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An Empirical Analysis of the Patent Court

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William M. Landes & Richard A. Posner†

The U.S. Court of Appeals for the Federal Circuit was created on October 1, 1982, by a merger of the appellate section of the U.S. Court of Claims (the jurisdiction of which was limited to cases in which the federal government was the defendant) with the Court of Customs and Patent Appeals (CCPA). The new court inherited the appellate jurisdiction of the CCPA, which was limited, so far as patents were concerned, to appeals from decisions by the Patent and Trademark Office. More important, so far as patent law is concerned, the new court was given exclusive jurisdiction over appeals from federal district courts in patent infringement cases. Before then such appeals had gone to the regional court of appeals in which the district court whose decision was being appealed was located. This system had been criticized for producing inconsistent results. The courts of appeals differed widely in their attitude toward patent validity, reflecting the tug of war between those who thought patents essential to technological progress and those who thought them mainly a tool for stifling competition. The preponderant attitude seems to have been negative, as only about 35 percent of patents whose validity was challenged in court survived the challenge.[1] The intercircuit differences fomented forum shopping, which was possible because there would often be multiple alleged infringers. There was even a risk of inconsistent rulings concerning the same patent, since a judgment of validity would not bind an alleged infringer who had not been a party to the suit in which the judgment was rendered.

It was predictable that a specialized patent court would be more inclined than a court of generalists to take sides on the fundamental question whether to favor or disfavor patents, especially since interest

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1 See Gloria K. Koenig, *Patent Invalidity: A Statistical and Substantive Analysis* 4-18 to 4-19, 4-22 to 4-23 (Clark Boardman rev ed 1980) (presenting data on district and appeals court patent decisions, 1953 through 1978); P.J. Federico, *Adjudicated Patents, 1948–54*, 38 J Patent & Trademark Off Socy 233, 236 (1956) (presenting data on patent infringement and validity in appellate courts).

groups that had a stake in patent policy would be bound to play a larger role in the appointment of the judges of such a court than they would in the case of the generalist federal courts. It would be difficult to get the patent bar excited about the appointment of an appellate judge who might hear only two or three patent appeals a year, but if the judge were going to be a member of the court that heard *all* patent appeals, the patent bar and its clients would exert themselves to influence the selection. A patent court would be more likely to take the pro-patent side of this fundamental controversy simply because a court that is focused on a particular government program, like an administrative agency (invariably specialized), is more likely than a generalist court to identify with the statutory scheme that it is charged with administering. This has been the bent of the Patent and Trademark Office itself. Prediction is complicated by the fact that the Federal Circuit is only semi-specialized, since it has a substantial nonpatent jurisdiction. However, although only about 30 percent of the judges of the court in recent years have had a patent background,[2] those judges have written 63 percent of the patent opinions,[3] suggesting that their influence on the court's patent jurisprudence has been preponderant.

As expected, the Federal Circuit has turned out to be a pro-patent court in comparison to the average of the regional courts that it displaced in the patent domain. The evidence that supports this conclusion is set forth in the book chapter on which this Essay is based.[4] Among the principal findings in that chapter, the creation of the Federal Circuit appears to have had a positive and significant impact on the number of patent applications, the number of patents issued, the success rate of patent applications, the amount of patent litigation, and, possibly, the level of research and development expenditures. In this Essay we extend the statistical analysis in that chapter by including additional variables in our original regression analysis, by distinguishing among different types of patent applications (for example, pharmaceutical and nonpharmaceutical), and by examining separately U.S.-resident and foreign-resident patent applications filed in Canada and Japan. The purpose of this additional empirical analysis is to test additional implications of the "patent court matters" hypothesis.

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2 John R. Allison and Mark A. Lemley, *How Federal Circuit Judges Vote in Patent Validity Cases*, 27 Fla St U L Rev 745, 751 (2000) (analyzing the patent backgrounds of judges on the Federal Circuit).

3 Id at 752–53.

4 See William M. Landes and Richard A. Posner, *The Economic Structure of Intellectual Property Law* ch 12 (Harvard 2003).

I. U.S. PATENT APPLICATIONS

To provide a more refined test of the effect of the creation of the new court on the number of patent applications, we add two explanatory variables to our original regression analysis. These are the probability that a patent application will be granted and the filing fee (in 2002 dollars). Other things the same, the higher the probability of success and the lower the fee, the greater the expected gain from filing and so the more applications filed. We estimated the probability of success in year *t* by the number of patent grants in that year divided by the number of applications in year *t–2*. (This assumes that prospective patent filers have unbiased expectations in year *t* based on the success in that year of applications in *t–2*.) The two-year lag approximates the average lapse between the application for and the issuance of a patent. Filing fees are a weighted average of the large-entity and small-entity filing fees; since 1983, there has been a 50 percent discount for a small entity, which is defined as either a nonemployee or an employee of a company with no more than five hundred employees, although nonprofit entities of whatever size are also entitled to the small-entity discount.[5] The weights are equal to 0.6 and 0.4, respectively, based on the fraction of large- and small-entity filings since 1983. Nominal application fees were $30 in 1952–1965, $65 in 1966–1983, $300 in 1983–1985, $340 in 1986–1989, $370 in 1989–1990, and $630 in 1991; since then they have gradually moved up to $770.[6] For years before 1983, these figures are for all applications; for years since 1983 they are for large-entity applications. Thus the small-entity fee is now $385.

