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The Surge in Worldwide Patent Applications

Study prepared by the International Bureau

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I. EXECUTIVE SUMMARY

1. The Working Group at its third session held in 2010 endorsed a series of recommendations to improve the functioning of the PCT system. The Working Group recommended, *inter alia*, that a study be conducted by the International Bureau, to look into the root causes behind the surge of patent applications and the consequent heavy load on the international patent system. The present document contains this study.

2. Over the past four decades, patent filings surged during two periods. The first occurred between 1983 and 1990 and the second took place between 1995 and 2007. The magnitude of growth in worldwide filings for the second surge was higher than the first one. Japanese applicants were the main source of filing growth during the first surge accounting for 16.9 percentage points of total growth (28.9 percent). For the second surge period, applicants from the USA contributed the most (17.5 percentage points) to overall growth (83.7 percent), followed by China (15.5 percentage points), the Republic of Korea (14.1) and Japan (10.6).

3. The study analyzes three factors that may explain the surge: multiple filings of the same invention, changes in R&D productivity, and patenting in specific fields of technology.

4. A breakdown of worldwide filings by first and subsequent filings reveals that first filings accounted for 71.3 percent of worldwide filing growth during the first surge. This suggests that the growth in worldwide filings was mainly due to new inventions. By contrast, a more even distribution between first (48.3 percent) and subsequent (51.7 percent) filings in contribution to worldwide filing growth is observed in the second surge. Since subsequent filings mostly represent filings abroad, the growth in this share of filings is most likely due to rapid growth in international commerce. The strong growth in filings abroad points to the importance of work sharing arrangements among offices in minimizing duplication of work and promoting high quality examination.

5. The contribution of first and subsequent filings varies across offices and origins. New inventions are the main factors behind the growth in filings originating from China, Japan, the Republic of Korea, and the Russian Federation. Multiple filings are the main source of growth in filings originating from European countries, Canada and the USA. There has also been an increase in the use of the PCT system for subsequent filings. For the second surge period, PCT national phase entries accounted for most the growth in subsequent filings.

6. Aggregate R&D productivity – first filings over real R&D expenditure – has been on a continuous downward trend. Worldwide changes in R&D productivity thus cannot account for the worldwide patent surge. Most countries analyzed in this report equally show a downward trend in R&D productivity. However, there are a few exceptions. The USA, the Russian Federation, the Netherlands, and Switzerland show an increase in R&D productivity.

7. Decomposing filing growth by fields of technology suggests that no single field of technology can account for the worldwide patent surge. Three of the broadly defined information and communication technologies (ICTs) – in particular, computer technology, digital communications, and telecommunications – are important sources of growth in filings, but even their combined contribution accounts for less than a fifth of the overall growth. Complex technologies are a more important driver of growth than discrete technologies. This likely reflects the nature of technological progress and shifting patenting strategies; however, more research is necessary to better understand how R&D investments and changes in company filing strategies have affected filing growth for specific technologies and how this has affected the worldwide patent surge.

8. There has been an increase in the number of pending applications at most offices in recent years. At the same time, pendency time has lengthened in some offices while shortened in others. The surge in filings is only one factor affecting pendency performance. Other factors include changes in office examination capacity, changes in the size and complexity of applications, and more frequent examiner-applicant communication.

9. Finally, the study identifies areas for further research. In the short to medium term, construction of richer data sets would make it possible to develop indicators of R&D productivity broken down by certain economic sectors or fields of technology. In other areas, progress will require more time – for example, in quantifying the causes of changed pendency performance.

II. INTRODUCTION AND OBJECTIVES

10. Worldwide patent filings have reached historically unprecedented levels. Figure 1 depicts the long-term trend in filings for selected offices. The number of filings at the largest patent offices was stable until the 1970s, followed by an acceleration in filings at the patent offices of Japan and later of the United States of America (USA). Growth in filings at other offices, such as Brazil, China, and India picked up from the mid 1990s onwards. Worldwide patent filings averaged between 800,000 and 1 million a year between 1982 and 1995, but then grew rapidly to reach 1.9 million in 2008.[1]

11. Understanding the causes behind the growth in worldwide patent filings – especially since the mid 1990s – is important. Increased patenting may signal accelerated technological progress, possibly enlarging economic output and generating prosperity. It may also reflect shifting innovation systems and shifting strategies of companies towards patenting. Increased international commerce and the greater need for companies to protect their knowledge assets in international markets are a third important factor, especially in more recent history. Finally, better understanding the worldwide growth in patenting is important for assessing the functioning of the international patent system and how it serves the need of the international community.

12. Against this background, a number of studies have sought to identify the causes of the so-called patent surge; however, most of these studies have focused on individual national offices, without much consideration for worldwide trends.[2]

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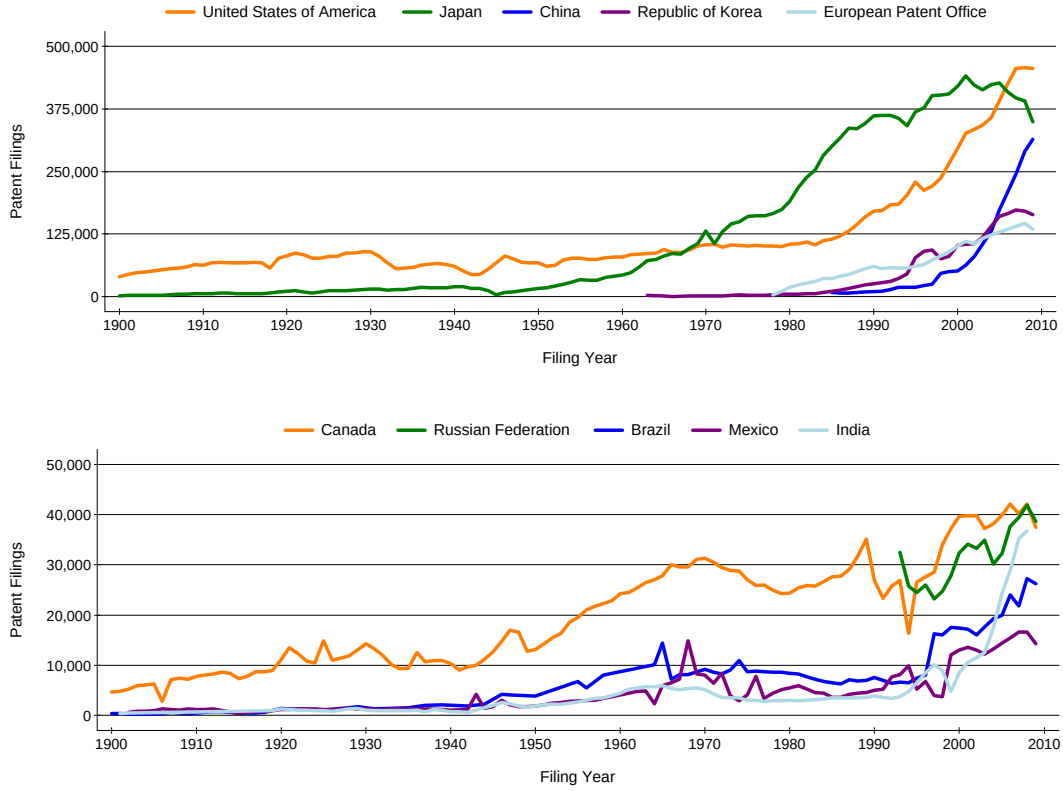
[1] World totals are WIPO estimates covering 80 patent offices. They include both published and unpublished publications.

[2] We follow the literature in referring to the increase in the number of patent filings as the ‘patent surge’. However, there is no accepted definition of what constitutes a ‘surge’ – say, in terms of average annual growth rate over a certain number of years.

Figure 1: Trend in patent filings at selected patent offices



Source: WIPO Statistics Database, April 2010

13. The Working Group at its third session, held in Geneva from June 14 to 18, 2010, endorsed a series of recommendations to improve the functioning of the PCT system based on a study prepared by the International Bureau entitled "The Need for Improving the Functioning of the PCT System"[3] and related submissions from certain Member States[4]. In discussions on addressing backlogs and improving the quality of granted patents, the Working Group recommended "that a follow-up study be conducted by the International Bureau, which should involve WIPO's Chief Economist, to analyze the root causes behind the surge of patent applications and the consequent heavy load on the international patent system".[5] This study seeks to fulfill this recommendation; it analyzes trends in worldwide patent filings and its impact on the international patent system.[6]

14. The main aims of the report are to provide answers to four key questions: What are the main features of the patent surge seen over the past four decades? Is the surge a global

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3 Document PCT/WG/3/2

4 Documents PCT/WG/3/5 and PCT/WG/3/13.

5 Recommendation 149bis, set out in paragraph 92 of meeting report document PCT/WG/3/14 Rev..

6 Our focus is on standard patents. We exclude utility models, because there has not been a similar increase in utility model filings; they grew by 1.1 percent a year during the 1995-2008 period. Moreover, one patent office – the State Intellectual Property Office of the People's Republic of China – accounted for 72 percent of total applications. We also exclude provisional patent applications, except where standard applications emerge from provisional applications.

phenomenon or specific to certain offices? What are the main factors that explain the surge? What are the consequences for the international patent system?

15. A number of studies have analyzed the growth in patent filings. However, almost all of them focus on the United States of America (USA) and China. This may partly reflect the substantial filing growth in these countries.[7] We are not aware of any study that has focused on the surge in worldwide patent filings. This study seeks to fill this gap by providing an analysis of the surge in worldwide filings based on the most comprehensive data currently available.

16. The discussion is organized as follows. Section II provides an overview of the prior literature. Section III documents the trend in worldwide patent filings, while Section IV outlines the factors that explain the growth in filings. Section V briefly looks at the consequences of the surge for patent offices. The final section provides a summary of the main findings.

III. LITERATURE REVIEW

17. Most of the prior studies have focused on the growth of filings in the USA (Kortum and Lerner, 1999; Hall and Ziedonis, 2001; Kim and Marschke, 2004; Hall, 2005) and China (Hu and Jefferson, 2009; Zhang, 2010). In addition, one study analyzes what is behind the increase in patent filings in Canada (Rafiquzzaman and Whewell, 1998).

18. The first prominent study to analyze in detail the surge of patenting in the USA was Kortum and Lerner (1999). They test three different hypotheses that might explain rapid filing growth: increased friendliness of courts, expanded technological opportunities, and changes in the management of research and development (R&D). The first hypothesis is motivated by changes in the United States patent system – notably the creation of the Court of Appeals of the Federal Circuit – that Kortum and Lerner describe as favorable to patentees. They accordingly test whether the increased probability of upholding a patent led to a higher proportion of potentially patentable inventions to be patented.[8] The test of the second hypothesis – expanded technological opportunities – focuses on whether the patent surge is confined to the high-technology area, particularly biotechnology and information technology. Finally, the test of the last hypothesis – changes in R&D management – centers on whether there was a movement towards applied R&D activities that are likely to generate more patents.

19. Kortum and Lerner employ statistics on total international patent applications, patent grant data by technology and applicant from the United States Patent and Trademark Office (USPTO), and aggregate R&D expenditure statistics. By process of elimination, they conclude that the “increase in patenting has been driven by changes in the management of innovation, involving a shift to more applied activities”.[9] However, they acknowledged

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7 The growth of patent filings in the Republic of Korea also appears substantial; however, we are not aware of any study that has analyzed its causes. Japan receives a large volume of patent filings, but it has seen relatively modest growth in recent years.

8 See also Jaffe, A. (2000).

9 Data show that the USA has become a significant source of patenting, but has not increased as a destination for patenting. Kortum and Lerner (1999) therefore rule out the friendly court hypothesis as the main factor for the surge in patenting; if the hypothesis were true, there should have been an increase in patenting by non-residents as well. All technology classes show an increased rate of patenting rather than particular technologies; therefore, data also do not support the technological opportunities hypothesis as the driving force behind the surge in patenting.

"…changes in the management of research may have had costs and benefits. The net impact on research productivity was potentially modest."

20. Kim and Marschke (2004) also studied the causes of the patent surge in the USA using industry level data. They decompose aggregate data to analyze the effects of changes in R&D productivity, patent propensity, and R&D expenditure on patenting in different manufacturing industries. They find that increases in R&D expenditure and R&D productivity contributed to the surge in the 1983-1992 period. Three industries – computers, electronics, and automobiles account for more than 60 percent of the total increase in patenting. Their evidence supports the findings of Kortum and Lerner (1999) that changes in the conduct of R&D are an important factor in explaining the growth in patenting.

21. The findings of the study by Hall (2005) support the conclusion reached by Kim and Marschke (2004). Hall's analysis shows that the growth in patent applications in the USA is mostly due to increased patenting by firms in "computing and electronics". She points to a major strategic shift towards patenting in those two sectors.

22. Hall and Ziedonis (2001) studied the patenting behavior of the semiconductors industry in the USA and found evidence of a patent portfolio race induced by legislative changes. They argue that the patent surge is in response to an increased threat of holdup. Furthermore, they argue that firms have strong motivations for increased defensive – or strategic –patenting to enhance bargaining power for cross licensing or in case of litigation.

23. Indeed, several researchers have associated the growth in patenting to so-called strategic patenting behavior. While there appears no commonly agreed definition of this concept, it is generally used to describe patenting practices aimed at blocking other firms from patenting, preventing litigation, and enlarging patent portfolios for cross licensing negotiations (Blind, et. al. 2009). Strategic patenting has also been linked to the emergence of so-called patent thickets, with possibly harmful effects on innovation. Shapiro (2001) defines a patent thicket as "an overlapping set of patent rights requiring that those seeking to commercialize new technology obtain licenses from multiple patentees". To the extent that patent thickets increase the transaction costs for innovators, they may undermine the incentive to innovate. Researchers have proposed solutions such as cross-licensing, patent pools, joint ventures and other cooperative mechanisms for minimizing transaction costs and holdup problems associated with patent thickets. However, despite the concern about patent thickets, Noel and Schankerman (2006) point out that the "econometric evidence on the effects of patent thickets is limited". One more recent study (von Graevenitz et al. 2008) based on European Patent Office (EPO) data concluded that there are patent thickets in nine technology areas and their incidence has increased in recent years.

24. Over the past two decades, China's innovation landscape has changed considerably. R&D expenditure increased from 9 to 111 billion and R&D intensity – defined as R&D expenditure over Gross Domestic Product (GDP) – increased from 0.7 to 1.5 percent between 1990 and 2008. There also have been considerable inflows of foreign direct investments (FDI). Starting in the mid-1980, China several times revised its patent law and saw strong filing growth, especially after the mid 1990s.[10] These developments have attracted the attention of policymakers and researchers. Selected studies (Hu and Jefferson, 2009; Zhang, 2010) have investigated China's patent surge. Hu and Jefferson (2009) identified and tested five hypotheses for the causes of China's patent surge: policy

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[10] The patent law came into force in 1985 and was amended twice (1992 and 2000). China joined the Patent Cooperation Treaty in 1994.

reforms, increased R&D investments, greater economic integration, economic reforms, and changed industry composition. They concluded that a single factor does not explain China's patent surge. Amendment of the patent law in 2000 emerges as the main source of patenting growth in their study. However, FDI inflows also play an important role in encouraging Chinese firms to file more patents. Intensification of R&D is not a major driving force behind the rapid growth in patenting. Zhang (2010) largely confirms these results.

