how the patent examination outcomes vary by the country of priority without attributing any possible causal reasons as to why this may occur.

II. Data

To analyze differences in patent application outcomes, we constructed a dataset consisting of the population of 70,473 non-PCT, single, common priority patent applications (unit records) with priority years from 1990 to 1995. The dataset was compiled from four main sources: (1) the Organisation for Economic Co-operation and Development (OECD) Triadic Patent Family (TPF) database;[29] (2) the EPO's public access online database;[30] (3) the JPO's public access Industrial Property Digital Library (IPDL) online databases (Patent & Utility Model Concordance, both English[31] and Japanese[32] versions, and the Japanese-only database[33]); and (4) the National Bureau of Economic Research (NBER) Patent-Citations Data File.[34]

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[27] Nancy J. Linck & John E. McGarry, *Patent Procurement and Enforcement in Japan—A Trade Barrier*, 27 Geo. Wash. J. Int'l L. & Econ. 411, 411 (1994).

[28] *See generally* Kimberly A. Moore, *Xenophobia in American Courts*, 97 Nw. U. L. Rev. 1497 (2003) (providing some evidence that there is bias against foreigners in American courts with to regard patent litigation cases). It is also possible that similar biases exist at the patent examination stage.

[29] Organisation for Economic Co-operation and Development, OECD Work on Patents, http://www.oecd.org/scripts/cde/members/patentfamiliesauthenticate.asp (last visited Apr. 10, 2006).

[30] European Patent Office, esp@cenet® and the IPC Reform IPC8, http://ep.espacenet.com/search97cgi/s97_cgi.exe?Action=FormGen&Template=ep/EN/home.hts (last visited Apr. 10, 2006).

[31] Industrial Property Digital Library, Patent & Utility Model Concordance, http://www4.ipdl.ncipi.go.jp/Tokujitu/tjbansakuen.ipdl?N0000=116 (last visited Apr. 10, 2006) (English language version).

[32] Industrial Property Digital Library, Patent & Utility Model Concordance, http://www.ipdl.ncipi.go.jp/Tokujitu/tjbansaku.ipdl?N0000=110 (last visited Mar. 16, 2006) (Japanese language version).

[33] Industrial Property Digital Library, http://www1.ipdl.ncipi.go.jp/SA1/sa_search.cgi?TYPE=000&sTime=1089941778920 (last visited Apr. 10, 2006) (Japanese-only database).

[34] Bronwyn H. Hall, Adam B. Jaffe & Manuel Trajtenberg, *The NBER Patent-Citations Data File: Lessons, Insights, and Methodological Tools*, *in* Patents, Citations, and Innovations: A Window on the Knowledge Economy 403, 407–09 (Adam B. Jaffe & Manuel Trajtenberg eds., 2002) (describing the Patent-Citations Data File).

The first database provided us with a list of triadic patent families, "defined as a set of patents taken in various countries to protect a same invention" where the "priority application must have at least one equivalent patent at the EPO, at the USPTO and at the JPO."[35] The TPF database contains triadic patent families for patents with priority years in the period of 1978–2003. However, to allow for ample examination time and minimize the amount of data truncation with regards to the application outcome, we only used data with priority years up to 1995. In effect, this provided approximately eight years of examination time from the claimed priority application, because we did not extract the data from the online EPO and JPO databases until late 2004. In addition, to take into account changes in patent application procedures at the JPO following the 1988 Japanese Patent Law reforms,[36] we limited our data to those patent applications whose priority year is 1990 or later. Considering the entire dataset, 99.9% of priority applications were lodged in both the JPO and EPO by the end of 1996.

To control for the quality of application, we only used patent families with a single priority application. Patent families with multiple priorities may have multiple applications through divisionals, which would result in a variation in the applications filed across offices—making comparing the outcomes problematic.[37] Finally, it was not possible to extract information on PCT examination outcomes in the JPO and we were forced to limit our analysis to non-PCT filings only.[38] Thus, all 70,473 patents in our final dataset relate to non-PCT complete patent applications with a single patent application filed at the EPO, a single patent application filed at the JPO, and a single patent application granted as a patent by the USPTO. A summary of the numbers of complete patent applications is provided in Table 1.

[35] Hélène Dernis & Mosahid Khan, *Triadic Patent Families Methodology* 14 (OECD Sci., Tech. & Indus., Working Paper No. 2004/2, 2004).

[36] *See* Mariko Sakakibara & Lee Branstetter, *Do Stronger Patents Induce More Innovation? Evidence from the 1988 Japanese Patent Law Reforms*, 32 RAND J. of Econ. 77, 78–79 (2001).

[37] For a similar reason, we also dropped any families involving continuation, continuation-in-parts, or divisional patent applications at the USPTO.

[38] However, PCT applications only represented 10% of triadic patent families during this period.

Table 1. Summary of Patent Applications in the Trilateral Offices, 1990–1995

Office of Application	Complete Patent Applications/Families
USPTO	843,435
EPO	433,186
JPO	2,191,084
All Triadic Patent Families	190,583
• PCT families	18,488
• Non-PCT families	172,095
-single priority	70,477
-multiple priorities	101,618

While the aim of selecting only single-priority, single-application filings was to ensure we had a matched sample with respect to both the invention and the substance of the application as far as possible, the effect of this selection, together with the necessity to limit ourselves to non-PCT filings, suggests that our dataset may be a biased sample of the population of all applications filed at the USPTO, the EPO, and the JPO. In particular, it is possible that the applications in our dataset have more commercial potential than applications that were confined to only one national office, but possibly less commercial potential than applications filed in more than three offices, and would thus probably result in taking the PCT route. The effect of disregarding applications with multiple priorities may also introduce unknown biases.[39]

The second and third data sources provided us with information on the status of applications at the EPO and the JPO. Using the list of EPO and JPO application numbers in the TPF database, we downloaded all necessary information from these online databases corresponding to each patent application. The types of information we collected included dates of filing, publication, examination request, notification of refusal, withdrawal, abandonment, rejection, appeal, appeal decision, grant/registration, and opposition. From the EPO database, we also collected information related to certain characteristics of the patent applications such as technology classes, names and countries of inventors, names and countries of applicants, title, citations, and claims. Based on the dates collected above, we classified the outcome of the patent examination process as pending, withdrawn, rejected, or granted.[40] Finally,

[39] In addition, we excluded applications that resulted in divisionals or continuations, but these only affected four out of our population of 70,477 families.