In Table 1 below, the regressions labeled (1) and (2) correspond to regressions (1) and (2) in Table 2 in the patent court chapter. The success and fee variables are in logarithms so that the regression coefficient of each of them measures the elasticity of applications with respect to success and filing fees respectively. In both equations the success variable has a positive and significant effect on the number of applications. The elasticity is about 0.18, indicating that a 10 percent increase in the success rate would increase the number of applications

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5 35 USC § 41(h)(1) (2000). See also Revision of Patent and Trademark Fees, 47 Fed Reg 43273 (1982) (reducing fees for small businesses effective October 1, 1982).

6 USPTO Fee Schedule, online at http://www.uspto.gov/web/offices/ac/qs/ope/fee2004jan01.htm (visited Jan 16, 2004) (listing current fees); Bryson Act, Pub L No 82-593, 66 Stat 792, 796 (1952), codified at 35 USC § 41 (1952) (1952–1965 fees); Patent Fees § 1, Pub L No 89-83, 79 Stat 259 (1965), codified at 35 USC § 41 (1965) (1965–1982 fees); Revision of Patent and Trademark Fees Confirmation, 47 Fed Reg 41272, 41273 (1982), setting fees at 37 CFR § 1.16(a) (1983) (1983–1986 fees); Revision of Patent Fees, 50 Fed Reg 31818, 31824 (1985), amending 37 CFR § 1.16(a) (1985) (1986–1989 fees); Revision of Patent and Trademark Fees, 54 Fed Reg 6893, 6900 (1989), amending 37 CFR § 1.16(a) (1989) (1989–1990 fees); Patent Fees, 55 Fed Reg 49040, 49041 (1990), amending 37 CFR § 1.16(a) (1991) (1991 fees).

by about 1.8 percent. Filing fees have a negative, though at best marginally significant, effect on applications. The elasticity is very small: a 10 percent increase in filing fees results in only a 0.3 percent reduction in the number of applications.

Most importantly, adding the success and fee variables to the regression does not change our estimates of the impact of the patent court. Indeed, when the success variable is added, the coefficients and levels of significance of the patent-court variables are slightly larger and more significant than those in the original regressions. The GDP variable is still positive but is no longer statistically significant. The adjusted R^2 hardly changes, as is not surprising, since without it we already explain about 98.6 percent of the variation in the log of applications.

TABLE 1

Spline Regression Analysis of Patent Applications: 1960–2001
(*t*-statistics in parentheses)

Independent Variables	*Patent Applications* OLS (1)	OLS (2)
$Year_1$	0.004 (0.47)	0.003 (0.44)
$Year_2$	0.05 (7.31)	0.05 (6.29)
$Year_3$	-	0.05 (6.35)
$LGDP_{t-1}$	0.19 (0.78)	1.20 (0.78)
LRD_{t-j}	0.07 (0.57)	0.06 (0.47)
Lsuccess	0.18 (2.85)	0.18 (2.79)
Lfee	–0.03 (1.28)	–0.03 (1.27)
Constant	2.25 (0.17)	21.7 (1.69)
Durbin-Watson	1.52	1.53
R^2	0.99	0.99
No. observations	39	39

Notes: *OLS* denotes ordinary least squares. Equations (1) and (2) assume that the effective starting date of the Federal Circuit (the $Year_2$ variable) is the end of 1984 or beginning of 1985. Equation (2) divides the period following the effective date of the Federal Circuit into two subperiods: $Year_2$ runs from the beginning of 1985 to 1991, and $Year_3$ from the beginning of 1992 to 2001.

As in any time-series analysis, we must consider the possibility that our variable of interest (the creation of the patent court) is picking up effects that are due to other events that happened at the same time. Two events in particular deserve attention. One is the passage of the Hatch-Waxman Act,[7] effective at the end of 1984, which is the starting date that we use for the patent court.[8] The Act expanded the experimental-use defense to patent infringement and also extended the term of pharmaceutical drug patents. But since the Act is entirely limited to drugs, we can avoid its confounding effect by excluding drugs from our patent-application data. The second possible confounding factor was an increase in software patents resulting from a shift by software manufacturers from protecting their intellectual property with copyright to protecting it with patents. We can avoid any confounding effect here by excluding software applications from our analysis. Drug and computer software patents account for about 3.7 percent and 7.6 percent, respectively, of issued utility patents from 1991 through 1995.

