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GLOBAL OVERVIEW OF INNOVATIVE ACTIVITIES FROM THE PATENT INDICATORS PERSPECTIVE

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GLOBAL OVERVIEW OF INNOVATIVE ACTIVITIES FROM THE PATENT INDICATORS PERSPECTIVE

Mosahid KHAN and Hélène DERNIS

ABSTRACT

This paper provides an overview of innovative activities across a wide range of OECD member and non-member countries, based on international comparable patent indicators. Patent data are frequently used to measure innovative activities, because patent-based indicators reflect the inventive performance of countries, regions, firms, as well as other aspects of the dynamics of the innovation process.

Analysis of data from a wide range of sources (*e.g.* triadic patent families, EPO, USPTO, etc.) shows that there has been a significant increase in the level of patenting for all the countries over the past 15 years. Most of the increase in EPO patents is accounted for by European inventors and similarly, US inventors accounted for the majority of the increase in USPTO patents. The share of European countries (EU-25) in all EPO patents has remained stable between 1991 and 2002. In contrast, the share of the United States in all USPTO patents has increased by 5 percentage points. Developing countries (such as Brazil, China and India) account for a small share of triadic, EPO and USPTO patents. However, their growth rates in recent years have been higher than that of the OECD countries.

There has also been an increase in internationalisation of patenting activities (cross-border ownerships and patents with foreign co-inventors), reflecting the globalisation dimension of Science and Technology activities. ICT and biotechnology industries' innovative activities tend to be more internationalised than the overall level of internationalisation. In addition, non-member countries, such as China, India and the Russian Federation have a high level of internationalisation compared to large OECD countries. Breakdown of internationalisation indicators by partner country shows that common language, historical links and geographical proximity play an important role in determining partner countries.

APERÇU DES ACTIVITÉS INNOVANTES AU TRAVERS D'INDICATEURS BASÉS SUR LES BREVETS

Mosahid KHAN et Hélène DERNIS

RÉSUMÉ

Ce document propose un aperçu des activités en matière d'innovation dans un grand nombre de pays de l'OCDE et quelques non membres, au travers d'indicateurs basés sur les brevets. Les données sur les brevets sont souvent utilisées pour mesurer les activités d'innovation. Elles reflètent en effet la performance de pays, régions, entreprises en matière d'innovation, et d'autres aspects de la dynamique du processus d'innovation.

Les données, issues de différentes sources (familles triadiques de brevets, OEB, USPTO) montrent un accroissement significatif de la quantité de brevets durant les 15 dernières années pour l'ensemble des pays. L'augmentation du nombre de brevets à l'OEB est principalement due aux inventeurs européens. De même, c'est aux inventeurs américains que l'on doit la majorité de la croissance des brevets USPTO. La part des pays européens (UE 25) dans le total des demandes auprès de l'OEB est restée stable entre 1991 et 2002. En revanche, la part des États-Unis dans les brevets USPTO s'est accrue de 5 points, en pourcentage. Si les pays en voie de développement (comme le Brésil, la Chine et l'Inde) représentent une faible proportion des familles triadiques et des brevets OEB et USPTO, leur croissance est plus forte ces dernières années que pour les pays de l'OCDE.

L'internationalisation des activités liées aux brevets s'est également renforcée (globalisation de la propriété des inventions ; brevets avec co-inventeurs étrangers), reflétant ainsi la globalisation dans les Sciences et Technologies. L'innovation dans les industries des TIC et de biotechnologies est plus internationalisée que la moyenne. De plus, les pays non membres, tels que la Chine, l'Inde et la Fédération de Russie, collaborent davantage avec l'étranger que les grands pays de l'OCDE. Les indicateurs d'internationalisation en matière de brevets, ventilés par pays partenaires, montrent que la langue commune, les liens historiques et la proximité géographique jouent un rôle déterminant dans la collaboration avec un pays étranger.

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1. Introduction

The objectives of this paper are to provide an overview to global innovative/creative activity (as measured by patent[1]), based on international comparable data, to track the sources of growth of innovative activities, and to measure the level and the evolution of internationalisation. Patent indicators reported here are specifically designed to reflect innovative activities rather than patenting activity of patent offices (see Annex A). The methodology used by the OECD to construct indicators limits biases associated with traditional patent indicators (*e.g.* double counts, administrative procedures, differences in the patent propensity between domestic and foreign applicants, etc.). This is in contrast to most of the other studies, where patent data are directly derived from patent offices to measure innovative activity. The problem with the use of patent office data for measuring innovative/creative activity is that they are designed to reflect patenting activity of an office and are for administrative purposes (*e.g.* budget planning). In addition, this paper provides analysis of innovative activity based on information from a wide range of patent offices – European Patent Office (EPO), US Patent and Trademark Office (USPTO), Triadic patent families, national patent offices, and Patent Cooperation Treaty data – rather than a single office data. The problem with comparing innovative activity across countries based on a single patent office data is that it has the potential to provide a distorted view due to home advantage bias.[2] For example, US inventors are mostly responsible for the increase in USPTO patents and European inventors are mostly responsible for the increase in EPO patents.

2. Innovative activities as reflected by patents

Patents are an exclusive right issued by authorised bodies to inventors to make use of and exploit their inventions for a limited period of time (generally 20 years). Patents are granted to firms, individuals or other entities as long as the invention is novel, non-obvious and industrially applicable. The patent holder has the legal authority to exclude others from commercially exploiting the invention (for a limited time period). In return for the ownership rights, the applicant must disclose information relating to the invention for which protection is sought. The disclosure of the information is thus an important aspect of the patenting system. By providing a legal framework for protecting inventions, the patent system affects economic performance by stimulating innovation that increases productivity.

Patent-based statistics reflect the inventive performance of countries, regions, firms, as well as other aspects of the dynamics of the innovation process (*e.g.* co-operation in innovation or technology paths). Patent indicators, along with other science and technology indicators, thus contribute to our understanding of the innovation system and factors that support economic growth. For example, using the inventors' address, indicators can be developed to monitor the internationalisation of and international collaboration in science and technology (S&T) activities. Among the few available indicators of technology output, patent indicators are probably the most frequently used. Griliches (1990) calls patents a "good index of inventive activity"; Eaton and Kortum (1996) approve of patent data as a widely accepted measure of innovation. Patents are frequently viewed as an output indicator; however, they could also be viewed as an input indicator, as patents are used as a source of information by subsequent inventors (Griliches, 1990).

Like any other indicator, patent indicators have many advantages and disadvantages (see Dernis *et al.*, 2001). The advantages of patent indicators are: *a)* patents have a close link to inventions; *b)* patents cover a

1. Patent-based indicators are frequently used to measure innovative activity. Here we use patenting activity and innovative activity interchangeably.

2. A common problem associated with single-office patent data is the "home advantage" bias, where, proportionate to their inventive activity, domestic applicants tend to file for more patents in their home country compared to foreign applicants.

broad range of technologies on which there are sometimes few other sources of data; *c)* the contents of patent documents are a rich source of information (on the applicant, inventor, technology category, claims, etc.); and *d)* patent data are readily available from patent offices.

However, patents are subject to certain drawbacks: *a)* the value distribution of patents is skewed as many patents have no industrial application (and hence are of little value to society) whereas a few are of substantial value; *b)* many inventions are not patented because they are not patentable or inventors may protect the inventions using other methods, such as secrecy, lead time, etc.; *c)* the propensity to patent differs across countries and industries; *d)* differences in patent regulations make it difficult to compare counts across countries; and *e)* changes in patent law over the years make it difficult to analyse trends over time.

Patent documents are a rich source of information that includes detailed and complex information about the invention, inventor, applicant, time path of the application, procedure used to file the application, etc. Certain methodological choices have to be made to select the relevant information from patent documents. The relevant criteria for calculating patent indicators to reflect innovative activities are: inventor's country of residence, priority date (the first date of filing of a patent application, anywhere in the world, to protect an invention), and fractional counts (Box A). Most of the data reported in this document are based on these criteria. Due to the time lag between priority date and the availability of patent information, data can be reported up to 2002 (Triadic and USPTO patent data for 2001 and 2002 are estimates). However, it should be noted that although the data refers to "priority" year 2002, all the indicators are based on available information up to December 2005 (see Annex A).

Box A. Criteria for compiling patent indicators

- **Geographical distribution:** Three main criteria can be used: *i)* counts by priority office (country where the first application is filed, before protection is extended to other countries), indicate the attractiveness of a country's patenting process, the quality of intellectual property regulations (rules and cost of patenting), the reputation of the patent office and general economic features (*e.g.* market size); *ii)* counts by the inventor's country of residence indicate the inventiveness of the local labour force; and *iii)* counts by the applicant's country of residence (the owner of the patent at the time of application), indicate control of the invention. The most widely used method is patent counts by the inventor's country of residence although others are legitimate in their own way. The majority of the OECD patent indicators are based on the inventor's country of residence method.

- **Patents with multiple inventors from different countries**: Such patents can either be partly attributed to each country mentioned (fractional count) or fully attributed to every relevant country, thus generating multiple counting. In general, it is better to use fractional counting procedures, but the alternative is sometimes preferable (*e.g.* for indicators of internationalisation). The majority of the OECD patent indicators are based on the fractional counting method.

- **Reference date:** The choice of one date among the set of dates included in patent documents is important. The priority date (first date of filing of a patent application, anywhere in the world, to protect an invention) is the earliest and therefore closest to the invention date. Counts by application date introduce a bias owing to a 12 month lag between residents and foreigners: the latter usually first file a patent application at their domestic office (the priority office) and later in other countries. But if the purpose is to measure the activity level of a patenting office, the application date might a better measure. The lag is even longer (around 30 months) for Patent Co-operation Treaty (PCT) applications (see Annex B). To measure inventive activity, patent indicators should be computed with respect to the priority date.

3. Overview of patenting activity

3.1. Triadic patent families

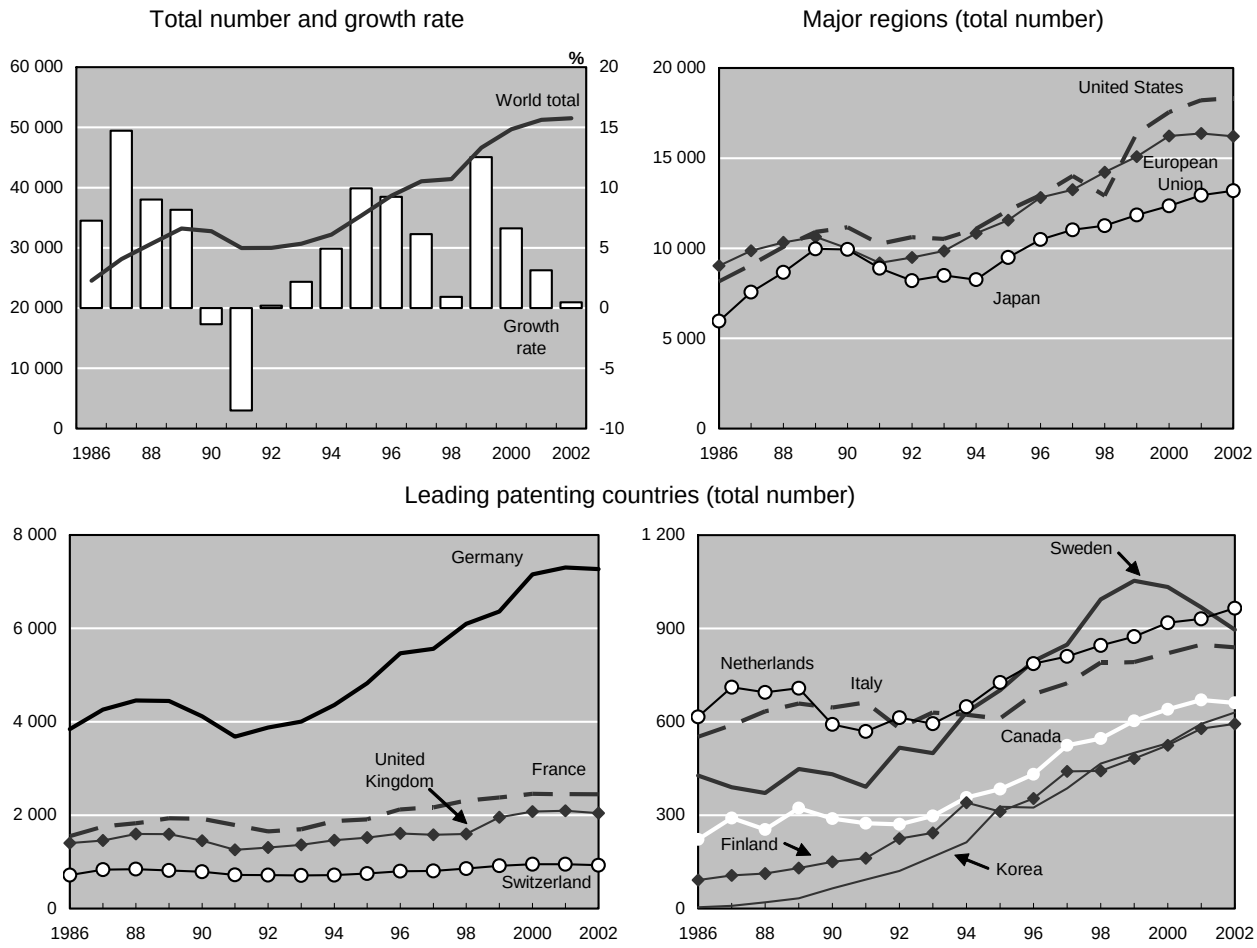
Frequently, patent indicators are reported based on information from a single patent office. While the richness and strength of data derived from patents filed at a given patent office are broadly recognised, these data show specific weaknesses as indicators of international technology performance. A common problem associated with this type of indicator is the "home advantage" bias, where, proportionate to their inventive activity, domestic applicants tend to file for more patents in their home country compared to foreign applicants. To improve the quality and international comparability of patent-based indicators, the OECD has developed indicators of triadic patent families. The triadic patent families are defined as a set of patents taken at the European Patent Office (EPO), the Japan Patent Office (JPO) and the US Patent and Trademark Office (USPTO) that share one or more priorities. The triadic patent families data are consolidated to eliminate double counting of patents filed at different patent offices (*i.e.* regroup all the interrelated priorities in EPO, JPO and USPTO patent documents). Triadic patent families eliminate the "home advantage" bias and generally represent patents of high value (Box B).

The latest available figures show a total number of triadic patent families of around 51 500 in 2002[3], a considerable increase from the 1986 level. Most of the increase occurred from 1986-89, 1994-96 and 1999-2000 (Figure 1). This trend is also observed for countries with a large number of triadic patent families, such as the United States, Japan and Germany. Between 1991 and 2002, the average annual growth rate of triadic patents for the European Union (5.3%) and the United States (5.4%) was higher than for Japan (3.7%). Compared to the growth rate of EPO and USPTO patents (Figures 3 and 7), the number of triadic patent families has grown at a slower pace. This could be due to the fact that patentees are more selective when deciding to protect inventions at a global level and the slow growth rate of patent applications at the JPO. The number of triadic patent families increased by 5% a year, whereas EPO patent applications and USPTO patent grants increased by 5.7% and 6.8% a year, respectively. Between 1991 and 2002 Asian countries plus Brazil had the highest average annual growth rates of triadic patent families: China (25.3%, average annual growth rate), India (22.2%), Korea (19%), Brazil (17.7%) and Chinese Taipei (17.6%). In terms of number of triadic patent families the three large EU countries are Germany, France and the United Kingdom. Between 1991 and 2002, the number of triadic patent families originating from Germany almost doubled, whereas the number of triadic patent families originating from France and the United Kingdom increased by 37% and 63%, respectively.

The latest available figures show that the United States accounted for the largest share of total triadic patent families (35.6%), followed by the European Union (31.5%) and Japan (25.6%). The EU share in the triadic patents is dominated by Germany. For example, the share of Germany (14.1%) is significantly higher than that of France (4.8%) and the United Kingdom (4.0%) (Figure 2). As a result of the reduction of the "home advantage" bias, the gap between the shares of the three regions (EU, US and Japan) is smaller for triadic patent families than for EPO (Figure 4) and USPTO (Figure 8) patents. The share of Chinese Taipei is negligible for triadic patent families, but for the USPTO it has an extremely high share (Figure 8). This reflects the strong trade links between Chinese Taipei and the United States.

3. Based on priority date, patent indicators can be reported up to 2002 (2003 and 2004 are incomplete). This is due to two factors. First, the EPO data includes only the PCT applications that proceed to the EPO regional phase. The time lag between priority date and the date of the EPO regional phase entry of the PCT applications can be up to 30 months (and longer when administrative delays are taken into account). Secondly, prior to the recent change in the rule at the USPTO, patent documents were only available after patents had been granted. The time lag between the priority date and the date of grant on average is around 3 to 5 years.

Figure 1. Trends in triadic patent families[1]

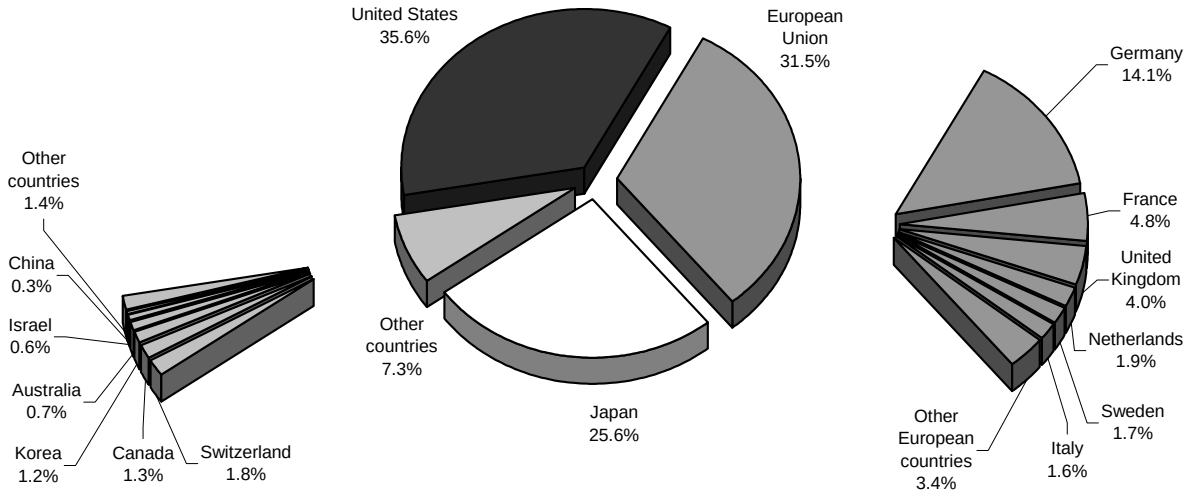


1. Patents all applied for at the EPO, USPTO and JPO. Figures for 2000 to 2002 are estimates.

Source: OECD, Patent Database, December 2005.

Figure 2. Share of countries in total triadic patent families[1]

Shares, 2002



1. Patents all applied for at the EPO, USPTO and JPO. Figures for 2000 to 2002 are estimates.

Source: OECD, Patent Database, December 2005.

Between 1991 and 2002, the share of the United States and the European Union have increased by 1.4 and 1.8 percentage points, respectively; while that of Japan and France has decreased by 4.1 and 1.2 percentage points, respectively. For the majority of the reported countries, the share of triadic patent families increased over this time period. The largest increase in the country shares of triadic patent families is observed for Germany, whose share increased from 12.3% in 1991 to 14.1% in 2002. In contrast, notable declines in the shares of triadic patent families occurred in Japan, France and Switzerland. For example, country share of triadic patent families for Japan declined from 29.7% in 1991 to 25.6% in 2002.

The total number of triadic patent families originating from developing countries, such as Brazil, China, India and South Africa, is increasing rapidly, but their share in total triadic patent families in still very small. In 2002, these four countries accounted for only 0.58% of total triadic patent families, a substantial increase from their 1991 share (0.15%). This is reflected in the small decrease in the share of OECD countries. OECD countries' share of triadic patents in the world total decreased from 98.9% in 2002 to 98.0% in 1991. This figure is expected to decrease in the future as developing countries such as India and China start to increase their patenting activity at a global level.

Box B. OECD Triadic Patent Families

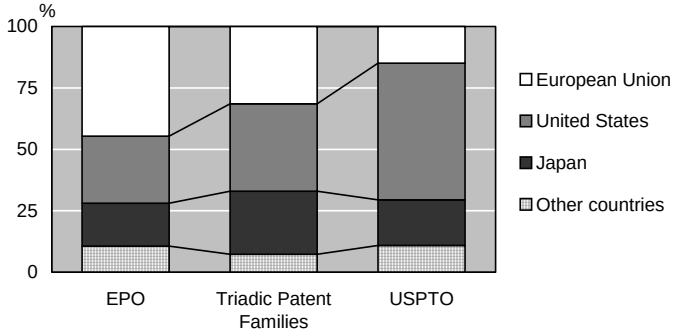
Figure B1 shows the impact of home bias on the country (regional) shares. In 2002, the United States accounted for 55.5% of the total USPTO patent grants compared to 15% for the European Union, whereas for the patent applications at the EPO, the European Union accounted for 44.7% of total EPO applications, compared to 27.3% for the United States. The triadic patent families data shows the gap in the shares of the United States and the European Union to be smaller, compared to EPO and USPTO data. Another weakness of the single patent office indicator is that patenting is influenced by factors other than technology, such as patenting procedures, trade flows, proximity, etc. The value distribution of patents is also skewed as many patents are of low value and few are of extremely high value. This is another drawback associated with traditional indicators based on a single patent office as such counts give equal weight to all patents.

The triadic patent families are defined at the OECD as a set of patents taken at the EPO, JPO and USPTO that share one or more priorities (Dernis and Khan, 2004). The advantages of using the triadic patent families indicators for statistical analysis are:

- They improve the international comparability of patent-based indicators. Only patents applied for in the same set of countries are included in the "family", eliminating home advantage and the influence of geographical location.
- Patents in the family are high-value patents. The patentee will only take on the additional costs and delay related to the extension of the protection to other countries if it is deemed worthwhile.

The criteria for counting the triadic patent families are the earliest priority date, the inventor's country of residence, and fractional counts.

Figure B1. Share of countries in EPO and USPTO patents, and in triadic patent families, 2002[1]



1. Figures for USPTO and Triadic Patent Families are estimates.

Source: OECD, Patent Database, December 2005.

3.2. Patenting in Europe

Patent applications to the European Patent Office are one of the most frequently reported indicators for measuring innovative activity. The EPO is a regional patent office which provides the possibility to seek patent rights in all European Patent Convention (EPC) countries with a single European patent application (Box C). The EPO data reported in this document (and in other OECD publications) includes only direct EPO applications (*i.e.* first filing or national patent applications extended to EPO application within 12 months of the first filing) and international applications filed under PCT procedure that proceed to the EPO regional phase. International applications filed under the PCT procedure that do not proceed to the EPO regional phase are excluded from EPO patent counts (see Khan and Dernis, 2005). Therefore, because of the legal time lag between the priority date and the entry of a PCT application in the EPO regional phase, 2002 is the latest available data (see Annex B).

In 2002, more than 110 000 patent applications were filed at the EPO, an increase of 84% from the 1991 level. Patent applications to the EPO grew rapidly during the second half of the 1980s, stagnated in the first half of the 1990s and increased again in the second half of the 1990s (Figure 3). 2001 and 2002 data show a slowdown in the number of EPO patent applications, which may be due to the reduction in business R&D expenditure and the economic downturn in OECD countries after 2000. The available data for 2003 and 2004 point to an acceleration in the number of EPO patent applications. Because of the differences in the growth rate of EPO patent applications of the European Union, Japan and the United States, the gap in the volume of EPO patent applications of European Union countries on the one hand and the United States and Japan on the other hand has increased. The number of EPO patent applications filed by European Union countries grew by 5.7% a year between 1991 and 2002, whereas patent filings originating from the United States and Japan grew by 5.1% and 4.6%, respectively.

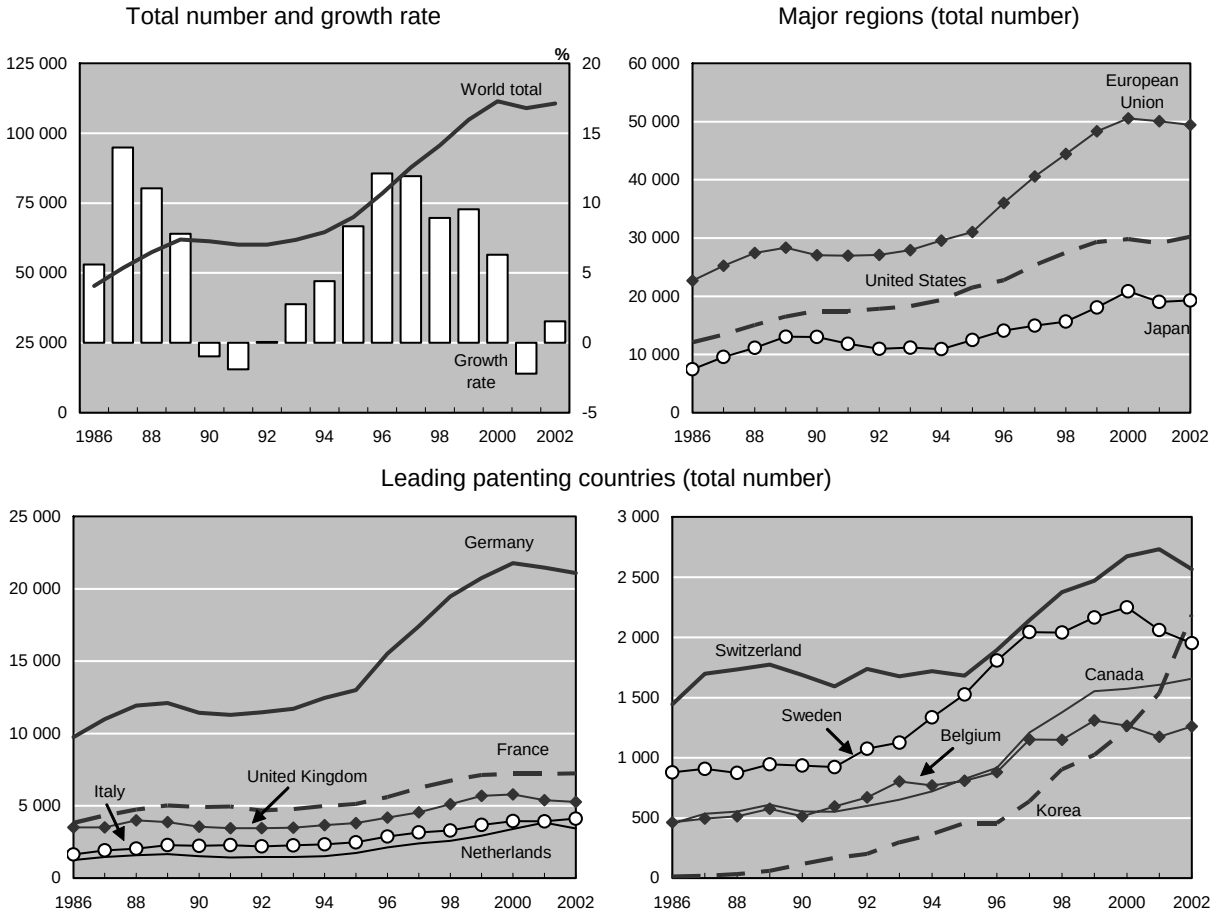
Box C. European Patent Convention

The Convention on the Grant of European Patents (European Patent Convention, EPC) was signed in Munich 1973 and entered into force in 1977. As a result of the EPC, the European Patent Office (EPO) was created to grant European patents. Currently, there are 31 EPC member countries (as at December 2005). In addition, extension agreements exist with five countries, which allow the possibility of extending European patents to those countries upon request. EPC member countries are Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, the Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom. EPC extension countries are Albania, Bosnia and Herzegovina, Croatia, the Former Yugoslav Republic of Macedonia, and Serbia and Montenegro.