[40] More precisely, withdrawn in the EPO included *deemed withdrawn*, *withdrawn* and *disposed*, and in the JPO it included *disposed*, *deemed withdrawn*, *withdrawn*, and *abandoned*. Pending in the EPO included *undecided* and *appealed*, and in the JPO it included *undecided*, *notified*, and *appealed*. Rejected in the EPO included *rejected*, and in the JPO it included

we match-merged the applications data we obtained from the TPF database with the NBER patent database using the USPTO patent numbers.

III. Patent Application Outcomes

Table 2 shows the application outcomes at the JPO for the set of matched patent applications. Note that all data are conditional on the application being granted in the United States. There are a number of striking features of the data presented in Table 2. The first observation is that there is a low proportion of grants and a high proportion of rejects by the JPO of patents that have been granted by the USPTO. On average across the six priority years, 44.5% of patents granted by the USPTO were granted by the JPO, while 14.6% of patents granted by the USPTO were rejected by the JPO. The trend in both the rate of grant and rejection by the JPO is falling: that is, over time, the JPO seems to be less likely to reject a patent granted by the USPTO, but it also seems to be less likely to grant a patent already granted by the USPTO.

Table 2. Patent Application Outcomes at the JPO, by Priority Year

Priority Year	Withdrawn[b]	Pending[c]	Rejected	Granted	Total
1990	4,661	224	2,342	7,163	14,390
1991	3,723	307	2,095	6,280	12,405
1992	3,285	475	1,976	5,279	11,015
1993	3,052	1,099	1,777	4,752	10,680
1994	3,039	2,471	1,143	4,034	10,687
1995	3,119	3,382	918	3,825	11,244
Total	20,879	7,958	10,251	31,333	70,421[a]
% of all applications	29.7	11.3	14.6	44.5	100
% of all examinations			25	75	100

[a] There were 52 *missing* observations which are not included here.

[b] 96.5% of those withdrawn applications at the JPO had *not* requested an examination by the end of 2004.

[c] 97.5% of those applications still pending had requested an examination by the end of 2004.

Much of this result can be explained by the high proportion of withdrawn (29.7%) and pending (11.3%) applications. The rate of withdrawn applications is constant over time, which suggests that there may be significant issues associated with applicant behavior because it is typically applicants

invalid, *rejected*, *declined*, and *appeal refused*. Granted in the EPO included *granted*, and in the JPO it included *registered*. This approach to coding patent application outcomes is similar to that used by Dietmar Harhoff & Stefan Wagner, *Modelling the Duration of Patent Examination at the European Patent Office* 5, 11–12 (Ctr. for Econ. Policy Research, Working Paper No. 5283, 2005), *available at* http://www.cepr.org/pubs/dps/DP5283.asp.

who choose to withdraw or abandon an application. There is a fairly strong increase in the rate of pendency over time, suggesting that, despite our best efforts, there may be truncation issues in the dataset. The last observation regarding the JPO outcomes data relates to the outcome of patent application procedures where there is a final decision on the examination—i.e., grant or rejection—which is presented in the last row of Table 2. When we ignore the withdrawn and pending applications, we see that the JPO rejects 25% and grants 75% of those patents granted by the USPTO. However, this probably under-estimates the level of rejected applications because it is likely that many of the withdrawn applications would have been rejected if the examination process had been finalized.

The patent application outcomes observed at the JPO are quite different from those at the EPO, which are presented in Table 3. The most marked differences relate to the grant and reject rates: on average across the six priority years studied, the EPO granted 72.5% and rejected 3.8% of the patents granted by the USPTO. Other major differences between the two offices included the EPO's much lower average rate of withdrawn applications (18.5%) compared to the JPO (29.7%) and that the average rate of pending decisions (5.1%) at the EPO was approximately half the level of that observed at the JPO (11.3%). Once more, the increasing trend in pendency suggests a truncation problem with the EPO data, albeit much less severe than with the JPO data. If we consider just the applications where a final examination decision has been made, we can see that the EPO grants 95% and rejects 5% of the patents granted by the USPTO. However, for the same reasons as above, the level of rejected applications is probably masked by the high rate of withdrawn applications.

Table 3. Patent Application Outcomes at the EPO, by Priority Year

Priority Year	Withdrawn[b]	Pending[c]	Rejected	Granted	Total
1990	2,857	324	687	10,526	14,394
1991	2,330	224	474	9,369	12,397
1992	1,946	231	399	8,431	11,007
1993	1,805	367	395	8,095	10,662
1994	2,025	799	353	7,471	10,648
1995	2,072	1,671	369	7,082	11,194
Total	13,035	3,616	2,677	50,974	70,302[a]
% of all applications	18.5	5.1	3.8	72.5	100
% of all examinations			5	95	100

[a] There were 171 *missing* observations which are not included here.

[b] 16.0% of those applications withdrawn at the EPO had *not* requested an examination by end 2004.