We have reestimated the equations in Table 1 accordingly, but must acknowledge several problems with the drug and software data. First, industry-specific application data are limited to applications that were successful; failed applications, about 30 percent of the total, were not in our data source.[9] Second, the application data are not usable after 1995 because many applications filed during or after that year were still in the prosecution stage in 1999, the last year of the industry-specific data. Third, the data, because they do not permit us to separate software from hardware patents, overstate the number of software applications. Whatever the significance of these limitations in the data, our results do not change when we exclude drug and computer patents. Although the regression specification is the same as in Table 1, we reproduce below in Table 2 only the coefficients and *t*-statistics of the year variables. We note, however, that in the new regression the success variable is positive and significant (elasticity of 0.19); the filing fee variable is negative but only marginally significant; and neither the GDP nor the R&D variable is significant. A new result is that the rate of growth of applications is 4.7 percent from 1992 to 1995 compared to 5.7 percent between 1985 and 1991. Although this difference is not

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7 Drug Price Competition and Patent Restoration Act of 1984, Pub L No 98-417, 98 Stat 1585, codified at 35 USC § 156 (2000) (enabling the extension of patents for drugs, medical devices, or food additives under certain conditions).

8 See note in Table 1 above.

9 The industry-specific data are from Bronwyn H. Hall, Adam B. Jaffe, and Manuel Trajtenberg, *The NBER Patent Citation Data File: Lessons, Insights, and Methodological Tools* 8, 41–42 (National Bureau of Economic Research Working Paper No 8498 Oct 2001), online at http://papers.nber.org/papers/w8498 (visited Oct 25, 2003).

significant, it points in the right direction—a reduction over time in the impact of the Federal Circuit, which we predicted in our book chapter.

TABLE 2

Spline Regression Analysis of Patent Applications Minus Drugs and Computers: 1993–1995
(*t*-statistics in parentheses)

Independent Variables	*Equation (1)*	*Equation (2)*
$Year_1$	0.006 (0.008)	0.006 (0.76)
$Year_2$	0.053 (6.51)	0.057 (5.83)
$Year_3$	-	0.047 (3.65)
Durbin-Watson	1.32	1.38
R^2	0.98	0.97
No. observations	33	33

II. U.S.-RESIDENT VERSUS FOREIGN-RESIDENT APPLICATIONS

The chapter of our book did not attempt to distinguish between patent applications by (and patents issued to) foreign residents versus U.S. residents. The distinction is potentially important, however, to discriminating between two hypotheses about the cause of the surge in patent applications and grants starting in the 1980s and documented in the chapter. In the chapter we suggested that a significant cause was the pro-patentee orientation of the Federal Circuit. The competing hypothesis, advanced by Kortum and Lerner,[10] is that the only significant cause was accelerated technological progress in the United States. If Kortum and Lerner are correct, an innovation upsurge in the U.S. occurring at the same time as the creation of the patent court gave rise to the positive relation between the creation of the patent court and the number of patent applications that we found in our analysis. Since the hypothesized upsurge occurred only in the U.S., we should not (if Kortum and Lerner are correct) observe a positive correlation between the creation of the patent court and the number of foreign-resident applications for U.S. patents or grants of those applications. A complicating factor, however, is that because a U.S. filing may be merely a way for the foreign inventor to extend the geo-

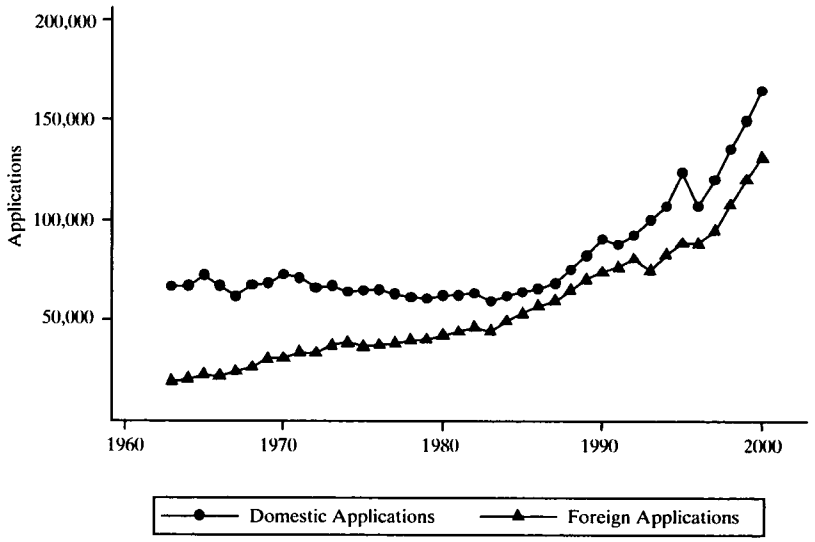
[10] Samuel Kortum and Josh Lerner, *Stronger Protection or Technological Revolution: What Is Behind the Recent Surge in Patenting?*, 48 Carnegie-Rochester Conference Series Pub Pol 247, 251–52 (1998).

graphic scope of his patent, the creation of a pro-patent U.S. court would be less of an inducement to foreign than to U.S. inventors.