The European Patent Office (a regional patents office) was created by the EPC to grant European patents, based on a centralised examination procedure. A European patent can be obtained for all the EPC countries by filing a single application at the EPO in one of the three official languages (English, French or German). European patents granted by the EPO have the same legal rights and are subject to the same conditions as national patents (granted by the national patent office). A granted European patent is a “bundle” of national patents, which must be validated at the national patent office for it to be effective in member countries. The validation process could include submission of a translation of the specification, payment of fees and other formalities at the national patent office. This is because once a European patent is granted, competence is transferred to the national patent offices.

The trend of patent applications of most OECD countries is similar to the trend observed for the total number of EPO applications: a slowdown in the early 1990s and a rapid increase in the late 1990s. The number of EPO applications originating from Korea increased considerably during the 1990s. Compared to OECD countries the number of patent applications originating from non-OECD countries/economies (*e.g*. China, India and Chinese Taipei) is relatively small, but their growth rate between 1991 and 2002 has been higher than that of the large OECD countries. Between 1991 and 2002, India (35.2%), China (30.7%) and Korea (26.3%) had the highest growth rates in EPO patent applications. In contrast, EPO patent applications originating from France, the United Kingdom, Switzerland and Japan grew by less than 5% a year.

Figure 3. Trends in patent applications to the EPO



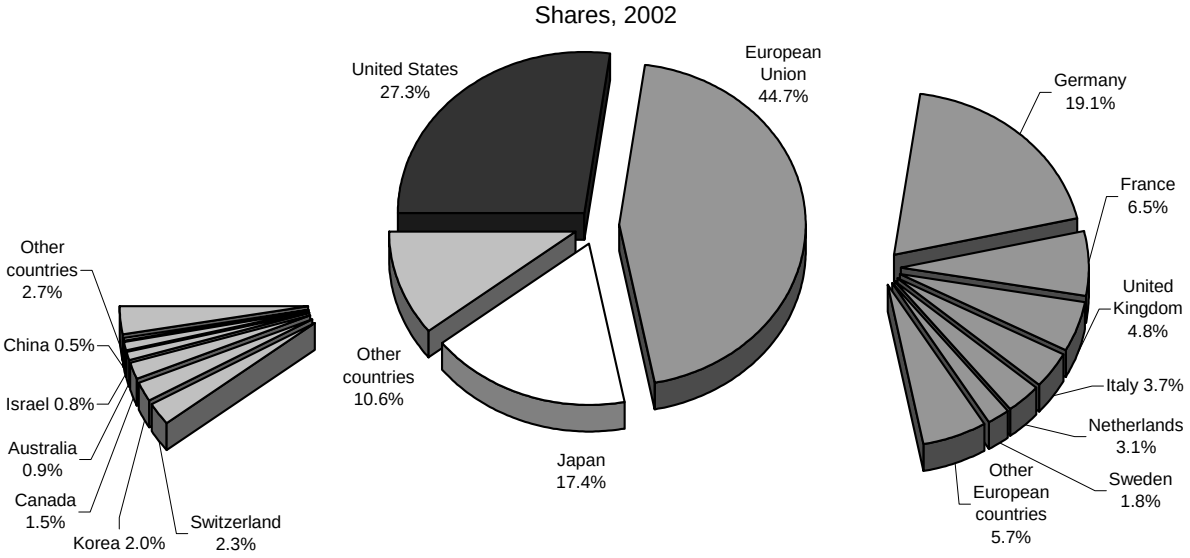
Source: OECD, Patent Database, December 2005.

Figure 4 show that in 2002, the European Union countries accounted for the largest share of EPO patent applications (44.7%), a share far above that of the United States (27.3%) and Japan (17.4%). This somewhat overstates the EU's inventive performance, as patents taken at the EPO primarily reflect the EU countries' domestic market. These countries therefore have a "home advantage". EPO patents are concentrated in a small number of countries. The United States, Japan, Germany, France and the United Kingdom account for around 75% of all EPO patents, a share similar to the share of these countries in OECD's total gross domestic expenditure on research and development (78%). Although patent applications originating from China, India and Israel increased sharply during the second half of the 1990s, their share in EPO patents is still relatively small. In 2002, China (0.5%), India (0.4%) and Israel (0.8%)

accounted for only 1.7% of total EPO patent applications. The share of these countries in EPO patents is higher than their respective share in triadic patent families.

For large OECD countries, except Germany, the 2002 share in all EPO applications is lower than their respective 1991 share. The most significant declines are observed for Japan, the United States, France and the United Kingdom. Their combined shares in all EPO patents decreased from 62.7% in 1991 to 56.1% in 2002. In contrast, the combined shares of Korea, the Netherlands and Canada increased by 3 percentage points over the same period.

Figure 4: Share of countries in total EPO patent applications



Source: OECD, Patent Database, December 2005.

Designation of countries in EPO patent applications

Filing an EPO patent application does not necessarily imply that protection is being sought in all EPC member countries. EPC countries where protection is being sought have to be explicitly designated by the applicant at the time of the application (Box D). Analysis of designation (country) data might shed some light about the patenting behaviour of inventors and provide some indication whether applicants are considering the EU as a single economic zone. A commonly held belief is that if inventors wish to protect their invention in a single EPC country, they will file patent application directly at the national patent office, rather than file for an EPO application. Inventors seeking to protect inventions in more than three EPC countries tend to use a single EPO application, rather the filing applications with the national patent office of each country. Therefore, our prior expectation is that most of the EPO patent applications will include more than one designation country.

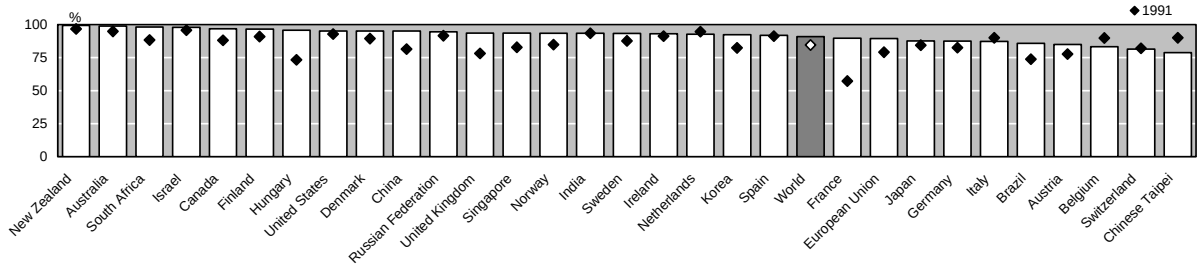
Box D. Designation of EPC countries in EPO patent applications

At the time of the EPO patent application, the applicant has to specify (designate) the EPC countries in which he /she wishes to protect the invention. It is also possible to extend EPO patent applications to extension countries by designating them at the time of the application. Countries that have been designated in an EPO application can be withdrawn at any time, but countries that have not been specified in the initial EPO application can not be added. At present, if an applicant pays designation fees for seven countries, then it is considered that the designation fees for all countries have been paid and all countries will be automatically selected.

Granting of an EPO patents does not imply that the invention is protected in all the designated countries. The applicant has to validate the EPO patents in each designated counties for it to be effective in EPC countries.

Figure 5 shows that the three large European countries (France, Germany and the United Kingdom) are designated in 91% of all EPO patent applications. The share of EPO patent applications that designated France, Germany and the United Kingdom ranged from close to 99.4% to 78.7% in 2002. Nearly all EPO patent applications originating from Australia and New Zealand designated these three countries. The share of EPO patent applications that designated the three large European countries is high for non-European countries. For the majority of countries, the share of EPO patents that designated France, Germany and the United Kingdom increased between 1991 and 2002. The largest increase is observed for France. There are few exceptions, however – the most notable decline is observed for Chinese Taipei, Belgium and Germany. Analysis of EPO patent applications that designated all the countries that were members of EPC prior to 1991 also shows a similar trend.[4] In 2002, 75.8% of all EPO patent applications designated all 14 countries (EPC members before 1991).[5] More than 95% of EPO patent applications originating from Australia, Israel, New Zealand and South Africa designated all 14 countries. Japan, Chinese Taipei and Korea are more selective with respect to designating all 14 EPC countries. In 2002, less than 65% of EPO patent applications originating from these countries designated all 14 EPC countries. Designation data of EPO patents provides evidence that the EPO procedure is being used to seek patent protection in a large number of EPC countries.[6]

Figure 5. Share of EPO patent applications that designated France, Germany and the United Kingdom, 2002



Source: OECD, Patent Database, December 2005.

Average number of inventors per EPO patent application

The number of inventors per EPO patent provides some indication of the level of domestic and foreign co-operation amongst researchers. In 2002, there were 2.8 inventors per EPO patent, a small increase from the 1991 level (2.4). The average number of inventors per EPO patent is high for India (4.2 inventors per patent), the Russian Federation (3.7), Hungary (3.6) and Ireland (3.3). In contrast, it is low for Chinese Taipei (1.9), South Africa (2.0) and Italy (2.1).

4. The number of countries that are party to the EPC has increased continuously. At present 31 countries are party to the treaty, compared to 7 in 1977. For comparison purposes we selected the 14 countries who were party to the EPC treaty prior to 1991 and analysed evolution of EPO patents that designated those 14 countries during the 1990s.

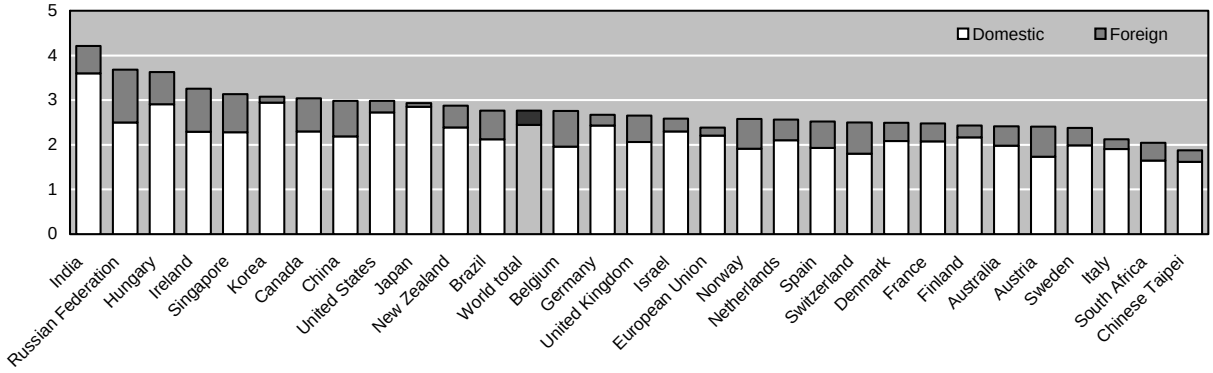
5. An applicant has to pay a fee for each designation country. At present, if an applicant pays the fee for seven countries, then it is considered that the applicant has paid for all EPC countries (*i.e.* all EPC countries are designated).

6. The designation data reported in this paper relates to the designation of countries during the EPO patent application process. Once an EPO patent has been granted to an applicant, it has to be validated at the national patent office of each designated country. In which designated countries EPO patents are validated and what proportion of EPO patents are validated at the national level would be an interesting issue to explore in the future. At present it is not possible to explore this issue due to data limitations.

Breaking down the average number of inventors per EPO patent by domestic and foreign inventors shows that for all countries, the average number of domestic inventors per EPO patent is higher than the average number of foreign inventors (Figure 6). The average number of foreign inventors per EPO patent is high for the Russian Federation (1.2 foreign inventors per EPO patent), Ireland (1.0), Singapore (0.9) and Belgium (0.8). In contrast, Japan and Korea have a low number of foreign inventors per EPO patent: 0.1 foreign inventors per EPO patents. For the majority of the countries/economies, the average number of foreign inventors increased between 1991 and 2002. This is most clearly the case for the Russian Federation and Ireland. A notable decrease in the average number of foreign inventors can be observed for China and India.

Figure 6. Average number of inventors per EPO patent application

Selected countries/economies[1], 2002



1. The graph only covers countries/economies with more than 100 EPO applications in 2002.

Source: OECD, Patent Database, December 2005.

3.3. Patenting in the United States

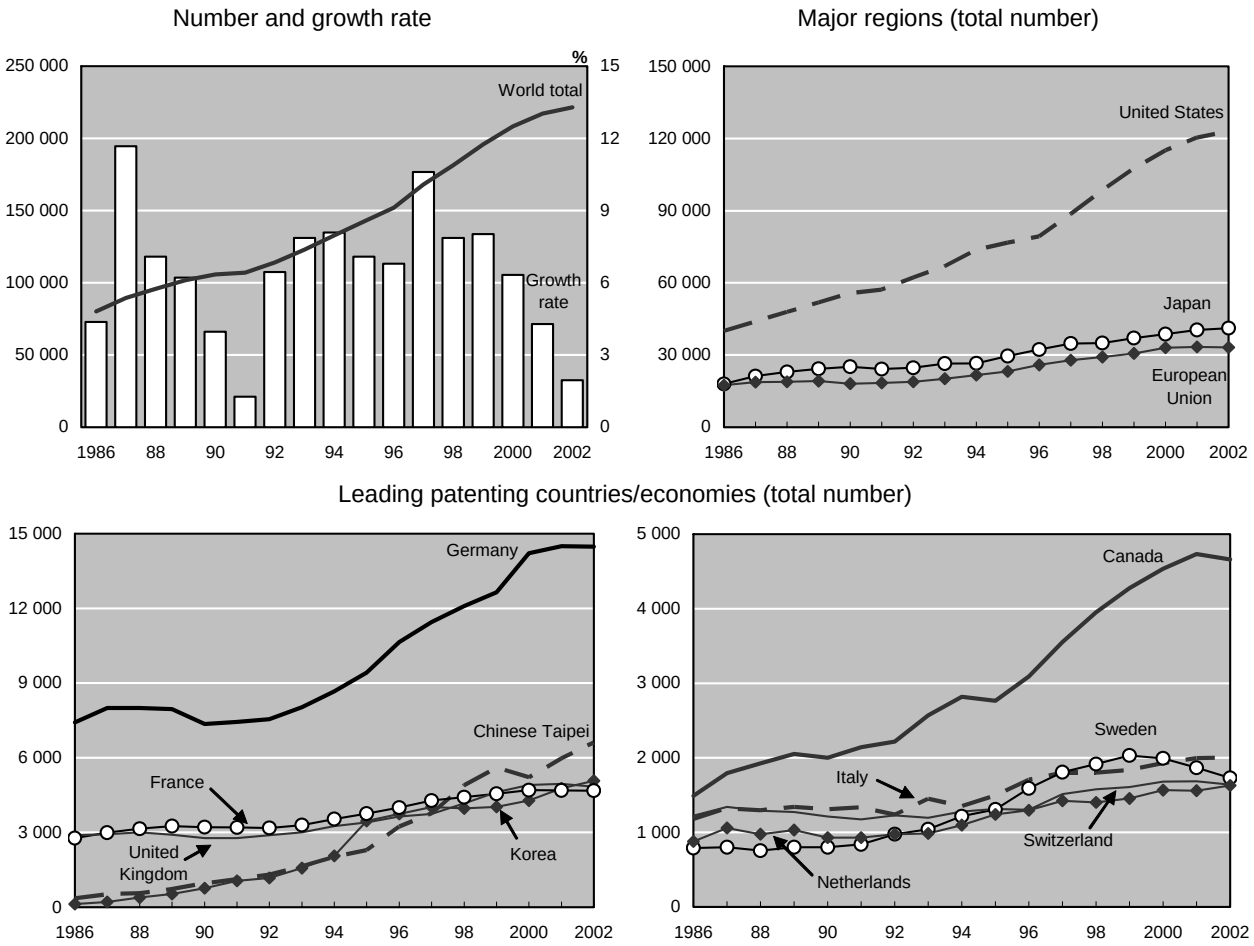
The United States Patent and Trademark Office (USPTO) data reported in this paper refers to number of patent grants rather than number of patent applications (as is the case for EPO patents). This is due to the fact that patent documents (filed prior to 29 November 2000) were only published being granted, and information about unsuccessful (*i.e.* rejected and withdrawn patents) and pending applications were not publicly available (*i.e.* kept secret) (see Annex B). Due to the time lag between the priority date and the USPTO grant date, when the information is available to the public, data can be reported up to 2002 (2001 and 2002 are estimates).[7]

The number of patents granted by the USPTO grew substantially during the second half of the 1980s, and during most of the 1990s. There was a slowdown in the number of patents granted by the USPTO in the early 1990s and in 2000-02, which could partly be due to the economic downturn in OECD countries. The rate of growth of USPTO patents is higher than that of EPO patents and triadic patent families. Between 1991 and 2002, the number of USPTO patents grew by 6.8% a year, compared to 5.7% and 5.0% for EPO patents and triadic patent families, respectively.

7. Data can be reported up to 2005 if counts are based on grant date. However, patent data based on grant date counting procedure is not appropriate for measuring innovative / creative activity (see annex A for details).

Since 1996, the number of patents granted to US inventors increased rapidly compared to patents granted to inventors from the European Union and Japan: patents granted to inventors from the United States, the European Union and Japan increased by 7.6%, 4.2% and 4.1% a year, respectively. There was also a sharp increase in the number of patents granted to Canada, Chinese Taipei and Germany during the same period (Figure 7).

Figure 7. Trends in patents granted by the USPTO[1]



1. Figures for 2000 to 2002 are estimates.

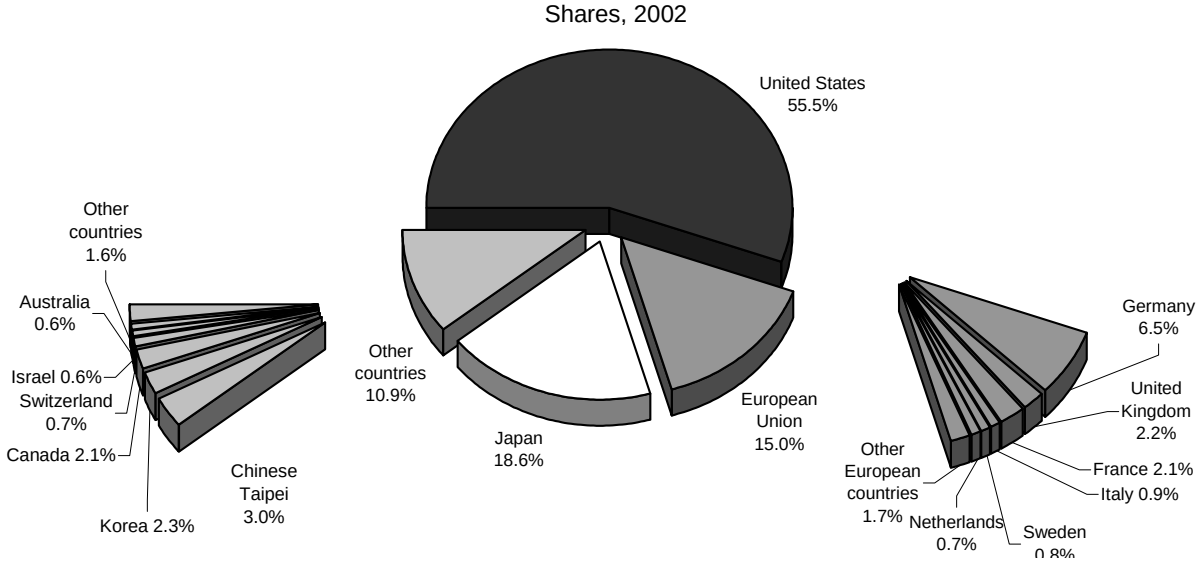
Source: OECD, Patent Database, December 2005.

In 2002, the estimated number of patents granted by the USPTO was in excess of 221 000 (this count is based on the priority date), the majority of which was granted to US inventors (Figure 8). Inventors from the European Union countries and Japan accounted for 15.0% and 18.6% of the total, respectively. The share of patents granted to foreign inventors continuously decreased from 1987 onwards, except for the 1994-96 period, when there was a slight increase in the share of patents granted to foreign inventors. In 2002, foreign inventors accounted for 44.5% of all patents granted by the USPTO, a significant decrease from the peak of 1987 (50.9%).

The share of Chinese Taipei (3.0%), Korea (2.3%) and Canada (2.1%) is higher than that of most large EU countries (*e.g.* France and Italy). The share of Chinese Taipei in USPTO patents (3.0%) is far above its share in EPO patents (0.4%). Canada and Korea also have a higher ranking in USPTO patents compared to their respective ranking based on either triadic patent families (Figure 2) or EPO patents

(Figure 4), reflecting trade links with the United States. The share of the United States, Chinese Taipei and Korea increased significantly between 1991 and 2002. In contrast, a significant decrease can be observed for Japan and the European Union over the same time period. The share of non-member economies, such as China, Israel and India, increased during the 1990s, while the share of large EU countries, such as France, Germany and the United Kingdom, decreased.

Figure 8. Share of countries in total USPTO patent grants



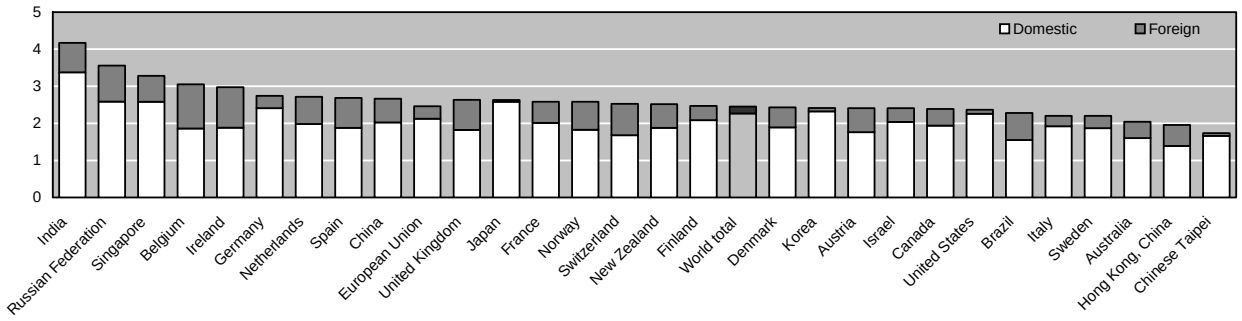
Source: OECD, Patent Database, December 2005.

Average number of inventors per USPTO patents

The average number of inventors per USPTO patents is slightly lower than the average number of inventors per EPO patents. Latest available data shows that there are 2.5 inventors per USPTO patents (Figure 9). India has the highest number of average inventors per USPTO patent, followed by the Russian Federation, Singapore and Belgium: more than 3 inventors per patent. In contrast, Chinese Taipei and Hong Kong, China have less than 2 inventors per USPTO patent. Breakdown of inventors by domestic and foreign inventors shows most of the co-operation takes place between domestic inventors. However, the average number of foreign inventors per USPTO patent is high for Belgium, Ireland and the Russian Federation, where on average each patent has one or more foreign inventors. In contrast, Chinese Taipei, Japan, Korea and the United States have a low number of foreign inventors per USPTO patent. For all countries, except India, Israel and Singapore, the average number of foreign inventors increased between 1991 and 2002. The most significant increase is observed for Ireland.

Figure 9. Average number of inventors per patent granted at the USPTO

Selected countries/economies[1], 2000



1. The graph only covers countries/economies with more than 100 USPTO grants in 2000.

Source: OECD, Patent Database, December 2005.

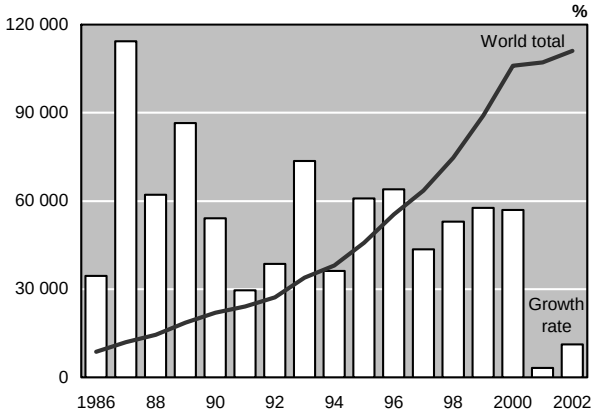
3.4. Patent applications filed under the Patent Co-operation Treaty (PCT applications)

The Patent Co-operation Treaty (PCT) provides the possibility to seek patent rights in a large number of countries by filing a single international application (see Annex B). The PCT procedure is increasingly being used for patent applications, which is reflected by the substantial increase in the number of PCT applications between 1986 and 2002. The available data shows that there was a slowdown in the growth rate in 2001 and 2002, however.

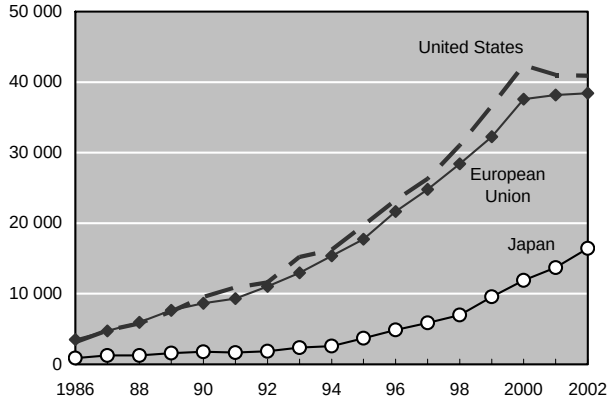
The total number of PCT applications increased from around 8 600 in 1986 to around 111 000 in 2002. Inventors from the United States and the European Union accounted for 36.8% and 34.6% of the total PCT applications in 2002, whereas inventors from Japan accounted for only 14.8% of the total (Figure 10). Since 1991, shares of the United States and the European Union have continuously decreased, while that of Japan increased. The number of PCT applications filed by developing economies, such as India, China and South Africa, has been increasing rapidly, but they still account for a small proportion of all PCT applications. In 2002, non-OECD countries accounted for 5.1% of all PCT applications, a substantial increase from their 1991 share (1.6%).