[c] 100% of those applications still pending at the EPO had requested an examination by the end of 2004.

While the data on the patent application outcomes in each office provide valuable information, of more interest is the interaction of the outcomes across all three offices. Are the applications rejected by the EPO the same as those rejected by the JPO? To determine this, Table 4 shows a cross-tabulation of the EPO and JPO patent application outcomes—once again, conditioned on the patent being granted by the USPTO. It reveals that 37.7% of USPTO grant decisions are affirmed by *both* of the other offices and that 0.6% of applications are being rejected by both offices. Moreover, it shows that 10.0% of those patents granted by both the USPTO and the EPO are rejected by the JPO, while only 1.0% of those patents granted by the by the USPTO and the JPO are rejected by the EPO. In many ways, the 2x2 matrix highlighted in Table 4 is at the heart of the patent harmonization debate, at least as it pertains to patent examination procedures and outcomes.

Table 4. Cross-Tabulation of Patent Application Outcomes, Priority Years 1990–1995

	EPO				
JPO	**Withdrawn**	**Pending**	**Rejected**	**Granted**	**Total**
Withdrawn	7,064	1,024	1,403	11,304	20,795
(%)	10.1	1.5	2.0	16.1	29.6
Pending	698	914	142	6,174	7,928
(%)	1.0	1.3	0.2	8.8	11.3
Rejected	2,361	406	439	7,024	10,230
(%)	3.4	0.6	0.6	10.0	14.6
Granted	2,892	1,261	688	26,456	31,297
(%)	4.1	1.8	1.0	37.7	44.6
Total	13,015	3,605	2,672	50,958	70,250[a]
(%)	18.5	5.1	3.8	72.5	100

[a] There were 223 *missing* observations that have been removed.

The other striking feature of Table 4 is the high proportion of patents granted by the USPTO that were either withdrawn or still awaiting a decision at either of the other offices. Specifically, of those patent applications granted by the USPTO, 29.6% were withdrawn at the JPO while 18.5% were withdrawn at the EPO. Moreover, 10.1% of all patents granted by the USPTO were withdrawn at *both* the JPO and the EPO. This is an important, and often overlooked, dimension of the patent harmonization debate: it provides further evidence that patents are being granted by the USPTO that are not being granted elsewhere. While there are many reasons why such applications are withdrawn, a substantial proportion has presumably been abandoned by applicants who have realized that the marginal cost of continuing with the

application is greater than the marginal benefit.[41] Some of these may have been granted if the examination proceeded, but no doubt many would have been rejected or modified substantially.

The number of applications where a decision was still pending at the EPO or the JPO is also of concern. Specifically, 11.3% of patent applications at the JPO still had decisions pending and 5.1% of all patent applications were still pending at the EPO. The lack of a decision in these instances is a concern for economists because of the uncertainty that it creates for investment decisions. Although there is an ongoing debate about the optimal length of patent examination,[42] the fact that some decisions are still pending after 10 years is troublesome. One possible explanation for the high rate of pending applications at the JPO is that it is a result of the seven year window allowed to request (and examine) an application.[43]

The main conclusion to be drawn is that a substantial amount of disharmony exists across the trilateral offices: from our matched sample, only 37.7% of the patent applications granted by the USPTO were also granted by the EPO and the JPO. The remaining applications (62.3%) were either rejected outright, were withdrawn (or deemed withdrawn), or were still awaiting a final decision. Although much of the disharmony appears to be centered in the JPO, this is not to say that the JPO is making mistakes in its patent examination procedures.[44] In fact, it is difficult to determine whether the JPO was correct in rejecting the 7,024 patents granted by the USPTO

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[41] Analysis of our dataset indicates that 75.9% and 95.4% of all the withdrawn applications at the EPO and the JPO, respectively, were deemed withdrawn; that is, the applicant failed to respond to the patent office.

[42] *See, e.g.*, Harhoff & Wagner, *supra* note 40, at 7–8; *see also* Pierre Régibeau & Katharine Rockett, *Are More Important Patents Approved More Slowly and Should They Be?* 1–2 (Univ. of Essex, Dep't of Econ., Working Paper No. 556, 2003), *available at* http://www.essex.ac.uk/economics/discussion-papers/papers-text/dp556.pdf.

[43] From analyzing our data, we know that at the JPO, the median applicant requested an examination by 5.75 years and the vast majority waited until the maximum period allowed (7 years). Almost all applicants who withdraw allow the application to lie pending for the maximum time and presumably withdraw by default. At the EPO, applicants request examination within 2.5 years and are deemed withdrawn within 3 years.

[44] *See* Jensen & Webster, *supra* note 18, at 421 (arguing that differences in patent examination outcomes across patent offices can be thought of as either Type I or Type II errors). For example, if a patent is granted by the USPTO and the EPO but rejected by the JPO, either the JPO has rejected a patent application that *should* have been granted (a Type I error), or the USPTO and the EPO have granted patents that *should not* have been granted (a Type II error). It is the Type II errors that many commentators have argued have contributed to the proliferation of patent thickets in the United States. *See, e.g.*, Shapiro, *supra* note 18, at 119–22. However, Jensen and Webster point out that it is very difficult

and EPO because we cannot observe the reasons for the rejection, nor do we have perfect knowledge of the patentability threshold. Nevertheless, it is the JPO that seems to be in disagreement with the other two offices about which patent applications to grant and which to reject. Moreover, many of the patents granted by the USPTO were withdrawn or remain pending at the JPO and the EPO.