Figure 1 graphs U.S.-resident and foreign-resident applications from 1963 to 2000.[11] Notice the sharp increase in U.S.-resident applications beginning in the early 1980s, whereas foreign applications appear to grow at a fairly steady rate throughout the entire period. The contrast supports the Kortum-Lerner hypothesis, but we must use regression analysis for a more precise test of the hypothesis.

FIGURE 1

Time Series of U.S. and Foreign Patent Applications



Equations (1) and (2) in Table 3 reestimate the regressions presented earlier in this Essay, but for U.S. residents only. Equations (3) and (4) are the corresponding regressions for foreign residents. The foreign regressions include the years and success variables, as do the U.S. regressions, and an estimate of worldwide real GDP[12] (excluding the U.S.), but no measures of "foreign" research and development expenditures. We measure the probability of success without distinguishing between U.S. and foreign residents. Thus we assume that the PTO does not treat foreign residents differently from U.S. residents. As a

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[11] The Patent Office provides data on the nationality of the inventor listed first in the patent application.

[12] See Alan Heston, Robert Summers, and Bettina Aten, *Penn World Table Version 6.1* (Center for International Comparisons at the University of Pennsylvania Oct 2002), online at http://datacentre2.chass.utoronto.ca/pwt (visited Oct 25, 2003). Worldwide GDP is in trillions of 1996 dollars.

check on this assumption, we estimated the U.S. and foreign regressions with success-specific variables, but this did not affect our results.

TABLE 3

Spline Regression Analysis of U.S.- and Foreign-Resident Patent Applications: 1960–2001
(*t*-statistics in parentheses)

Independent Variables	*U.S. Residents*		*Foreign Residents*	
	OLS (1)	OLS (2)	PW (3)	PW (4)
$Year_1$	–0.004	–0.004	0.035	0.035
	(0.38)	(0.37)	(2.47)	(2.43)
$Year_2$	0.06	0.06	0.051	0.05
	(6.52)	(5.40)	(4.69)	(3.32)
$Year_3$	-	0.06	-	0.05
		(6.12)		(3.88)
$LGDP_{t-1}$	–0.03	–0.03	0.22	0.21
	(0.09)	(0.09)	(0.84)	(0.82)
LRD_{t-1}	–0.05	–0.04	-	-
	(0.33)	(0.27)		
Lsuccess	0.17	0.17	0.14	0.14
	(2.25)	(2.15)	(2.26)	(2.22)
Lfee	–0.03	–0.03	–0.06	–0.06
	(1.09)	(1.05)	(2.15)	(2.07)
PCT Dummy	-	-	–0.037	–0.04
			(0.76)	(0.75)
Constant	19.7	19.7	–59.5	–59.6
	(1.13)	(1.11)	(2.15)	(2.11)
Rho	-	-	0.70	0.74
Durbin-Watson	1.84	1.84	1.79	1.79
R^2	0.97	0.97	0.99	0.99
No. observations	38	38	38	38

Notes: *PW* denotes Prais-Winston correction for first-order autocorrelation. $Year_2$ assumes that the effective start of the Federal Circuit is 1985. Equations (2) and (4) divide the post-1985 period into two subperiods: 1985–1991 ($Year_2$) and 1992–2001 ($Year_3$). GDP for foreign residents is world GDP minus U.S. GDP.

The U.S. regressions reveal a positive and highly significant impact of the patent-court variables ($Year_2$ in equation (3) and $Year_2$ and $Year_3$ in equation (4)). Indeed, these regressions suggest an even faster rate of growth in U.S. applications than in all applications—6 percent per year compared to 5 percent per year, although this difference is not statistically significant. As before, we find a positive and significant effect of the probability of success on the number of applications and a negative but statistically insignificant effect of the filing fee on the number of applications.