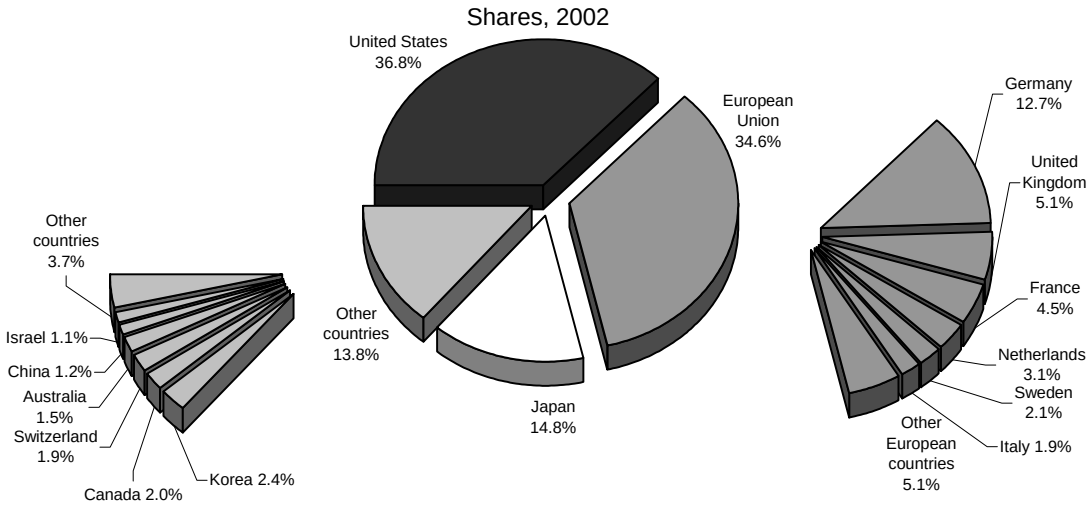
Figure 10. International patent applications filed under the Patent Co-operation Treaty (PCT)

Total number and growth rate



Major regions (total number)





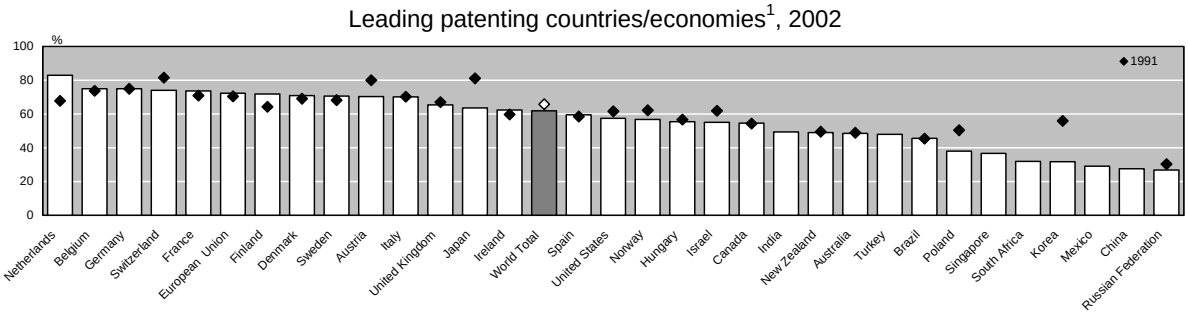
Note: Patent counts are based on the applicant's country of residence, the priority date and fractional counts.

Source: OECD, Patent Database, December 2005.

The PCT procedure consists of two main phases: an international phase, and a PCT national / regional phase (see Annex B). The methodology used by the OECD to construct patent indicators includes only the PCT national/regional phase data (see Khan and Dernis, 2005). Due to the time lag between the priority date and entry to the EPO regional phase, 2002 is the latest available year for PCT EPO regional phase data. In 2002, 97.7% of all PCT applications designated the EPO. However, a fraction of the total PCT applications enters the national/regional phase, where a decision on whether to grant patent rights is made. In 2002, around 67 200 PCT applications entered the EPO regional phase. That is to say around 61.9% of all EPO designated PCT applications proceeded to the EPO regional phase. However, there is considerable cross-country variation in the share of PCT applications that proceeded to the EPO regional phase (Figure 11). The Netherlands, Belgium, Germany and Switzerland have the highest share, with more than 74% of the PCT applications proceeding to the EPO regional phase. In contrast, less than 30% of PCT applications originating from Ukraine, China and the Russian Federation proceeded to the EPO regional phase.

The overall share of PCT applications that proceed to the EPO regional phase has decreased from 65.8% in 1991 to 61.9% in 2002. Between 1991 and 2002, a notable increase in the share of PCT applications that proceeded to the EPO regional phase was observed for the Netherlands and Finland. In contrast, a notable decrease was observed for Korea, Japan, Poland and Iceland.

Figure 11. EPO designated PCT applications entering the EPO regional phase



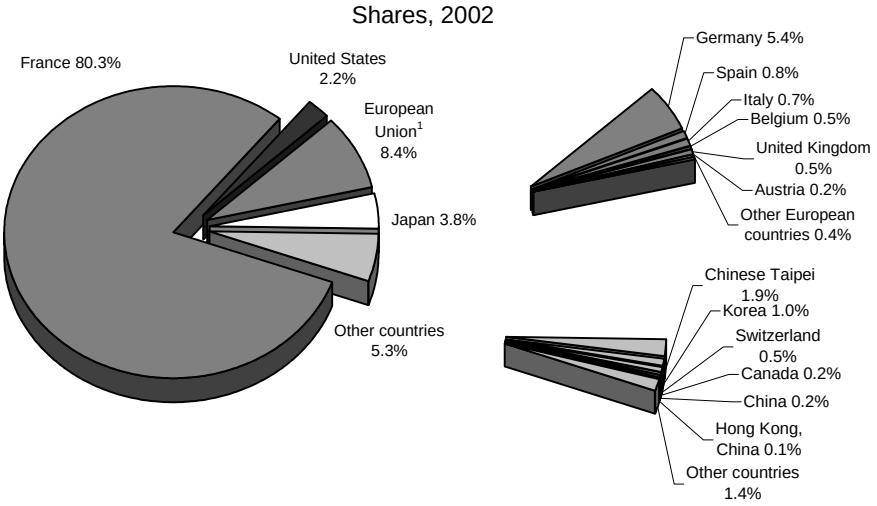
1. The graph only covers countries/economies with more than 100 Euro-PCT filings in 2002.

Source: OECD, Patent Database, December 2005.

3.5. Patenting at selected national patent offices

The total number of patent applications filed at the national patent office of France (INPI) was stable between 1997 and 2002. On average, approximately 15 100 applications are filed at INPI every year. This number includes only published patent applications and does not include EPO patent applications designating France. In 2002, 80.3% of the total patent applications (15 166) were filed by residents of France (Figure 12). Germany accounted for the largest foreign share (5.4%), followed by Japan (3.8%) and the United States (2.2). The share of Chinese Taipei (1.9%) at INPI is far above the share of some large European countries (*e.g.* the United Kingdom, Switzerland and Italy). The share of patents filed by foreign inventors at INPI is significantly lower than the share of foreign patents in other national patent offices. For example, the share of foreign patents at UKPO (Figure 13) is around 54%. Between 1997 and 2002, the share of foreign patents decreased from 22.9% to 19.7%, most of which is accounted for by the decrease in the shares of Germany and the United States. The decrease in the share of foreign patents to INPI is related to an increase in the use of EPO and PCT routes by foreign applicants to file patent applications in France instead of directly filing applications to INPI.

Figure 12. Patent applications to the French patent office (INPI)[1]

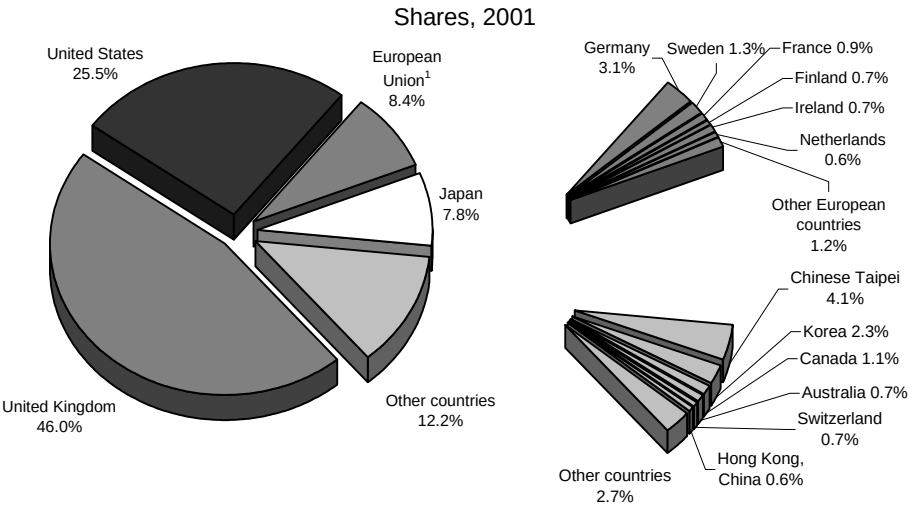


1. *Institut national de la propriété industrielle*. The European Union share excludes France.

Source: OECD, Patent Database, December 2005.

The total number of patent applications filed at the national patent office of the United Kingdom (UKPO) was stable between 1995 and 2001. The latest available data shows that around 12 900 patent applications were filed at the UKPO in 2001. This number includes only published patent applications and does not include EPO patent applications designating the United Kingdom. Domestic applications account for 46% of the total applications (Figure 13), which represents a slight increase from the 1995 share. The share of foreign applications (54%) at the UKPO is significantly higher than the share of foreign applications (19.7%) at the French patent office (Figure 12). The United States (25.5%) and Japan (7.8%) account for one third of the total number of patents filed at the UKPO. Chinese Taipei accounts for 4.1% of total UKPO patent applications, which is higher than some large OECD countries (*e.g.* Germany and France). Between 1995 and 2001, a notable increase in country shares can be observed for the United States, the United Kingdom, Chinese Taipei and Sweden. In contrast notable declines can be observed for Japan, Germany and Korea.

Figure 13. Patent applications to the United Kingdom patent office (UKPO)[1]

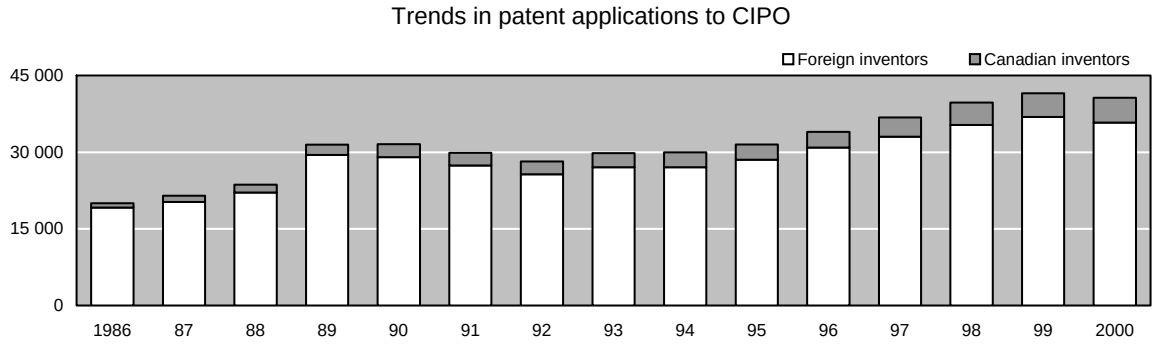


1. The Patent Office – United Kingdom. The European Union share excludes the United Kingdom.

Source: OECD, Patent Database, December 2005.

The number of patent applications filed at the Canadian Patent Office (CIPO) was stable during the first half of the 1990s (Figure 14), averaging around 30 000 applications per year. There has been a steady increase from 1996 onwards and the latest available data shows that around 35 800 patents were filed at the CIPO in 2000. The bulk of the patents filed at the CIPO is accounted for by foreign inventors (88.1% of the total patents filed in 2000). The share of patents filed by domestic inventors is low compared to the foreign share. Nevertheless, it has increased during the 1990s, from 8.3% in 1991 to 11.9% in 2000. The United States (45.6%) accounted for the largest share of CIPO patent filings, followed by the European Union (25.8%) and Japan (8.8%). The high share of the United States at CIPO is due to the geographical proximity to Canada. The share of Germany (7.9%) is slightly below that of Japan (8.8%), but it is significantly above that of France (4.8%) and the United Kingdom (4.8%). Between 1991 and 2000, a notable increase in its country share can be observed for Canada (increased from 8.3% in 1991 to 11.9% in 2000), while a considerable decline is observed for Japan (11.7% to 8.8%) and the United States (47.7% to 45.6%).

Figure 14. Patent applications to the Canadian patent office (CIPO)[1]



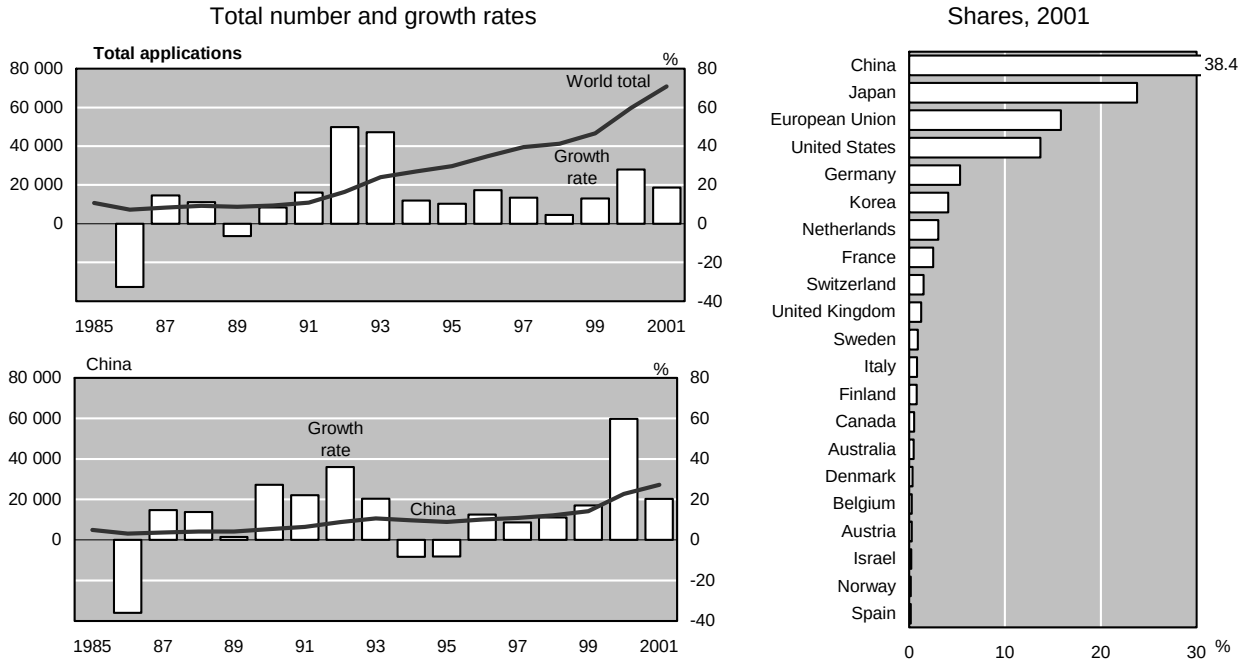
1. Canadian Intellectual Property Office.

Source: OECD, Patent Database, December 2005.

The total number of patents filed at the State Intellectual Property Office of China (SIPO) was relatively stable between 1987 and 1991: average annual growth rate of 0.22%. Since 1991, there has been a rapid increase in the number of patent filed at the SIPO, however (Figure 15). The average annual growth

rate between 1991 and 2001 is 20.6%. The bulk of the increase in SIPO patents is accounted for by foreign inventors. Between 1991 and 2001, the number of foreign patents increase by 25.7% a year, compared to a 15.4% a year increase for domestic patents. In 2001, more than 70 880 patent applications were filed at the SIPO, most of which were due to foreign inventors. The share of patents filed by foreign inventors increased from 41% in 1991 to 62% in 2001. In 2001, Japan (23.8%) had the highest share of foreign patents at the SIPO, followed by the European Union countries (15.8%) and the United States (13.7%). Germany, Korea and the Netherlands also accounted for a significant share of all SIPO patents applications.

Figure 15. Patent applications to the Chinese patent office (SIPO)[1]



1. State Intellectual Property Office of the People's Republic of China (SIPO). Provisional data.

Source: OECD, Patent Database, December 2005.

3.6. Sources of worldwide increase of patenting

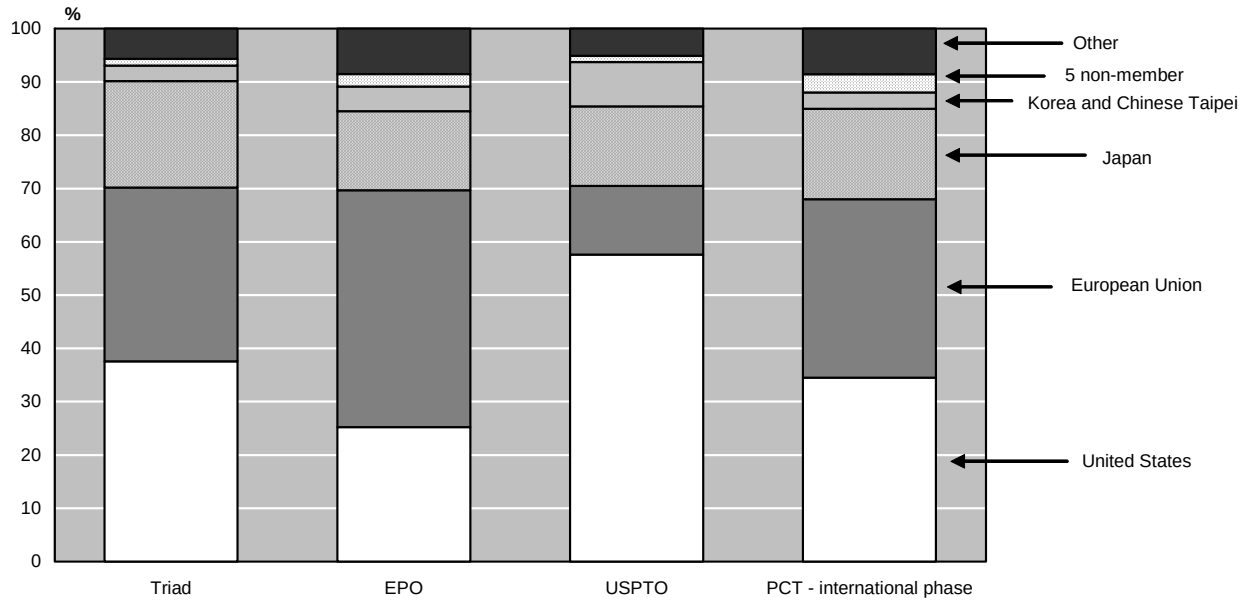
Figure 16 provides a breakdown of the growth of triadic patent families, EPO patent applications, USPTO patent grants and PCT applications. Decomposition of the growth of triadic patents shows the United States and the European Union countries to be the main sources of increase in patenting. Between 1991 and 2002, the number of triadic patents increased by 71.9%. Inventors from the United States and the European Union countries accounted for 27% and 23.5% of the total increase, respectively; whereas 14.4% of the total increase is attributed to inventors from Japan.

European inventors are the main source of the increase in EPO patents: 37.3% of the total increase in EPO patents is attributed to European inventors. Inventors from the United States and Japan accounted for 21.2% and 12.4% of the total increase, respectively. The growth of the USPTO patents is mainly driven by US inventors. Between 1991 and 2002, 61.4% of the total increase (106.7%) in USPTO patents is attributed to US inventors. The contribution of the US inventors to the overall growth rate of USPTO patents is far above the contribution of EU inventors to the overall growth rate of EPO patents. Inventors from Chinese Taipei and Korea also contributed to around 9% of the total growth in USPTO patent grants.

PCT applications grew rapidly during the 1990s (360% increase between 1991 and 2002). Inventors from the European Union countries and the United States equally contributed to the growth of international patenting. The contribution of inventors from developing countries to the growth rate of PCT applications is higher than their respective contribution to the growth rate of triadic, EPO and USPTO patents.

Contrary to the claims made by some researchers, US inventors are not solely responsible for the increase in patenting during the 1990s. EU inventors are the main driving force behind the surge in patenting in Europe, while US inventors are mainly responsible for the increase in patenting in the United States. This illustrates a good example of home advantage bias associated with single patent office data, and the pitfall of deriving conclusions from such data. Data from triadic patent families and PCT applications reveals both EU and US inventors to be equally responsible for the surge in PCT patent applications. This is due to the fact that triadic patent families data and PCT applications data are less likely to be affected by the home advantage bias.

Figure 16. Contribution of countries/regions to the surge of patenting during the 1990s: Triadic patent families, EPO and PCT patent applications, and USPTO patent grants



Source: OECD, Patent Database, December 2005.

4. Patent intensity

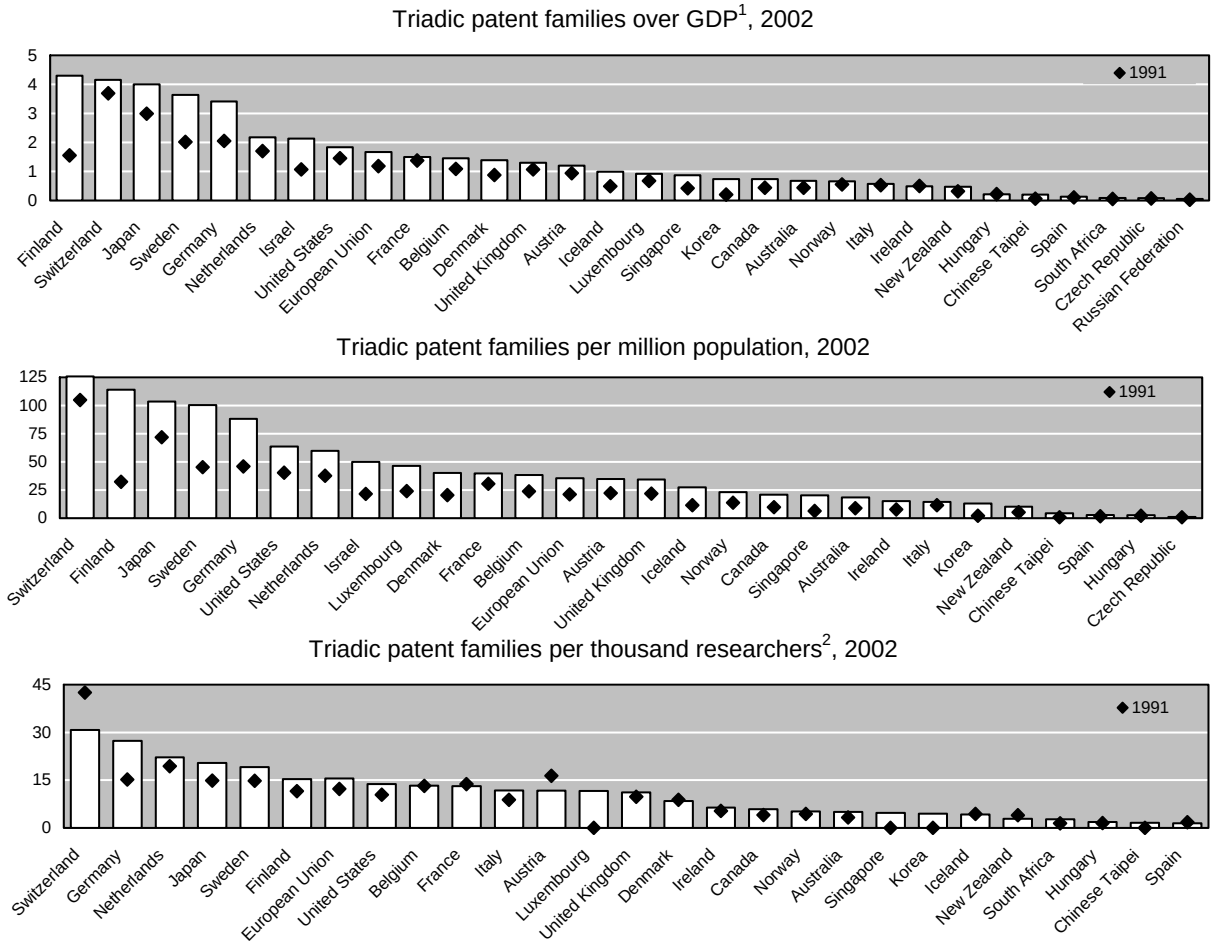
4.1. Patent intensity: patent-to-GDP, patent-to-population and patent-to-researchers

To standardise for the country size and input factors, patent data are expressed relative to population, gross domestic products (GDP), R&D expenditure and researchers. Figure 17 presents triadic patent families relative to GDP, population and researchers. In contrast to its ranking in absolute numbers of triadic patent families, Japan has high patent-to-GDP, patent-to-population and patent-to-researchers ratios compared to the European Union and the United States. In 2002, the patent-to-GDP ratio of Japan (4.0 triadic patents per billion GDP) was more than double that of the United States (1.8) and the European Union (1.8). The number of triadic patents per million population for Japan (104) is far higher than that for the United States (64) and the European Union (36). In 2002, Japan invented 20 triadic patents per thousand researchers, whereas the European Union countries and the United States invented around 15 triadic patents per thousand researchers.

Finland, Switzerland and Japan had the highest patent-to-GDP and patent-to-population ratios, whereas Switzerland and Germany had the highest patent-to-researcher ratio. In 2002, Switzerland and Germany invented 30.7 and 27.4 triadic patents per thousand researchers, respectively. In contrast, the Russian Federation, the Czech Republic, Spain, Chinese Taipei and Hungary have low patent ratios by all measures. Among non-OECD economies Israel has the highest patent-to-GDP and patent-to-population ratios.

Between 1991 and 2002, patent-to-GDP and patent-to-population ratios increased for all the reported countries, except Hungary. The increases were largest in Finland, Sweden and Germany. In Hungary, there was a small increase in the patent-to-population ratio and a small decrease in the patent-to-GDP ratio. For most countries there was an increase in the patent-to-researcher ratio during the same period, particularly for Germany, Japan and Sweden. A number of countries also experienced a decline on patent-to-researchers ratio. This is most notably the case for Switzerland and Austria, where the patent-to-researchers ratio declined from 42.5 to 30.7 and 16.4 to 11.7, respectively.

Figure 17. Triadic Patent Families : intensity



1. Gross Domestic Product (GDP), billion 2000 USD using purchasing power parities. European Union figure refers to EU 15.
2. Number of researchers in full time equivalent. European Union figures refer to EU 15.

Source: OECD, Patent and R&D Databases, December 2005.

Compared to the European Union countries and the United States, Japan has high patent-to-GDP and patent-to-population ratios, based on EPO data (Figure 18). This is similar to the situation observed for the

triadic patent families (Figure 17). In 2002, Japan invented 5.9 EPO patents per billion GDP and 151 EPO patents per million population. However, compared to the European Union countries Japan has a lower patent-to-researchers ratio, this is in contrast to the situation observed for the triadic patents.

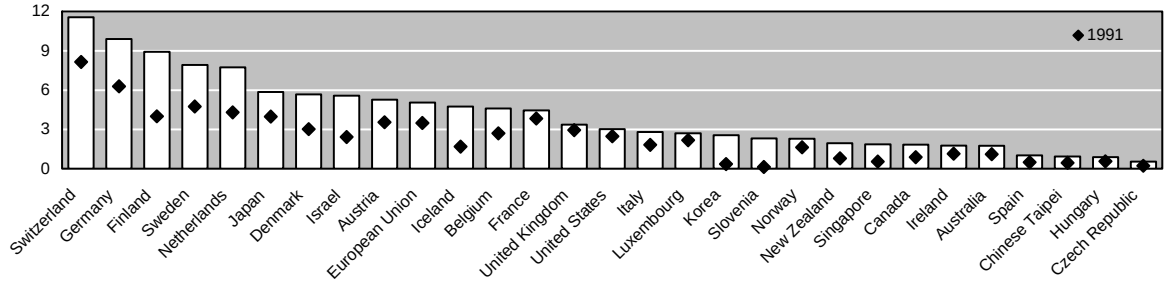
The top rankings as regards EPO patent intensity are taken by European countries. The highest ranking non-European countries are Japan and Israel. Switzerland and Germany have the highest patent-to-GDP, patent-to-population and patent-to-researchers ratios. In 2002, Switzerland invented 12, 350 and 85 EPO patents per billion GDP, million population and thousands researchers, respectively. Southern and Central European countries and Chinese Taipei have low patent-to-GDP, patent-to-population and patent-to-researchers ratio.