25. In the case of Canada, the study by Rafiquzzaman and Whewell (1998) concludes that two factors – patent policy changes and expanded technological opportunities – explain the growth in patenting; however, the latter factor offers a better empirical fit.

26. The above discussion shows that no single factor explains why patent filings have grown over the past decades. Factors such as policy reforms, strategic patenting, patenting in new technology areas, changed management of R&D, and economic integration have been identified as the main drivers.[11]

IV. TREND IN WORLDWIDE PATENT FILINGS

27. Analyzing worldwide patenting trends ideally requires a data source that covers all countries and that offers bibliographical information on individual patents. This study employs WIPO's patent family database – a combination of the EPO PATSTAT database and PCT national phase entries in the WIPO statistical database – that comes closest to this ideal. In particular, the patent family database contains information on individual records, allowing, for example, breakdowns by first and subsequent filings or by technology fields. WIPO's patent family database provides comprehensive data up to 2007. One drawback of this databases is that it only captured patents that have been published; however, comparing patent family data to survey data that include unpublished filings suggests that the resulting bias is likely small – see Annex A1 for further details.

Is There a Surge in Worldwide Patent Filings?

28. Figure 2 depicts the trend in worldwide filings. It shows that growth in filings occurred in two periods. The first took place between 1983 and 1990 – henceforth referred to as the first surge; the second occurred between 1995 and 2007 – henceforth referred to as the second surge. Statistical tests confirm that there were structural breaks in the data series in 1983 and in 1995.[12] It is apparent that the magnitude of the increase for the second surge is higher than for the first one. Between 1995 and 2007, filings grew by 5.2 percent a year, compared to 3.7 percent for the 1983-1990 period. The growth rates for the two surge periods are higher than the overall annual growth rate of 2.8 percent between 1972 and 2007.

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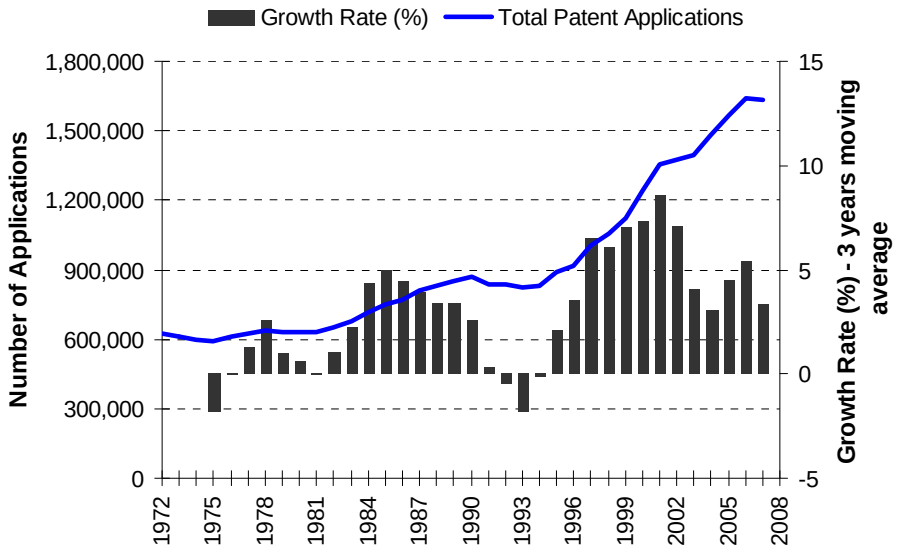
[11] Another possible source of growth in filings is filing by universities. However, there is little evidence to support this hypothesis.

[12] We use the Zandrews, Clemao2, and Clemio2 routines from STATA to test for structural breaks.

Figure 2: Worldwide patent filings: 1972-2007



Source: WIPO Statistics Database, April 2010

At Which Offices Did the Surge Take Place?

29. Table 1 decomposes the change in total filings during the two surge periods by office. From 1983 to 1990, total filings grew by 28.9 percent, mostly due to rapid growth at the Japan Patent Office (JPO).[13] The JPO accounted for 16.6 percentage points of the total growth, followed by the USPTO (8.1 percentage points) and the EPO (4.6 percentage points). From 1995 and 2007, total filings grew by 83.7 percent, mostly due to fast growth at the patent offices of China, the USA, and the Republic of Korea.[14] Those three offices accounted for 60 percentage points of the total growth. The main difference between the first and the second surge is that the surge in worldwide filings in the 1980s was specific to one or at most three offices; the surge in filings during the 1995-2007 period is more broadly spread.

30. The worldwide trend masks important cross-country differences. We therefore take a closer look at the filing activity of the top 15 offices.[15] Annex A2 provides detailed figures for each of the top 15 offices. The graphs show that many offices experienced considerable increases in filings. We employ statistical tests and inspection of the data to determine the time periods that saw elevated filing growth. Annex A2 (Table A2) reports the years in which we suspect structural breaks in the series. Based on this information, we separate the full sample period (1972-2007) into high and low growth periods for each office.[16]

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13 The numbers refer to change in volume and not in growth rate.

14 Once should not directly compare the change in the volume of filings during the first and second surge (28.9 and 83.7 percent, respectively), because the number of years covered by the two periods differs (7 and 12 years, respectively).

15 The top 15 offices are selected according to their total number of filings from 2000 to 2007.

16 For example, the US data show a marked pick-up in filing activity from 1984 onwards. For this reason, the US data are divided into the 1972-1983 and the 1984-2007 sample periods.

Table 1: Contribution of patent office to change in total volume of filings

Office	Surge period: 1983-1990	Office	Surge period: 1995-2007
Total	28.9	Total	83.7
Japan	16.6	China	24.6
United States of America	8.1	United States of America	20.3
European Patent Office	4.6	Republic of Korea	15.2
Soviet Union	1.5	European Patent Office	8.2
Republic of Korea	1.1	Japan	4.7
Canada	1.0	Mexico	2.8
Others	-4.0	Russian Federation	2.5
		Others	5.4

Note: Data represent changes in volume. For example, the number of filings in 1990 is 28.9 percent higher than in 1983 and Japan accounts for 16.6 percentage points of the 28.9 percent increase.

Source: WIPO Statistics Database, April 2010

31. We find that there was a considerable surge in filings during the high growth period at ten offices (Table 2, Panel A). At the majority of them, the rise in filings took place starting in the mid to late 1990s. Nonetheless, there are some exceptions. Japan saw high growth until the mid-1980s.[17] The growth in filings at the USPTO started from 1984 onwards. The EPO experienced strong filing growth between 1979 and 1990; this reflects the fact the EPO came into operation in 1978 and during the early period, the volume of filings was small, generating high rates of growth. The increase in filings during the high-growth period was in excess of 4.5 percent a year for all the ten offices. China, Mexico, and the Republic of Korea experienced double-digit growth.

32. Five offices recorded a drop or a slight increase in filings during the high growth period (Table 2, Panel B). The drop in filings in France, Italy and the United Kingdom and the low growth rate in Germany are arguably due to the creation of the EPO; applicants opted to file at the EPO rather than at the national office if they also wanted to obtain protection in other EPO member states.

[17] Since 1988, the number of applications at the JPO has been fairly stable (growing at 0.8 percent a year). This could be due to the rule change at the JPO in 1988 that made it possible to include multiple claims in a single application.

Table 2: Applications growth rate by patent office (in percent)

Panel A: Offices with high growth in applications

Office	Low Growth Period	Annual Growth (%)	High Growth Period	Annual Growth (%)
Australia	1972-1998	1.4	1999-2007	7.1
China	1985-1991	4.3	1992-2007	21.4
European Patent Office	1991-1996	2.8	1979-1990	16.5
			1997-2007	6.0
Israel	1972-1994	1.8	1995-2007	5.7
Japan	1988-2007	0.8	1972-1980	5.7
			1981-1987	7.8
Mexico	1976-1995	-0.7	1995-2007	13.4
Republic of Korea			1976-1994	18.8
			1995-2007	14.1
Russian Federation	1993-2000	2.0	2001-2007	8.1
South Africa	1972-1994	-0.5	1995-2006	4.6
United States of America	1972-1983	-2.5	1984-2007	7.0

Panel B: Offices with low growth and drop in applications

Office	Low Growth Period	Annual Growth (%)	High Growth Period	Annual Growth (%)
Canada	1972-1988	-0.5	1989-2007	2.8
France	1972-1982	-7.4	1983-2007	-1.0
Germany	1972-1995	-2.8	1996-2007	2.9
Italy	1972-1982	-7.8	1983-2007	-0.7
United Kingdom	1972-1982	-4.8	1983-2007	-1.2

Note: Growth rate refers to average annual growth rate.

Source: WIPO Statistics Database, April 2010

Which Origins Account for the Surge?

33. This section analyzes which origins account for the worldwide patent application surge, with origin defined as the country of residence of the first named applicant. Table 3 shows the contribution of countries to the change in overall filings. The main source of filing growth during the first surge were Japanese applicants – mirroring the breakdown by offices (Table 1). They accounted for 16.9 percentage points of total growth (28.9 percent). The combined contribution of German and US applicants was 10 percentage points. For the second surge, applicants from the USA contributed the most (17.5 percentage points) to the overall growth (83.7 percent), followed by China (15.5 percentage points), the Republic of Korea (14.1), and Japan (10.6). Note that for the origin breakdown, applicants from the USA are the largest source of filing growth, whereas China is the main source of growth when data are broken down by office (Table 1). As in the case of the breakdown by offices, the surge in filings during the 1995-2007 shows greater geographic diversity.

Table 3: Contribution of countries to the change in total volume of filings

Origin	Surge Period: 1983-1990	Origin	Surge Period: 1995-2007
Total	28.9	Total	83.7
Japan	16.9	United States of America	17.5
United States of America	6.9	China	15.5
Germany	3.1	Republic of Korea	14.1
Others	2.0	Japan	10.6
		Germany	5.5
		Russian Federation	2.0
		France	1.7
		Canada	1.4
		Switzerland	1.1
		Others	14.2

Note: Data represent change in volume. For example, the number of filings in 1990 is 28.9 percent higher than in 1983; applicants from Japan accounted for 16.9 percentage points of the total change.

Source: WIPO Statistics Database, April 2010

Table 4: Filings growth by country of origin (in percent)

Panel A: Origin with high growth of applications

Origin	Low Growth Period	Annual Growth (%)	High Growth Period	Annual Growth (%)
Canada	1972-1996	3.0	1997-2007	7.3
China	1985-1998	9.9	1999-2007	32.8
Finland	1972-1982	2.2	1993-2007	5.8
France	1972-1994	-1.2	1995-2007	3.6
Germany	1972-1994	-0.6	1995-2007	4.2
Italy	1972-1993	-0.8	1994-2007	3.9
Japan	1994-2007	2.1	1972-1993	5.4
Netherlands	1972-1995	-2.5	1996-2007	7.3
Republic of Korea	..	..	1972-1993	35.4
	..	..	1994-2007	16.5
Russian Federation	..	..	1993-2007	6.6
Sweden	1972-1991	-0.7	1992-2007	5.7
Switzerland	1972-1996	-2.1	1997-2007	4.8
United States of America	1972-1983	-3.2	1984-2007	4.8

Panel B: Origin with low growth in applications

Origin	Low Growth Period	Annual Growth (%)	High Growth Period	Annual Growth (%)
Australia	1972-1990	0.9	1991-2007	2.7
United Kingdom	1972-1995	-1.0	1996-2007	2.1

Note: Growth rate refers to average annual growth rate.

Source: WIPO Statistics Database, April 2010

34. Annex A3 provides filing trends by country of origin for the top 15 origins.[18] We again separate the sample period (1972-2007) into high and low growth periods. Table 4 provides average annual growth rates for both periods for each office. All origins saw an increase in filings during the high-growth period. Applications from China and the Republic of Korea experienced the fastest growth. Australia and the United Kingdom stand out with relatively modest filing growth during the high growth period.

V. WHAT MIGHT EXPLAIN THE GROWTH IN WORLDWIDE FILINGS?

35. This section focuses on three factors that might explain the surge in worldwide filings: multiple filings of the same invention, changes in the productivity of R&D, and patenting in new technological areas. Multiple filings of the same invention as the driver behind the patent surge is a new hypothesis not considered in the prior literature. Previous studies have investigated the possibility that changes in R&D productivity contributed to the surge; however, we propose a new measure of R&D productivity that arguably better reflects inventive output. Finally, we will also explore whether any particular areas of technology can account for the worldwide surge.

Do More Inventions or Multiple Filings Explain the Patent Surge?

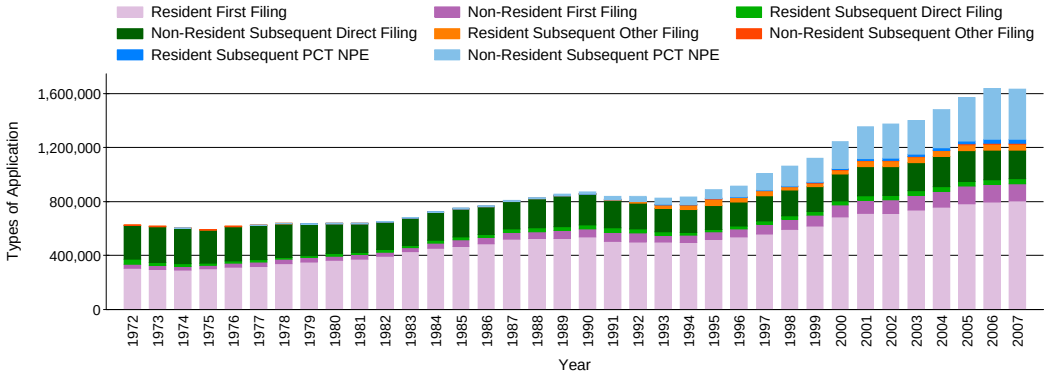
36. Figure 3 provides a breakdown of worldwide patent applications by types of filings – first and subsequent filings (see Annex A4). First filings are closely associated with the idea of a new invention, whereas subsequent filings are linked to earlier filings and thus do not introduce a new invention. If the growth in filings is due to first filings, then the patent

[18] The top 15 origins are selected according to their total number of filings from 2000 to 2007.

surge would reflect an invention surge. However, if subsequent filings are the source of growth then the surge in filings is due to multiple filings of the same invention.

37. Table 5 reports the breakdown of the growth rate in different periods by first and subsequent filings as well as their respective shares. In the first surge period, first filings (3.9 percent) saw a higher growth rate than subsequent filings (3.3 percent). The opposite holds for the second surge period – first filings (4.2 percent) grew more slowly than subsequent filings (6.8 percent).

Figure 3: Worldwide filings by type of filings: 1972-2007



Note: For definition of first and subsequent filings refer to Annex A4.