The regression results for foreign applicants (equations (3) and (4) in Table 3) provide modest support for our hypothesis that the patent court contributed to the increase in patent applications. The rate of growth of foreign applications in the post-creation period is positive and statistically significant, although of smaller magnitude than we find for the U.S. applicants—5 percent per year compared to more than 6 percent, though again the difference is not statistically significant. In contrast to our finding with respect to U.S. residents, we also find a positive and significant increase in foreign applications *before* the creation of the Federal Circuit. But the rate of growth in that period is smaller (3.2 percent compared to 5 percent), although the difference is statistically significant only in equation (3). The success variable is positive (with an elasticity of about 0.14) and significant; the worldwide-GDP variable is positive and insignificant; and the filing fee is negative and significant.[13]

The fact that the differences in growth rates between the pre- and post-patent-court years are larger for U.S. than for foreign residents suggests, however, that the patent court is not the only reason for the increase in applications since the mid-1980s; for if it were we would expect comparable rates of increases for U.S. and foreign residents. The 1.2 percent higher rate for U.S. applicants (6.2 compared to 5.0 percent) implies that about 20 percent of the increase in applications by U.S. residents was due to factors unrelated to the patent court. It can be argued, moreover, that the true impact of the patent court is measured by the 1.8 percent difference between the growth of foreign-resident applications before and after the effective date of the court—3.2 percent, compared to 5.0 percent in regressions (1) and (2). This would mean that of the roughly 6.2 percent increase in U.S.-resident applications that our regression analysis attributes to the creation of the patent court, less than 30 percent (still a substantial percentage) was due to that and 70 percent was due to other factors.

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[13] Both foreign regressions are corrected for first-order autocorrelation. The Prais-Winston method, which we use for making the correction, is an option in Stata that allows one to retain the first observation in the regression, which is lost when the Cochran-Orcutt method is used.

Just as with our analysis in Part I of this Essay, we have two possible confounding variables with regard to foreign-resident patents. First, the Patent Cooperation Treaty (PCT),[14] effective in 1978, to which the major nations, including the United States, are signatories, makes it simpler for nonresidents to file patent applications, thus effectively reducing the cost of filing patents outside one's own country. One might expect this to lead to an increase in U.S. patent applications by non-U.S. residents. To test this hypothesis, we added a dummy variable that takes a value of 0 before 1978 and 1 thereafter to the regressions in Table 3 for foreign-resident applications. As shown in that table, the regression coefficient on PCT is negative and statistically insignificant—we cannot reject the hypothesis that the PCT had no impact on U.S. patent filings by foreign residents. More importantly, none of our prior results is changed by the addition of the PCT variable.[15]

The second possible confounding variable concerns U.S. patent applications filed by Japanese residents, which might have grown rapidly over the last thirty years not because of the creation of the patent court but instead because of economic growth (though Japan has experienced very little growth in recent years), increased innovation, and a greater willingness of Japanese firms to seek intellectual property protection outside Japan.

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14 28 UST 7645, TIAS No 8733 (1978).

15 We had considered adding a dummy variable for TRIPS, the new international treaty that sets minimum enforcement standards for intellectual property rights. See Agreement on Trade-Related Aspects of Intellectual Property Rights (Apr 15, 1994), reprinted in *The Legal Texts: Results of the Uruguay Round of Multilateral Trade Negotiations* Annex 1C at 321–53 (Cambridge 1994). But we refrained because of the late dates for implementation—one year from 1995 for developed countries, five years from 1995 for developing countries, and eleven years from 1995 for less developed countries.

Figure 2 seeks to correct for a "Japanese effect" by separating U.S. patent applications for all foreign residents, for Japanese residents, and for foreign residents excluding Japanese. The figure shows that Japanese filings did increase more rapidly than other foreign filings over the past fifty years, accounting for 20 percent of foreign applications in 1970 and 48 percent by 1991, before declining to 40 percent by 2000. We therefore reestimated in Table 4 the foreign-resident regressions with Japanese applicants excluded (equations (1) and (2)). If the patent court had a positive impact on patent filings, we would expect this result to hold when Japanese applications are excluded. Table 4 also includes a separate regression on U.S. patent applications by Japanese residents (equation (3)).