IV. Analysis of Patent Disharmony

The objective of this section is to analyze the characteristics of patent disharmony. Specifically, we looked more closely at the JPO outcomes for those 50,958 applications that were granted by both the USPTO and the EPO. We broke these applications down by both technology area and priority country to ascertain whether these characteristics vary systematically with patent application outcomes. We then did exactly the same thing with the EPO patent application outcomes by looking at the characteristics of the 31,297 patent applications that were granted by the USPTO and the JPO, but not the EPO.

Figure 1 presents a summary of the JPO patent application outcomes (conditional on being granted by the USPTO and the EPO) disaggregated into 30 Office of Science and Technology (OST) technology groups.[45] This suggests there are some significant differences by technology area. Biotechnology had the highest grant rate (59.8%), and the lowest outright reject rate (6.6%), but it also had a high rate of pending decisions (21.5%). Other technology areas with high rates of patent grants in the JPO were semiconductors (58.0%) and telecommunications (56.6%). Engine pump turbines had the lowest grant rate (42.7%) and a moderately high reject rate (15.6%). Optics also had both a low grant rate (49.6%) and the highest reject rate (18.0%). Overall, this suggests there is substantial variation across technology areas for those patent applications where the JPO disagrees with the USPTO and the EPO.

The other interesting dimension of the data on patent application outcomes at the JPO is the high proportion of non-decisions; that is, pending applications and withdrawals. There do appear to be some differences across technology areas with regard to the rate of pending applications and withdrawals. For example, basic chemical processes and petroleum had a very high withdrawal rate (30.1%) compared to other technology areas such as biotechnology

to determine whether a Type I or Type II error has been committed. *See* Jensen & Webster, *supra* note 18, at 421.

[45] Office of Science and Technology, Department of Trade and Industry, United Kingdom classifications. See http://www.ipaustralia.gov.au/about/statistics.shtml#patents (last visited Apr. 11, 2006) for details of the classification system. The data on JPO patent application outcomes are presented in Appendix I.

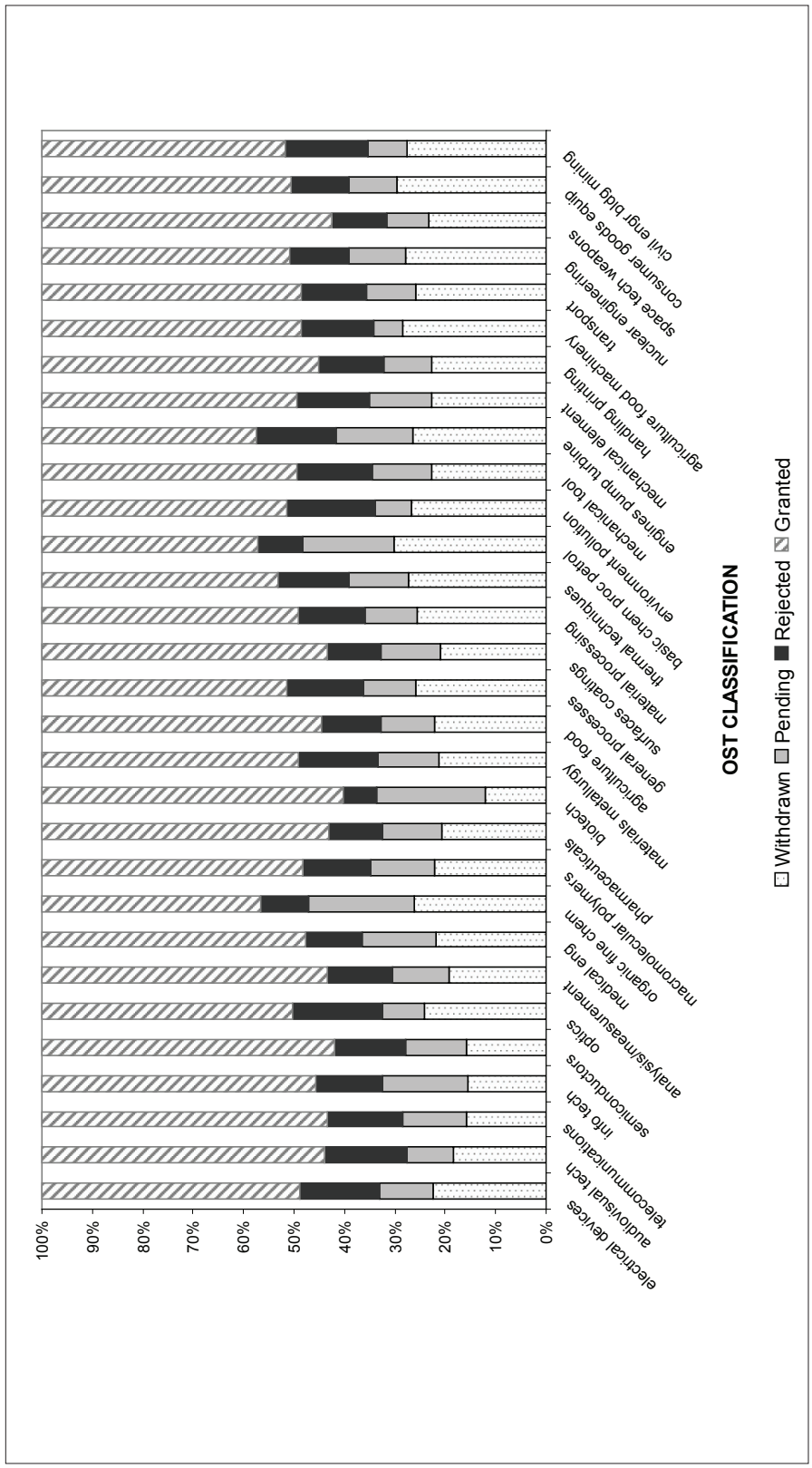


Figure 1. JPO Patent Application Outcomes Conditional on Grant by the USPTO and the EPO, by OST Classification

(12.0%). This provides additional support for the contention that technology area plays an important role in patent application outcomes.