Source: WIPO Statistics Database, April 2010

Table 5: Growth rate and share of first and subsequent filings

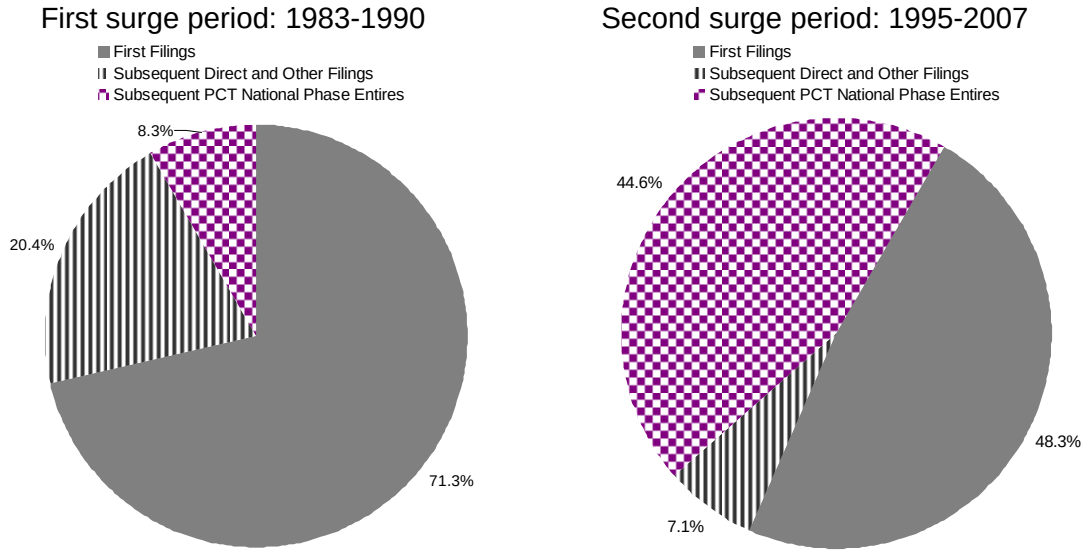
	Average annual growth rate (%)					Share of first and subsequent filings (%)				
	1972-07	1972-82	1983-90	1991-94	1995-07	1972-07	1972-82	1983-90	1991-94	1995-07
First Filings (Original)	3.0	2.5	3.9	-1.2	4.2	62.0	58.0	68.7	67.0	60.2
Subsequent Filings (Duplications)	2.6	-2.5	3.3	2.2	6.8	38.0	42.0	31.3	33.0	39.8
Total	2.8	0.4	3.7	-0.1	5.2	100.0	100.0	100.0	100.0	100.0

38. Figure 4 shows the contribution of first and subsequent filings to the overall growth during the two surge periods. For the first surge, first filings accounted for 71.3 percent of the total growth and subsequent filings for the rest. In other words, the first surge was mainly due to new inventions.

39. In contrast, subsequent filings accounted for the largest share of total growth during the second surge period. However, the contribution of first (48.3 percent) and subsequent filings (51.7 percent) to total growth is more even. In other words, both multiple filings and new inventions contributed to the second surge.

40. Subsequent filings mostly represent filings abroad. While a detailed analysis of what has driven increased filings abroad is beyond the scope of this study, rapidly growing international commerce – or more colloquially “globalization” – is likely to be a key explanatory factor. Overall, the share of subsequent filings grew from 31.3 percent in 1983-1990 to 39.8 percent in 1995-2007 (Table 5). Within the category of subsequent filings, there has been an increase in the use of the Patent Cooperation Treaty (PCT) system. In fact, PCT national phase entries account for most of the growth in subsequent filings during the second surge period. Again, globalization is likely the main driver of increasing PCT use, though growing PCT membership may have also played a role.

Figure 4: Contribution of first and subsequent filings to total growth



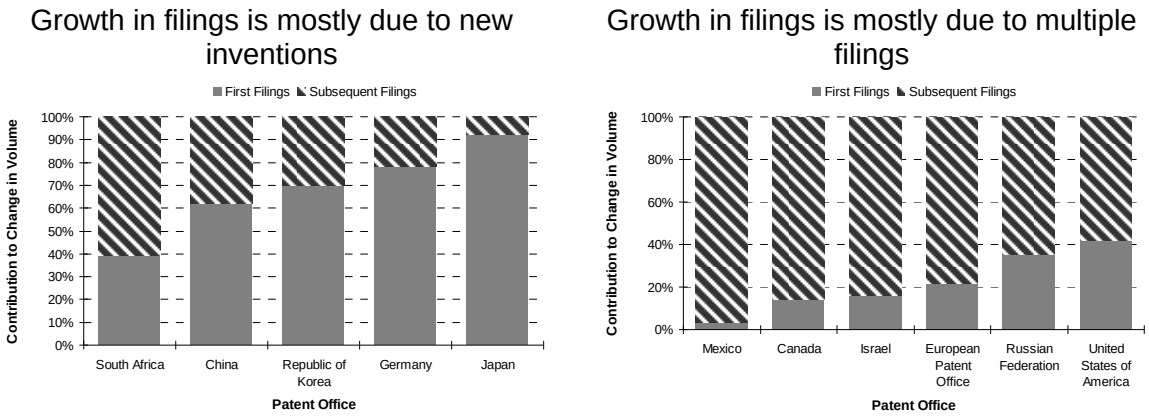
Note: See Annex 4 for definition of first and subsequent filings.

Source: WIPO Statistics Database, April 2010

41. Figure 5 depicts the contribution of first and subsequent filings to total growth for the top offices during the previously identified high growth periods. In China, Germany, Japan, the Republic of Korea, and South Africa first filings – approximating new inventions – are the main source of filing growth. For example, more than 90 percent of the total growth in Japan is due to first filings. In seven offices, multiple filings are the main factor behind the surge. For example, almost all the growth in Mexico is due to multiple filings.

42. Figure 6 shows the contribution of first and subsequent filings to total growth by country of origin, again focusing on the high growth periods. New inventions are the main factor behind growth in filings originating from China, Japan, the Republic of Korea and the Russian Federation. For those countries, the contribution of multiple filings is small. This reflects the fact that applicants from those countries mostly file in their domestic markets. Multiple filings are the largest contributor to total growth in filings for 10 countries. For the origins reported in Figure 6, more than 55 percent of total growth is due to multiple filings.

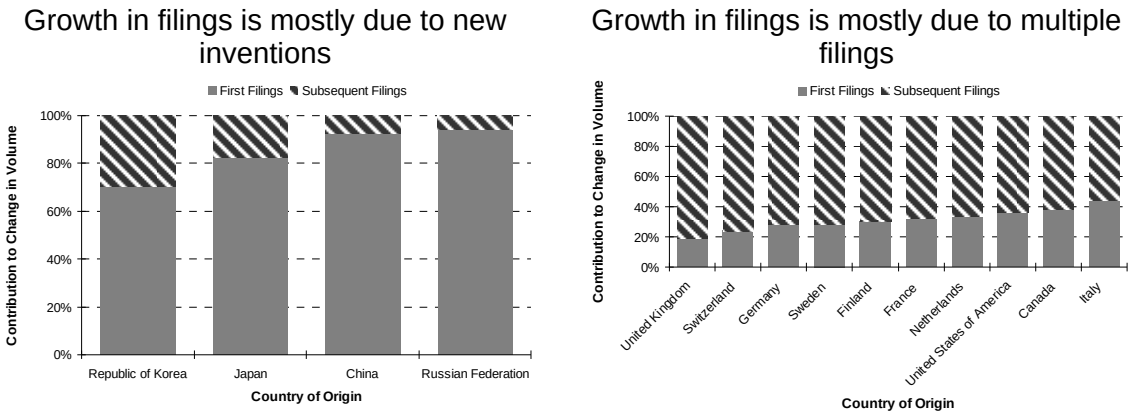
Figure 5: Contribution of first and subsequent filings to filing growth by office



Note: The list of offices and the high growth sample period reported here are same as in table 2. We exclude France, Italy and the United Kingdom because they saw a drop in filings (see table 2). Canada (1989-2007), China (1992-2007), European Patent Office (1997-2007), Germany (1996-2007), Israel (1995-2007), Japan (1981-1987), Mexico (1995-2007), Republic of Korea (1995-2007), Russian Federation (2001-2007), South Africa (1995-2006), and United States of America (1984-2007).

Source: WIPO Statistics Database, April 2010

Figure 6: Contribution of first and subsequent filings to filing growth by origin



Note: The list of countries and the high growth sample period reported here are the same as in table 4. Canada (1997-2007), China (1999-2007), Finland (1993-2007), France (1995-2007), Germany (1995-2007), Italy (1994-2007), Japan (1972-1993), Netherlands (1996-2007), Republic of Korea (1994-2007), Russian Federation (1993-2007), Sweden (1992-2007), Switzerland (1997-2007), United Kingdom (1996-2007), and United States of America (1984-2007).

Source: WIPO Statistics Database, April 2010

43. Table 6 shows filings abroad by country of origin and destination office for the two surge periods. During the first surge period, filings abroad grew by 31 percent. German filings at the JPO account for the largest share (5.6 percentage points) of total growth (31 percent). In addition, Japanese filings at the USPTO and the EPO account for a large share of total growth.

44. During the second surge, filings abroad grew by 146.2 percent. Japanese filings at the USPTO (11.2 percentage points) and China (9.0 percentage points) account for the largest shares of total growth (146.2 percent). The USA as an origin country also appears high in the ranking. China and the Republic of Korea overall emerge as popular destinations for filings abroad.

Table 6: Origin and destination of abroad filings

First Surge Period				Second Surge Period			
Origin - Destination	1983	1990	Contribution to Growth	Origin - Destination	1995	2007	Contribution to Growth
Total	233,465	305,947	31.0	Total	305,441	751,901	146.2
Germany -Japan	5,490	18,558	5.6	Japan -USA	28,567	62,680	11.2
Japan -USA	10,724	21,548	4.6	Japan -China	5,395	32,979	9.0
Japan -EPO	4,219	12,742	3.7	USA -China	4,858	29,161	8.0
USA -EPO	9,413	17,237	3.4	Germany -EPO	14,097	34,004	6.5
Germany -EPO	6,781	14,260	3.2	Republic of Korea -USA	2,128	18,810	5.5
USA -Japan	12,287	16,751	1.9	USA -Japan	10,337	25,346	4.9
Germany -German Democratic Republic	831	5,006	1.8	USA -Republic of Korea	1,476	16,414	4.9
Russian Federation -Soviet Union	1,410	5,532	1.8	Japan -Republic of Korea	4,490	19,217	4.8
Japan -Republic of Korea	1,331	4,921	1.5	USA -EPO	18,589	32,885	4.7
Germany -USA	5,361	7,799	1.0	Germany -USA	8,376	21,049	4.1
USA -Australia	3,366	5,457	0.9	USA -Mexico	1,030	13,252	4.0
France -EPO	2,821	4,816	0.9	Japan -EPO	10,663	20,773	3.3
USA -Canada	11,290	13,207	0.8	Republic of Korea -China	1,022	9,017	2.6
Japan -Canada	2,124	3,894	0.8	Germany -China	1,926	9,806	2.6
Italy -EPO	803	2,373	0.7	USA -Australia	3,806	11,241	2.4
USA -Republic of Korea	970	2,519	0.7	France -EPO	4,720	9,478	1.6
France -USA	2,036	2,976	0.4	USA -Canada	13,945	18,591	1.5
Germany -Republic of Korea	157	984	0.4	China -USA	65	4,696	1.5
Switzerland -EPO	1,378	2,183	0.3	Republic of Korea -Japan	1,735	6,332	1.5
Germany -Canada	1,394	2,181	0.3	Canada -USA	2,433	6,956	1.5
Others - Others	149,279	141,003	-3.5	Others - Others	165,783	349,214	60.1

Source: WIPO Statistics Database, April 2010

Does Increased R&D Productivity Explain the Filing Surge?

45. Figure 7 shows the worldwide trend in R&D productivity – defined here as first filings over constant dollar business sector R&D expenditure. Contrasting the surge in patent filings, R&D productivity has been on a continuous downward trend. In other words, shifts in the productivity of R&D cannot account for the worldwide patent surge.

46. We use data on first filings in Figure 7, rather resident filings as some of the prior literature has done (Jaffe 2000; Kim and Marschke 2004). This is arguably a better measure of R&D output: some inventors may not seek a patent in their home office, whereas others may file two or more patents for the same invention at home. Indeed, measuring R&D productivity based on resident filings may be misleading for some countries. Annex A5 depicts R&D productivity based on first filings and resident filings for the top 15 origins. The measure based on resident filings shows a downward trend for the Netherlands and Switzerland (Annex 5). However, the first filings measure shows an upward trend in those two countries. This is due to the preference of Dutch and Swiss applicants to file abroad without first filing at their respective domestic patent offices. For the USA, R&D productivity based on resident filings exceeds R&D productivity based on first filings. This is due to the inclusion of subsequent domestic filings – for example, continuations in part – in the former measure.

47. Table 7 presents the R&D productivity of the top 14 origins during the high and low growth periods. The measure varies from 0.54 in the US to 4.0 in the Republic of Korea during the high growth period. Asian countries – in particular, China, Japan, and the Republic of Korea – show the highest propensities to patent. Comparing R&D productivity for the two periods shows mixed results. The measure was lower for five countries during the high growth period, with Japan seeing the largest differences between the two periods. For five countries, the measure was higher during the high growth period.

48. For the top five origins, we observe the following trend. R&D productivity for the USA and Japan was higher during the high growth period.[19] In contrast, R&D productivity for Germany was higher during the low growth period. For China and the Republic of Korea, it is not possible to make similar comparisons because of insufficient R&D data.

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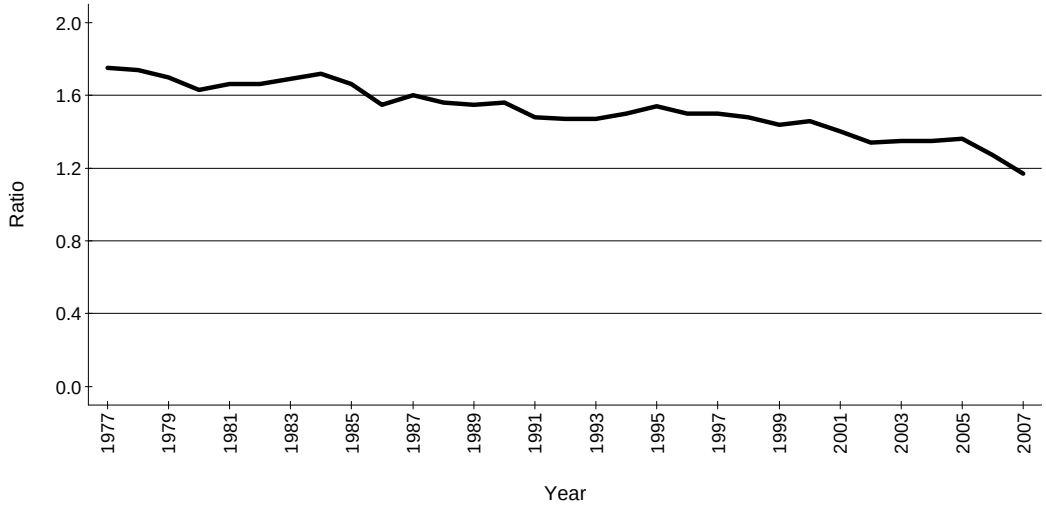
[19] Note that for Japan, the high growth period is from 1976 to 1993.

Figure 7: Worldwide R&D productivity



Note: 20 countries are included in the total figure. They account for 65 percent of world first filing in 2007. It includes all the main R&D spenders except China, the Republic of Korea, and the Russian Federation because of insufficient data. R&D data refer to business sector R&D expenditure in constant 2005 PPP dollars. Patent filing data refer to first filing data.