FIGURE 2

Time Series of Foreign Patent Applications:
Japanese and Other Foreign Residents

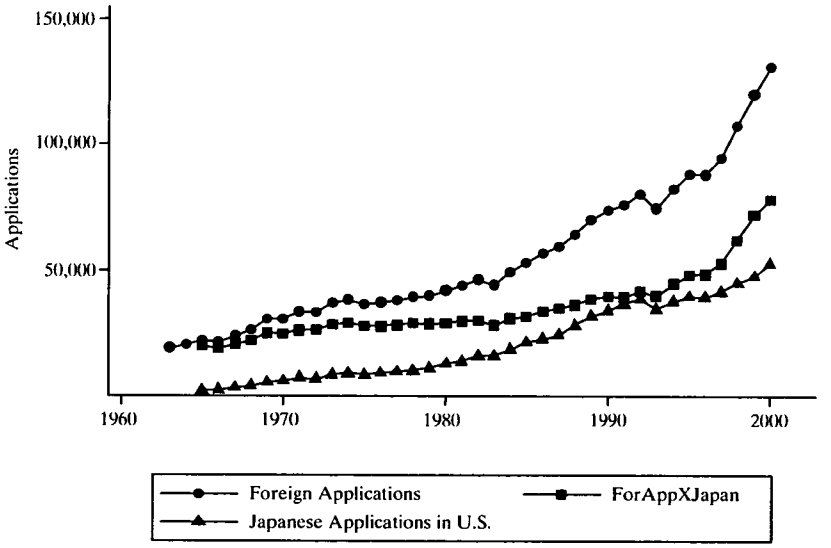


TABLE 4

Spline Regression Analysis of Foreign-Resident Applications: 1965–2000 Excluding Japan and Japan Only
(*t*-statistics in parentheses)

Independent Variables	*Foreign Residents*		
	Excluding Japan	*Japan Only*	
	PW	PW	OLS
	(1)	(2)	(3)
$Year_1$	0.026	0.022	0.019
	(1.71)	(1.64)	(1.21)
$Year_2$	0.058	0.029	0.014
	(4.44)	(1.87)	(1.90)
$Year_3$	-	0.07	-
		(5.40)	
$LGDP_{t-1}$	–0.03	0.08	1.48
	(0.13)	(0.30)	(6.95)
LSuccess	0.14	0.15	0.37
	(2.05)	(2.14)	(2.70)
Lfee	–0.08	–0.07	0.11
	(2.66)	(2.30)	(2.74)
PCT Dummy	–0.01	–0.03	0.05
	(0.22)	(0.55)	(0.60)
Constant	–41.1	–34.0	–29.6
	(1.40)	(1.28)	(0.95)
Rho	0.86	0.69	-
Durbin-Watson	1.79	1.68	1.51
R^2	0.99	0.99	0.99
No. observations	36	38	36

Note: *PW* denotes Prais-Winston corrections for first-order autocorrelation. *LGDP* in equations (1) and (2) is the logarithm of world GDP net of the U.S. and Japan. *LGDP* in equation (3) is for Japan only. The other variables are the same as those in Table 3.

A comparison of Tables 3 and 4 indicates little change when Japanese applications are excluded from foreign applications. We continue to observe a significant increase in the rate of growth associated with the creation of the patent court. The success rate has a positive and significant impact on applications, and fees have a negative and

significant impact; compare equation (3) in Table 3 with equation (1) in Table 4. When the post-patent-court variable is divided into two periods ($Year_2$ and $Year_3$ in equation (2) in Table 4), we find a significant positive difference between the two periods (post-1992 and pre-1992) (equation (4) in Table 3). Our theory does not directly account for the lagged response of foreign applications (excluding Japanese applications), but one possible explanation is that foreign firms required more time than U.S. firms to conclude that the decisions of the patent court signaled a significant legal shift in favor of patent holders.

Turning to the "Japan Only" regression in Table 4 (equation (3)), we see that GDP in Japan and the patent success rate are the most significant determinants of Japanese patent applications in the United States. The creation of the patent court, however, had no significant impact on the number of applications.

We also added the logarithm of patent applications filed in Japan (lagged one period) as an independent variable in equation (3). The regression coefficient was 0.418 and statistically significant ($t = 2.02$), indicating that each 10 percent increase in the number of patents filed in Japan was associated with about a 4 percent increase in Japanese applications filed in the United States. As we pointed out earlier, patent applications in Japan have grown rapidly since the 1960s; if 40 percent of these result in a U.S. filing, this means that it is activity in Japan that largely determines Japanese filings in the U.S., rather than the existence of the patent court.

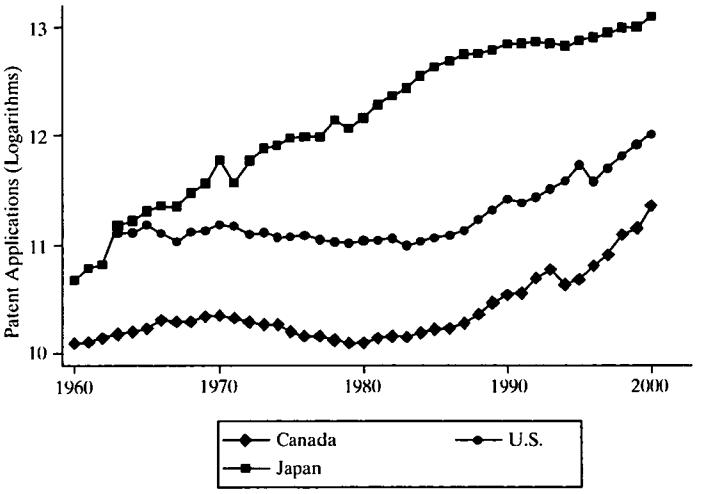
The other variables were unchanged by the addition of the Japan filings, except for the fee variable, which was still positive but no longer significant (with a coefficient of 0.06 and a t-ratio of 1.56).