Of the large EU countries, Germany has the highest patent-to-GDP, patent-to-population and patent-to-researchers ratios. The patent-to-GDP ratio of Germany is larger than that of the United Kingdom and France by a factor of 2.9 and 2.2, respectively. In addition, the gap in the patent-to-GDP ratio of Germany on the one hand and the United Kingdom and France on the other increased during the 1990s.

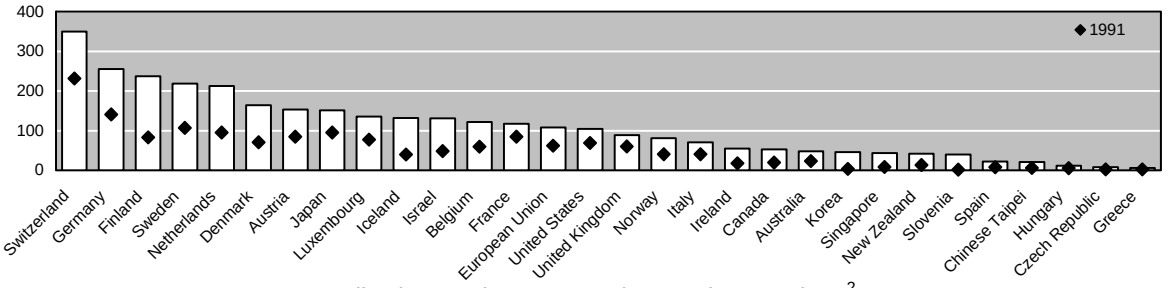
For all the reported countries, the patent-to-GDP and patent-to-population ratios increased between 1991 and 2002, in particular for Finland, Germany, the Netherlands and Switzerland. There was a large decline in the patent-to-researchers ratio for Austria and Switzerland over the same period, while a large increase is observed for Germany, the Netherlands and Italy.

Figure 18. EPO patent applications: intensity

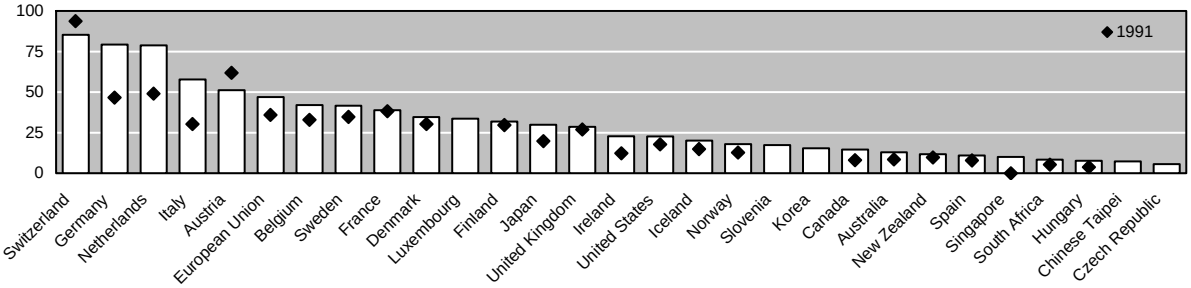
Patent applications to the EPO over GDP[1], 2002



Patent applications to the EPO per million population, 2002



Patent applications to the EPO per thousand researchers[2], 2002



1. Gross Domestic Product (GDP), billion 2000 USD using purchasing power parities. European Union figure refers to EU 15.
2. Number of researchers in full time equivalent. European Union figures refer to EU 15.

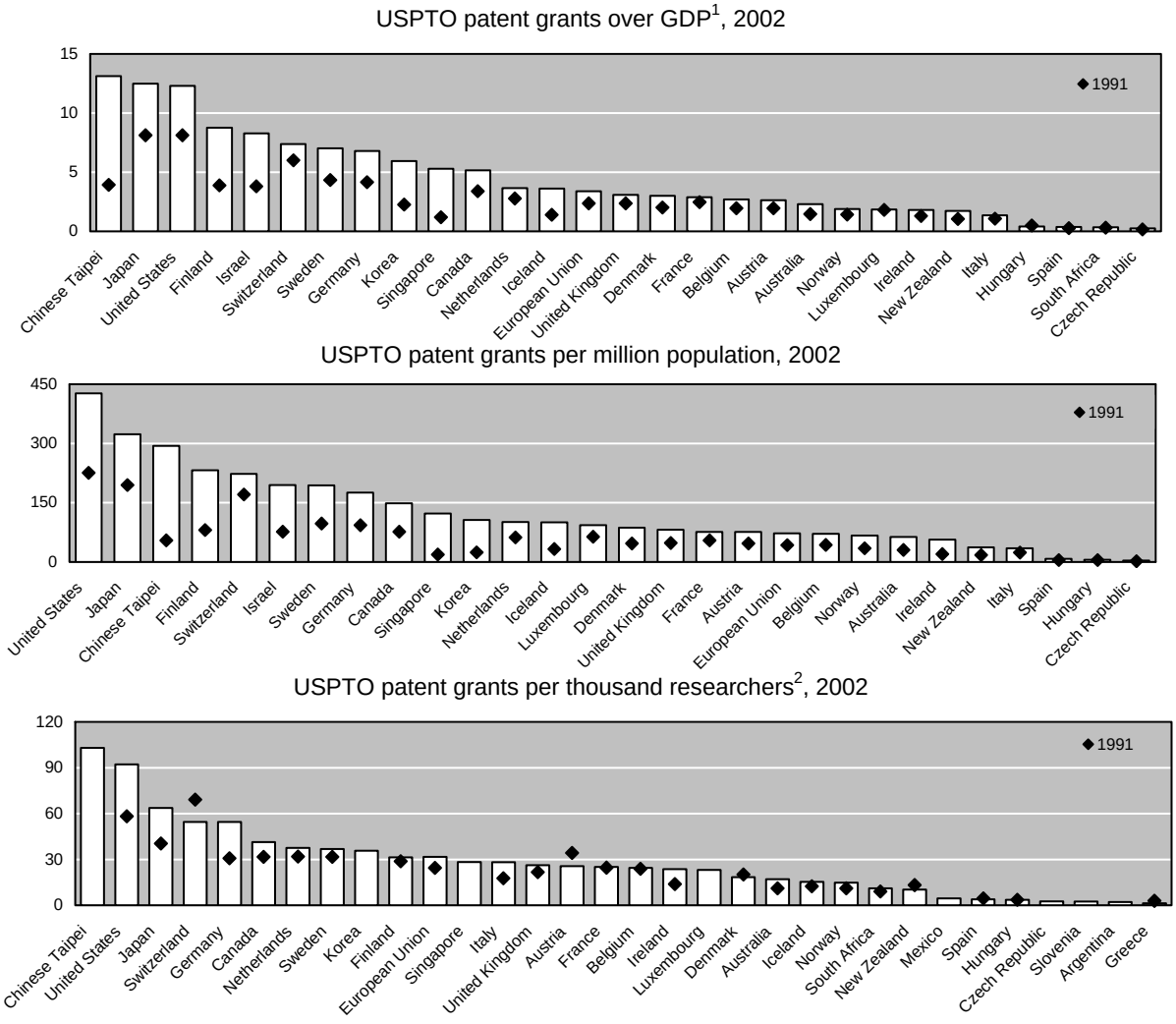
Source: OECD, Patent and R&D Databases, December 2005.

The patent-to-GDP, patent-to-population and patent-to-researchers ratios of Japan and the United States, based on USPTO data, are significantly higher than those of the European Union (Figure 19). This is in contrast to the ratios observed for EPO patents (Figure 18). The large differences in the ratios of the European Union and the United States in Figures 18 and 19 is to a certain extent explained by the "home advantage" factor (*i.e.* proportionate to their inventive activity, domestic applicants tend to file for more patents in their home country compared to foreign applicants).

Chinese Taipei has the highest patent-to-GDP and patent-to-researchers ratios, and the third highest patent-to-population ratio on the basis of USPTO grant data. This is in contrast to the situation observed for the triadic patents (Figure 17) and EPO patents (Figure 18), where Chinese Taipei has the lowest ratios for all three measures. Israel, Korea and Singapore also have high patent-to-GDP and patent-to-population ratios for USPTO patents.

Between 1991 and 2002, the patent-to-GDP and patent-to-population ratios increased for all reported countries, except Hungary (a small decrease in the patent-to-GDP ratio). The most notable increases are observed for Chinese Taipei, Finland, Israel, Japan and the United States. A significant decline in the patent-to-researchers ratio is observed for Switzerland and Austria, while a large increase is observed for the United States and Japan.

Figure 19. USPTO patent grants: intensity



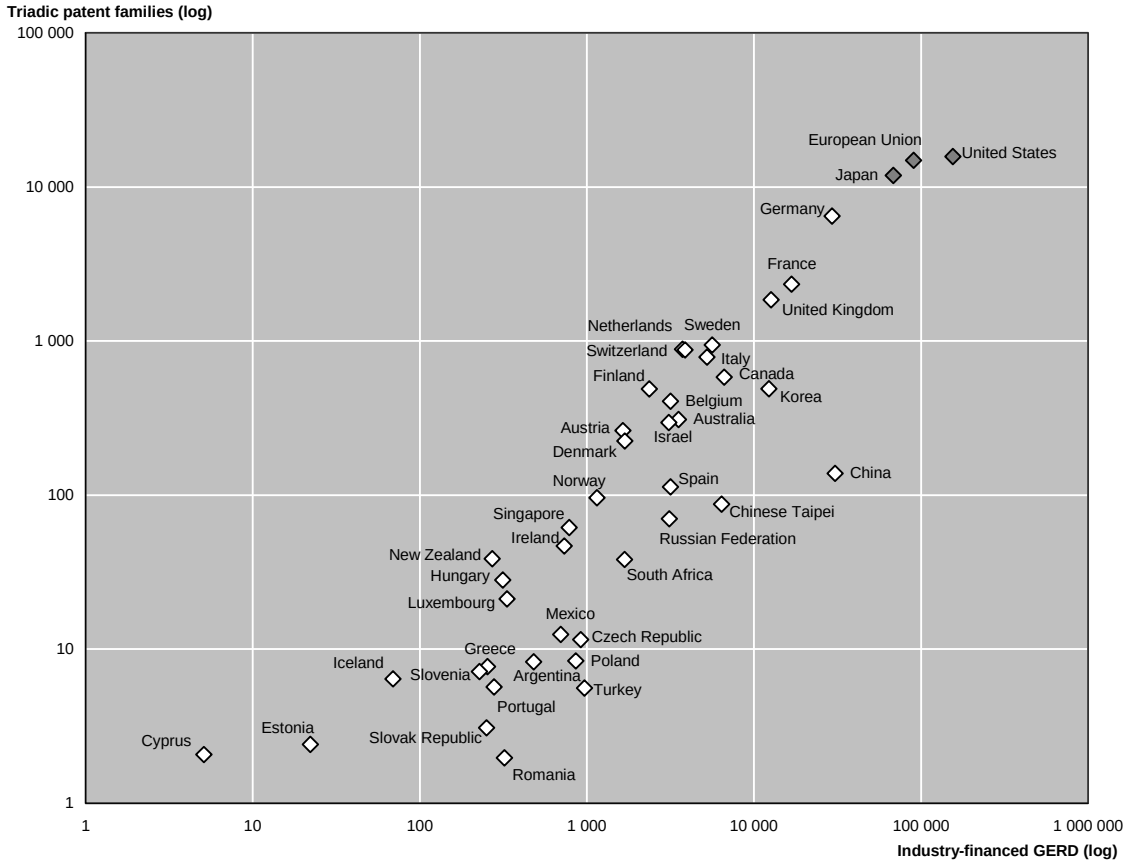
1. Gross Domestic Product (GDP), billion 2000 USD using purchasing power parities. European Union figure refers to EU 15.
2. Number of researchers in full time equivalent. European Union figures refer to EU 15.

Source: OECD, Patent and R&D Databases, December 2005.

4.2. Patent intensity: patents over industry-financed R&D expenditure

There is a strong positive correlation between the number of triadic patent families and industry-financed research and development (R&D) expenditure (Figure 20). Countries with high level of industry-financed R&D expenditures (such as the United States, Japan and Germany) also have large numbers of triadic patent families. In contrast, countries with a low level of industry-financed R&D expenditure (such as Latvia, Estonia, Iceland and Chile) have small numbers of triadic patent families. A similar trend is observed (*i.e.* positive correlation) for EPO and USPTO patents and industry-financed R&D expenditure.

Figure 20. Triadic patent families and industry-financed R&D[1]
1996-2002 average



1. Gross domestic expenditure on R&D (GERD) financed by industry, million 2000 USD using purchasing power parities, lagged by one year.

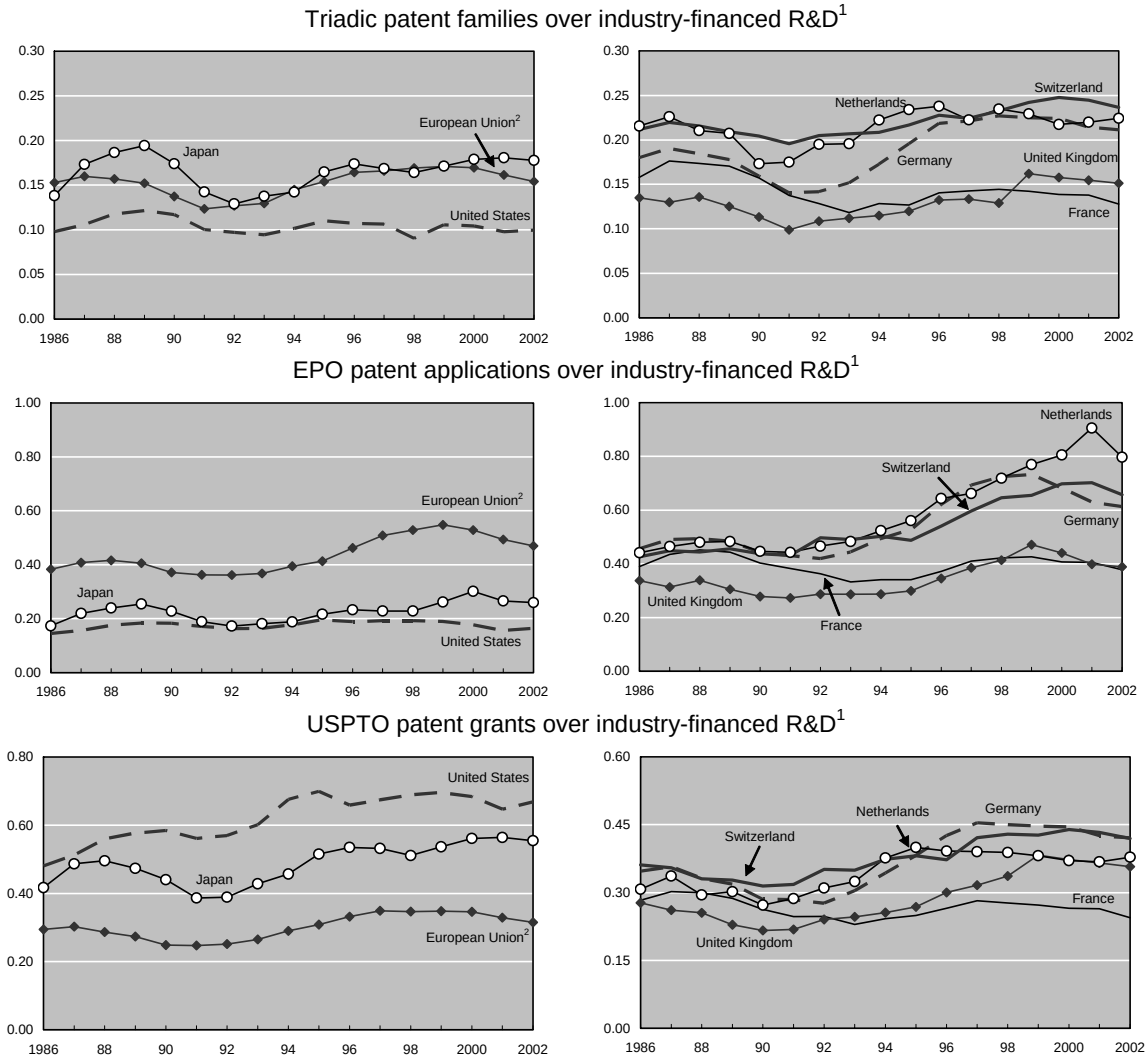
Source: OECD, Patent Database, December 2005.

The triadic patent intensity (triadic patent families divided by industry-financed R&D) of the three OECD regions has followed similar patterns and appears to be cyclical: it decreased during the late 1980s and increased in the mid-1990s (Figure 21). A similar trend is observed for the EPO and USPTO patent intensity (EPO and USPTO patents divided by industry-financed R&D). However, there is an important difference in the magnitude and ranking of patent intensity. The triadic patent intensity is similar in the European Union countries and Japan: 0.15 and 0.16 on average between 1986 and 2002, respectively. In contrast, it is low in the United States: 0.10 on average over the same period. The EPO patent intensity in

the European Union countries (0.44 on average between 1986 and 2002) is far higher than the EPO patent intensity in Japan (0.23) and the United States (0.18). The opposite is observed for the USPTO patent intensity, where the USPTO has a higher patent intensity compared to the European Union countries and Japan. The high patent intensity ratio for the European countries and the United States in their respective domestic market (EPO and USPTO) is mostly due to the "home advantage" factor – domestic applicants tend to file more patents in their home country compared to foreign applicants. Japan has a high USPTO patent intensity, which reflects the trade link between Japan and the United States.

Germany, the Netherlands and Switzerland have a high triadic, EPO and USPTO patent intensity. In addition, the patent intensity of these three countries followed an upward trend from 1992 onwards. Although the three patent intensity ratios (triadic, EPO and USPTO) for France and the United Kingdom have followed an upward trend since 1992, both of these countries have a lower patent intensity ratio relative to Germany, the Netherlands and Switzerland. Italy had the third highest patent intensity ratio for the EPO patents in 2002 and it increased significantly during the 1990s. Italy's EPO patent intensity ratio increased from 0.32 in 1992 to 0.75 in 2002. Chinese Taipei (0.97) had the highest USPTO patent intensity ratio in 2002. Canada also has a high USPTO patent intensity ratio.

Figure 21. Trends in patent intensity: Triadic, EPO and USPTO patents



1. Gross domestic expenditure on R&D (GERD) financed by industry, million 2000 USD using purchasing power parities, lagged by one year.
2. Before 1996, the European Union figure refers to EU 15.

Source: OECD, Patent Database, December 2005.

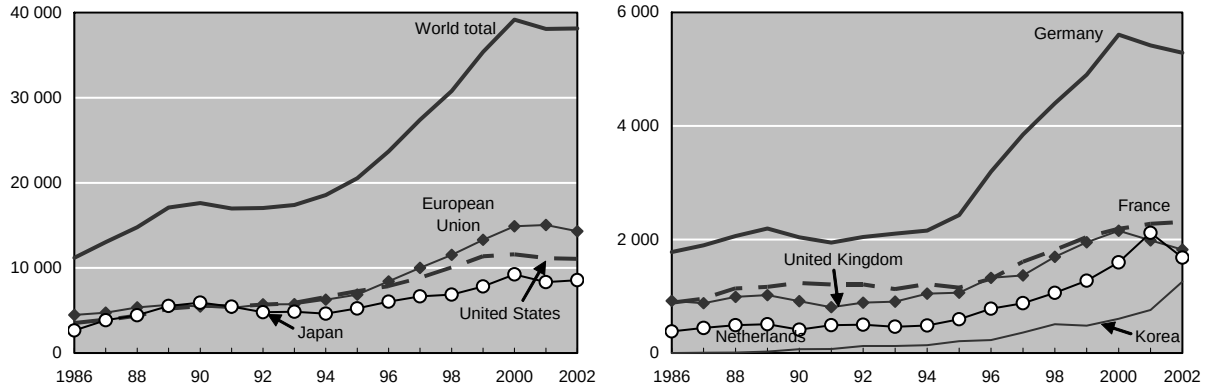
5. Patent by technological areas

5.1. ICT patents

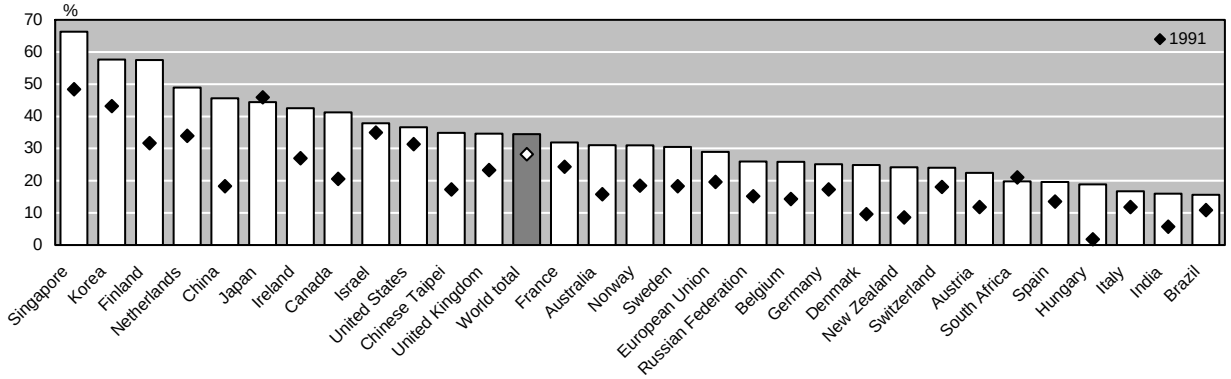
ICT-related patents have grown much more rapidly than overall patent applications at the European Patent Office (EPO). Between 1991 and 2002, ICT-related patents grew by 7.6% a year, while overall EPO patent applications grew by 5.7%. According to the broad definition of ICT-related patents (Box E), around 34.5% of all EPO patent applications filed in 2002 were ICT-related patents, representing a 6.2 percentage points increase from the 1991 level. However, the share of ICT-related patents in national patents varies across countries. Singapore, Korea, Finland and the Netherlands have a high ratio of ICT-related patents to total patents: around 50% or more of the EPO patent applications originating from these countries are ICT-related patents (Figure 22). This is related to the presence of large electronics (*e.g.* Phillips and Samsung) and telecommunications (*e.g.* Nokia) firms in those countries. Brazil, India, Italy, Hungary, Spain and South Africa have a low ratio of ICT-related patents to total patents: less than 20% of patents originating from these countries are ICT-related patents. For all reported countries/economies, except Japan and South Africa, the ratio of ICT-related patents to total patents increased between 1991 and 2002. The most significant increases are observed for China, Finland and Canada.

Figure 22. Trends in ICT-related patents filed at the EPO

Total number, major regions and leading countries



ICT-related patents as a percentage of the national total (EPO): selected countries/economies[1], 2002

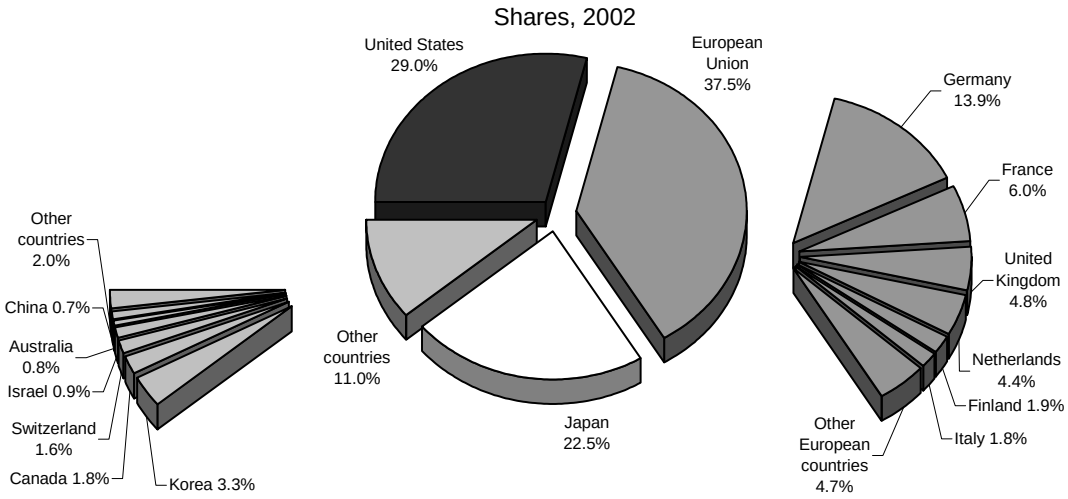


1. The graph only covers countries/economies with more than 100 EPO applications in 2002.

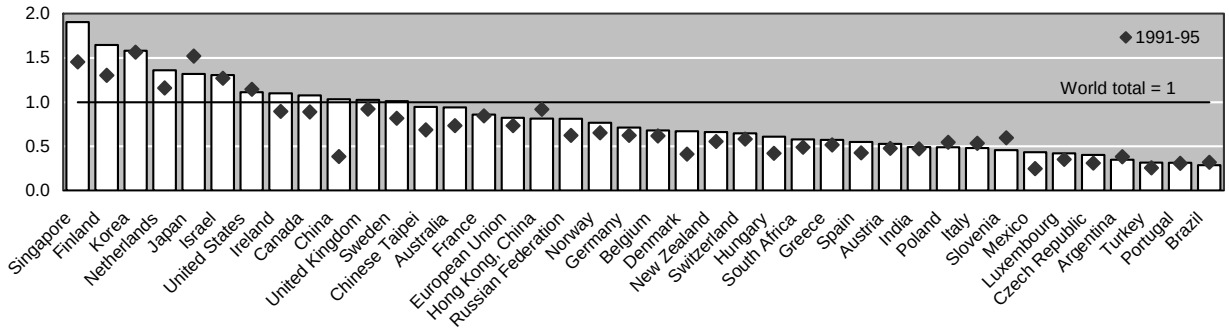
Source: OECD, Patent Database, December 2005.

In 2002, 38 145 ICT-related patents were filed at the EPO. The European Union countries accounted for 37.5% of the total (Figure 23), significantly more than the United States (29%) and Japan (22.5%). Between 1991 and 2002, the share of ICT-related patents filed by European Union countries increased considerably, while the shares of the United States and Japan decreased. The share of Japan and Korea is higher in ICT-related patents than their respective share in all EPO patents (Figure 4). This is reflected by the specialisation index (Box E). By the specialisation index measure, Japan and the United States are specialised in ICT-related patents, while the European Union is not. Singapore, Finland and Korea are the most specialised countries in ICT-related patents. In contrast, Brazil, Portugal and Turkey are least specialised in ICT-related patents. For a majority of countries, the specialisation index of ICT-related patents was higher in the early 2000s than in the early 1990s. This is most notably the case for China, Singapore and Finland.