Source: WIPO Statistics Database and UNESCO R&D Database, April 2010

Table 7: R&D productivity by main origins

Origin	Low Growth Period (LGP)	High Growth Period (HGP)	Intensity based on First Filing	
			LGP	HGP
Canada	1976-1996	1997-2007	0.54	0.66
China	1986-1998	1999-2007	..	1.72
Finland	1976-1982	1993-2007	1.87	1.11
France	1976-1994	1995-2007	0.76	0.62
Germany	1976-1994	1995-2007	1.38	1.25
Italy	1976-1993	1994-2007	1.13	1.18
Japan	1994-2007	1976-1993	3.95	5.61
Netherlands	1976-1995	1996-2007	0.63	0.82
Republic of Korea	..	1994-2007	..	4.00
Russian Federation	..	1993-2007	..	1.69
Sweden	1976-1991	1992-2007	1.29	0.78
Switzerland	1976-1996	1997-2007	1.15	1.13
United Kingdom	1976-1995	1996-2007	0.86	0.88
United States	1976-1983	1984-2007	0.51	0.54

Note: R&D data refer to business sector R&D expenditure in constant 2005 PPP dollars. High and low growth periods are defined in table 4. However, 1976 is the first year in this table rather than 1972, reflecting the availability of R&D data.

Source: WIPO Statistics Database and UNESCO R&D Database, April 2010

Can Specific Technologies Account for the Patent Surge?

49. As discussed in section 2, some studies have attributed the patent surge to certain high technology industries. Table 8 shows the growth rate for the top 16 fields of technology.[20] From 1995 to 2007, digital communication saw the fastest average annual growth (15.2 percent), followed by pharmaceuticals (10.7 percent), computer technology (9.2 percent), medical technology (8.1 percent), semiconductors (7.7 percent) and telecommunications (7.2 percent).

Table 8: Filing growth rate by technology

Technology	Average Annual Growth Rate (%)			
	1972-82	1983-90	1991-94	1995-07
Digital communication	4.9	9.3	4.0	15.2
Pharmaceuticals	7.8	5.3	4.8	10.7
Computer technology	6.0	10.4	-5.7	9.2
Medical technology	4.9	6.4	5.9	8.1
Semiconductors	8.7	8.4	-7.6	7.7
Telecommunications	4.1	8.6	0.5	7.2
Biotechnology	5.7	9.0	7.3	5.8
Electrical machinery, apparatus, energy	1.2	1.1	0.5	5.6
Measurement	2.2	2.5	-5.1	5.5
Organic fine chemistry	-1.9	0.9	1.1	4.7
Audio-visual technology	5.7	6.2	-3.2	4.5
Transport	-0.6	3.2	3.4	4.2
Optics	3.4	7.6	-2.3	3.8
Civil engineering	0.0	1.9	4.4	2.3
Handling	-0.9	1.2	2.9	2.2
Other special machines	-0.6	2.9	-0.7	2.0

Note: WIPO's IPC-Technology concordance table is used to classify the data by fields of technology.

Source: WIPO Statistics Database, April 2010

50. The average annual growth rates shown in Table 8 mask the relative weight of different technologies in overall patenting activity. Table 9 therefore provides information on the contribution of each technology field to total filing growth between 1995 and 2007. Computer technology (8.9 percentage points) accounts for the largest share of the total overall increase (83.7 percent). Pharmaceuticals, electrical machinery, digital communication, telecommunications, and medical technology each contributed between 5.0 and 6.1 percentage points. Interestingly, despite average annual growth of close to 6 percent, the contribution of biotechnology to overall filing growth is modest at 2 percentage points; this reflects a relatively small share of biotechnology in overall patenting activity.

51. Overall, the figures presented in Table 9 suggest that no single field of technology can account for the worldwide patent surge. Three of the broadly defined information and communication technologies (ICTs) – in particular, computer technology, digital communications, and telecommunications – are important sources of growth, but even their combined contribution accounts for less than a fifth of the overall increase.

52. Table 9 also reports the shares of first and subsequent filings for the different technology fields. For computer technology, digital communications, telecommunications, and biotechnology, first filings – approximately, inventions – account for the majority of filings between 1995 and 2007. For the other fields of technology listed in Table 9, this share is below 50 percent; for audio-visual technology, optics, handling, and other special machines, it even lies below 40 percent.

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[20] We use WIPO's IPC-Technology concordance table to classify data by technology. There are 35 technologies, but we focus on the top 16 technologies based on average number of filings during the 1995-2007 period.

53. Hall and Ziedonis (2001) have put forward the idea that firms that innovate in so-called complex technology fields will patent more than those that operate in so-called discrete technology fields. Complex technologies are usually defined as technologies for which the resulting products or processes consist of numerous separately patentable elements; discrete technologies, in turn, describe products or processes that consist of a single or relatively few patentable elements.[21] Hall and Ziedonis argue that incentives for acquiring patent rights are stronger for complex technologies because of "an increased threat of hold-up". The study by von Graeventiz, et. al. (2008) puts forward a similar argument: "greater complexity increases the scope for hold-up and raises the need for strategic build-up of patent portfolios". Several other researchers (Ziedonis 2004; von Graeventiz, et. al. 2008) have similarly pointed out that greater fragmentation of patent ownership is associated with more aggressive defensive patenting. The reason for more patenting in a situation of fragmented ownership is that firms need to build-up their patent portfolios to strengthening their bargaining position – be it for cross-licensing or litigation.

54. We adopt the definition complex and discrete technologies developed by von Graevenitz et al. (2008) to explore whether filing growth differed for these two broad categories of technology. Between 1995 and 2007, complex technologies accounted for 74 percent of first filings and 63 percent of subsequent filings and discrete technologies for the remaining 26 and 37 percent, respectively. Figure 8 depicts the filing trends for these two broad technology categories, whereby filing figures are converted into index numbers with a common base year. Looking at first filings, filing growth for complex technologies has been consistently faster than for discrete technologies, especially since the mid-1990s. Subsequent filings for the two technology types saw similar trends up to the mid-1990s, not experiencing any growth; however, from the mid-1990s onward, subsequent filings picked up for both types and grew substantially faster for complex technologies.

55. These findings at first appear consistent with the prior literature. However, faster filing growth for complex technologies may equally reflect the nature of technological progress, with complex technologies possibly having seen more radical technological breakthroughs – as illustrated by the ICT revolution, for example. In addition, the notion of increased strategic patenting does not appear to be reflected in aggregate R&D productivity which has been on a continuous downward trend since the late 1970s (see Section 4.2). More research is needed to better understand how R&D investments and changes in company filing strategies have affected filing growth for specific technologies and how this has affected the patent surge.

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[21] See, for example, Cohen, et. al.(2000).

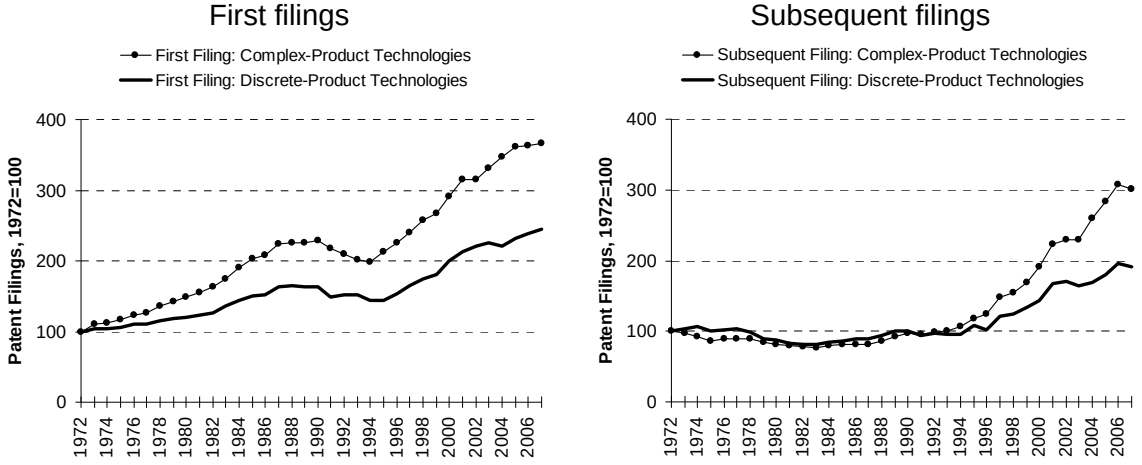
Table 9: Contribution of technology to change in volume of filings between 1995 and 2007

Technology	Change in total volume	First filing share (%)	Subsequent filing share (%)
Total	83.7		
Computer technology	8.9	51.7	48.3
Pharmaceuticals	6.1	41.3	58.7
Electrical machinery, apparatus, energy	5.3	46.4	53.6
Digital communication	5.2	50.5	49.5
Telecommunications	5.0	53.9	46.1
Medical technology	5.0	41.1	58.9
Semiconductors	4.7	45.9	54.1
Measurement	3.5	49.7	50.3
Audio-visual technology	3.2	35.6	64.4
Transport	2.8	49.9	50.1
Optics	2.7	38.9	61.1
Organic fine chemistry	2.6	41.5	58.5
Biotechnology	2.0	53.6	46.4
Civil engineering	1.4	45.2	54.8
Handling	1.1	25.7	74.3
Other special machines	1.0	37.5	62.5
Others	23.5		

Note: WIPO's IPC-Technology concordance table is used to classify the data by fields of technology.

Source: WIPO Statistics Database, April 2010

Figure 8: Filing trends for complex versus discrete technologies (1972=100)



Note: WIPO's IPC-Technology concordance table is used to classify the data by fields of technology. The classification of complex and discrete technologies follows von Graevenitz et. al. (2008). See Annex A6 for details.

Source: WIPO Statistics Database, April 2010

VI. IMPLICATIONS FOR PATENT OFFICES

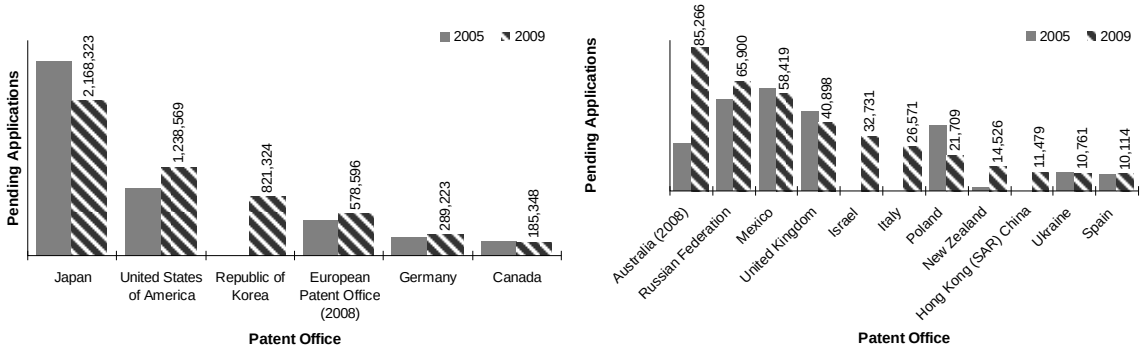
56. Over the past two decades, many offices have seen increases in the number of pending patent applications – applications awaiting a final decision by a patent office – and pendency time – the period between filing an application and the final decision of the patent office (or withdrawal of the application). These developments have raised concerns about the effectiveness of the patent system in promoting innovation. Lengthened pendency time increases the period of uncertainty about whether an application will be granted. This harms applicants that need to finance the development and commercialization of their inventions; it also harms third parties that may forgo innovative activities for fear of violating a future patent right. From the viewpoint of offices, large and increasing processing backlogs may create pressures to process examinations quickly, possibly compromising the quality of examination (Jaffe and Lerner, 2004).

57. At first, the surge in patent applications appears as the obvious driver of growing pending application numbers and pendency times. However, other factors have contributed to these trends: the size of patent applications has grown and, in some offices, there has been more extensive communication between examiners and applicants (van Zeebroeck, et. al., 2009; Mejer and van Pottelsberghe, 2011). In other words, there might have been longer pendency times and more pending applications, even if there had not been an increase in filings. In addition, changes in offices' examination capacity influence pendency performance. Indeed, most offices that have experienced strong filing growth have responded by employing additional patent examiners. It is only when the inflow of new applications exceeds the existing examination capacity that pendency time goes up.

58. This section briefly reviews how the number of pending applications and pendency time have evolved in recent years. This is done against the background of the worldwide patent surge described in the previous section, though the discussion does not seek to quantify to what extent growing application numbers have caused these phenomena.

59. Figure 9 presents figures on "potentially pending" applications across the world. The concept of "potentially pending" applications include all filings that still await a final decision. The number of potentially pending applications may or may not coincide with what offices consider their backlog of unprocessed applications.[22] WIPO estimates that the number of potentially pending applications across the world stood at 5.94 million in 2008.[23] The JPO saw the largest number of potentially pending applications, followed by the offices of the USA, the Republic of Korea, and the EPO. Most patent offices have experienced growth in number of potentially pending applications over the past few years; in the USA, for example, they grew by 7.1% a year from 2005 to 2009. Japan and the United Kingdom are notable exceptions, seeing a drop over the 2005-2009 period.

Figure 9: Potentially pending applications at selected patent offices



Note: Potentially pending applications include all applications, at any stage in the process, that await a final decision by the patent office, including those applications for which applicants have not filed a request for examination (where applicable). For example, total potentially pending applications in Japan includes 1.45 million applications awaiting a request for examination.

Source: WIPO Statistics Database, April 2010

22 For example, some offices may consider filings to be part of the backlog only when certain procedural requirements have been met or when the applicant formally requested examination of the application.

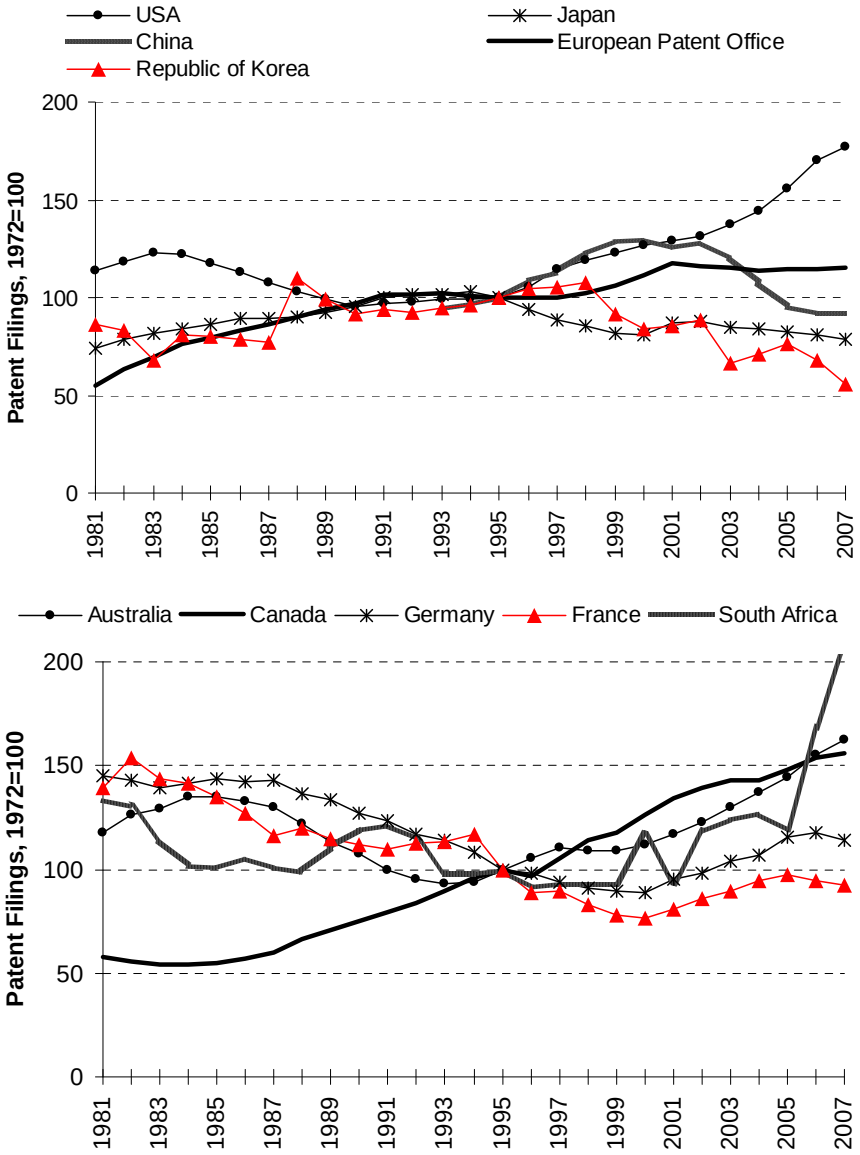
23 WIPO (2010), "World Intellectual Property Indicators 2010". This estimate is based on data from 71 offices, which include the top 20 offices except China, India, Singapore, and South Africa.