III. Patent Applications in Canada and Japan

Another way to test the "patent court matters" hypothesis versus the Kortum-Lerner "surge in U.S. innovation" hypothesis (though we have pointed out that they are not mutually exclusive) is to examine patent applications filed outside the United States. If the Federal Circuit were responsible for most or a substantial part of the increase in U.S. patent applications, we would not expect to observe similar increases in patent applications in foreign countries starting in the mid-1980s, although it is conceivable that the increase in foreign applications in the United States brought about by the patent court might lead these companies to seek additional patents in their home country.

Figure 3 plots patent applications (in logarithms) for Canada and Japan between 1960 and 2001 and compares them with U.S. patent applications. Figure 3 reveals that over this period U.S. and Canadian applications closely tracked each other, whereas Japanese applications increased continuously.

FIGURE 3
Patent Applications (Logarithms) in Canada, Japan, and the United States



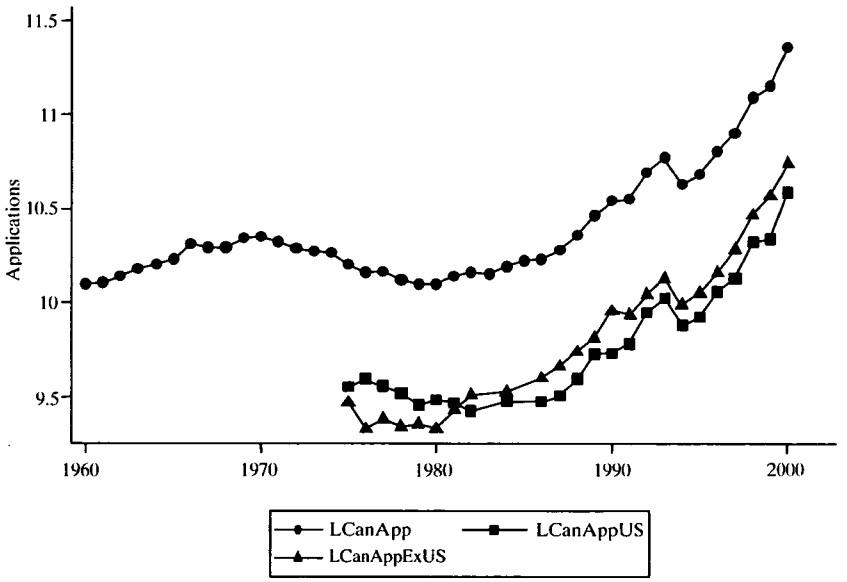
Regression analysis confirms these patterns. We first regressed the logarithm of patent applications in Japan and Canada on U.S. applications and a time-trend variable from 1960 to 2000. As both Figure 3 and the regression (Table 5) show, Canadian and U.S. patent applications are highly correlated even when time is held constant (which eliminates any correlation between Canadian and U.S. applications that is due to the fact that patent applications have increased in both countries). In contrast, the correlation between U.S. and Japanese patent applications is negative (again holding constant the increase in applications in both countries). The results for Canada do not support the hypothesis that the creation of the patent court has been a significant factor in the growth in U.S. applications. Canadian applications were growing in step with U.S. applications and it seems unlikely that the increase in Canada is attributable to the creation of the patent court in the United States, unless U.S. firms have a practice of routinely applying for Canadian patents at the same time that they apply for U.S. ones. Contrary to the last suggestion, it does not appear that the increase in Canadian applications was the result primarily of an increase in applications filed by U.S. residents. Although we have data for only about twenty-four years starting in 1975,[16] Figure 4 indicates

[16] *WIPO Industrial Property Statistics, Publication B* (World Intellectual Property Organization 1975–2000), online at http://www.wipo.int/ipstats/en/publications/b/index.htm (visited Oct

that Canadian applications filed by non-U.S. residents grew at a rate comparable to all Canadian applications.

FIGURE 4

Canadian Patent Applications by U.S. and Non-U.S. Applicants



The results for Japan are difficult to interpret but are more consistent with the "patent court matters" hypothesis, because, as shown in Table 5, Japanese patents are negatively correlated with U.S. applications once we hold constant the time trend of patent applications.

27, 2003). Statistics for 1994–2000 are currently available online and on CD-ROM; statistics for 1975–1994 were published in paper form; statistics for 1983 and 1985 are unavailable.