Figure 2 presents data on EPO patent application outcomes (conditional on being granted by the USPTO and the JPO) disaggregated into 30 OST technology groups.[46] Comparing the data from the JPO with that of the EPO, a couple of observations stand out. First, if an application has been granted by both of the other offices, the EPO is much more likely to grant the application than is the JPO. This is reflected in Figure 2 by the fact that the proportion of patent applications granted at the EPO ranges from 67.5% (information technology) and 68.8% (semiconductors) to 94.6% (handling and printing). Second, the EPO is much less likely than the JPO to reject or withdraw an application that has been granted by the other two offices. For example, the highest level of withdrawn applications at the EPO for patents granted by both the USPTO and the JPO is 22.8% (information technology).

Following this, we cut the data on JPO application outcomes by priority country[47] (conditional on being granted by the USPTO and the EPO) and found substantial inter-country differences. Figure 3 shows patent application outcomes for priorities from Japan, Germany, the United States and all other countries. Japanese priority applications have a much higher grant rate (69.9%) in the JPO than the United States (49.7%), Germany (40.3%) and all other countries (41.8%).[48] Moreover, Japanese priority applications have a slightly lower reject rate (12.3%) by contrast with Germany (12.9%) and the rest of the world (14.4%). Much of the difference between Japanese applicants and the rest of the world is due to withdrawal rates, which may be explained by non-Japanese applicants changing their mind about the invention after the USPTO and EPO examination, but before having to request a JPO examination.

In the same way, Figure 4 presents the data on the EPO application outcomes by priority country. Once again, the figure illustrates the fact that the EPO has a much higher grant rate than the JPO for applications that have already been granted by the USPTO and the JPO. Overall, the data suggest that there are some differences in patent application outcomes by priority country in the EPO. For example, German patent applications are more likely to be granted (94.0% are granted) than applications from the U.S. (76.9%), Japan (83.9%), and other countries (91.5%). At the same time, German patent applications at the EPO are also less likely to be pending (1.8%) than

[46] The data on EPO patent applications by OST Classification are presented in Appendix II.

[47] Priority country is highly correlated with the addresses of both the applicant(s) and inventor(s).

[48] The data for Figures 3 and 4 are presented in Appendix III.

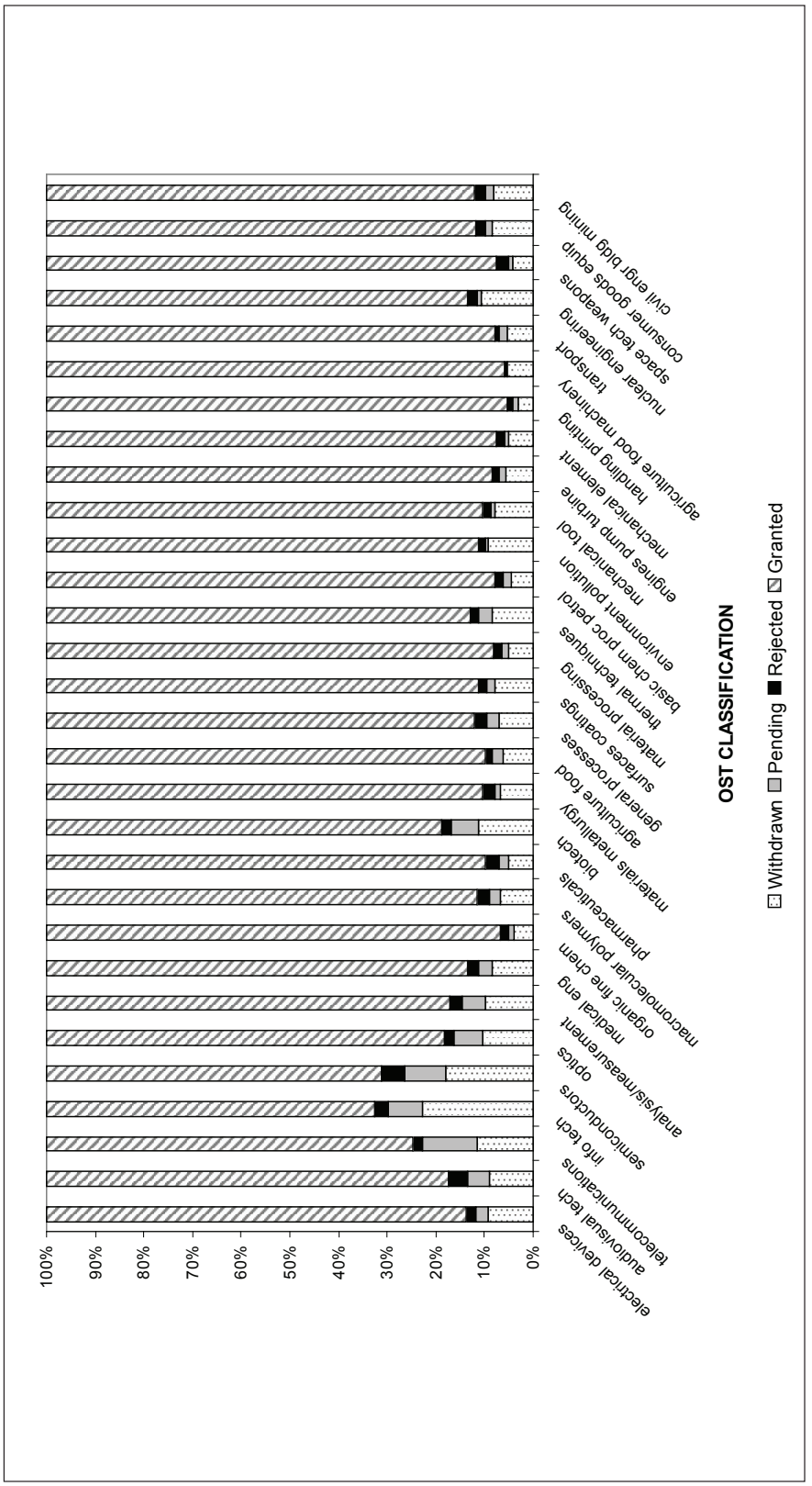


Figure 2. EPO Patent Application Outcomes Conditional on Grant by the USPTO and the JPO, by OST Classification