60. Along with growing numbers of pending patent applications, many offices have seen an increase in pendency time. Only a few offices report consistent pendency time data to WIPO and most available data are for the past few years. However, it is possible to construct a proxy for pendency time using the EPO's PATSTAT database. In particular, one can proxy ex-post pendency time by employing information on the filing and grant dates of patents. Note that if pendency time is systemically different for applications that are not granted, this proxy may over- or underestimate actual pendency time.

61. It is not meaningful to compare pendency times across offices, as they reflect to some extent differences in national patent procedures. For example, at some offices – notably the JPO and the EPO – applicants can delay the request for examination of the patent by several years; at other offices – notably at the USPTO – no such delays are possible. That said, one can meaningfully analyze how patent pendency time has evolved over time in individual offices.

62. Figure 10 and Table 10 provide data on the evolution of pendency time for selected offices. In Figure 10, pendency time data are converted into index numbers with a common base year. The Figure shows that during the second surge (1995-2007), pendency time rose in some offices and dropped in others. The five offices that contributed most to the second surge (see table 1) equally offer a mixed picture: China, Japan and the Republic of Korea saw a decrease in pendency time; the EPO and the USA saw an increase. This shows that there is no inevitable causality from growing application numbers to increasing pendency time.

Figure 10: Growth of pendency time: selected offices



Note: Pendency times data are only based on granted patents. They refer to the average ex-post pendency period of all the patents granted in a given year. Figures are converted into index numbers with 1995 as the common base year.

Source: WIPO Statistics Database, April 2010

Table 10: Change in pendency time between 1995 and 2007 (in percent): selected patent offices

Increasing Pendency Time		Decreasing Pendency Time	
Office	1995-2007	Office	1995-2007
South Africa	109.6	Russia Federation	-2.5
Poland	91.6	France	-7.3
United States of America	76.9	China	-7.6
Australia	62.1	United Kingdom	-8.8
Canada	56.3	Spain	-14.1
European Patent Office	15.5	Japan	-21.6
Germany	13.8	Italy	-27.9
Noway	11.5	Sweden	-38.4
		Republic of Korea	-44.5
		Netherlands	-85.8

Note: Pendency times are only based on granted patents. They refer to the average ex-post pendency period of all the patents granted in a given year.

Source: WIPO Statistics Database, April 2010

VII. CONCLUSIONS

63. The surge in patent filings over the past four decades raises important questions about its causes and its consequences for innovation and the functioning of the international patent system. This study has sought to identify the factors behind the surge in filings and the consequent heavy workload on the patent system.

64. Patent filings surged during two periods. The first occurred between 1983 and 1990 and the second took place between 1995 and 2007. The magnitude of growth in worldwide filings for the second surge was higher than the first one.

65. Of the top 15 patent offices, 10 offices saw considerable growth in patent filings. At the majority of the offices, the rise in filings started in the mid to late 1990s. China, the Republic of Korea and Mexico experienced double-digit growth.

66. Japanese applicants were the main source of filing growth during the first surge. They accounted for 16.9 percentage points of total growth (28.9 percent). For the second surge period, applicants from the USA contributed the most (17.5 percentage points) to overall growth (83.7 percent), followed by China (15.5 percentage points), the Republic of Korea (14.1) and Japan (10.6).

67. The study looked at three factors that may explain the surge in worldwide filings: multiple filings of the same invention, changes in R&D productivity, and patenting in specific fields of technology.

68. A breakdown of worldwide filings by first and subsequent filings reveals the following:

– For the first surge, first filings accounted for 71.3 percent of worldwide filing growth and subsequent filings for the rest. This suggests that the growth in worldwide filings was mainly due to new inventions.

– For the second surge, subsequent filings accounted for the largest share of total growth in filings. However, the distribution of first (48.3 percent) and subsequent (51.7 percent) filings to total growth is more even. In other worlds, both multiple filings and new inventions are drivers of the worldwide surge. Subsequent filings mostly represent filings abroad. The growth in the share of subsequent filings is most likely due to rapid growth in international commerce. The strong growth in filings abroad points to the importance of work sharing arrangements among offices in minimizing duplication of work and promoting high quality examination.

– The contribution of first and subsequent filings varies across offices and origins. New inventions are the main factors behind the growth in filings originating from China, Japan, the Republic of Korea, and the Russian Federation. Multiple filings are the main source of growth in filings originating from European countries, Canada and the USA.

– There has been an increase in the use of the PCT system for subsequent filings. For the second surge period, PCT national phase entries accounted for most the growth in subsequent filings.

69. Aggregate R&D productivity – first filings over real R&D expenditure – has been on a continuous downward trend. Worldwide changes in R&D productivity thus cannot account for the worldwide patent surge. Most countries analyzed in this report equally show a downward trend in R&D productivity. However, there are a few exceptions. The USA, the Russian Federation, the Netherlands, and Switzerland show an increase in R&D productivity.

70. Decomposing filing growth by fields of technology suggests that no single field of technology can account for the worldwide patent surge. Three of the broadly defined information and communication technologies (ICTs) – in particular, computer technology, digital communications, and telecommunications – are important sources of growth in filings, but even their combined contribution accounts for less than a fifth of the overall growth. Complex technologies are a more important driver of growth than discrete technologies. This likely reflects the nature of technological progress and shifting patenting strategies; however, more research is necessary to better understand how R&D investments and changes in company filing strategies have affected filing growth for specific technologies and how this has affected the worldwide patent surge.

71. There has been an increase in the number of pending applications at most offices in recent years. At the same time, pendency time has lengthened in some offices while shortened in others. The surge in filings is only one factor affecting pendency performance. Other factors include changes in office examination capacity, changes in the size and complexity of applications, and more frequent examiner-applicant communication.

72. Finally, the study has raised a number of questions that could not be fully answered, mainly because of data limitations. In some areas, the construction of richer data sets appears possible in the short to medium term – for example, developing indicators of R&D productivity broken down by certain economic sectors or fields of technology. In other areas, progress will require more time – for example, in quantifying the causes of changed pendency performance.

73. The Working Group is invited to note the contents of the study set out in this document.

References

Blind, K., K. Cremers, and E. Mueller (2009), “The influence of strategic patenting on companies’ patent portfolios”, Research Policy, Vol. 38(2), pp. 428-436.

Cohen, W., R. Nelson. and J. Walsh (2000), “Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not)”, NBER Working Paper No. 7552.

Hall, B. (2005), “Exploring the patent explosion”, Journal of Technology Transfer, Vol. 30(1-2), 35-48.

Hall, B. and R. Ziedonis (2001), “The patent paradox revisited: determinants of patenting in the U.S. semiconductor industry, 1980-94”, Rand Journal of Economics, Vol. 32(1), pp. 101-128.

Hu, A. and G. Jefferson (2009, “A great wall of patents: What is behind China’s recent patent explosion?”, Journal of Development Economics, Vol. 90(1), pp. 57-68.

Jaffe, A. (2000), “The US patent system in transition: policy innovation and the innovation process”, Research Policy, Vol. 29, pp. 531-557.

Jaffe, A. and J. Lerner (2004), “Innovation and its discontents: How our broken patent system is endangering innovation and progress, and what to do about it”, Princeton University Press, New Jersey.

JPO (2010), Annual Report 2010.

Kim, J. and G. Marschke (2004), “Accounting for the recent surge in U.S. patenting: ”changes in R&D expenditures, patent yields, and the high tech sector”, Economics of Innovation and New Technology, Vol. 13(6), pp. 543-558.

Kortum, S. and J. Lerner (1999), “What is behind the recent surge in patenting?”, Research Policy, Vol. 28(1), pp. 1-22.

Mejer, M. and B. van Pottelsberghe (2011), “Patent backlogs at USPTO and EPO: systemic failure vs deliberate delays”, World Patent Information, *forthcoming*.

Noel, M. and M. Schankerman (2006), “Strategic patenting and software innovation”, Centre for Economic Research Working Paper No. 5701.

Rafiquzzaman, M. and L. Whewell (1998), “Recent jumps in patenting activities: comparative innovative performance of major industrial countries, patterns and explanations”, Industry Canada Research Publications Program, Working Paper No. 27.

Rodriguez, V. (2010), “The backlog issue in patents: a look at the European case”, Research Policy, Vol. 32(4), pp. 287-209.

Shapiro, C. (2001), “Navigating the patent thicket: cross-licenses, patent pools, and standard-setting”, in Jaffe, A., Lerner, J. and Stern, S. (edited), Innovation policy and the Economy, Vol. 1. MIT Press.

van Zeebroeck, N., B. van Pottelsberghe, and D. Guellec (2009), “Claiming more: the increased voluminosity of patent applications and its determinants”, Research Policy, Vol. 38(6), pp. 1006-1020.

von Graevenitz, G., S. Wagner, and D. Harhoff (2008), “Incidence and Growth of Patent Thickets - the Impact of Technological Opportunities and Complexity”, CEPR Discussion Paper No. DP6900.

WIPO (2010), “World Intellectual Property Indicators 2010”.

Zhang, H. (2010), “What is behind the recent surge in patenting in China?”, International Journal of Business and Management, Vol. 5(10), pp. 83-91.

Ziedonis, R. (2004), “Don’t fence me in: fragmented markets for technology and the patent acquisition strategies of firms”, Management Science, Vol. 50(6), pp. 804-820.

[Annex A1 follows]

ANNEX A1

COMPARISON OF WIPO PATENT FAMILY WITH WIPO SURVEY DATABASE

1. This study mainly relies on WIPO's patent family database – a combination of the EPO's PATSTAT database and the WIPO statistical database. The WIPO statistical database includes records of all PCT applications, records of PCT national phase entries (NPE) at certain offices, as well as aggregate patent statistics collected by WIPO through its annual IP Statistics Survey ("survey data"). The PATSTAT database contains individual records of published national applications covering more than 130 offices.

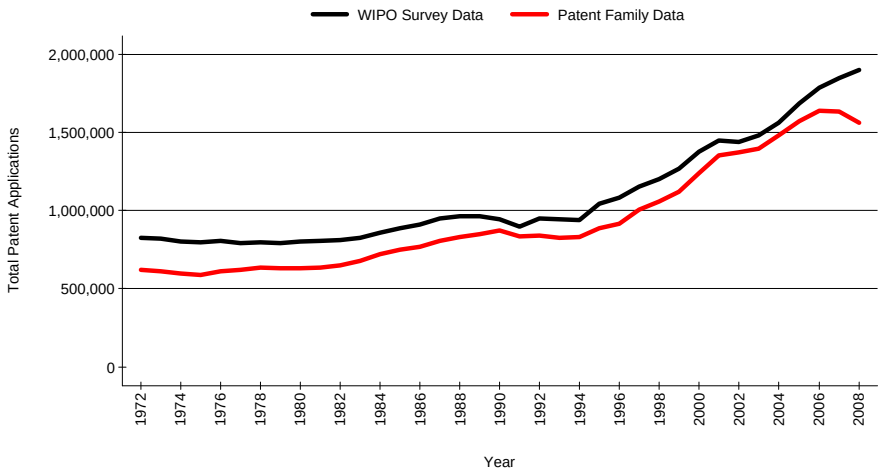
2. This study mainly relies on WIPO's patent family database – a combination of the EPO's PATSTAT database and the WIPO statistical database. The WIPO statistical database includes records of all PCT applications, records of PCT national phase entries (NPE) at certain offices, as well as aggregate patent statistics collected by WIPO through its annual IP Statistics Survey ("survey data"). The PATSTAT database contains individual records of published national applications covering more than 130 offices.

3. For the present study, using the WIPO patent family database has certain advantages. It allows for data breakdowns by office, origin, first and subsequent filings, and technology field. To build the family database, we firstly "cleaned" the PATSTAT database. This process involved removing data for PCT designations data and duplicated publication records. We grouped the "clean" PATSTAT records according to their relationship: first, subsequent, and continuations or divisional filings. We then supplemented the PCT NPE data in the PATSTAT database with available PCT NPE data from the WIPO statistical database[24]. We finally compare the family database with survey data to evaluate how accurate the family database is.

4. Figure A1.1 compares total applications data from WIPO's Statistics Survey and WIPO's patent family data. We expect the patent family data to show fewer patents than the Statistics Database because the former include only the published applications, whereas the latter capture all applications. Both data series follow the same trend, except for the latest available year, 2008. For the 1972-2007 period, the patent family data include 85 percent of the worldwide data collected through the Statistics Survey.

[24] The reason for adding PCT NPE data from WIPO statistics database is that the PATSTAT database is incomplete and or missing.

Figure A1.1: Total patent filings based on patent family and survey data



5. The world average may hide more pronounced data discrepancies at the office level. Therefore, we analyze the two data series for the top 15 offices.[25] Table A1 provides summary statistics. It shows that the family data include more than 80 percent of total filings for all offices, except for Mexico and the Russian Federation. Figure A1.2 illustrates the two series graphically. It shows that they follow a similar trend for all offices, except Australia, Israel, and South Africa.[26]

6. From these comparisons, we conclude that the patent family data reasonably captures time series trends at the worldwide level and for most offices. The present study therefore relies on this data source, enabling richer analysis. However, the study only analyzes data up to 2007 to avoid distortions due to missing data.

Table A1: Average number of filings by office: top 15 offices

Patent Office	Patent Families	Survey Data	Families / Survey (%)
Australia	15,276	17,542	87.1
Canada	27,821	30,123	92.4
China	56,237	58,354	96.4
European Patent Office	68,085	66,730	102.0
France	21,904	23,255	94.2
Germany	43,099	52,674	81.8
Israel	4,443	4,203	105.7
Italy	13,159	13,368	98.4
Japan	305,127	309,647	98.5
Mexico	5,761	7,396	77.9
Republic of Korea	42,304	49,936	84.7
Russian Federation	23,702	30,578	77.5
South Africa	7,134	8,471	84.2
United Kingdom	31,382	35,839	87.6
United States of America	159,516	195,096	81.8

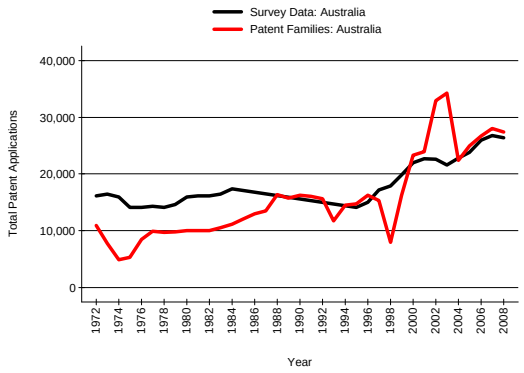
25 We selected the top 15 offices according to the total number of filings during the 2000-2007 period. Brazil is one of the top 15 offices, but we had to exclude it from the sample because of inconsistent data. The top 15 offices account for around 93 percent of all patent families.