TABLE 5

Regression Analysis of Patent Applications in Canada and Japan: 1960–2001
(*t*-statistics in parentheses)

Independent Variables	*Patent Applications*	
	Canada OLS (1)	*Japan* PW (2)
LUSApp	1.46	–0.51
	(17.29)	(2.56)
Year	–0.02	0.07
	(8.05)	(11.53)
Constant	32.8	124.8
	(8.18)	(12.07)
Rho	-	0.62
Durbin-Watson	1.33	2.06
R^2	0.95	0.98
No. observations	41	41
Note: PW denotes Prais-Winston corrections for first-order autocorrelation.		

We also estimated regression equations for Japan and Canada using the time variables $Year_1$ and $Year_2$ and then $Year_1$, $Year_2$, and $Year_3$; GDP for the respective countries; and the patent-application success rate. Japanese patents, we find, grew significantly more slowly in the post-patent-court era than in the pre-patent-court era, which is consistent with the "patent court matters" hypothesis. On the other hand, the results for Canada are more consistent with the "innovation surge" hypothesis because Canadian patent applications increased significantly in the post-patent-court era even though no such court was created in Canada.

IV. PATENT GRANTS

We turn now from patents applied for to (U.S.) patents granted. In Table 12-2 of the book chapter, we showed that the number of patents issued had declined by about 2 percent per year in the period prior to the effective date of the patent court but had declined insignificantly in the subsequent period, and we concluded that the patent court appeared to have arrested a long-term decline in patent grants. We now examine whether that result continues to hold when we look

at U.S. and foreign patent grantees separately, as we do in Table 5, where equations (1) and (2) regress grants to U.S. residents and (3) and (4) regress grants to foreign residents. The equations are of the same form, use the same lags, etc., as the patents-granted equations in Table 12-2.

The regression estimates for patents granted to U.S. residents are similar to what we found with aggregated data for U.S. and foreign residents. There is a small, though statistically significant, decline of about 0.1 percent per year in grants prior to the effective date of the patent court and a small, but again statistically significant, positive increase of about 0.5 percent per year after that date, holding constant the number of patent applications. Moreover, the differences between the pre- and post-patent-court variables are statistically significant in both equations (1) and (2). Consistent with our results in the chapter, the patent court appears to have arrested a slow decline in patent grants. Putting the application and grant regressions together, therefore, we find that the main effect of the patent court has been to increase the number of patent applications rather than the number of patent grants, holding applications constant. Surprisingly, applications (lagged two years) have a negative (not positive) effect on patent grants, although we cannot reject the null hypothesis that the effect is zero.

The analysis of patent grants to foreign residents indicates a small (less than 0.1 percent), though not statistically significant, increase in grants after the effective date of the patent court. Foreign applications have a positive but not statistically significant impact on foreign grants.

Overall, the U.S.-resident and foreign-resident statistics indicate a small positive increase in the rate of growth of grants after the creation of the patent court, holding constant patent applications. The effect is small, however, relative to the court's effect on applications.

TABLE 6

Spline Regression Analysis of U.S.- and Foreign-Resident Patent Grants: 1960–2001
(*t*-statistics in parentheses)

Independent Variables	*U.S. Residents*		*Foreign Residents*	
	OLS (1)	OLS (2)	PW (3)	PW (4)
$Year_1$	–0.001	–0.001	0.003	0.003
	(4.67)	(4.82)	(3.92)	(3.87)
$Year_2$	0.006	0.005	0.004	0.004
	(6.61)	(4.25)	(4.26)	(2.43)
$Year_3$	-	0.006	-	0.004
		(6.77)		(3.63)
LRD_{t-j}	0.02	0.03	-	-
	(2.18)	(2.47)		
LUSApp	–0.02	–0.02	-	-
	(1.32)	(1.36)		
LFORApp	-	-	0.02	0.02
			(1.19)	(1.21)
Constant	4.48	4.61	–3.88	–53.0
	(9.46)	(9.59)	(2.80)	(2.00)
Rho	-	-	0.64	0.63
Durbin-Watson	1.84	1.91	1.74	1.74
R^2	0.98	0.98	0.99	0.99
No. observations	36	36	36	36

Notes: *PW* denotes Prais-Winston corrections for first-order autocorrelation. All equations assume that the effective starting date of the Federal Circuit (the $Year_2$ variable) is the end of 1984 or beginning of 1985. Equations (2) and (4) divide the period following the effective date of the Federal Circuit into two subperiods: $Year_2$ runs from the beginning of 1985 to 1991 and $Year_3$ from the beginning of 1992 to 2001. GDP variable for foreign residents is world GDP minus U.S. GDP.

To summarize, the more refined statistical analysis in this Essay yields results consistent with our earlier study. The creation in 1982 of a court having a monopoly of patent appeals has had a significant effect on patent activity as a consequence of the pro-patent leanings of the new court.