Figure 23. Share of countries in ICT-related patents filed at the EPO



Specialisation index of ICT-related patents filed at the EPO[1], 1996-2002



1. The graph only covers countries/economies with more than 200 EPO applications for the period 1996-2002.

Source: OECD, Patent Database, December 2005.

Box E. Definition of ICT-related patents based on IPC

The definition used to calculate ICT-related patents is very broad and covers a wide range of classes of the International Patent Classification (IPC). The following IPC classes are covered by the definition:

Telecommunications
[G01S,G08C,G09C,H01P,H01Q,H01S3/(025,043,063,067,085,0933,0941,103,133,18,19,25), H1S5,H03B,H03C, H03D,H03H,H03M,H04B,H04J,H04K,H04L,H04M,H04Q];

Consumer electronics
[G11B,H03F,H03G,H03J,H04H,H04N,H04R,H04S];

Computers, office machinery
[B07C,B41J,B41K,G02F,G03G,G05F,G06,G07,G09G,G10L,G11C,H03K,H03L];

Other ICT
[G01B,G01C,G01D,G01F,G01G,G01H,G01J,G01K,G01L,G01M,G01N,G01P,G01R,G01V, G01W,G02B6, G05B,G08G,G09B,H01B11, H01J(11/,13/,15/,17/,19/,21/,23/,25/,27/,29/,31/,33/,40/,41/,43/,45/),H01L]

The ***specialisation index*** (SI) for ICT-related patents is calculated as the share of a country in ICT-related patents (filed at EPO) divided by the share of that country in all technology areas (total EPO patents). When the SI value of ICT-related patents is greater than 1, the country has a higher share in ICT-related patents relative to its share in all technology areas. Conversely, when the SI value of ICT-related patents is below 1, the country has a lower share in ICT-related patents than in all technology areas combined.

For further details on the IPC classes, see *www.wipo.int/classifications/fulltext/new_ipc/index.htm*

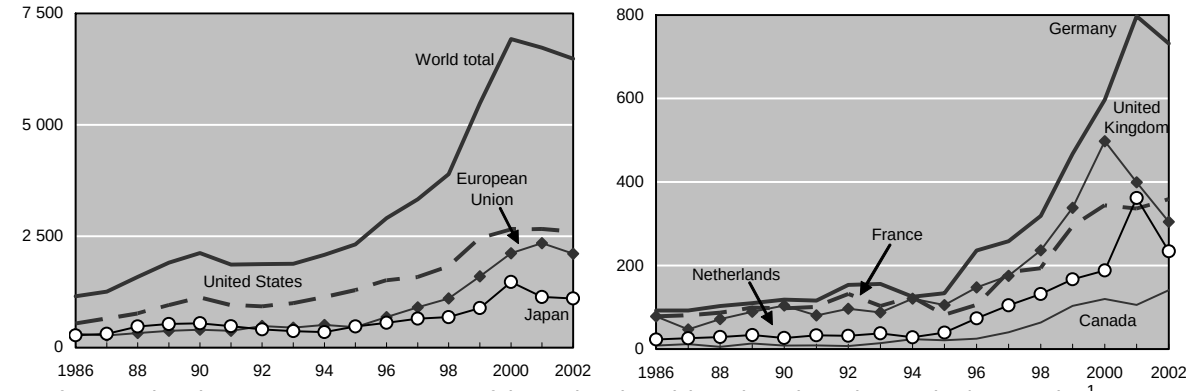
5.2. "Software-related" patents

There is no widely accepted definition for software-related patents. Definitions developed by Graham and Mowery (2003) and Bessen and Hunt (2004) are the most frequently cited definitions of software patents[8]. Both of these definitions have certain limitations however. Considering the lack of definition for software patents, we focus on a single International Patent Classification (IPC) class, GO6F, which we believe includes a large proportion of the total software-related patents (Box F). This is a narrow definition of software patents, as it does not include software patents that are included in other IPC classes. The aim here is to shed some light on the level of activity in this technological area, rather than to provide definitive figures for the number of software-related patents. The total number of software-related patent applications filed at the EPO increased substantially from 1994 onwards (figures for 2001 and 2002 show a small decrease). A similar trend is observed for countries with a large number of software-related patent applications (Figure 24). Similar to ICT and biotechnology patents, software-related patent applications filed at the EPO have grown more rapidly than the overall EPO patent applications. In 2002, around 5.9% of all applications filed at the EPO were in IPC class GO6F, representing a considerable increase from the 1994 level (3.2%). Singapore, Finland, Chinese Taipei and the United States have a high ratio of software-related patents to all EPO patents. More than 8.5% of these countries' patents (filed at the EPO) are in this technological area. For all reported countries/economies, the ratio of software-related patents to total EPO patents almost doubled between 1994 and 2002.

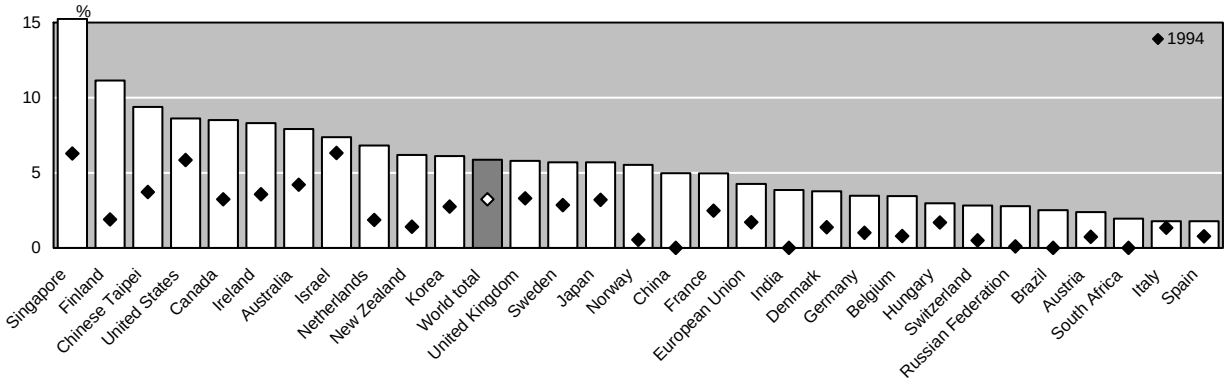
8. The definition of software patent advocated by Graham and Mowery is based on the following IPC classes: GO6F (3/, 5/, 7/, 9/, 11/, 12/, 13/ and 15/), GO6K (9/ and 15/) and HO4L (9/). Bessen and Hunt on the other hand developed a search algorithm to identify software patents.

Figure 24. Trends in software–related patents filed at the EPO

Total number, major regions and leading countries



Software-related patents as a percentage of the national total (EPO): selected countries/economies[1], 2002

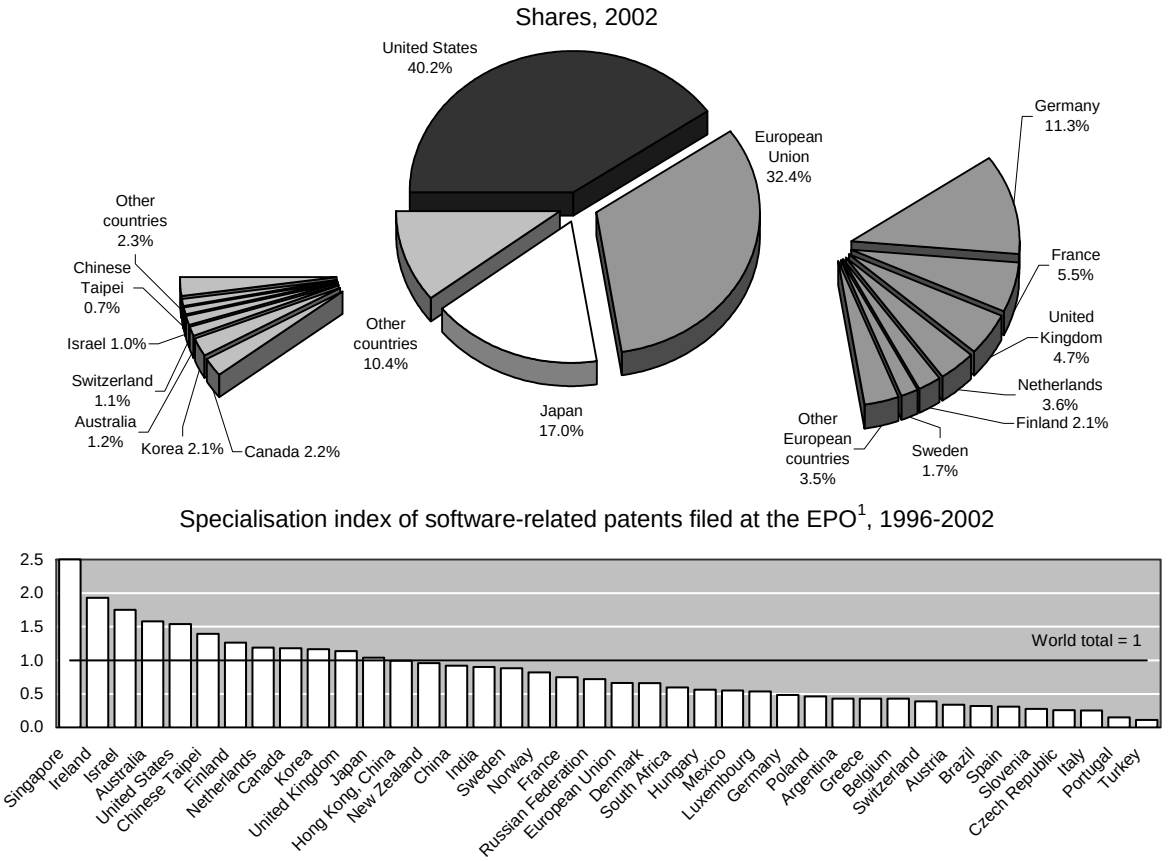


1. The graph only covers countries/economies with more than 100 EPO applications in 2002.

Source: OECD, Patent Database, December 2005.

In 2002, around 6 400 software-related patents applications were filed at the EPO, most of which are from US inventors (Figure 25). The share of the United States in IPC class GO6F (40.2%) is far above its share in all EPO patents (Figure 4) and the opposite holds for the European Union. This reflects the strong position of the United States in the software industry. The share of software-related patent applications for large European countries such as Germany, France and Italy is lower than their respective share in all EPO patent applications. Whereas Ireland, Finland, the Netherlands and the United Kingdom have a similar or higher share in software-related patent applications compared to their respective share in all EPO patent applications. The specialisation index shows mostly non-European countries to be specialised in IPC class GO6F. Ireland, Finland, the Netherlands and the United Kingdom are the four European countries specialised in this IPC class.

Figure 25. Share of countries in software-related patents filed at the EPO



1. The graph only covers countries/economies with more than 200 EPO applications for the period 1996-2002.

Source: OECD, Patent Database, December 2005.

Box F. IPC subclasses for software-related patents

For the calculation of the number of software-related patents, we only take IPC class G06F into consideration. IPC class G06F covers patents relating to electric digital data processing technology. The following IPC (7th edition) subclasses are included in G06F:

G 06 F: Electric Digital Data Processing

- 1/ 00 Details not covered by groups G06F 3/00 to G06F 13/00;
- 3/ 00 Input arrangements for transferring data to be processed into a form capable of being handled by the computer; Output arrangements for transferring data from processing unit to output unit (*e.g.* interface arrangements);
- 5/ 00 Methods or arrangements for data conversion without changing the order or content of the data handled (*e.g.* coding);
- 7/ 00 Methods or arrangements for processing data by operating upon the order or content of the data handled;
- 9/ 00 Arrangements for programme control (*e.g.* control unit);
- 11/ 00 Error detection, error correction and monitoring;
- 12/ 00 Accessing, addressing or allocating within memory systems or architectures;
- 13/ 00 Interconnection of, or transfer of information or other signals between, memories, input/output devices or central processing units;
- 15/ 00 Digital computers in general and data processing equipment in general;
- 17/ 00 Digital computing or data processing equipment or methods, specially adapted for specific functions;
- 19/ 00 Digital computing or data processing equipment or methods, specially adapted for specific applications.

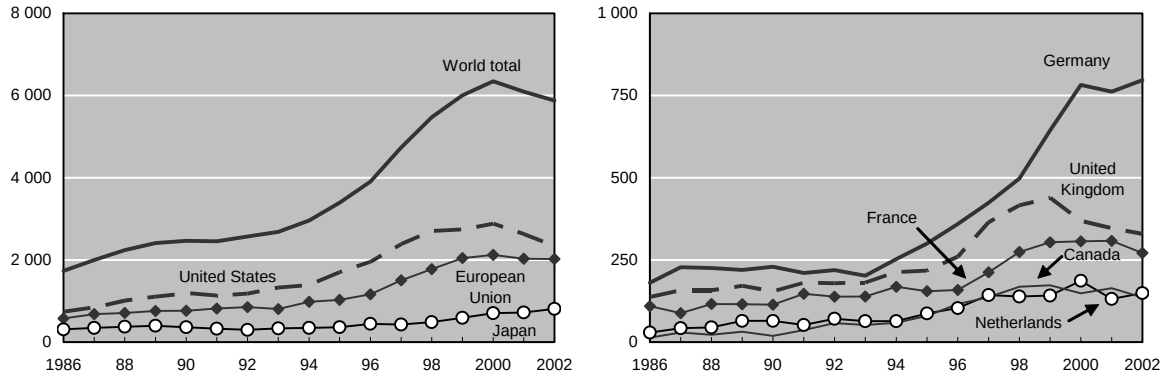
For further details on the IPC classes, see *www.wipo.int/classifications/fulltext/new_ipc/index.htm*

5.3. Biotechnology patents

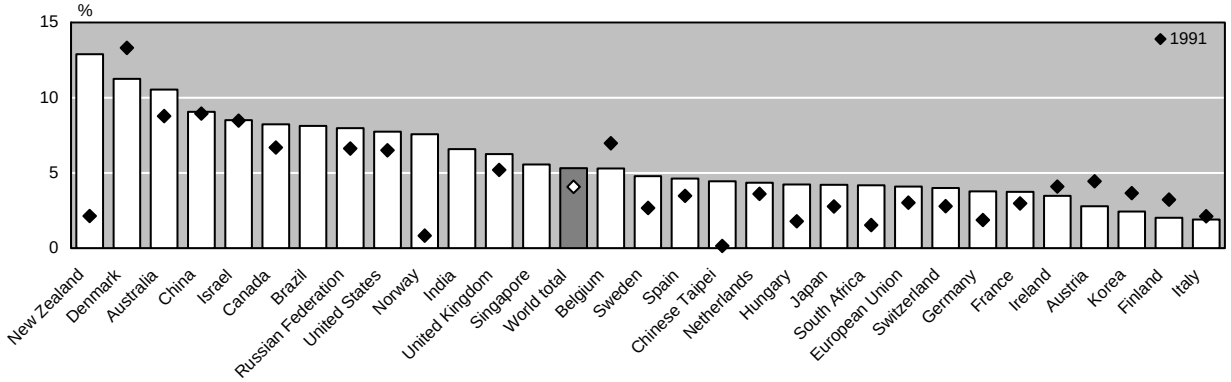
Similar to the trend observed for ICT-related patents, biotechnology patents have grown more rapidly than overall patent applications at the EPO. Between 1991 and 2002, they grew by 8.3% a year, while total EPO patent applications grew by 5.7%. The rate of increase in biotechnology patents accelerated from 1994 onwards. The latest available data show a slight decline in biotechnology patent filings at the EPO. This could be related to the adoption by the EPO of more restrictive policies for examining biotechnology patents in recent years. This trend is also observed for countries with a large biotechnology patent portfolio. The latest available data show that around 5.3% of all EPO patent applications are in the biotechnology field (see Box G for definition), representing a 1.2 percentage points increase from the 1991 level. However, the ratio of biotechnology patents to all EPO patents varies substantially across countries (Figure 26). New Zealand, Denmark and Australia have a very high ratio of biotechnology patents to all EPO patents (more than 10%). In contrast, only around 2% of all EPO patents originating from Finland and Italy are biotechnology patents. For the majority of countries, the ratio of biotechnology patents to all EPO patents increased between 1991 and 2002. However, notable exceptions are Denmark and Belgium as well as countries with a low ratio of biotechnology patents to all EPO patents.

Figure 26. Trends in biotechnology patents filed at the EPO

Total number, major regions and leading countries



Biotechnology patents as a percentage of the national total (EPO): selected countries/economies[1], 2002



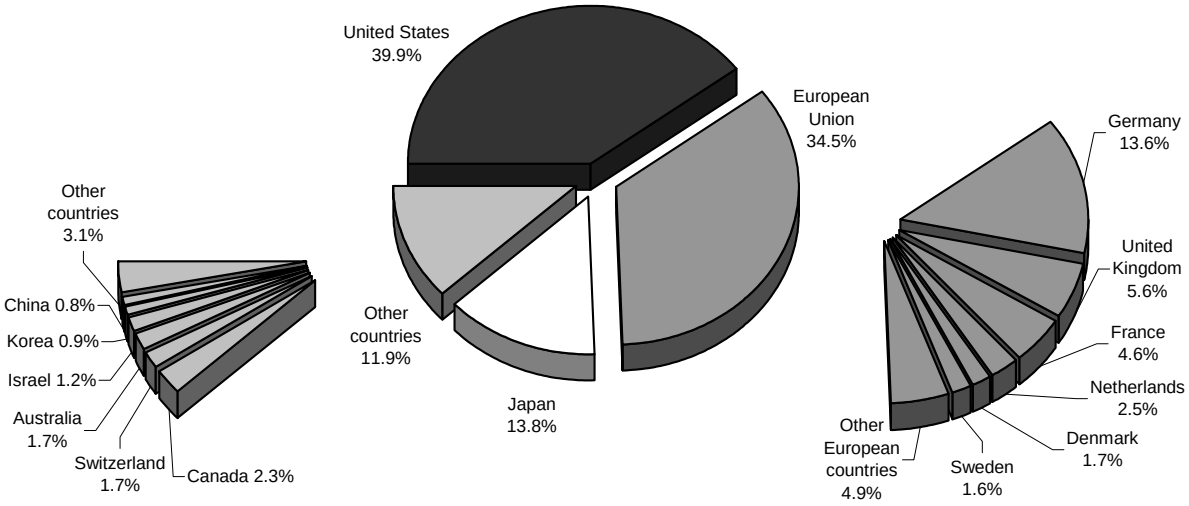
1. The graph only covers countries/economies with more than 100 EPO applications in 2002.

Source: OECD, Patent Database, December 2005.

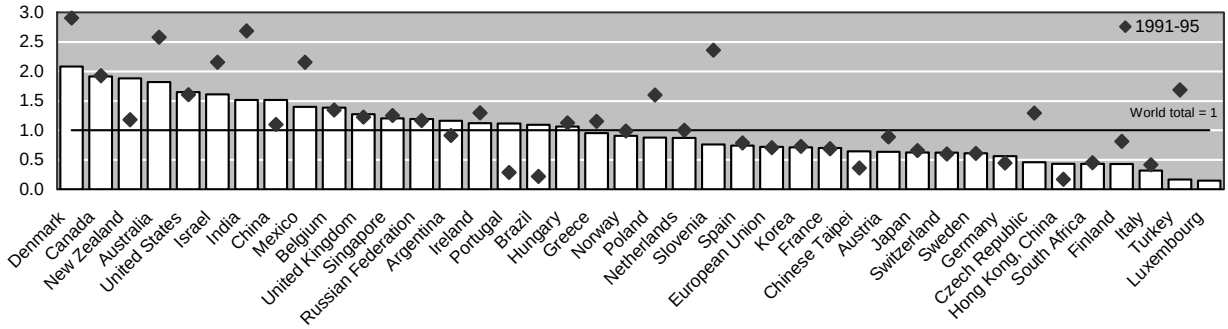
In 2002, more than 5 800 biotechnology patents were filed at the EPO, most of which originated from the United States (39.9%) and the European Union (34.5%). Around 14% of the EPO biotechnology patents originate from Japan (Figure 27). Since 1997, the shares of the European Union and Japan in biotechnology patents have increased, while those of the United States have continuously decreased. To measure a country's level of specialisation in biotechnology patents, country shares can be expressed in terms of a specialisation index (Box G). By this measure, the United States is highly specialised in biotechnology patents, while the European Union and Japan are not. Denmark, Canada, New Zealand and Australia are the most specialised countries in biotechnology patents. Italy, Turkey and Luxembourg are the least specialised. Three non-OECD countries (Israel, China and India) are also relatively specialised in biotechnology patents.

Figure 27. Share of countries in biotechnology patents filed at the EPO

Shares, 2002



Specialisation index of biotechnology patents filed at the EPO[1], 1996-2002



1. The graph only covers countries/economies with more than 200 EPO applications for the period 1996-2002.

Source: OECD, Patent Database, December 2005.

Box G. Definition of Biotechnology patents based on IPC

The definition used to calculate Biotechnology patents covers a wide range of classes of the International Patent Classification (IPC). The following IPC classes are covered by the definition:

[A01H1/00,A01H4/00,A61K38/00,A61K39/00,A61K48/00,C02F3/34,C07G(11/00,13/00,15/00), C07K(4/00,14/00,16/00,17/00,19/00),C12M,C12N,C12P,C12Q,C12S,G01N27/327, G01N33/(53*,54*,55*,57*,68,74,76,78,88,92)]

The specialisation index (SI) for biotechnology patents is calculated as the share of a country in biotechnology patents (filed at EPO) divided by the share of that country in all technology areas (total EPO patents). When the SI value of biotechnology patents is greater than 1, the country has a higher share in biotechnology patents relative to its share in all technology areas. Conversely, when the SI value of biotechnology patents is below 1, the country has a lower share in biotechnology patents than in all technology areas combined.

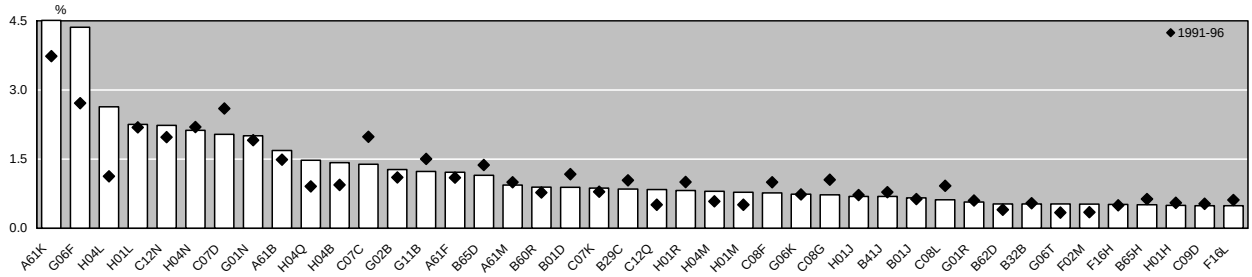
For further details on the IPC classes, see *www.wipo.int/classifications/fulltext/new_ipc/index.htm*

5.4. Patents in leading IPC classes

Figure 28 shows the top 42 of the 631 3-digit International Patent Classification (IPC, see Annex C for details). A breakdown of EPO (European Patent Office) patent applications data by IPC classes shows that the largest proportion of patents filed at the EPO belong to IPC class A61K (Preparations for medical, dental, or toilet purposes) and IPC class G06F (Electric digital data processing). Those classes accounted for 8.9% of all EPO patent applications during 1997-2002. This is related to the fact that A61K is related to biotechnology and G06F is related to software. IPC class H04L (Transmission of digital information), H01L (Semiconductor devices), C12N (Micro-organisms or enzymes), H04N (Pictorial communication), C07D (Heterocyclic compounds) and G01N (Investigating or analysing materials) also accounted for a large proportion of total EPO patent applications. Each IPC class mentioned accounted for more than 2% of total EPO patents. H04L, H01L, H04N and G01N are related to ICT patents and C12N is related to biotechnology patents. The share of the top three IPC classes (A61K, G06F and H04L) increased during the 1990s. The most notable decrease in share is observed for IPC class C07C (Acyclic or carbocyclic compounds) and C07D (Heterocyclic compounds).

Figure 28. EPO patent applications by main IPC classes

EPO patents by main IPC class[1], as a percentage of the EPO total, 1997-2002



1. Main IPC class or first-cited IPC class.

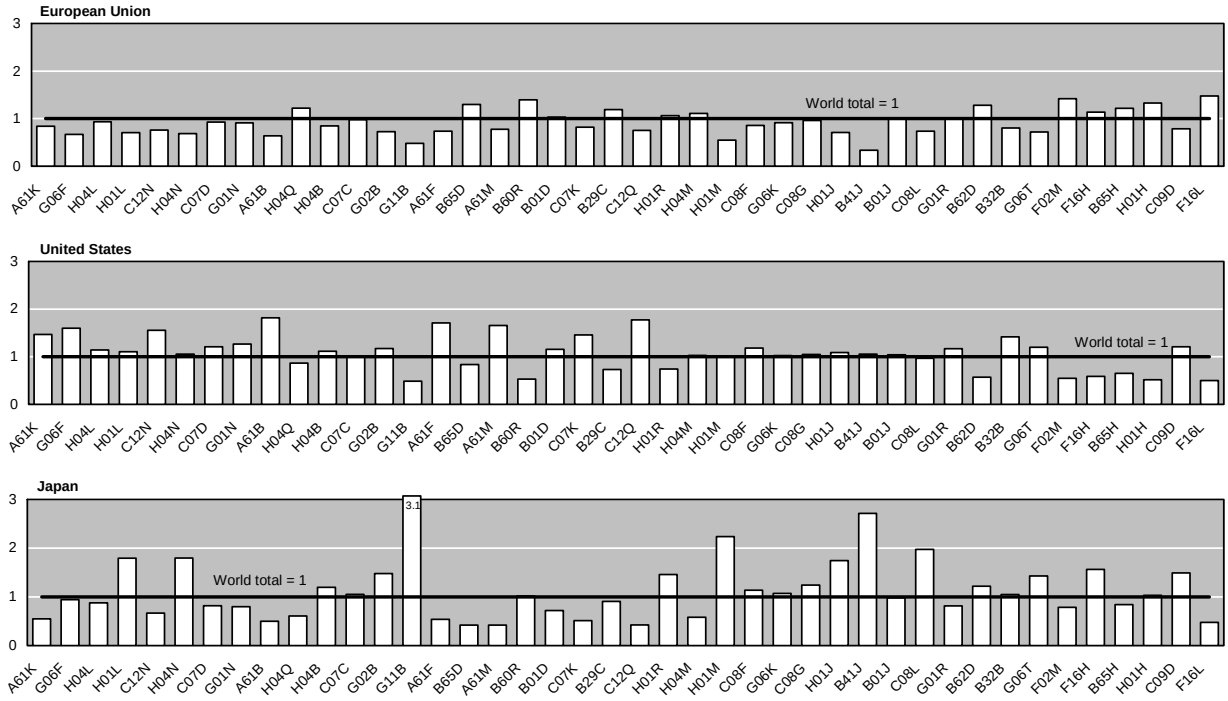
Source: OECD, Patent Database, December 2005.

To measure the level of specialisation of a country (or region) in specific technology areas, patents can be expressed in terms of a specialisation index (see Boxes E and G). A value greater than 1 for a IPC class indicates that the country is specialised in that specific IPC class. Figure 29 presents the specialisation index of the top 42 IPC (International Patent Classification) classes for the three main OECD regions.