Figure 3. Priority Country and JPO Application Outcomes Conditional on Patent Grant in the USPTO and the EPO

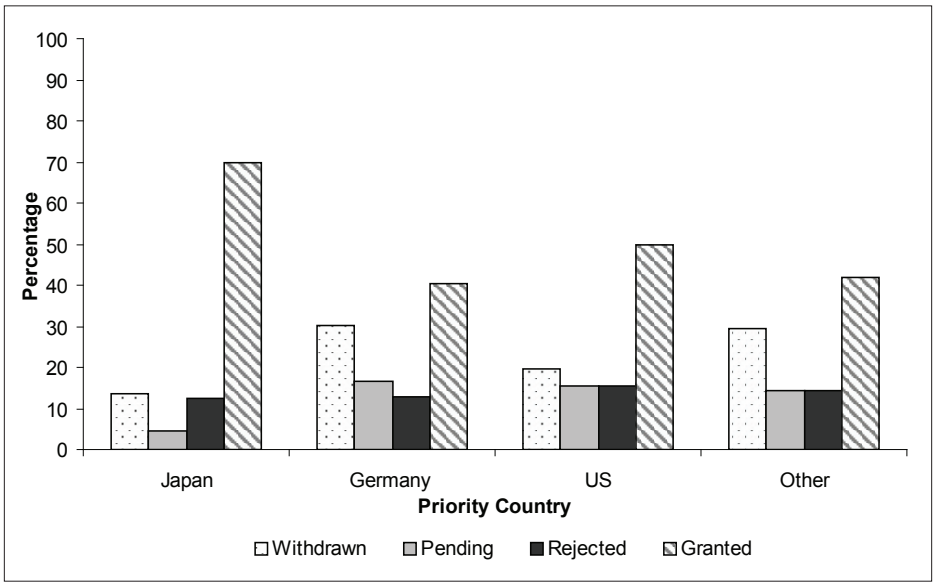
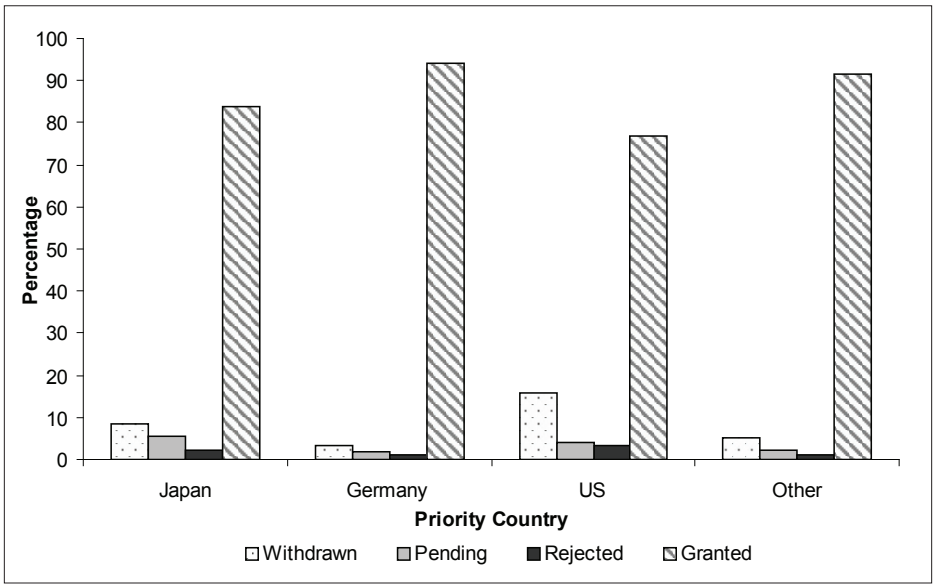


Figure 4. Priority Country and EPO Application Outcomes Conditional on Patent Grant in the USPTO and the JPO



applications from the U.S. (4.0%), Japan (5.6%), or other countries (2.3%). Overall, this suggests that of the patents already approved by the USPTO and the JPO, German patent applicants are more likely to get a positive and certain decision than applicants from other countries.

Conclusions

This Article examined the application outcomes for all non-PCT patent applications with priority years 1990–1995 granted by the USPTO and submitted to the JPO and the EPO. The results suggest that despite the efforts of the trilateral patent offices (and other supporting efforts under the umbrella of patent harmonization), there is significant disharmony in patent application outcomes. For instance, only 37.7% of all patents granted by the USPTO were also granted by the JPO and the EPO; the remainder (62.3%) were either rejected, withdrawn, or were still awaiting a final decision. Such disharmony may have important economic effects because it induces uncertainty into the ex ante investment decisions firms make with regard to innovation if their inventions are protected in some jurisdictions but not others. Much of the disharmony is centered on differences between the JPO and the other two offices. While it is tempting to argue that the JPO must be making *mistakes* in its patent examination procedures, such a conclusion is erroneous because we cannot tell whether it is Japan that is rejecting *good* patents (Type I error) or whether the USPTO and the EPO are granting *bad* patents (Type II error).