26 For those three counties, the series tend to diverge for the later years. However, they account for a small proportion of total patent families; we therefore do not expect them to affect the conclusions of this study.

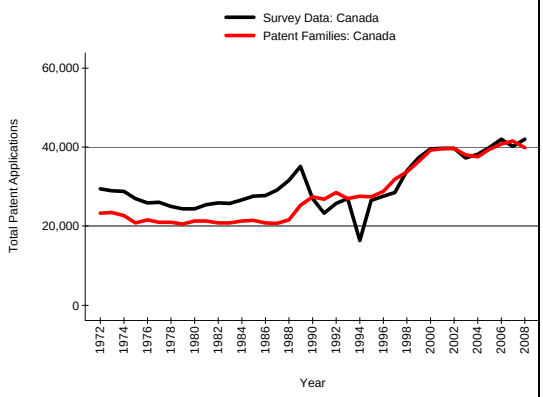
Note: Sample varies for offices and depends on data availability for both data sources.

Figure A1.2: Trends in patent filings based on patent family and survey data: top 15 offices

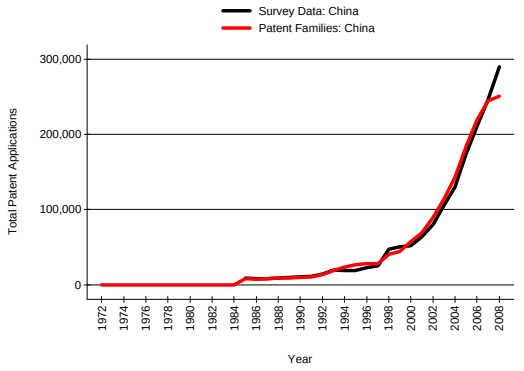
Office: Australia



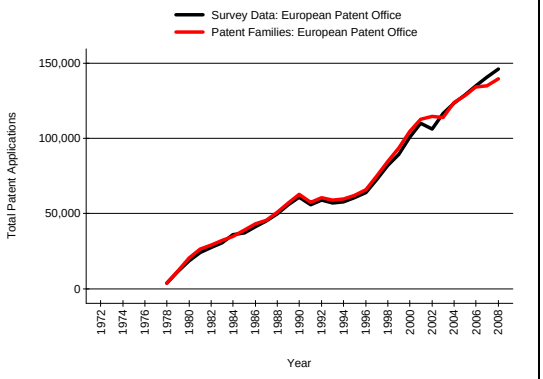
Office: Canada



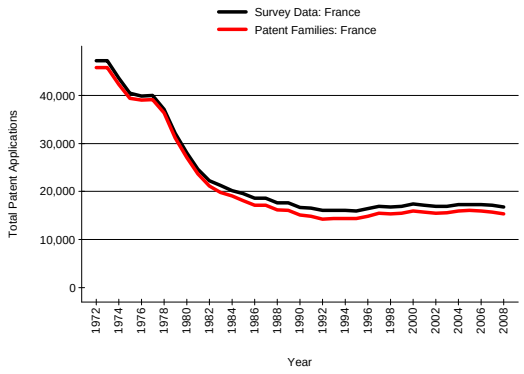
Office: China



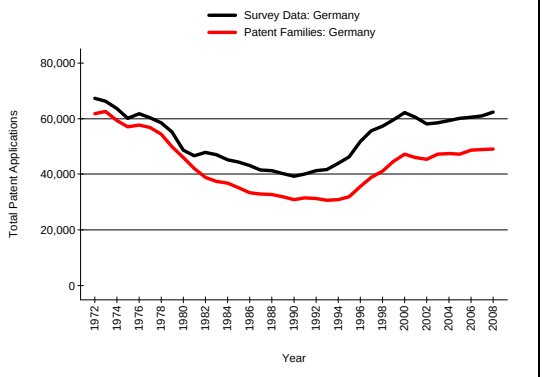
Office: European Patent Office



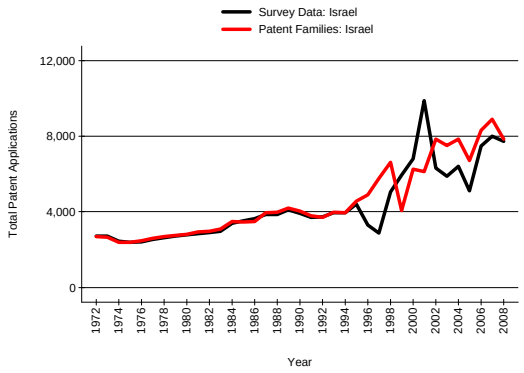
Office: France



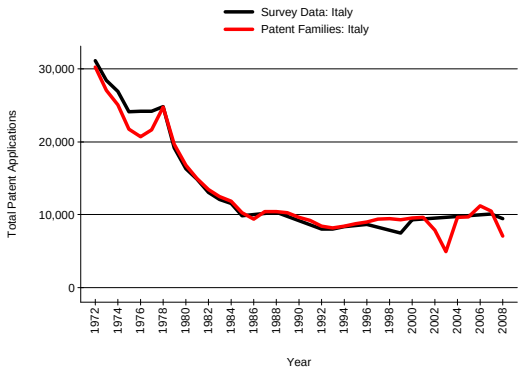
Office: Germany



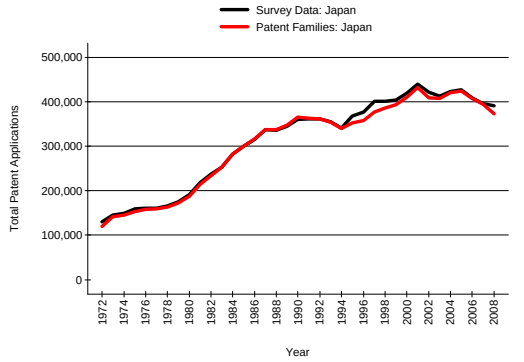
Office: Israel



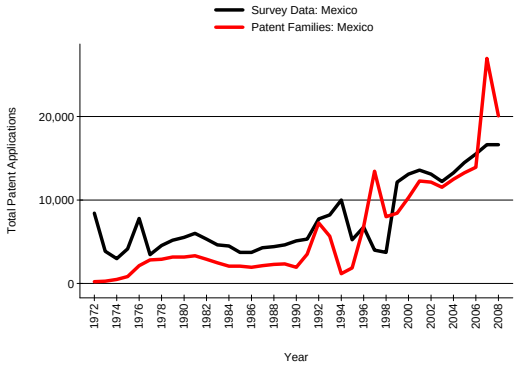
Office: Italy



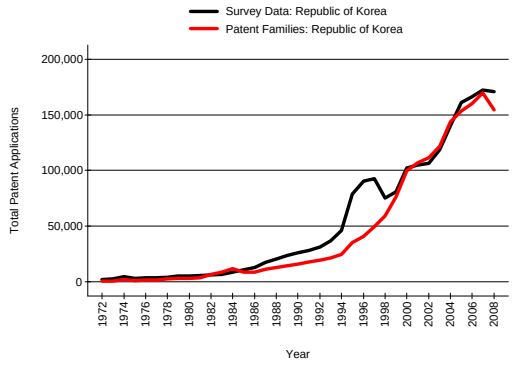
Office: Japan



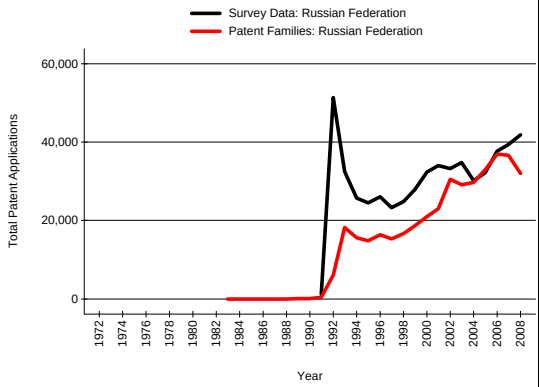
Office: Mexico



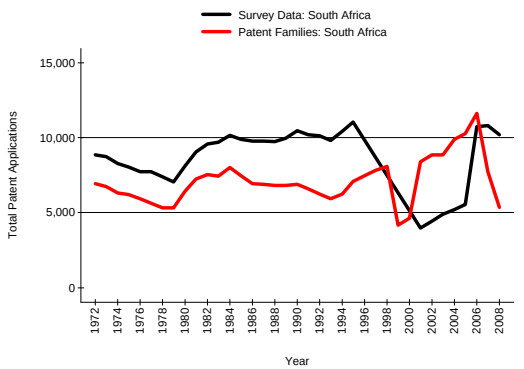
Office: Republic of Korea



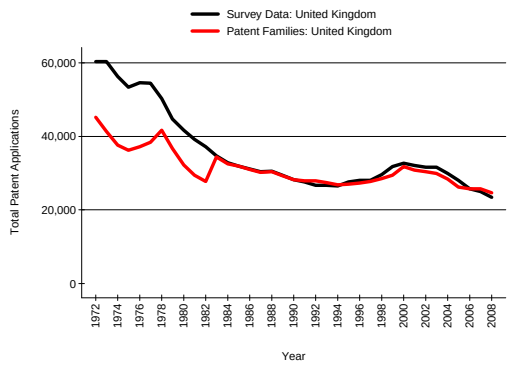
Office: Russian Federation

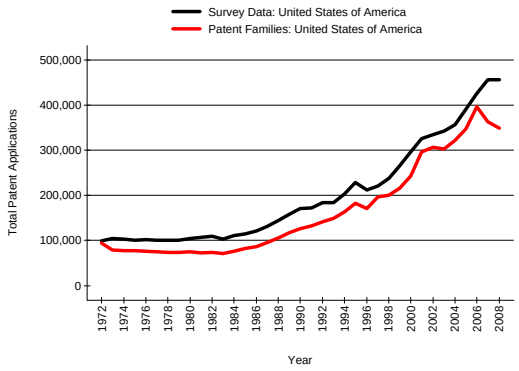


Office: South Africa



Office: United Kingdom



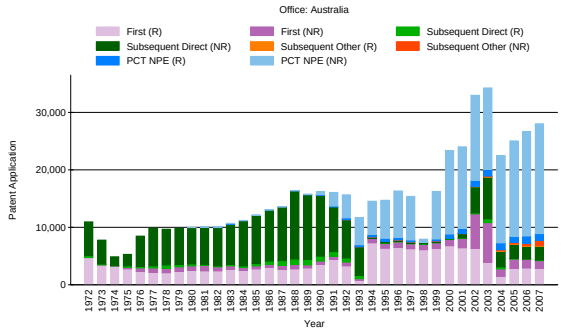
Office: United States of America	
	

[Annex A2 follows]