The United States is specialised in 28 of the top 42 IPC classes. The top 4 highly specialised IPC classes are A61B (Diagnosis, surgery, identification), C12Q (Processes involving enzymes or micro-organisms), A61F (Filters implantable into blood vessels) and A61M (Devices for introducing media into, or onto, the body). The United States is notably specialised in some IPC classes that belong to either biotechnology or ICT-related patents. Japan is specialised in 21 of the top 42 IPC classes. The top three highly specialised IPC classes are G11B (Information storage), B41B (Photographic or photoelectronic composing devices) and H01M (Processes or means, *e.g.* batteries, for the direct conversion of chemical energy into electrical energy). Many of the IPC classes in which Japan is highly specialised are related to ICT patents. The European Union is specialised in only 14 of the top 42 IPC classes. The top three highly specialised IPC classes are F16L (Supports for pipes, cables or protective tubing, and thermal insulation), F02M (Combustion Engines) and B60R (Vehicles, vehicle fittings, or vehicle parts). The largest number of EPO patent applications are filed in IPC classes A61K and GO6F (Figure 28). The United States is specialised in these two IPC classes, whereas the European Union and Japan are not.

Figure 29. EPO patent applications by main IPC class, major regions

Specialisation index, 1997-2001



1. Main IPC class or first-cited IPC class.

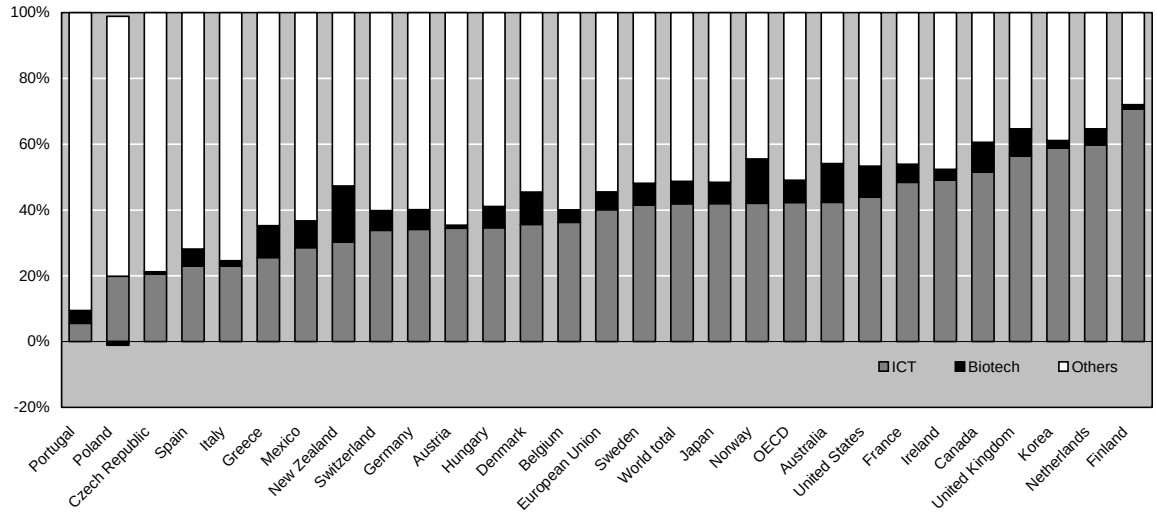
Source: OECD, Patent Database, December 2005.

5.5. Contribution of ICT and biotechnology to overall surge in patenting

Figure 30 provides a breakdown of the growth rates of EPO patent applications data by field of technology. The surge in EPO patent applications is mostly driven by ICT-related inventions. Between 1991 and 2002, ICT-related patents accounted for 41.9% of the total increase in all EPO patents. However, there is a cross-country difference in the contribution of ICT-related inventions to the overall surge in EPO patents. For example, ICT-related patents accounted for more than half of the total increase in EPO patents for Finland, the Netherlands, Korea, the United Kingdom and Canada. In contrast, the contribution of ICT-related inventions to the overall surge in EPO patents in small for Portugal, Poland and the Czech Republic. The contribution of biotechnology patents to the overall surge in all EPO patents is around 6.8%.

The contribution of biotechnology inventions to the overall surge in EPO patents is high in New Zealand, Norway and Australia – more than 10% of the overall increase is attributed to biotechnology inventions.

Figure 30: Contribution of ICT and biotechnology industries to the overall growth of EPO patents
1991-2002 (%)



Source: OECD, Patent Database, December 2005.

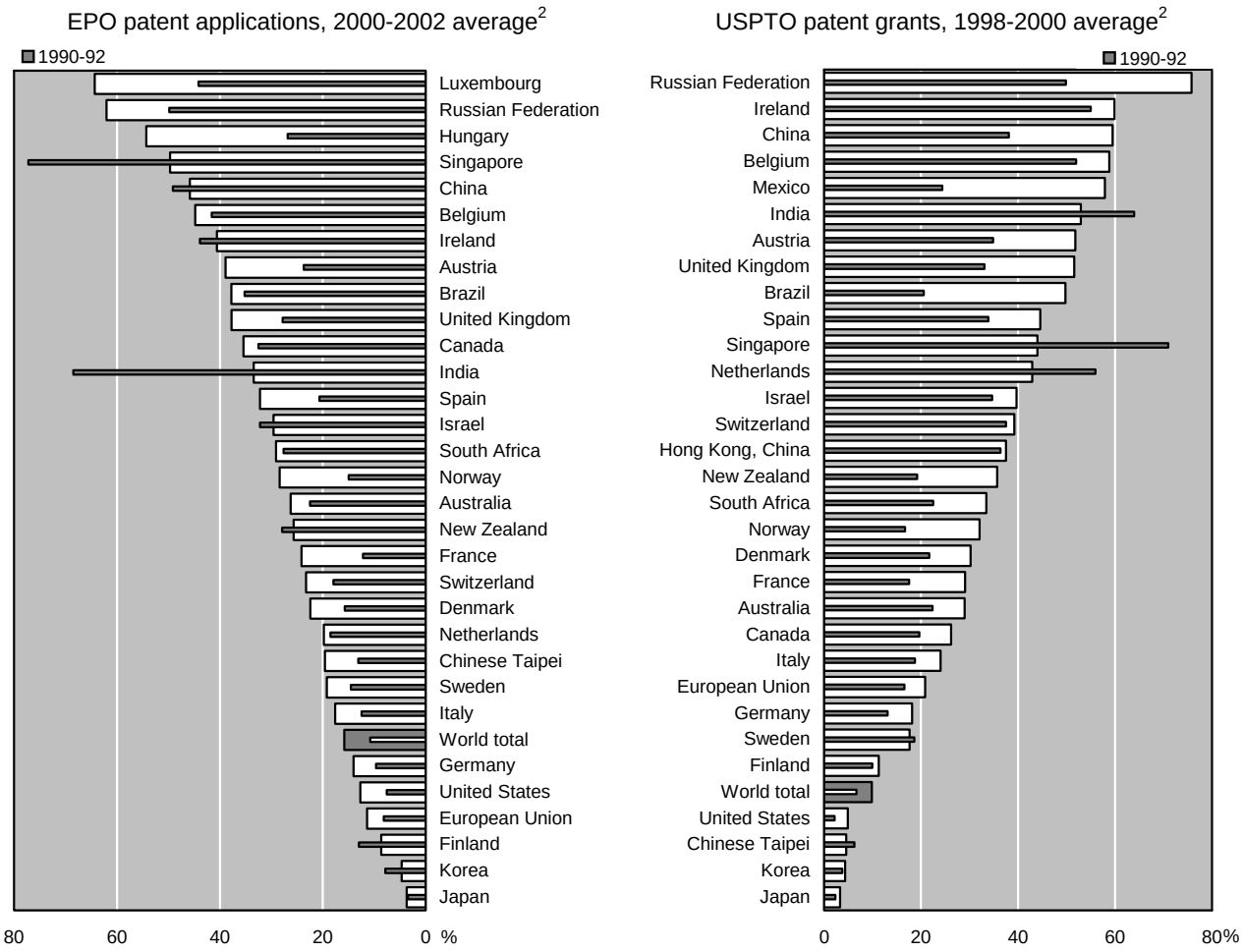
6. Internationalisation of innovative activities as reflected by patent data

6.1. Foreign ownership of domestic inventions

Although R&D activities are less internationalised than trade and production, they have become increasingly so over the past decade. Firms are progressively relocating production and research facilities abroad as part of their business strategy, and an increasing share of technology is owned by firms of a country that is not the inventor's country of residence. On average 15.8% of all inventions filed at the European Patent office (EPO) were owned or co-owned by a foreign resident in 2000-2002, representing a significant increase from the 1990-92 level (10.8%). Foreign ownership of domestic inventions is particularly high for Luxembourg, the Russian Federation, Hungary and Singapore, where 50% or more of their respective domestic inventions (filed at the EPO) are owned or co-owned by a foreign resident (Figure 31). Japan, Korea and Finland, on the other hand, are much less internationalised; less than 10% of their patents filed at the EPO are foreign-owned. In the case of Japan and Korea, possible explanations for low foreign ownership include linguistic barriers and the low penetration of foreign affiliates. For a majority of the reported countries, the share of patents owned (or co-owned) by a foreign resident was higher in 2000-2002 compared to the early 1990s. Of the large OECD countries, France has had the largest increase in foreign ownership over this period. A large decrease in the share of foreign ownership can be observed for India and Singapore, which is partly due to an increase in domestic patents.

As for the USPTO patent data, the share of patents owned or co-owned by a foreign resident is around 10%. The lower share for foreign ownership in USPTO patents compared to EPO patents could be due to the large volume of patents granted to US inventors, which are owned by domestic residents. The share of foreign ownership for USPTO patents in 1998-2000 is more than three percentage points higher than the 1990-92 share. Foreign ownership of domestic invention is high for the Russian Federation, where more than 75% of its inventions filed at the EPO are owned or co-owned by a foreign resident. The share of foreign ownership is also high for Ireland, China and Belgium. In contrast, the foreign ownership share for Japan and Korea is low – this is similar to the trend observed with EPO patent data.

Figure 31. Foreign ownership of domestic inventions[1]: EPO and USPTO patents



Note: Patent counts are based on the inventor's country of residence, the priority date and simple counts. The EU is treated as one country; intra-EU co-operation is excluded.

1. Share of patents owned by foreign residents in total patents invented domestically.
2. The graph only covers countries/economies with more than 300 EPO applications over the period 2000-2002, and more than 200 USPTO grants over the period 1998-2000.

Source: OECD, Patent Database, December 2005.

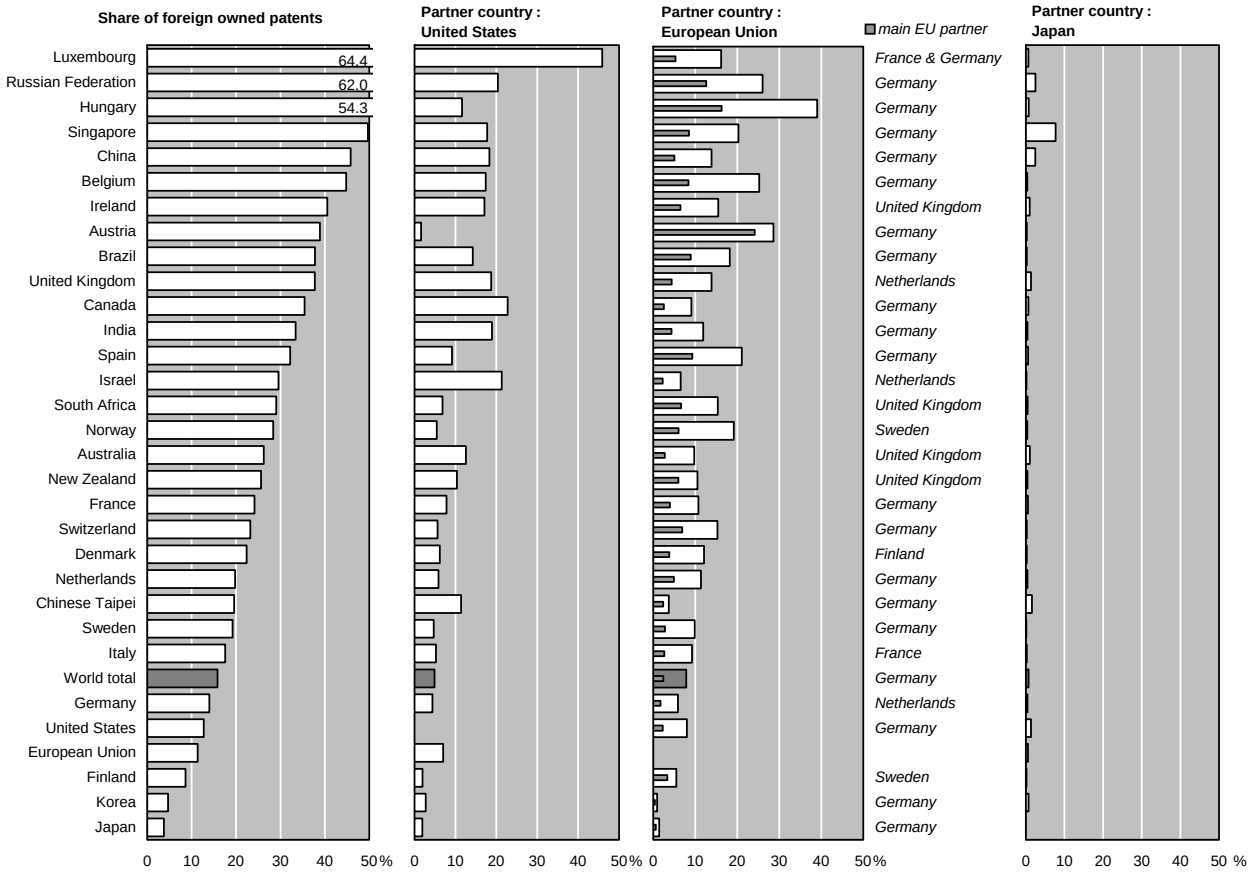
Data on foreign ownership by partner country shows that for most European countries, EU companies account for the largest share of foreign ownership; for most non-European countries, US companies account for the largest share of foreign ownership (Figure 32). However, there are some exceptions; for example, US companies account for the largest share of foreign ownership of domestic inventions of Luxembourg, Ireland and the United Kingdom, and EU companies account for the largest share of foreign ownership of domestic inventions in the Russian Federation and South Africa.

The level of foreign ownership of US inventions by EU residents and EU inventions by US residents is similar: 7% of EU patents are owned by residents of the United States and 8% of US patents are owned by residents of the European Union. The level of foreign ownership of domestic inventions in Japan is relatively low: 1.9% and 1.4% of Japanese patents are owned by residents of the United States and the European Union, respectively. Breaking foreign ownership of domestic inventions down by the main EU partner country shows that German companies account for the largest share of foreign ownership of domestic inventions in most countries.

Factors such as language, historical links and geographical proximity play a role in foreign ownership of domestic inventions. For example, the United Kingdom is the main EU partner country for Australia, Ireland, South Africa, and New Zealand. Similarly, the main EU partner country for Denmark, Finland and Norway is another Nordic country.

Figure 32. Foreign ownership of domestic inventions by partner country

EPO patent applications[1], 2000-2002 average



1. The graph only covers countries/economies with more than 300 EPO applications over the period 2000-2002.

Source: OECD, Patent Database, December 2005.

6.2. Domestic ownership of inventions made abroad

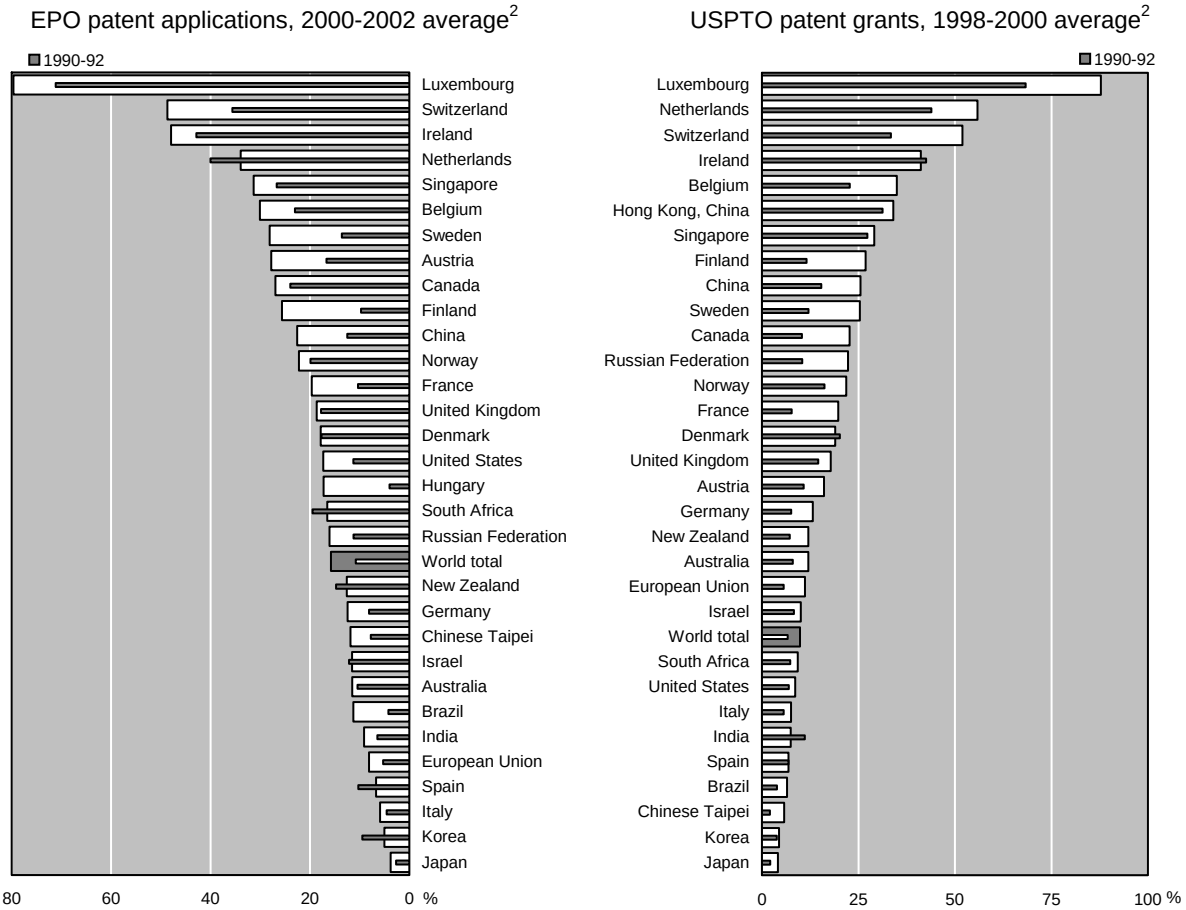
Patents filed at the European Patent Office (EPO) show that domestic ownership of inventions made abroad is high in small, open economies (Figure 33). For example, close to 80% of all inventions owned by residents of Luxembourg were made abroad (based on EPO data). This share is also high in Switzerland (48.7%) and Ireland (48.0%). In contrast, Japan, Korea, Italy and Spain are the least internationalised with respect to domestic ownership of inventions made abroad. There has also been a considerable increase in the share of domestic ownership of inventions made abroad during the 1990s. This share increased from 10.8% of all EPO patents in 1990-92 to 15.8% in 2000-2002.

In terms of absolute numbers, the United States and Germany are the largest owners of inventions made abroad. However, these countries also have a large patent portfolio, which partly explains the low share of inventions made abroad in domestically owned inventions. For the majority of reported countries,

the share of domestic ownership of inventions made abroad is higher in 2000-2002 compared to the 1990-92 period. Notable exceptions are Korea, the Netherlands, New Zealand, Spain and South Africa.

Analysis of the USPTO data shows a similar trend. Luxembourg has the highest share by far of domestic ownership of inventions made abroad. More than 85% of USPTO patents owned or co-owned by residents from Luxembourg are invented abroad. The Netherlands and Switzerland also have a high share of domestic ownership of inventions made abroad – more than 50% of USPTO patents owned or co-owned by residents of these countries are invented abroad. Asian countries (*e.g.* Japan), emerging economies (*e.g.* Brazil) and southern-European countries (*e.g.* Spain) have a low share of domestic ownership of inventions made abroad. The share of domestic ownership of inventions made abroad increased from 6.7% in 1990-92 to 9.9% in 1998-2000. For all the countries, except Denmark, India and Ireland, there has been an increase in the domestic ownership of inventions made abroad. This is most notably the case for Luxembourg, Switzerland and Finland.

Figure 33. Domestic ownership of inventions made abroad [1]: EPO and USPTO patents



Note: Patent counts are based on the applicant's country of residence, the priority date and simple counts. The EU is treated as one country; intra-EU co-operation is excluded.

1. Share of patents invented abroad in total patents owned by country residents.
2. The graph only covers countries/economies with more than 200 EPO applications over the period 2000-2002, and more than 200 USPTO grants over the period 1998-2000.

Source: OECD, Patent Database, December 2005.

Domestic ownership of inventions made abroad by partner country shows that for most countries the European Union is the main partner country. For example, 48.7% of all inventions owned by residents of Switzerland were made abroad, with 34.9% invented by EU inventors (Figure 34). For some non-European

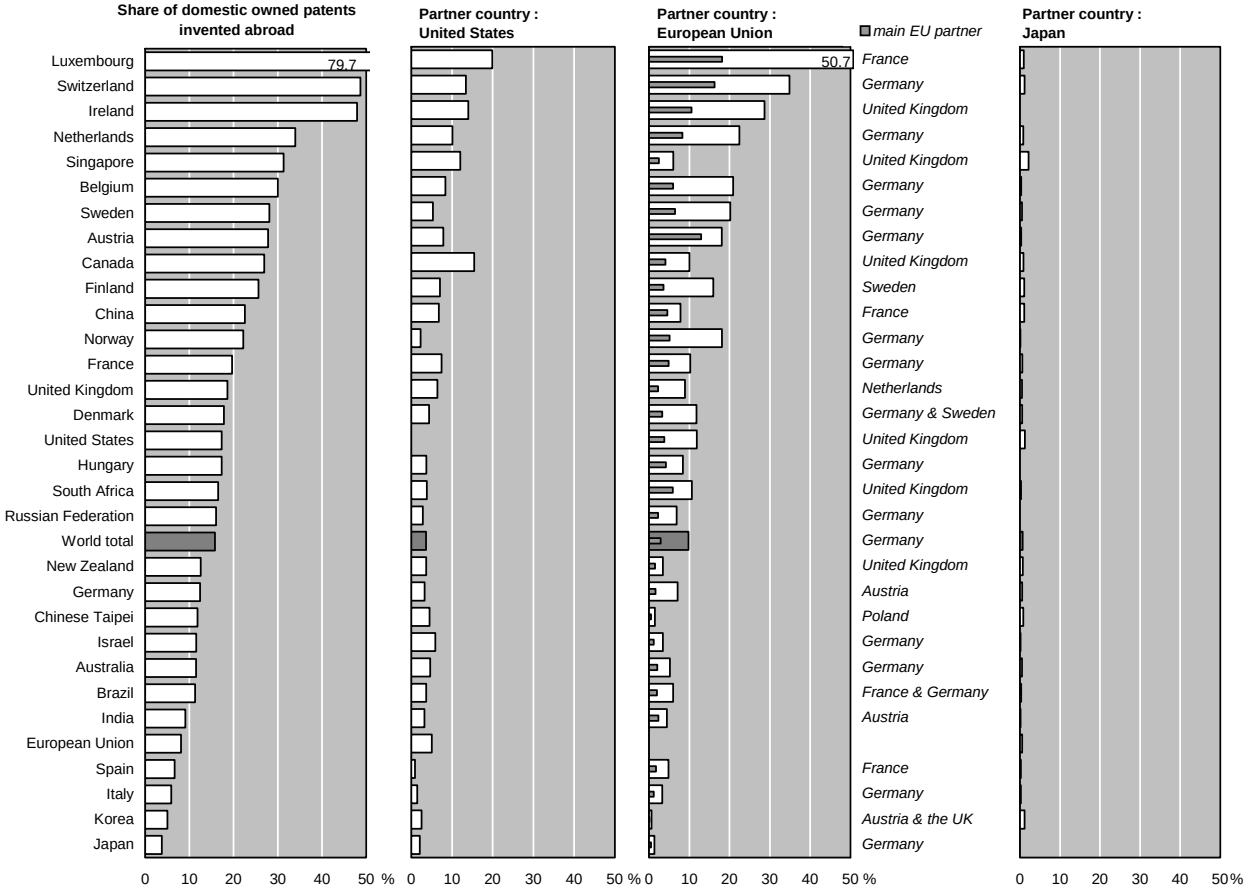
countries, the main partner country is the United States. For example, 26.9% of all inventions owned by residents of Canada were made abroad, with 15.5% invented by US inventors.

Breaking down domestic ownership of inventions made abroad shows that Germany and the United Kingdom are the main EU partner countries. The share of domestic ownership of inventions made in Japan is very small for all countries. The highest share of domestic ownership of inventions made in Japan is observed for Korea, Singapore, Switzerland and the United States.

The breakdown of ownership of inventions made abroad by main EU partner country shows that common language, historical links and geographical proximity play an important role in determining the domestic ownership of inventions by partner countries. For example, the United Kingdom is the main EU partner country for Canada, Ireland, South Africa, Singapore, New Zealand and the United States.

Figure 34. Domestic ownership of inventions made abroad by partner country

EPO patent applications[1], 2000-2002 average



1. The graph only covers countries/economies with more than 200 EPO applications over the period 2000-2002.

Source: OECD, Patent Database, December 2005.