Another insight from this Article relates to the high incidence of withdrawn and pending patent applications at the JPO and the EPO. Despite our efforts to avoid truncation problems, the number of applications for which a decision was still pending—11.3% at the JPO and 5.1% at the EPO—is quite alarming. Presumably, a patent application that takes more than 10 years to acquire a clear legal decision with regard to its patentability creates uncertainty in the investment climate. Similar concerns can be voiced with regard to the high incidence of withdrawn applications, many of which can be thought of as quasi-rejects since many applicants chose to withdraw (or abandon) an application after receiving a critical initial examination report. Regardless of the reasons why these applications were abandoned at the EPO and the JPO, it reinforces the fact that many patents granted by the USPTO are not granted in other jurisdictions. More research should be undertaken to examine the economic effects of this phenomenon.

We also analyzed whether application outcomes vary across different observable characteristics of the patents themselves (technology area and priority country). Our results suggest that the application outcomes do vary significantly across both dimensions. Priority country appears to have a strong effect on the outcome of decisions at both the JPO and the EPO. Once again, it might be tempting to infer that the JPO and the EPO are simply using patents as a type of strategic non-tariff trade barrier. However, we cannot tell—nor do we attempt to in this Article—whether this is due to strategic factors or whether it is just that local applicants are more familiar with the idiosyncrasies of the domestic patent system, for example.

There are a couple of important caveats to our analysis. First, we cannot observe the individual claims in each patent application so we cannot be sure that each single, common priority patent application is for exactly the same invention. It is conceivable that during the course of the examination process in each office, the claims within the patent were modified and that the resulting patents are, in fact, slightly different. To our knowledge, there have been no large-scale studies to test whether this factor does vary systematically across offices. However, we do know that there is a strong correlation between the number of claims in each single, common priority patent in our dataset and are therefore confident that the patent application outcomes we are comparing here are for essentially the same invention.

Second, we cannot observe the reasons why a patent office rejects a given patent application, so we have no way of determining whether a patent rejected in one jurisdiction is a Type I error, i.e., rejecting a *good* patent. Ultimately, one of the goals of patent harmonization must be to ensure that all patent offices grant *good* patents and reject *bad* patents.[49] One way to examine this would be to have a specialist patent attorney analyze the specifics of patent applications to see whether the patents were rejected on valid grounds. It is also possible that the Type I/Type II error distinction could be sorted out by examining patent renewal data or the outcomes of patent litigation. A court challenge is the ultimate test of a patent's validity but unfortunately doesn't provide us with much valuable information, as only a small fraction of patents granted ever end up in court.[50]

[49] *See generally* Barton, *supra* note 1, at 346–48.

[50] There are a number of empirical studies examining patent litigation outcomes and their implications for patent quality. *See generally* John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185 (1998); Kimberly A. Moore, *Judges, Juries, and Patent Cases—An Empirical Peek Inside the Black Box*, 99 Mich. L. Rev. 365 (2000); Kimberlee G. Weatherall & Paul H. Jensen, *An Empirical Investigation into Patent Enforcement in Australian Courts*, 33 Fed. L. Rev. 239 (2005).

Appendix I. JPO Patent Application Outcomes, by OST Classification

OST Classification	Withdrawn	Pending	Rejected	Granted	Subtotal
Electrical devices	806	374	566	1,835	3,581
%	22.5	10.4	15.8	51.2	100
Audiovisual technology	324	159	288	978	1,749
%	18.5	9.1	16.5	55.9	100
Telecommunications	731	579	694	2,613	4,617
%	15.8	12.5	15.0	56.6	100
Information technology	461	496	392	1,598	2,947
%	15.6	16.8	13.3	54.2	100
Semiconductors	210	162	187	771	1,330
%	15.8	12.2	14.1	58.0	100
Optics	836	279	622	1,712	3,449
%	24.2	8.1	18.0	49.6	100
Analysis/measurement	672	385	449	1,965	3,471
%	19.4	11.1	12.9	56.6	100
Medical engineering	342	227	177	818	1,564
%	21.9	14.5	11.3	52.3	100
Organic fine chemistry	728	584	264	1,211	2,787
%	26.1	21.0	9.5	43.5	100
Macromolecular polymers	545	313	335	1,277	2,470
%	22.1	12.7	13.6	51.7	100
Pharmaceuticals	212	119	109	582	1,022
%	20.7	11.6	10.7	56.9	100
Biotechnology	38	68	21	189	316
%	12.0	21.5	6.6	59.8	100
Materials metallurgy	304	171	228	728	1,431
%	21.2	11.9	15.9	50.9	100
Agriculture food	69	33	37	173	312
%	22.1	10.6	11.9	55.4	100
General processes	453	182	265	848	1,748
%	25.9	10.4	15.2	48.5	100
Surfaces coatings	206	116	103	554	979
%	21.0	11.8	10.5	56.6	100
Material processing	585	241	304	1,166	2,296
%	25.5	10.5	13.2	50.8	100
Thermal techniques	150	64	78	256	548
%	27.4	11.7	14.2	46.7	100
Basic chemical processes petrol	351	211	106	499	1,167
%	30.1	18.1	9.1	42.8	100
Environment pollution	79	22	52	144	297
%	26.6	7.4	17.5	48.5	100
Mechanical tool	337	176	221	748	1,482
%	22.7	11.9	14.9	50.5	100
Engines pump turbine	382	222	225	617	1,446
%	26.4	15.4	15.6	42.7	100
Mechanical element	390	214	246	866	1,716
%	22.7	12.5	14.3	50.5	100
Handling printing	771	322	435	1,861	3,389
%	22.8	9.5	12.8	54.9	100
Agriculture food machinery	69	14	35	125	243
%	28.4	5.8	14.4	51.4	100