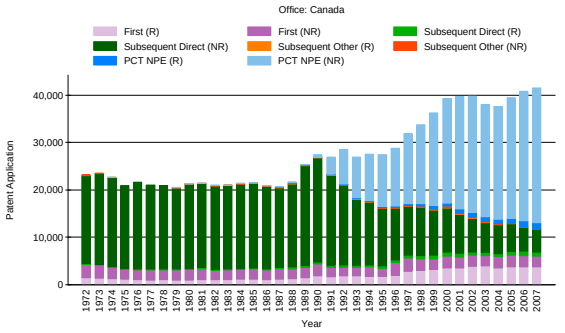
ANNEX A2

PATENT FILINGS BY OFFICE: TOP 15 OFFICES

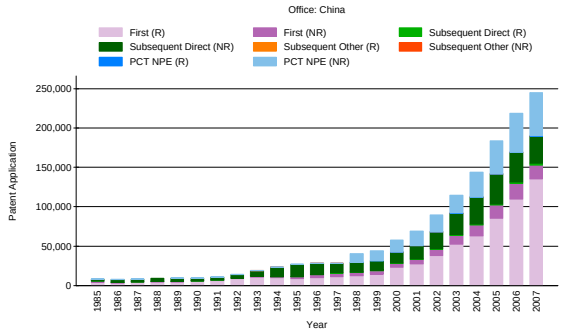
Office: Australia



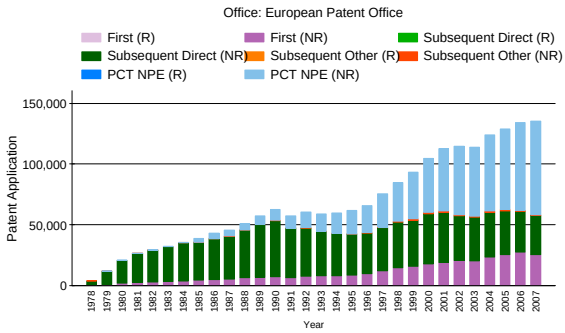
Office: Canada



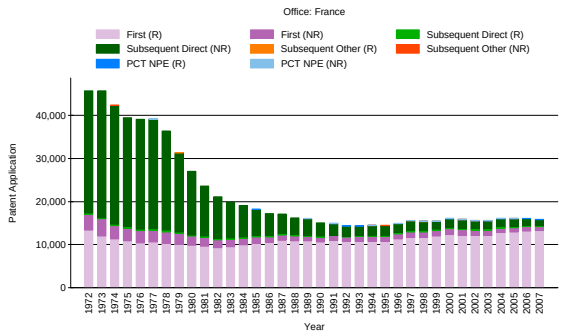
Office: China



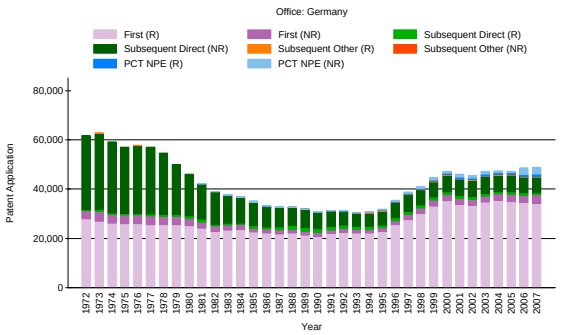
Office: European Patent Office



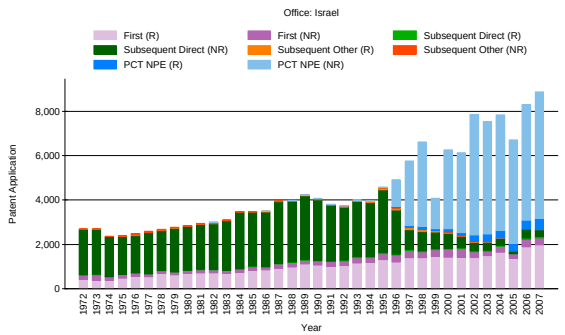
Office: France



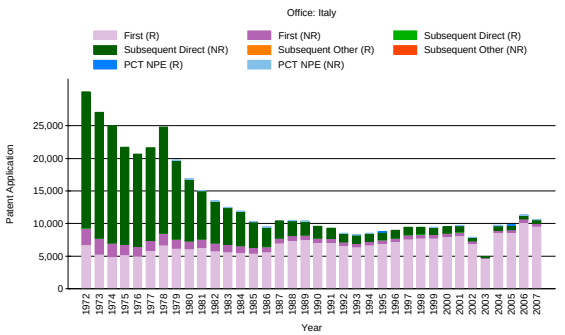
Office: Germany



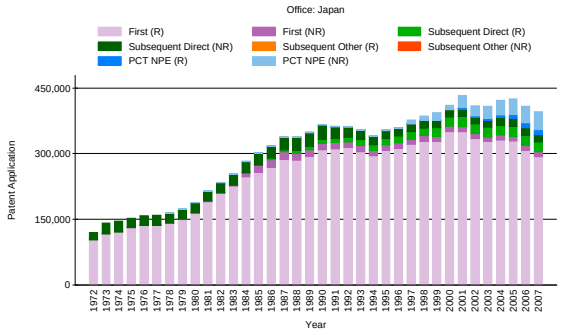
Office: Israel



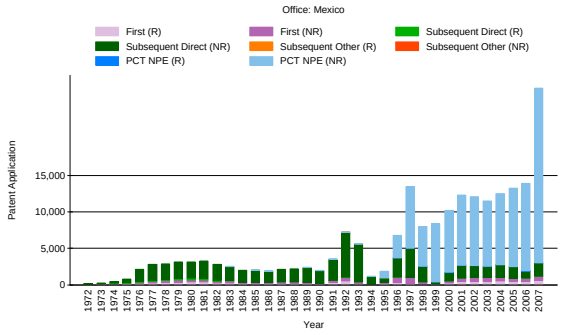
Office: Italy



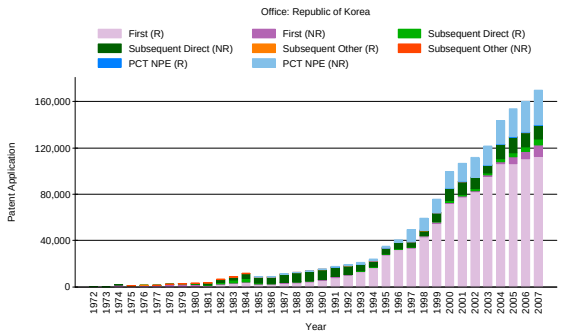
Office: Japan



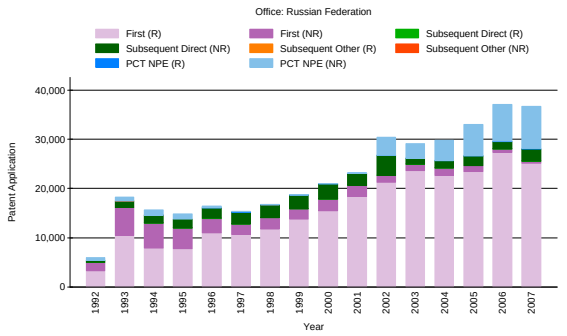
Office: Mexico



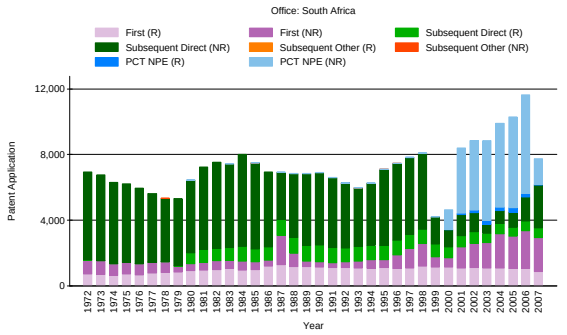
Office: Republic of Korea



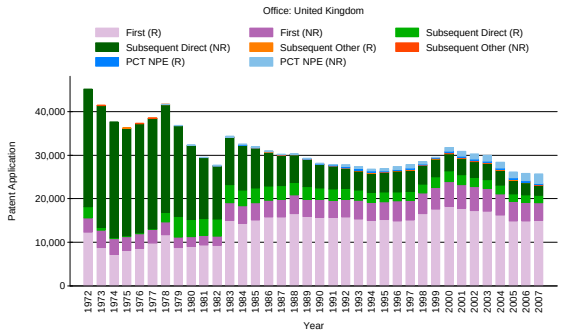
Office: Russian Federation



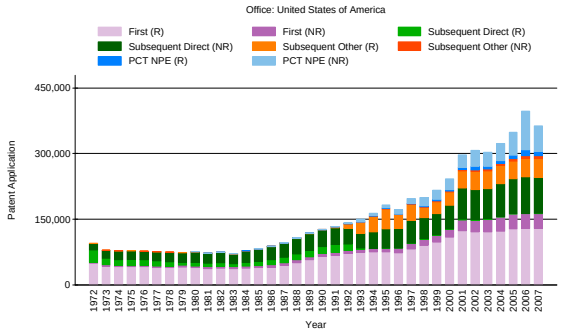
Office: South Africa



Office: United Kingdom



Office: United States of America



Note: Member States of the European Patent Convention have seen a drop in filings. This is likely due to the creation of the EPO; many applicants likely chose to file at the EPO rather than at the national office if they also wanted to obtain protection in other EPO member states.

Table A2: Detection of structural breaks in the series

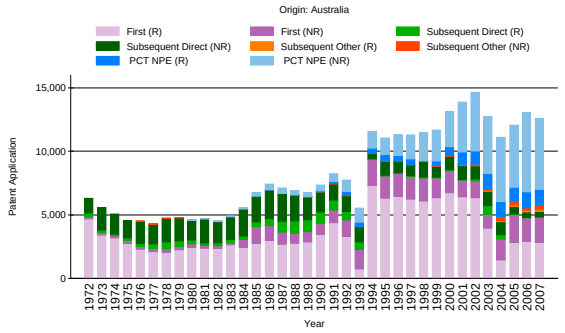
Office	Andrews Test		Based on inspection of the data
	Growth of Patent Applications	Change in log of patent applications	
Australia	1999	1999	1999
Canada	2001	2001	1989
China	2002	1992	1992
Germany	2001	2001	1996
European Patent Office	1997	1994	1979-90: 1997-07
France	1983	1978	n.a.
Israel	1995	1995	1995
Italy	1987	1979	n.a.
Japan	1980	1980	1981-87
Republic of Korea	1995	1995	1995
Mexico	1982	1979	1996
Russian Federation	2003	2003	2001
United Kingdom	1983	1983	n.a.
United States of America	2000	1984	1984
South Africa	2001	2001	2001

[Annex A3 follows]

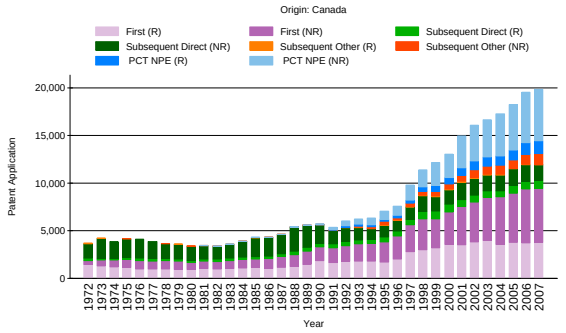
ANNEX A3

PATENT FILINGS BY ORIGIN: TOP 15 ORIGINS

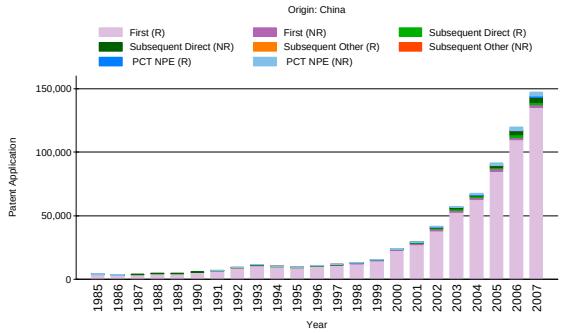
Origin: Australia



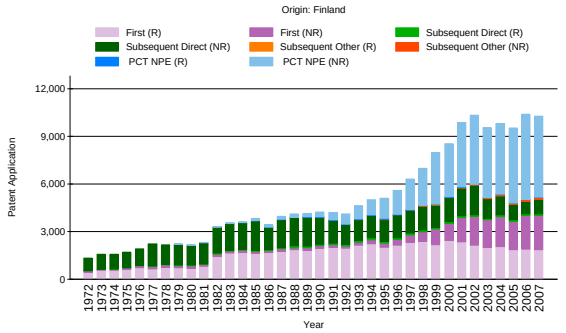
Origin: Canada



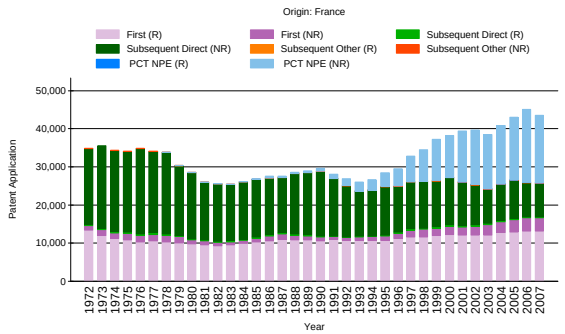
Origin: China



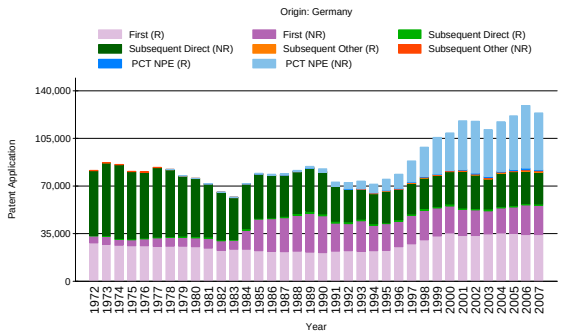
Origin: Finland



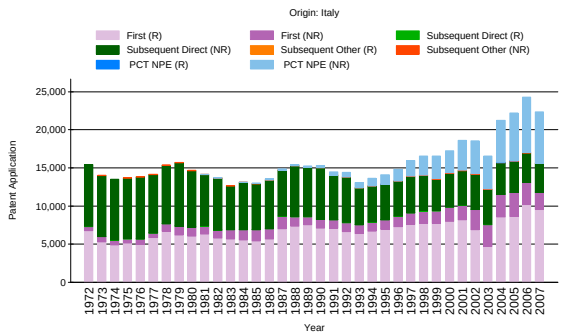
Origin: France



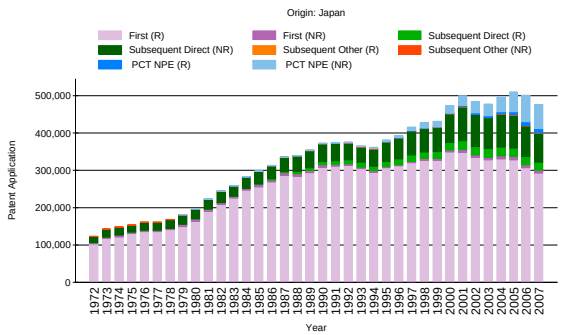
Origin: Germany



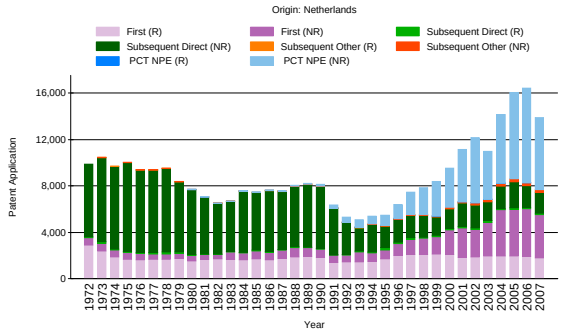
Origin: Italy



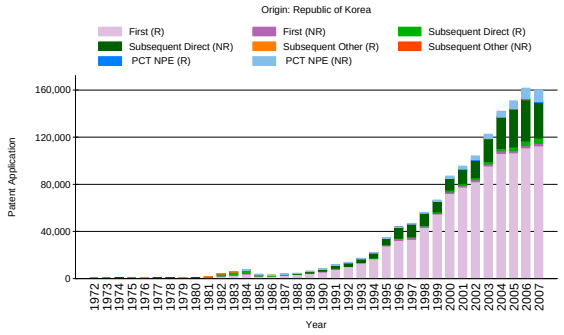
Origin: Japan



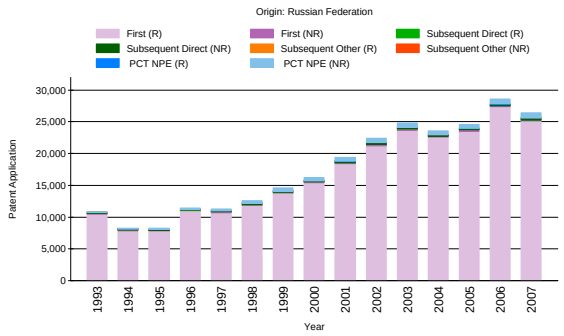
Origin: Netherlands



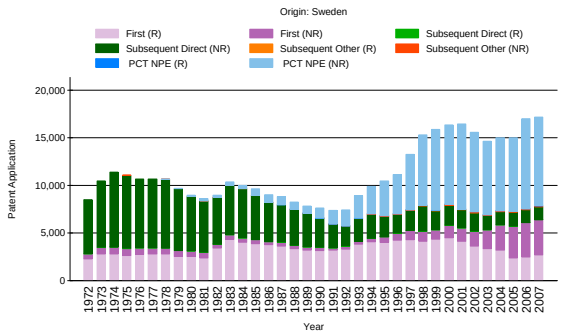
Origin: Republic of Korea



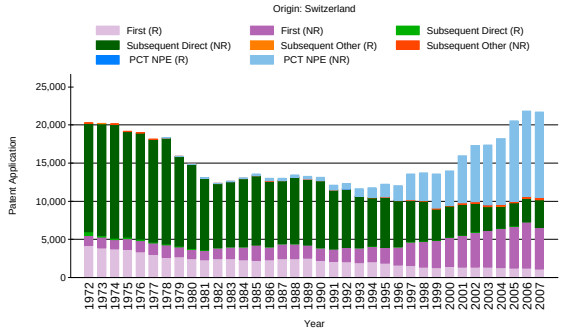
Origin: Russian Federation



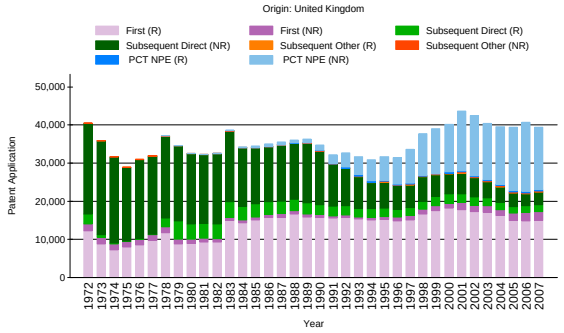
Origin: Sweden



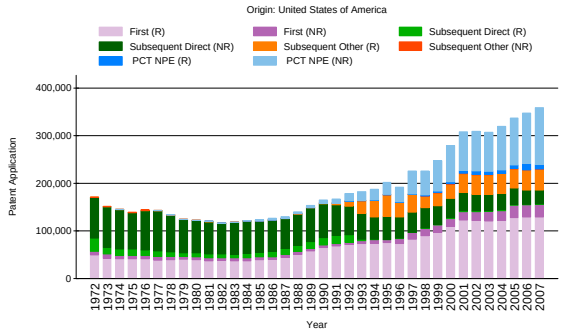
Origin: Switzerland



Origin: United Kingdom



Origin: United States



[Annex A4 follows]

ANNEX A4

DEFINITION OF FILING TYPES

An applicant files patent applications after making a new invention. The first time he does it, the application is a “first filing”; the next time he does it, linking it to the previous filing, it is a “subsequent filing”. The reasons why the applicant files subsequent applications include: (1) he further improves the invention, so he files another one to add those improvements; (2) he wants protection in another country after the first filing, so he files with a foreign office; (3) he wants to keep the application alive in certain offices, so he files a so-called “continuation” or “continuation-in-part”.