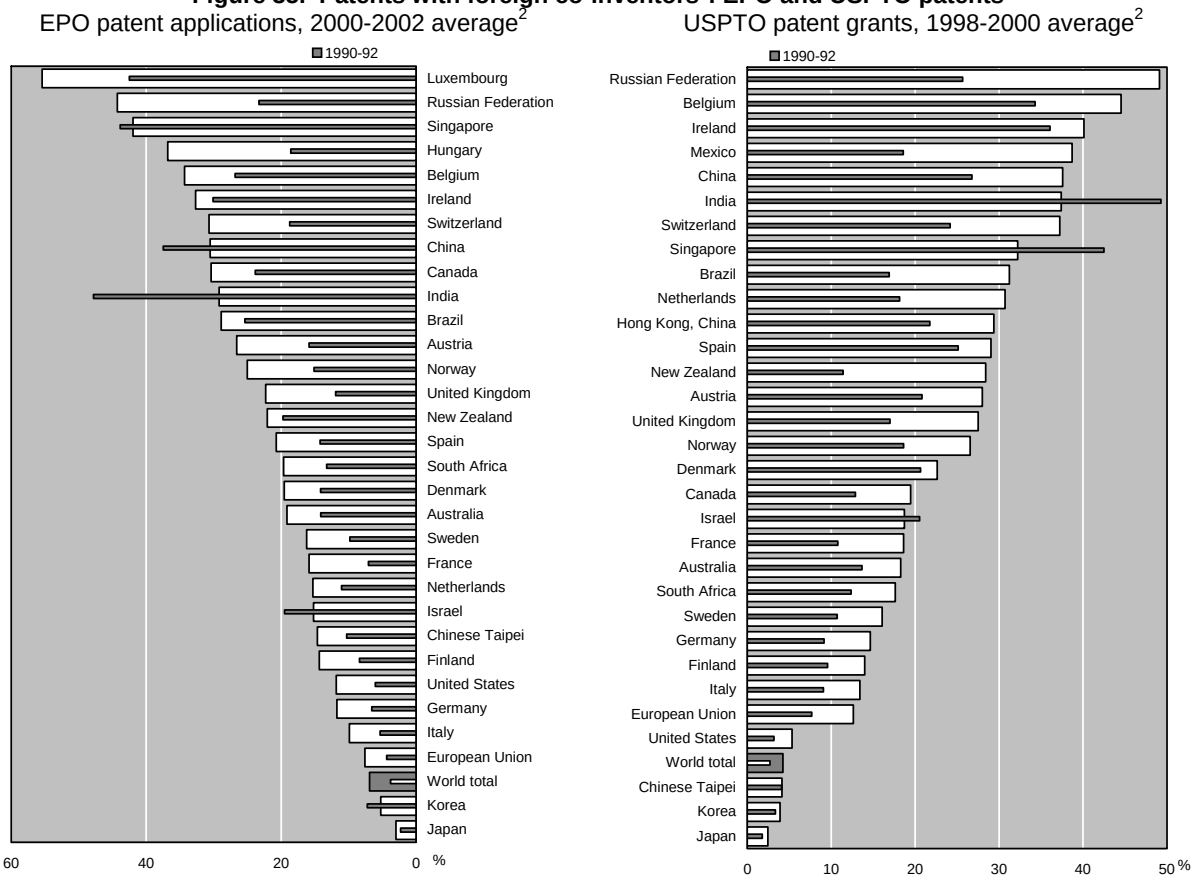
6.3. Patents with foreign co-inventors

Co-invention of patents points to the internationalisation of science and technology activities. This indicator reflects the level of international co-operation between researchers located in different countries and the exchange (flow) of knowledge and expertise across countries. To advance their domestic science and technology base, countries tend to rely on both domestic and foreign expertises. In 2000-02, 6.9% of

all patents filed at the European Patent Office (EPO) were the result of international collaborative research, a significant increase from the 1990-92 level (3.8%). Internationalisation tends to be high in small OECD countries and in large non-member countries. For example, 55.4% of EPO patents with an inventor from Luxembourg also have at least one inventor from another country. The Russian Federation, Singapore, Hungary and Belgium also have a high share of EPO patents with foreign co-inventors (Figure 35).

Of the G7 countries, Canada (30.4%) and the United Kingdom (22.3%) are the most internationalised, while Japan (3.0%) is the least internationalised. The data point to an increase in the share of (EPO) patents with foreign co-inventors between 1990-92 and 2000-2002, particularly in Hungary, Luxembourg, Switzerland and the Russian Federation. However, there are some exceptions; a notable decline is observed for India, China and Israel. This is due to the development of domestic research capacities.

Figure 35. Patents with foreign co-inventors[1]: EPO and USPTO patents



Note: Patent counts are based on the inventor's country of residence, the priority date and simple counts. The EU is treated as one country; intra-EU co-operation is excluded.

1. Share of patents with at least one foreign co-inventor in total patents invented domestically.
2. The graph only covers countries/economies with more than 300 EPO applications over the period 2000-2002, and more than 200 USPTO grants over the period 1998-2000.

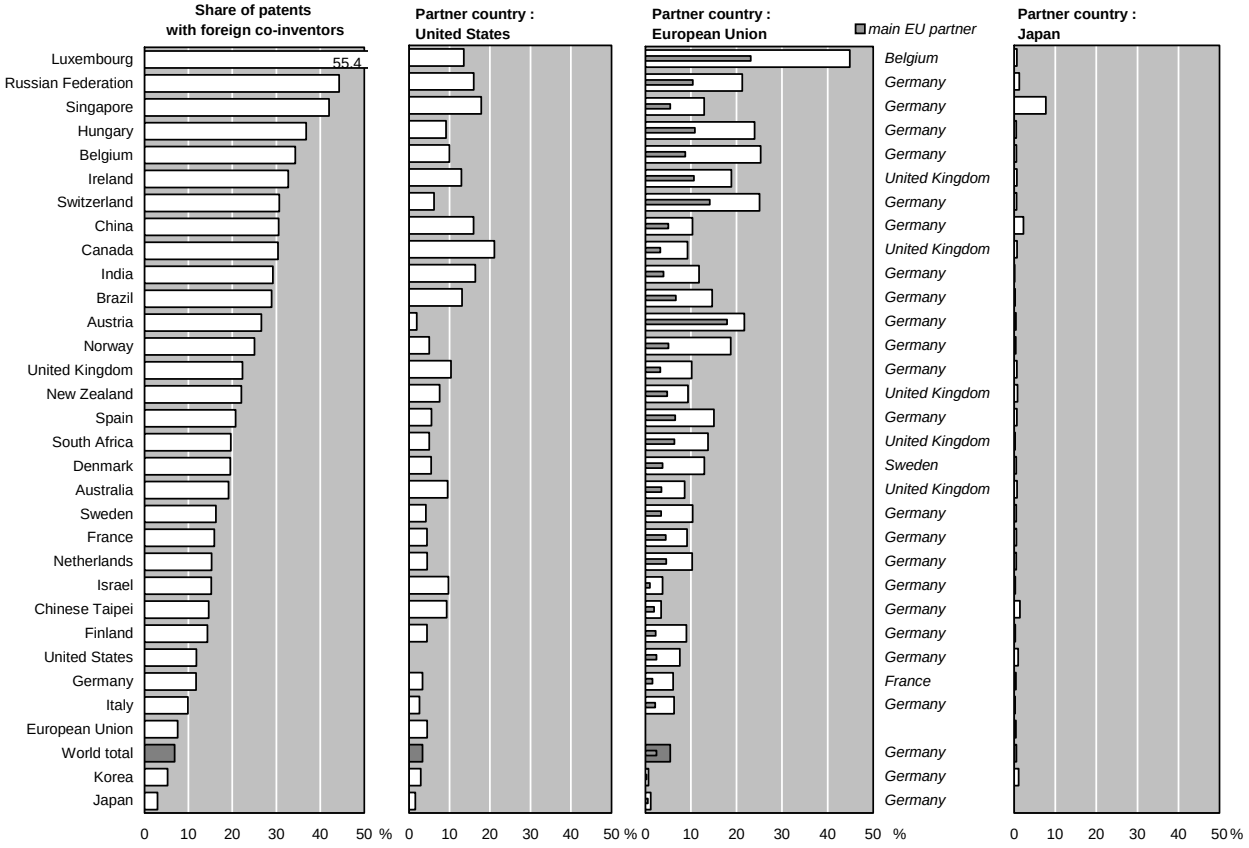
Source: OECD, Patent Database, December 2005.

A similar trend is shown by the USPTO data: internationalisation tends to be high in small OECD countries (*e.g.* Belgium and Ireland) and in large non-member economies (*e.g.* Russian Federation, China and India). The latest available data shows that around 4.2% of all patents granted by the USPTO were the result of international collaborative research. The overall share of patents with foreign co-inventors is lower in the USPTO (4.2%) compared to the figures for the EPO (6.9%). For all the European countries, except Finland and Sweden, the share of patents with foreign co-inventors is higher for USPTO patents than for EPO patents. For example, 30.7% of USPTO patents with inventors from the Netherlands have at

least one inventor from another country compared to 15.3% of EPO patents. In contrast, the United States has a high share of EPO patents with foreign inventors compared to the share of USPTO patents with foreign inventors. This indicates that foreign patents are more likely to result from international collaborative research than domestic patents.

Figure 36. Patents with foreign co-inventors by partner country

EPO patent applications[1], 2000-2002 average



1. The graph only covers countries/economies with more than 300 EPO applications over the period 2000-2002.

Source: OECD, Patent Database, December 2005.

Figure 36 shows the breakdown of EPO patents with foreign co-inventors by partner country. European Union countries are the main co-patenting partners for all the European countries, except for the United Kingdom. Whereas the United States is the main partner country for the non-European countries, notably for Canada, Israel, Chinese Taipei, Singapore and India. For the United Kingdom and Japan, the European Union and the United States are of equal importance. For example, 10.2% of patents with an inventor from the United Kingdom have at least one inventor from another EU country and 10.3% of patents with an inventor from the United Kingdom have at least one inventor from the United States. The level of co-patenting with inventors from Japan is low. Singapore and China have the highest level of co-patenting with Japan. 7.7% of patents with an inventor from Singapore and 2.3% of patents with an inventor from China have at least one inventor from Japan. A breakdown of patents with foreign co-inventors shows that Germany and the United Kingdom are the main EU partner countries.

6.4. Internationalisation of ICT-related inventions

Not all technology areas are equally internationalised. Indicators of internationalisation for rapidly growing areas of patenting, such as ICT and biotechnology, show considerable diversity. Most countries have a higher level of foreign ownership for ICT-related inventions than for all inventions (Figure 37). The largest difference between the level of foreign ownership for ICT-related inventions and all inventions is observed for India, Spain, Hungary, Austria and Denmark. For example, 72.6% of ICT-related EPO patents filed by Indian inventors are foreign owned, whereas only 33.4% of all EPO patents filed by Indian inventors are foreign owned. Notable exceptions are Sweden and the Netherlands, where the share of foreign ownership for ICT-related inventions is lower than for all inventions.

Cross-country differences can also be observed in the domestic ownership of ICT-related inventions made abroad. For example, France and Sweden have a higher share of domestic ownership of ICT-related inventions made abroad relative to the overall share. Luxembourg, Ireland and Switzerland, on the other hand, have a high share of domestic ownership of ICT-related inventions made abroad, but for these countries the share of domestic ownership of ICT-related inventions made abroad is lower than the share for all inventions.

Patents with foreign co-inventors for ICT-related inventions show that non-member countries, such as the Russian Federation, India and Brazil are much more internationalised than large OECD countries. These countries also have a large difference between the share of ICT-related inventions and all inventions with foreign co-inventors. For example, 49.1% of ICT-related EPO patents originating from Brazil have at least one foreign inventor compared to 28.9% of all EPO patents.

Figure 37. Internationalisation of ICT-related inventions

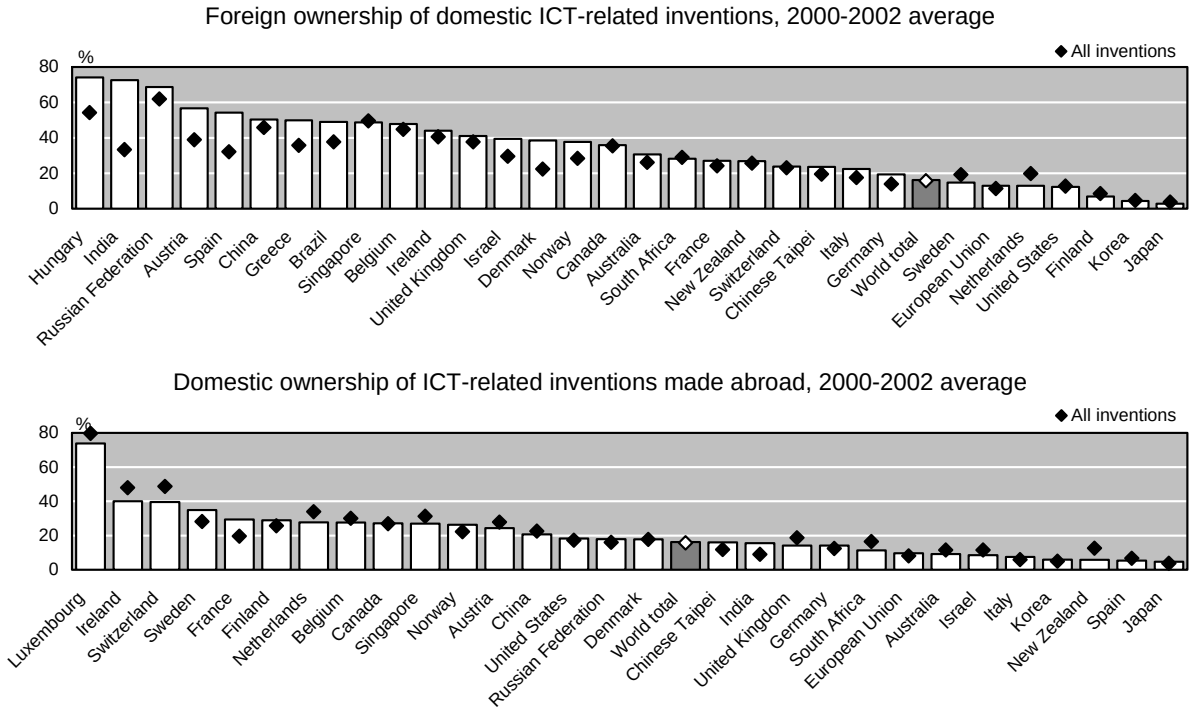
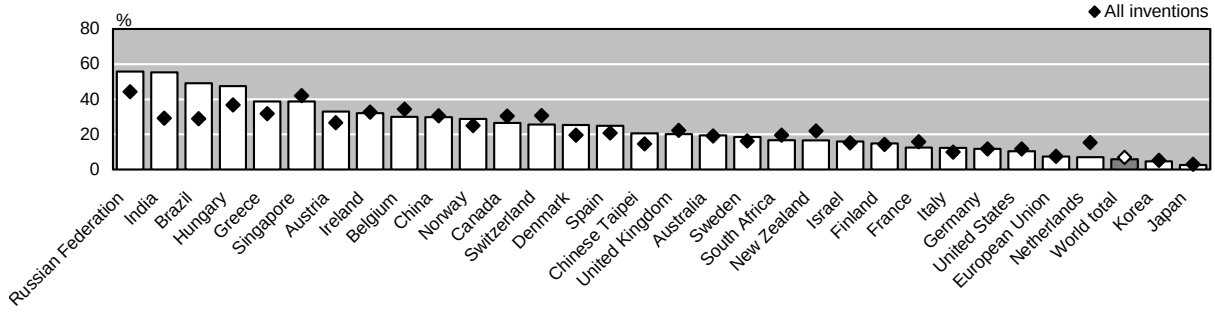


Figure 37 (*continued*). Internationalisation of ICT-related inventions
ICT-related patents with foreign co-inventors, 2000-2002 average



Notes: The EU is treated as one country; intra-EU co-operation is excluded. The graphs only cover countries/economies with more than 50 EPO applications in ICT-related patents over the period 2000-2002.

Source: OECD, Patent Database, December 2005.

6.5. Internationalisation of biotechnology inventions

Biotechnology (along with ICT) is more internationalised than other technologies. On measures of foreign ownership of domestic inventions and domestic ownership of inventions made abroad, Canada and the United Kingdom are the most internationalised G7 countries for biotechnology patents. Most of the reported countries have a higher share of foreign ownership in domestic biotechnology inventions than in all inventions (Figure 38). This is most notably the case for Finland, Greece, Italy, South Africa and Switzerland. Few countries have a lower share of foreign ownership in biotechnology inventions compared to all inventions, in particular Belgium, Singapore, Iceland and Hungary.

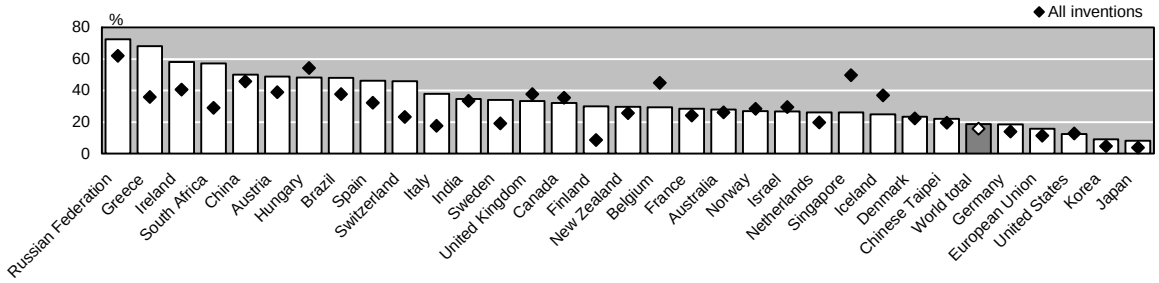
More than 50% of biotechnology inventions owned by residents of Switzerland, Ireland and Austria were made abroad. For all countries, except China, India and the United States, the share of domestic ownership of biotechnology inventions is higher than the share of domestic ownership for overall inventions.

In all reported countries, except Singapore and the Russian Federation, the level of international co-operation, as measured by patents with foreign co-inventors, is higher for biotechnology inventions than it is for all inventions. This is most clearly the case for Iceland, Greece, Switzerland and South Africa: more than 60% of biotechnology inventions were the result of international collaborative research.

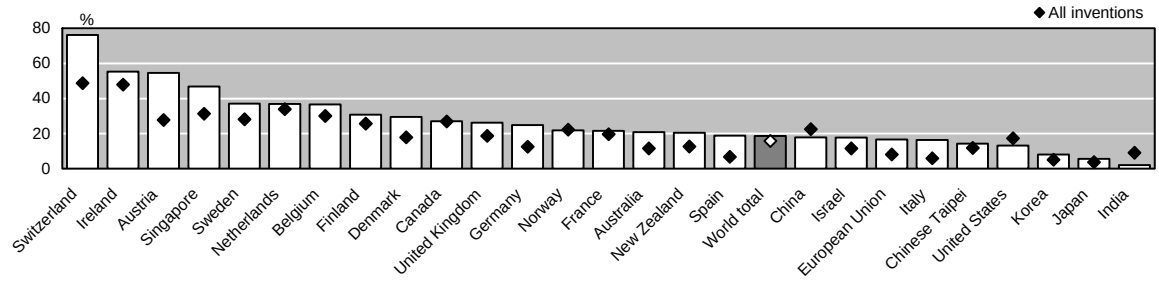
On the basis of all three measures of internationalisation (foreign ownership of domestic inventions, domestic ownership of inventions made abroad and patents with foreign co-inventors) Korea and Japan are the least internationalised in biotechnology inventions compared to other OECD countries.

Figure 38. Internationalisation of biotechnology-related inventions

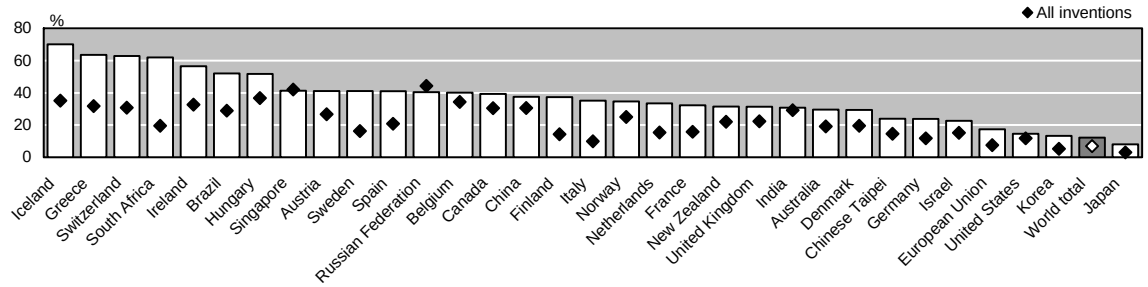
Foreign ownership of domestic biotechnology-related inventions, 2000-2002 average



Domestic ownership of biotechnology-related inventions made abroad, 2000-2002 average



Biotechnology-related patents with foreign co-inventors, 2000-2002 average



Notes: The EU is treated as one country; intra-EU co-operation is excluded. The graphs only cover countries/economies with more than 20 EPO applications in biotechnology-related patents over the period 2000-2002.

Source: OECD, Patent Database, December 2005.

7. Conclusion

Based on international comparable data, this paper provides an overview of innovative / creative activity (as measured by patents), for a large number of countries. We use a wide range of data (covering different patent offices) and indicators to measure the level of innovative activities, track the sources of growth of innovative activities, gauge the extent to which innovative activities are becoming internationalised. The main findings of the analysis are the following:

- The number of patents filed at the EPO increased from around 60 000 in 1991 to 110 000 in 2002 and patents granted by the USPTO increased from around 107 000 in 1991 to 221 000 in 2002. There was a slowdown in the number of EPO patent filings and USPTO patent grants in 2001 and 2002. The latest available partial data show an acceleration in EPO patent filings and USPTO patent grants in 2003-04. In terms of growth rates, EPO and USPTO patents increased by 5.7% and 6.8% a year, respectively, during the 1991-2002 period.

- Inventions protected in the three main OECD regions as measured by triadic patent families (Europe, Japan and the United States) increased from around 30 000 in 1991 to 51 500 in 2002. This represents an annual growth rate of 5.0% a year.
- There has been a significant increase in the use of PCT procedure for international patent filings. The number of PCT applications increased from around 24 000 in 1991 to 110 000 in 2002.
- With regard to the source of increase in patenting activities, we find that European inventors mainly drive the growth of EPO patents. Likewise, US inventors mainly drive the growth of USPTO patents. Both European and US inventors are equally responsible for the growth of triadic and international patents. For example, EU and US inventors accounted for 27% and 23.5% of the total increase in triadic patents, over the 1991-2002 period.
- Patenting activity is more concentrated than R&D activity. In 2002, France, Germany, Japan, the United Kingdom and the United States accounted for 84% of all triadic patent families, compared to 78% of OECD's R&D expenditure.
- The number of triadic patents per million USD of industry-financed research and development expenditure (R&D) for the European Union and Japan is similar and higher than that of the United States.
- The United States is specialised in biotechnology and ICT-related patents, and Japan is specialised in ICT-related patents. Singapore, Finland and Korea are the most specialised in ICT-related patents, while Denmark and Canada are the most specialised in biotechnology patents.
- ICT-related inventions are mainly responsible for the surge in EPO patents. Between 1991 and 2002, ICT-related patents accounted for 41.9% of total increase in all EPO patents.
- During the 1990s, there has been an increase in the level of internationalisation (foreign ownership of domestic inventions) and international collaboration (patents with foreign co-inventors) of innovative activities. The general trend points to a higher level of internationalisation in ICT-related inventions than for other inventions and a higher level of international collaboration in biotechnology inventions than for other inventions.
- Non-member countries, such as Brazil, China, India and the Russian Federation have a high level of internationalisation compared to large OECD countries. For example, 62% of the Russian Federation's EPO patents are owned or co-owned by foreign residents. Japan and Korea are the least internationalised OECD countries. For example, only 3.7% of Japanese EPO patents are owned or co-owned by foreign residents and only 3% of Japanese EPO patents include at least one foreign inventor.
- The breakdown of internationalisation indicators by partner country shows that common language, historical links and geographical proximity play an important role in determining partner countries. For example, a breakdown of foreign ownership shows that the United Kingdom is the main EU partner country for Australia, Ireland, South Africa and New Zealand. Similarly, the main EU partner country for Denmark, Finland and Norway is another Nordic country.

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TABLES

A1. Number of triadic patent families, patent applications to the EPO and patents granted by the USPTO

	Triadic Patent Families[1]			Patent applications to the EPO[2]			Patents granted by the USPTO[3]		
	1985	**1991**	**2002**	**1985**	**1991**	**2002**	**1985**	**1991**	**2002**
Australia	156	156	367	477	402	949	473	529	1 252
Austria	161	174	282	574	656	1 237	362	363	616
Belgium	164	240	397	392	596	1 260	309	432	735
Canada	200	274	661	416	551	1 656	1 338	2 143	4 659
Czech Republic	7	9	12	12	28	84	30	20	40
Denmark	81	106	216	231	365	884	207	242	467
Finland	55	162	594	179	417	1 232	222	405	1 209
France	1 487	1 784	2 447	3 682	4 962	7 233	2 650	3 199	4 684
Germany	3 610	3 681	7 271	9 315	11 283	21 090	7 303	7 447	14 479
Greece	2	5	7	7	25	71	7	18	20
Hungary	45	22	27	113	56	117	122	50	54
Iceland	1	3	8	4	10	38	4	9	29
Ireland	17	27	60	37	63	215	44	71	221
Italy	510	663	840	1 461	2 288	4 120	1 159	1 336	2 004
Japan	5 264	8 894	13 195	6 617	11 831	19 306	16 710	24 135	41 190
Korea	6	93	630	18	168	2 186	103	1 058	5 075
Luxembourg	15	9	21	31	30	60	26	25	42
Mexico	1	6	15	1	14	48	36	49	111
Netherlands	553	569	966	1 158	1 439	3 432	825	932	1 629
New Zealand	16	19	41	43	47	167	62	63	148
Norway	34	59	106	125	173	369	105	149	303
Poland	3	9	9	19	19	80	11	16	30
Portugal	2	3	6	6	10	33	5	6	15
Slovak Republic						21			
Spain	34	70	120	123	321	914	104	185	326
Sweden	426	391	896	958	923	1 952	820	841	1 729
Switzerland	743	723	924	1 497	1 594	2 567	1 239	1 175	1 639
Turkey	1	0	9	2	4	65	5	2	23
United Kingdom	1 272	1 254	2 045	3 218	3 461	5 265	2 705	2 771	4 831
United States	7 812	10 237	18 324	11 636	17 477	30 215	38 741	57 189	122 997
European Union (15)	8 388	9 139	16 167	21 373	26 839	48 998	16 748	18 272	33 009
European Union (25)	8 442	9 186	16 217	21 519	26 952	49 403	16 912	18 372	33 135
OECD total	22 676	29 644	50 494	42 355	59 213	106 867	75 728	104 859	210 558
World total	**22 879**	**29 964**	**51 502**	**42 957**	**60 148**	**110 640**	**76 748**	**107 124**	**221 437**
Argentina	2	5	8	6	15	44	18	33	56
Brazil	9	6	36	31	31	133	36	56	153
Chile		1	4	2	4	15	3	10	15
China	30	12	144	47	29	545	72	47	683
Chinese Taipei	4	17	102	41	129	469	263	1 130	6 610
Cyprus		2			2	5	1	3	
Estonia						6			
Hong Kong, China	9	15	32	18	31	37	34	72	277
India	5	9	78	13	15	424	15	26	505
Israel	52	107	328	111	241	861	247	380	1 280
Latvia			0		0	5		0	1
Lithuania						3			
Malta		1	1	1	4	4		1	1
Romania		1	2	2	4	11	2	3	6
Russian Federation	25	38	59	36	88	177	85	109	185
Singapore	2	20	85	5	26	181	6	59	513
Slovenia		2			3	80		9	
South Africa	20	17	38	74	65	129	87	110	160

Note: Patent counts are based on the inventor's country of residence, the earliest priority date and fractional counts.
1. Patents all applied for at the EPO, USPTO and JPO. Figures for 2002 are estimates.
2. Euro-Direct and EURO-PCT regional phase.
3. Figures for 2002 are estimates.

Source: OECD, Patent Database, December 2005.