OST Classification	Withdrawn	Pending	Rejected	Granted	Subtotal
Transport	553	211	276	1,096	2,136
%	25.9	9.9	12.9	51.3	100
Nuclear engineering	98	39	41	172	350
%	28.0	11.1	11.7	49.1	100
Space technology weapons	44	16	21	109	190
%	23.2	8.4	11.1	57.4	100
Consumer goods equipment	407	133	157	683	1,380
%	29.5	9.6	11.4	49.5	100
Civil engineering building mining	150	42	89	262	543
%	27.6	7.7	16.4	48.3	100
Unclassified	1	0	1	0	2
%	50.0	0.0	50.0	0.0	100
TOTAL	11,304	6,174	7,024	26,456	50,958
%	22.2	12.1	13.8	51.9	100

Appendix II. EPO Patent Application Outcomes, by OST Classification

OST Classification	Withdrawn	Pending	Rejected	Granted	Subtotal
Electrical devices	194	57	39	1,835	2,125
%	9.1	2.7	1.8	86.4	100
Audiovisual technology	107	51	48	978	1,184
%	9.0	4.3	4.1	82.6	100
Telecommunications	405	384	75	2,613	3,477
%	11.6	11.0	2.2	75.2	100
Information technology	539	163	68	1,598	2,368
%	22.8	6.9	2.9	67.5	100
Semiconductors	200	97	53	771	1,121
%	17.8	8.7	4.7	68.8	100
Optics	218	121	47	1,712	2,098
%	10.4	5.8	2.2	81.6	100
Analysis/measurement	231	118	55	1,965	2,369
%	9.8	5.0	2.3	82.9	100
Medical engineering	80	25	22	818	945
%	8.5	2.6	2.3	86.6	100
Organic fine chemistry	52	15	21	1,211	1,299
%	4.0	1.2	1.6	93.2	100
Macromolecular polymers	96	34	36	1,277	1,443
%	6.7	2.4	2.5	88.5	100
Pharmaceuticals	33	13	17	582	645
%	5.1	2.0	2.6	90.2	100
Biotechnology	26	13	5	189	233
%	11.2	5.6	2.1	81.1	100
Materials metallurgy	54	10	20	728	812
%	6.7	1.2	2.5	89.7	100
Agriculture food	12	4	3	173	192
%	6.3	2.1	1.6	90.1	100
General processes	69	22	25	848	964
%	7.2	2.3	2.6	88.0	100
Surfaces coatings	49	11	11	554	625
%	7.8	1.8	1.8	88.6	100
Material processing	65	17	23	1,166	1,271
%	5.1	1.3	1.8	91.7	100
Thermal techniques	25	8	5	256	294
%	8.5	2.7	1.7	87.1	100
Basic chemical processes petrol	25	8	9	499	541
%	4.6	1.5	1.7	92.2	100
Environment pollution	15	1	2	144	162
%	9.3	0.6	1.2	88.9	100
Mechanical tool	65	8	15	748	836
%	7.8	1.0	1.8	89.5	100
Engines pump turbine	37	11	8	617	673
%	5.5	1.6	1.2	91.7	100
Mechanical element	47	9	16	866	938
%	5.0	1.0	1.7	92.3	100
Handling printing	63	21	23	1,861	1,968
%	3.2	1.1	1.2	94.6	100
Agriculture food machinery	7	0	1	125	133
%	5.3	0.0	0.8	94.0	100

OST Classification	Withdrawn	Pending	Rejected	Granted	Subtotal
Transport	63	20	12	1,096	1,191
%	5.3	1.7	1.0	92.0	100
Nuclear engineering	21	2	4	172	199
%	10.6	1.0	2.0	86.4	100
Space technology weapons	5	1	3	109	118
%	4.2	0.8	2.5	92.4	100
Consumer goods equipment	65	12	15	683	775
%	8.4	1.5	1.9	88.1	100
Civil engineering building mining	24	5	7	262	298
%	8.1	1.7	2.3	87.9	100
Unclassified	0	0	0	0	0
%	0.0	0.0	0.0	0.0	0
TOTAL	2,892	1,261	688	26,456	31,297
%	9.2	4.0	2.2	84.5	100

Appendix III. JPO and EPO Patent Application Outcomes, by Priority Country

Priority Country	Withdrawn	Pending	Rejected	Granted	Total
JPO Application Outcome					
Japan	1,993	648	1,826	10,352	14,819
%	13.4	4.4	12.3	69.9	100
Germany	2,694	1,492	1,153	3,600	8,939
%	30.1	16.7	12.9	40.3	100
US	2,815	2,194	2,184	7,093	14,286
%	19.7	15.4	15.3	49.7	100
Other	3,772	1,825	1,842	5,352	12,791
%	29.5	14.3	14.4	41.8	100
Total	11,274	6,159	7,005	26,397	50,958[a]
%	22.2	12.1	13.8	51.9	100
EPO Application Outcome					
Japan	1,031	685	266	10,352	12,334
%	8.4	5.6	2.2	83.9	100
Germany	124	69	38	3,600	3,831
%	3.2	1.8	1.0	94.0	100
US	1,442	367	318	7,093	9,220
%	15.6	4.0	3.4	76.9	100
Other	291	137	66	5,352	5,846
%	5.0	2.3	1.1	91.5	100
Total	2,888	1,258	688	26,397	31,297[b]
%	9.2	4.0	2.2	84.5	100

[a] For 153 patent applications the priority country data were missing.
[b] For 66 patent applications the priority country data were missing.