A PCT application can be either a first or subsequent filing: if it has no priority claim, it is a first filing; otherwise it is a subsequent filing. A PCT national phase entry is a subsequent filing, as it is always associated with a PCT filing.

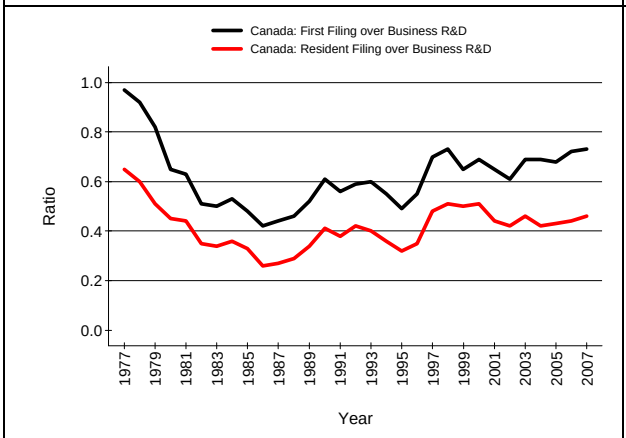
To summarize, a first filing is one that is not linked to any previous filing, whereas a subsequent filing is one that is linked to an earlier application by either priority claim, continuation, continuation-in-part, or PCT national phase entry. First filings are closely associated with new inventions; subsequent ones are repetitive filings for various reasons.

[Annex A5 follows]

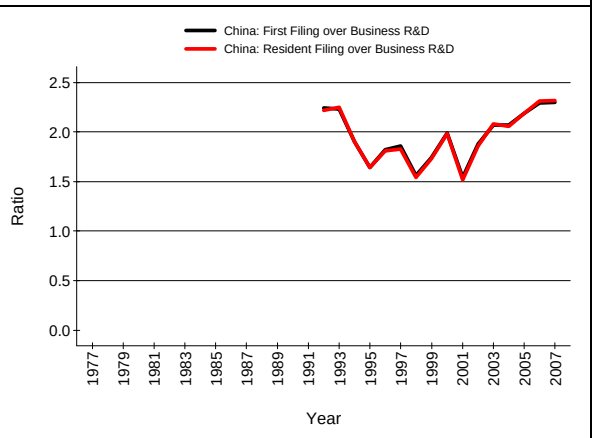
ANNEX A5

R&D PRODUCTIVITY (FIRST FILINGS AND RESIDENT FILINGS OVER MILLIONS OF CONSTANT DOLLAR BUSINESS R&D EXPENDITURE)

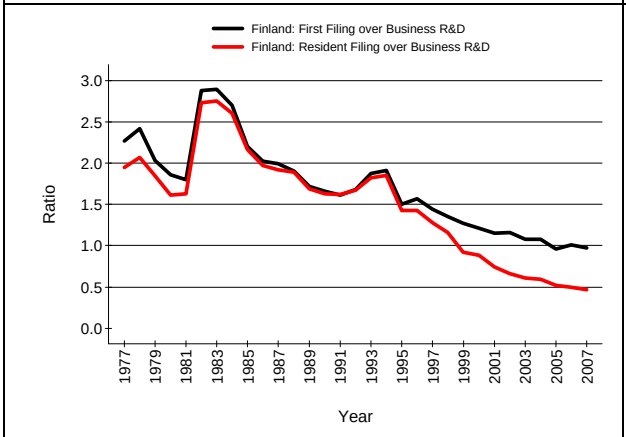
Canada



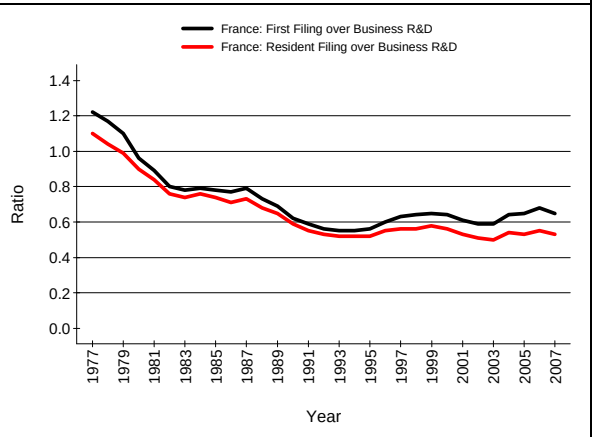
China



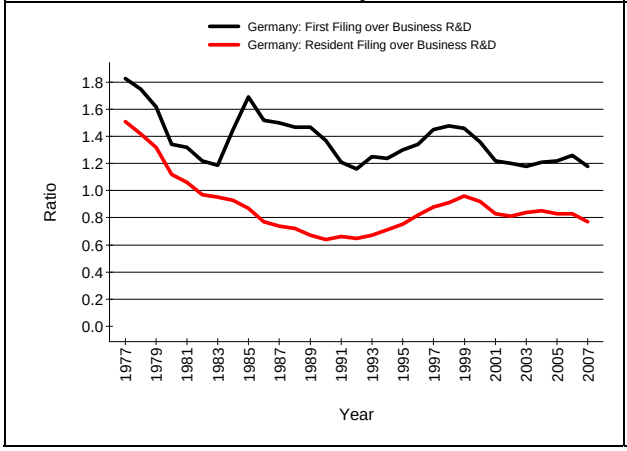
Finland



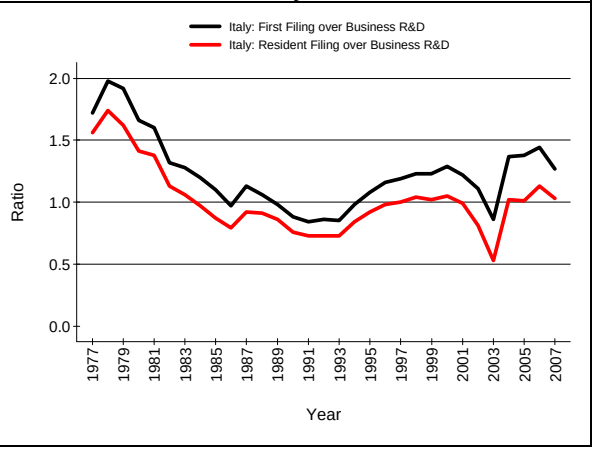
France



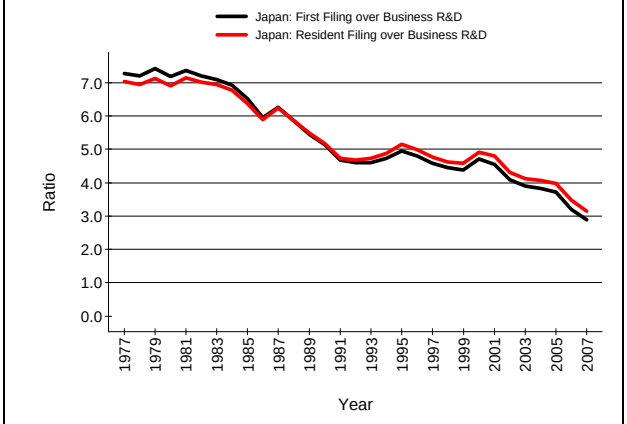
Germany



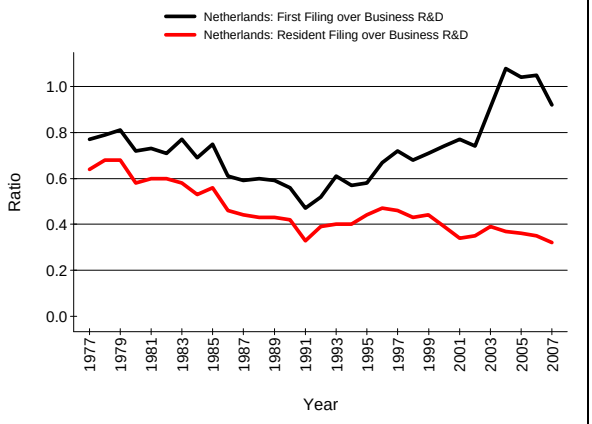
Italy



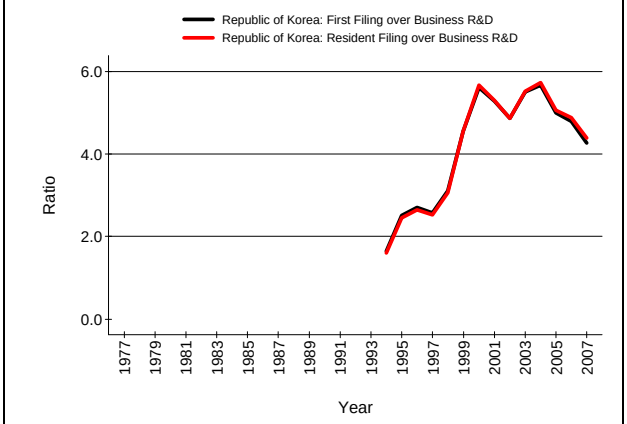
Japan



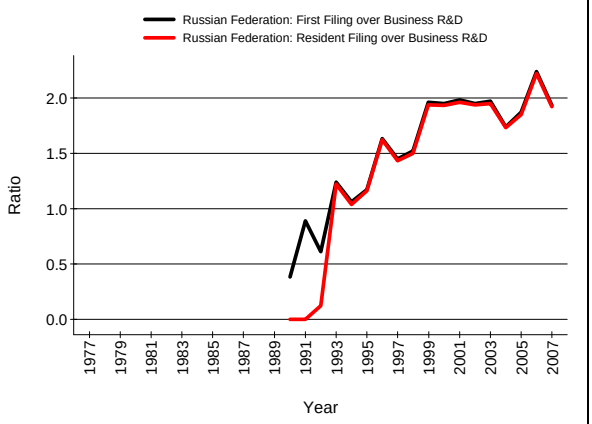
Netherlands



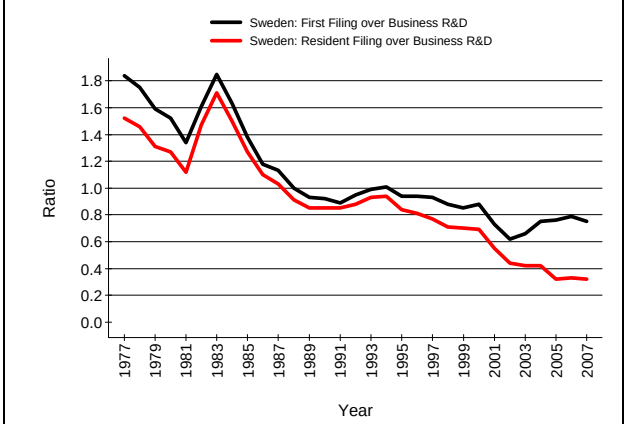
Republic of Korea



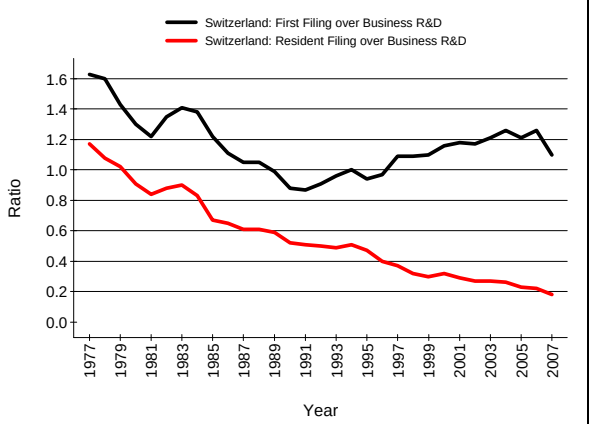
Russian Federation

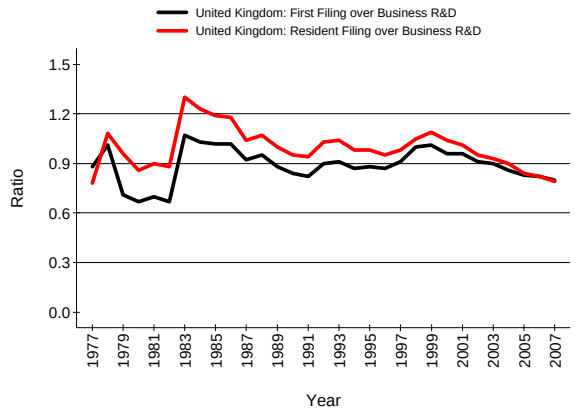
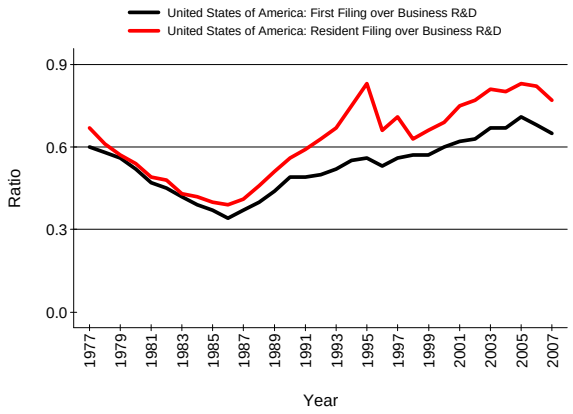


Sweden



Switzerland



United Kingdom	United States of America
	

Note: R&D data refer to business sector R&D expenditure in constant 2005 PPP dollars.

[Annex A6 follows]

ANNEX A6

CLASSIFICATION OF COMPLEX AND DISCRETE TECHNOLOGIES

Technology Fields		Classification
Electrical engineering		
	Electrical machinery, apparatus, energy	Complex
	Audio-visual technology	Complex
	Telecommunications	Complex
	Digital communication	Complex
	Basic communication processes	Complex
	Computer technology	Complex
	IT methods for management	Complex
	Semiconductors	Complex
Instruments		
	Optics	Complex
	Measurement	Complex
	Analysis of biological materials	Discrete
	Medical technology	Complex
Chemistry		
	Organic fine chemistry	Discrete
	Biotechnology	Discrete
	Pharmaceuticals	Discrete
	Macromolecular chemistry, polymers	Discrete
	Food chemistry	Discrete
	Basic materials chemistry	Discrete
	Materials, metallurgy	Discrete
	Surface technology, coating	Discrete
	Micro-structural and nano-technology	Complex
	Chemical engineering	Discrete
	Environmental technology	Complex
Mechanical engineering		
	Handling	Discrete
	Machine tools	Complex
	Engines, pumps, turbines	Complex
	Textile and paper machines	Discrete
	Thermal processes and apparatus	Complex
	Mechanical elements	Complex
	Transport	Complex
Other fields		
	Civil engineering	Complex

Note: This classification follows van Graevenitz et. al. (2008).

[End of Annex A6 and of document]