A2. Patent Intensity

	Patents over GDP[1]						Patents over industry-financed R&D[2]						Patents per million population					
	Triadic Patent Families[3]		EPO patent applications[4]		USPTO patent grants[5]		Triadic Patent Families[3]		EPO patent applications[4]		USPTO patent grants[5]		Triadic Patent Families[3]		EPO patent applications[4]		USPTO patent grants[5]	
	1991	2002	1991	2002	1991	2002	1991	2002	1991	2002	1991	2002	1991	2002	1991	2002	1991	2002
Australia	0.43	0.67	1.12	1.74	1.5	2.3	0.08	0.09	0.21	0.23	0.27	0.30	9.0	18.6	23.1	48.1	30.4	63.4
Austria	0.94	1.20	3.54	5.28	2.0	2.6	0.14	0.14	0.52	0.63	0.29	0.31	22.4	34.9	84.6	153.0	46.8	76.2
Belgium	1.08	1.45	2.70	4.61	2.0	2.7	0.11	0.11	0.26	0.35	0.19	0.20	24.0	38.5	59.6	122.0	43.2	71.2
Canada	0.43	0.73	0.87	1.84	3.4	5.2	0.07	0.07	0.14	0.18	0.56	0.52	9.8	21.1	19.7	52.8	76.5	148.5
Czech Republic	0.07	0.08	0.22	0.54	0.2	0.3	..	0.01	..	0.09	..	0.04	0.9	1.2	2.7	8.3	2.0	3.9
Denmark	0.88	1.39	3.03	5.68	2.0	3.0	0.12	0.09	0.40	0.39	0.27	0.21	20.6	40.1	70.9	164.5	47.0	86.9
Finland	1.55	4.30	4.00	8.93	3.9	8.8	0.14	0.18	0.35	0.38	0.34	0.37	32.3	114.1	83.1	237.0	80.7	232.5
France	1.38	1.50	3.83	4.44	2.5	2.9	0.14	0.13	0.38	0.38	0.25	0.24	30.5	39.8	84.9	117.8	54.7	76.3
Germany	2.05	3.41	6.29	9.90	4.2	6.8	0.14	0.21	0.43	0.61	0.28	0.42	46.0	88.2	141.1	255.7	93.1	175.5
Greece	0.03	0.04	0.17	0.37	0.1	0.1	0.05	0.02	0.23	0.18	0.16	0.05	0.5	0.7	2.4	6.5	1.7	1.8
Hungary	0.22	0.21	0.56	0.89	0.5	0.4	0.02	0.07	0.05	0.28	0.04	0.13	2.1	2.7	5.4	11.5	4.8	5.3
Iceland	0.49	0.99	1.68	4.76	1.4	3.6	0.21	0.07	0.71	0.33	0.58	0.25	11.6	27.4	39.7	132.0	33.0	100.4
Ireland	0.50	0.49	1.15	1.77	1.3	1.8	0.10	0.07	0.24	0.25	0.27	0.26	7.7	15.3	18.0	54.7	20.1	56.4
Italy	0.53	0.57	1.83	2.79	1.1	1.4	0.10	0.15	0.33	0.75	0.19	0.37	11.7	14.5	40.3	71.0	23.5	34.6
Japan	2.99	4.00	3.98	5.85	8.1	12.5	0.14	0.18	0.19	0.26	0.39	0.55	71.8	103.5	95.5	151.5	194.8	323.2
Korea	0.20	0.74	0.36	2.56	2.3	5.9	..	0.04	..	0.15	..	0.34	2.1	13.2	3.9	45.9	24.4	106.6
Luxembourg	0.68	0.92	2.19	2.70	1.8	1.9	..	0.06	..	0.18	..	0.13	24.1	46.4	77.4	135.4	64.1	93.2
Mexico	0.01	0.02	0.02	0.05	0.1	0.1	..	0.01	..	0.05	..	0.10	0.1	0.1	0.2	0.5	0.6	1.1
Netherlands	1.70	2.18	4.30	7.73	2.8	3.7	0.18	0.22	0.44	0.80	0.29	0.38	37.8	59.8	95.5	212.5	61.8	100.9
New Zealand	0.32	0.47	0.79	1.95	1.1	1.7	0.11	0.11	0.27	0.47	0.36	0.42	5.3	10.2	13.3	42.0	17.8	37.3
Norway	0.56	0.66	1.64	2.30	1.4	1.9	0.08	0.08	0.23	0.27	0.19	0.22	13.8	23.3	40.6	81.2	35.0	66.7
Poland	0.04	0.02	0.07	0.20	0.1	0.1	..	0.01	..	0.10	..	0.04	0.2	0.2	0.5	2.1	0.4	0.8
Portugal	0.02	0.03	0.07	0.18	0.0	0.1	0.02	0.01	0.06	0.07	0.03	0.03	0.3	0.6	1.0	3.2	0.6	1.4
Slovak Republic	0.00	0.00	0.00	0.34	0.0	0.0	..	..	..	0.10	0.00	..	0.0	0.0	0.0	4.0	0.0	0.0
Spain	0.11	0.13	0.48	1.01	0.3	0.4	0.03	0.03	0.13	0.24	0.08	0.09	1.8	2.9	8.2	22.1	4.7	7.9
Sweden	2.02	3.64	4.76	7.93	4.3	7.0	0.12	0.12	0.28	0.26	0.26	0.23	45.4	100.4	107.1	218.7	97.5	193.7
Switzerland	3.69	4.16	8.14	11.56	6.0	7.4	0.20	0.24	0.43	0.66	0.32	0.42	105.0	125.8	231.6	349.6	170.8	223.2
Turkey	0.00	0.02	0.01	0.14	0.0	0.0	0.00	0.01	0.01	0.05	0.01	0.02	0.0	0.1	0.1	0.9	0.0	0.3
United Kingdom	1.07	1.30	2.96	3.35	2.4	3.1	0.10	0.15	0.27	0.39	0.22	0.36	21.8	34.5	60.3	88.8	48.2	81.4
United States	1.45	1.83	2.48	3.02	8.1	12.3	0.10	0.10	0.17	0.16	0.56	0.67	40.4	63.6	68.9	104.8	225.6	426.7
European Union (15)	1.19	1.66	3.49	5.04	2.4	3.4	0.12	0.16	0.36	0.48	0.25	0.32	24.9	42.3	73.0	128.3	49.7	86.4
European Union (25)	..	..	..	..	..	..	..	0.15	..	0.47	..	0.32	21.2	35.5	62.2	108.2	42.4	72.6
OECD total	1.41	1.81	2.81	3.83	5.0	7.5	0.12	0.13	0.24	0.27	0.42	0.53	31.3	54.0	62.5	114.4	110.7	225.3
World total	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Argentina	0.02	0.02	0.05	0.11	0.1	0.1	..	0.02	..	0.12	..	0.15	0.2	0.2	0.5	1.2	1.0	1.5
Brazil	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chile	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
China	0.01	0.03	0.01	0.10	0.0	0.1	..	0.00	..	0.02	..	0.02	0.0	0.1	0.0	0.4	0.0	0.5
Chinese Taipei	0.06	0.20	0.45	0.93	3.9	13.1	..	0.02	..	0.07	..	0.97	0.8	4.5	6.3	20.8	54.8	293.5
Cyprus	..	..	..	..	..	..	..	..	..	0.83	..	..	..	..	..	..	..	..
Estonia	..	..	..	..	..	..	..	..	..	0.17	..	..	..	..	..	..	..	..
Hong Kong, China	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
India	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Israel	1.07	2.13	2.42	5.58	3.8	8.3	..	0.07	..	0.17	..	0.26	21.6	50.0	48.7	131.0	76.7	194.8
Latvia	..	..	..	..	..	..	..	0.03	..	0.34	..	0.06	..	..	..	..	..	..
Lithuania	..	..	..	..	..	..	..	..	..	0.03	..	..	..	..	..	..	..	..
Malta	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Romania	0.01	0.01	0.03	0.08	0.0	0.0	..	0.01	..	0.04	..	0.02	0.0	0.1	0.2	0.5	0.1	0.3
Russian Federation	0.02	0.05	0.05	0.16	0.1	0.2	..	0.01	..	0.04	..	0.04	0.3	0.4	0.6	1.2	0.7	1.3
Singapore	0.42	0.87	0.54	1.87	1.2	5.3	..	0.08	..	0.17	..	0.48	6.5	20.3	8.4	43.5	18.7	123.0
Slovenia	0.08	0.00	0.13	2.31	0.4	0.0	..	..	..	0.28	..	..	1.1	0.0	1.7	40.3	4.5	0.0
South Africa	0.05	0.09	0.19	0.29	0.3	0.4	..	0.02	..	0.08	..	0.10	0.5	0.9	1.7	2.9	2.9	3.6

Note: Patent counts are based on the inventor's country of residence, the earliest priority date and fractional counts.

1. Gross Domestic Product (GDP), billion 2000 USD using purchasing power parities.
2. Gross domestic expenditure on R&D (GERD) financed by industry, million 2000 USD using purchasing power parities, lagged by one year.
3. Patents all applied for at the EPO, USPTO and JPO. Figures for 2002 are estimates.
4. Euro-Direct and EURO-PCT regional phase.
5. Figures for 2002 are estimates.

Source: OECD, Patent Database, December 2005.

A3. EPO patent applications by technology fields

	ICT-related patents[1]				Biotechnology patents[1]				Software-related patents[2]			
	Number of patents		as a share of national total (%)		Number of patents		as a share of national total (%)		Number of patents		as a share of national total (%)	
	1991	2002	1991	2002	1991	2002	1991	2002	1994	2002	1994	2002
Australia	63	295	15.8	31.1	35	100	8.8	10.5	19	75	4.2	7.9
Austria	78	278	11.8	22.4	29	35	4.5	2.8	5	29	0.7	2.4
Belgium	85	326	14.3	25.9	42	67	7.0	5.3	6	44	0.8	3.5
Canada	113	683	20.5	41.2	37	136	6.7	8.2	23	141	3.2	8.5
Czech Republic	0	12	1.2	14.0	1	1	2.1	1.2	0	0	0.0	0.0
Denmark	35	220	9.6	24.9	49	99	13.3	11.2	6	33	1.4	3.8
Finland	132	708	31.7	57.5	13	25	3.2	2.0	13	137	1.9	11.1
France	1 207	2 308	24.3	31.9	147	271	3.0	3.7	124	359	2.5	5.0
Germany	1 947	5 290	17.3	25.1	210	797	1.9	3.8	125	732	1.0	3.5
Greece	6	17	22.7	24.5	2	8	8.4	10.7	0	1	0.0	1.2
Hungary	1	22	1.8	18.9	1	5	1.8	4.2	1	3	1.7	3.0
Iceland	0	7	0.0	17.5	0	9	0.0	23.5	0	2	2.7	4.6
Ireland	17	91	27.0	42.6	3	7	4.1	3.5	3	18	3.6	8.3
Italy	270	691	11.8	16.8	49	78	2.1	1.9	31	73	1.3	1.8
Japan	5 435	8 571	45.9	44.4	329	813	2.8	4.2	349	1 101	3.2	5.7
Korea	72	1 259	43.2	57.6	6	54	3.7	2.4	10	134	2.7	6.1
Luxembourg	4	10	12.5	17.2	0	1	0.0	1.7	0	2	0.0	3.6
Mexico	1	11	7.2	22.3	0	3	3.1	6.6	0	1	0.0	2.1
Netherlands	489	1 681	34.0	49.0	52	149	3.6	4.3	28	234	1.9	6.8
New Zealand	4	40	8.6	24.2	1	22	2.1	12.9	1	10	1.4	6.2
Norway	32	114	18.4	30.9	1	28	0.8	7.6	1	20	0.5	5.5
Poland	3	15	16.8	19.4	2	5	12.6	5.9	0	4	0.0	4.7
Portugal	2	3	14.4	8.4	0	1	0.0	3.3	0	0	0.0	0.0
Slovak Republic	0	4	0.0	17.1	0	4	0.0	20.2	0	0	0.0	0.0
Spain	43	179	13.5	19.6	11	42	3.5	4.6	3	16	0.8	1.8
Sweden	169	596	18.3	30.5	25	93	2.7	4.8	38	111	2.8	5.7
Switzerland	287	616	18.0	24.0	45	103	2.8	4.0	9	72	0.5	2.8
Turkey	0	4	0.0	6.3	1	1	11.8	1.2	0	1	0.0	1.5
United Kingdom	807	1 824	23.3	34.6	180	330	5.2	6.3	121	305	3.3	5.8
United States	5 482	11 070	31.4	36.6	1 136	2 342	6.5	7.8	1 134	2 605	5.8	8.6
European Union (15)	5 290	14 222	19.7	29.0	812	2 004	3.0	4.1	504	2 095	1.7	4.3
European Union (25)	5 296	14 299	19.6	28.9	816	2 025	3.0	4.1	505	2 104	1.7	4.3
OECD total	16 785	36 945	28.3	34.6	2 408	5 628	4.1	5.3	2 052	6 265	3.2	5.9
World total	**16 978**	**38 145**	**28.2**	**34.5**	**2 453**	**5 876**	**4.1**	**5.3**	**2 084**	**6 487**	**3.2**	**5.9**
Argentina	1	3	6.5	8.0	2	2	15.2	5.7	1	1	7.9	1.1
Brazil	3	21	10.9	15.7	0	11	0.0	8.1	0	3	0.0	2.5
Chile	0	2	0.0	13.5	0	1	0.0	3.4	0	0	0.0	0.0
China	5	248	18.3	45.6	3	49	9.0	9.1	0	27	0.0	5.0
Chinese Taipei	22	164	17.3	34.9	0	21	0.2	4.5	4	44	3.7	9.4
Cyprus	0	1	0.0	25.5	0	0	0.0	0.0	0	0	0.0	0.0
Estonia	0	3	0.0	55.9	0	0	0.0	4.6	0	1	0.0	8.8
Hong Kong, China	6	8	19.3	22.0	0	4	0.0	10.9	0	0	0.0	0.0
India	1	68	5.7	15.9	3	28	19.9	6.6	0	16	0.0	3.9
Israel	84	326	35.0	37.9	20	73	8.5	8.5	22	63	6.3	7.4
Latvia	0	2	0.0	44.6	0	1	0.0	25.5	0	1	0.0	19.1
Lithuania	0	1	0.0	49.8	0	0	0.0	0.0	0	0	0.0	0.0
Malta	0	2	0.0	50.0	0	0	0.0	0.0	0	0	0.0	0.0
Romania	1	2	34.8	18.8	0	0	0.0	0.0	0	1	0.0	6.9
Russian Federation	13	46	15.2	25.9	6	14	6.6	8.0	0	5	0.1	2.8
Singapore	13	120	48.4	66.3	0	10	0.0	5.6	3	28	6.3	15.3
Slovenia	1	14	30.0	17.0	0	5	0.0	5.7	0	0	0.0	0.6
South Africa	14	25	21.1	19.8	1	5	1.5	4.2	0	3	0.0	1.9

Note: Patent counts are based on the inventor's country of residence, the priority date and fractional counts.
1. The provisional definitions of ICT-related patents and biotechnology patents are presented in boxes E and G.
2. Patents related to electric digital data processing correspond to IPC class G06F.

Source: OECD, Patent Database, December 2005.

A4. Internationalisation in patenting

	Foreign ownership of domestic inventions[1]				Domestic ownership of inventions made abroad[2]				Patents with foreign co-inventors[3]			
	EPO		USPTO		EPO		USPTO		EPO		USPTO	
	1990-92	2000-02	1990-92	1998-2000	1990-92	2000-02	1990-92	1998-2000	1990-92	2000-2002	1990-92	1998-2002
Australia	22.5	26.2	22.4	29.0	10.4	11.5	8.0	12.0	14.1	19.1	13.7	18.3
Austria	23.7	38.9	34.8	51.8	16.7	27.8	10.8	16.1	15.9	26.6	20.8	28.0
Belgium	41.6	44.8	52.0	58.8	23.0	30.0	22.7	35.0	26.8	34.3	34.3	44.5
Canada	32.5	35.4	19.7	26.2	24.0	26.9	10.4	22.7	23.8	30.4	12.9	19.5
Czech Republic	38.5	51.6	42.4	70.7	22.1	13.4	31.8	21.3	26.4	41.0	35.3	53.6
Denmark	15.7	22.4	21.7	30.2	17.7	17.8	20.2	19.0	14.2	19.5	20.6	22.6
Finland	13.0	8.6	9.9	11.3	9.7	25.6	11.6	26.8	8.4	14.4	9.6	14.0
France	12.2	24.2	17.5	29.1	10.3	19.7	7.7	19.8	7.1	15.9	10.8	18.6
Germany	9.7	14.0	13.1	18.2	8.1	12.4	7.6	13.2	6.6	11.7	9.1	14.7
Greece	28.6	35.8	33.9	56.8	11.5	7.6	7.5	8.1	21.4	31.9	28.8	54.3
Hungary	26.8	54.3	22.6	55.4	4.0	17.3	5.1	26.0	18.6	36.8	19.0	29.9
Iceland	55.6	36.9	25.0	55.3	14.3	34.5	22.7	28.9	25.9	35.1	25.0	35.3
Ireland	43.9	40.6	55.0	59.9	42.9	48.0	42.5	41.2	30.1	32.7	36.1	40.1
Italy	12.4	17.6	18.7	24.0	4.6	5.9	5.7	7.5	5.3	9.9	9.1	13.4
Japan	3.4	3.7	2.4	3.3	2.7	3.8	2.1	4.2	2.3	3.0	1.8	2.4
Korea	7.8	4.7	3.8	4.3	9.5	5.0	3.9	4.4	7.2	5.2	3.4	3.9
Luxembourg	44.2	64.4	50.0	72.3	71.1	79.7	68.3	87.8	42.5	55.4	43.4	67.1
Mexico	44.9	66.7	24.4	57.9	15.6	26.6	12.6	16.0	36.7	50.3	18.6	38.7
Netherlands	18.5	19.8	55.9	42.9	40.0	33.9	43.9	55.8	11.1	15.3	18.2	30.7
New Zealand	27.9	25.6	19.2	35.7	14.8	12.6	7.2	12.0	19.7	22.1	11.4	28.4
Norway	14.9	28.4	16.7	32.1	19.9	22.2	16.2	21.9	15.1	25.0	18.6	26.6
Poland	72.4	52.2	85.5	81.7	12.5	18.6	25.0	40.5	50.0	48.2	64.5	68.7
Portugal	47.4	33.8	54.5	57.6	29.6	26.9	9.1	29.4	44.7	28.1	50.0	45.8
Slovak Republic	40.0	64.7	33.3	70.0	57.1	21.4	75.0	10.0	20.0	57.4	66.7	60.0
Spain	20.7	32.2	33.9	44.6	10.3	6.7	6.9	6.9	14.2	20.7	25.1	29.0
Sweden	14.5	19.2	18.6	17.7	13.6	28.1	12.1	25.3	9.8	16.2	10.7	16.1
Switzerland	17.9	23.2	37.5	39.2	35.6	48.7	33.4	52.0	18.7	30.7	24.2	37.3
Turkey	62.5	32.6	87.5	71.2	16.7	12.2	100.0	37.9	68.8	30.9	100.0	63.6
United Kingdom	27.8	37.7	33.1	51.6	17.8	18.6	14.6	17.8	11.9	22.3	17.0	27.5
United States	7.6	12.7	2.2	4.9	11.3	17.3	6.9	8.6	6.1	11.8	3.2	5.3
European Union (15)[4]	8.2	11.4	16.6	20.8	5.4	8.4	5.7	11.3	4.4	7.7	7.7	12.6
European Union (25)[4]	8.2	11.4	16.6	20.9	5.3	8.1	5.6	11.2	4.4	7.6	7.7	12.6
OECD average	10.4	15.1	6.3	9.2	10.5	15.4	6.6	9.7	3.8	7.0	2.7	4.4
World average	**10.8**	**15.8**	**6.7**	**9.9**	**10.8**	**15.8**	**6.7**	**9.9**	**3.8**	**6.9**	**2.7**	**4.2**
Argentina	37.3	56.8	23.1	34.3	8.8	8.1	9.2	2.2	9.8	34.5	12.5	19.2
Brazil	35.2	37.8	20.5	49.8	4.2	11.3	3.9	6.5	25.4	28.9	16.9	31.2
Chile	71.4	42.2	39.4	47.6	60.0	17.2	5.0	20.7	71.4	33.3	36.4	23.8
China	49.2	45.8	38.1	59.5	12.5	22.6	15.3	25.6	37.5	30.5	26.8	37.6
Chinese Taipei	13.1	19.6	6.3	4.5	7.8	11.8	2.1	5.8	10.3	14.7	4.1	4.1
Cyprus	40.0	51.5	22.2	100.0	70.0	79.7	50.0	100.0	20.0	36.4	22.2	55.6
Estonia	100.0	57.1	100.0	85.7	100.0	20.0	0.0	50.0	50.0	42.9	66.7	50.0
Hong Kong, China	42.5	68.1	36.4	37.5	32.2	51.7	31.3	34.0	19.8	23.7	21.8	29.4
India	68.5	33.4	64.0	52.9	6.5	9.1	11.1	7.4	47.8	29.2	49.3	37.4
Israel	32.2	29.6	34.7	39.7	12.1	11.5	8.3	10.1	19.5	15.2	20.5	18.7
Latvia	100.0	82.8	100.0	82.4	100.0	28.6	100.0	0.0	100.0	75.9	100.0	64.7
Lithuania	0.0	77.8	0.0	75.0	0.0	50.0	0.0	50.0	0.0	66.7	0.0	58.3
Malta	62.5	17.6	66.7	16.7	50.0	40.7	66.7	61.5	0.0	29.4	0.0	16.7
Romania	33.3	55.6	66.7	73.9	0.0	11.1	25.0	14.3	33.3	41.7	44.4	52.2
Russian Federation	49.9	62.0	49.9	75.8	11.2	16.0	10.5	22.3	23.3	44.3	25.7	49.1
Singapore	77.2	49.7	71.0	44.0	26.7	31.3	27.3	29.1	43.9	42.0	42.5	32.2
Slovenia	19.2	50.0	15.4	42.3	31.0	9.1	16.0	23.5	15.4	27.0	19.2	19.7
South Africa	27.7	29.1	22.5	33.5	19.5	16.5	7.3	9.3	13.3	19.6	12.4	17.6

Note: Patent counts are based on the inventor's (or applicant's) country of residence, the priority date and simple counts.
1. Share of patents owned by foreign residents in total patents invented domestically.
2. Share of patents invented abroad in total patents owned by country residents.
3. Share of patents with at least one foreign co-inventor in total patents invented domestically.
4. The EU is treated as one country; intra-EU co-operation is excluded.

Source: OECD, Patent Database, December 2005.

ANNEX A

What do patent indicators reflect?

Among the few available indicators of technology output, patent indicators are probably the most frequently used. Most national science and technology (S&T) publications include a section on patents. However, there is no standard method of calculating indicators from patent data, with the result that the analytical and policy lessons that can be drawn from patent indicators are widely divergent. It seems therefore necessary to improve standardisation in this field. This is all the more necessary at a time when patenting activity by firms, but also universities and government laboratories, has been expanding rapidly, increasing the "noise" (lack of precision) and sometimes biases (misleading information) as well as the information conveyed by patent statistics.

Patent documents are a rich source of information about the invention for which protection is being sought. It includes detailed information about the technical features of the invention (*e.g.* claims, technical classification, citations, etc.), details on inventors and applicants, and the history of the application (dates). The regulatory and administrative processes of the patenting system are also reflected in a patent document.

To count patent data, certain methodological choices which have significant influence on the derived indicators have to be made. The consequence of the methodological choices is that a single indicator can provide conflicting messages. As an example, different indicators of the number of patent applications to a specific patent office can be designed in order to reflect the inventive performance of a country, the ownerships of patent stock or the attractiveness of the country's patenting system, etc. What an indicator reflects depends on the underlying methodology used to construct the indicator. For instance, if the aim is to measure the inventive performance of countries, then the criteria for calculating the indicator ought to be the inventor's country of residence and priority date (see below). The decision to select one criterion over another is dependent on the phenomena that are to be measured. Furthermore, in order to interpret patent indicators in an accurate manner, it is important to grasp the following concepts:

- **Geographical distribution.** Three main criteria can be used: *i)* counts by priority office (country where the first application is filed, before protection is extended to other countries), indicate the attractiveness of a country's patenting process, the quality of intellectual property regulations (rules and cost of patenting), the reputation of the patent office and general economic features (*e.g.* market size); *ii)* counts by the inventor's country of residence indicate the inventiveness of the local labour force; and *iii)* counts by the applicant's country of residence (the owner of the patent at the time of application), indicate control of the invention. The most widely used method is patent counts by the inventor's country of residence although others are legitimate in their own way.
- **Patents with multiple inventors from different countries.** Such patents can either be partly attributed to each country mentioned (fractional count) or fully attributed to every relevant country, thus generating multiple counting. In general, it is better to use fractional counting procedures, but the alternative is sometimes preferable (*e.g.* for indicators of internationalisation).
- **Reference date.** The choice of one date among the set of dates included in patent documents is important. The priority date (first date of filing of a patent application, anywhere in the world, to

protect an invention) is the earliest and therefore closest to the invention date. Counts by application date introduce a bias owing to a 12 month lag between residents and foreigners: the latter usually first file a patent application at their domestic office (the priority office) and later in other countries. But if the purpose is to measure the activity level of a patenting office, the application date might be a better measure. The lag is even longer (around 30 months) for Patent Co-operation Treaty (PCT) applications (see Annex A on patenting procedures). To measure inventive activity, patent indicators should be computed with respect to the priority date.

OECD patent indicators

The focus of the OECD work is to develop patent indicators that can be used, in combination with other science and technology (S&T) indicators, to address various policy issues. Patent indicators are a key measure of innovative output, as they reflect the inventive performance of countries, regions, technology, etc. They are also used to measure diffusion of ideas and the level of internationalisation and international collaboration across countries. For these purposes, the relevant criteria for calculating patent indicators are: inventor's country of residence, priority date, and fractional counting. The data reported in this document are based on these criteria. A major drawback with the selection of priority date is the apparent deterioration of the timeliness of the patent indicators which is discussed below.

Patent statistics published in this publication are different from data published in other sources, such as patent office data. This is mainly due to the methodology applied to count patent statistics. OECD's patent indicators are designed to reflect inventive and creative activities, whereas patent data reported in annual reports of patent offices (*e.g.* EPO, JPO, USPTO, etc.) are designed to reflect their patenting activity and are primarily for administrative purposes (*e.g.* budget planning). Therefore, the data reported here should not be compared with those published by patent offices.

Patent indicators based on the priority date are frequently criticised for being outdated. It should be noted, however, that this delay is to a large extent a question of labelling the published statistics, *e.g.* the statistics published counted by year of grants seem to be more up to date, but in fact they are not as the label (year) corresponds to publication and not to the date when the invention was made. This is illustrated by Figure A3 where the number of patents granted by the USPTO are labelled according to priority, filing and grant dates.

The legal delay for publishing an application is 18 months after the priority date in most patent offices. Prior to the change in rules regarding the publication of patent applications (November 2000[9]) at the USPTO, publication only occurred after the patent had been granted. Therefore, the legal time lag between the priority date and the publication date can be up to five years (it can take up to five years for the patent to be granted). Similarly, patent applications filed using the Patent Co-operation Treaty (PCT) procedure also have a long time lag between the priority date and the date of "national/regional" phase entry. The time lag between the priority date and the "national/regional" phase entry can be up to 30 months and it takes another 1 to 6 months for the data to become available. In order to improve the

9. The USPTO revised the rules to implement the provisions of the American Inventors Protection Act (AIPA) of 1999. The Eighteen-Month Publication of Patent Applications provisions provides that, with certain exceptions, applications for patent shall be published promptly after the expiration of 18 months from the earliest filing date and that an application may be published earlier than the end of such an 18-month period at the request of the applicant. However, an applicant can "opt out" of the 18-month publication rule by making a request upon filing, certifying that the invention disclosed in the application has not been and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires 18-month publication.

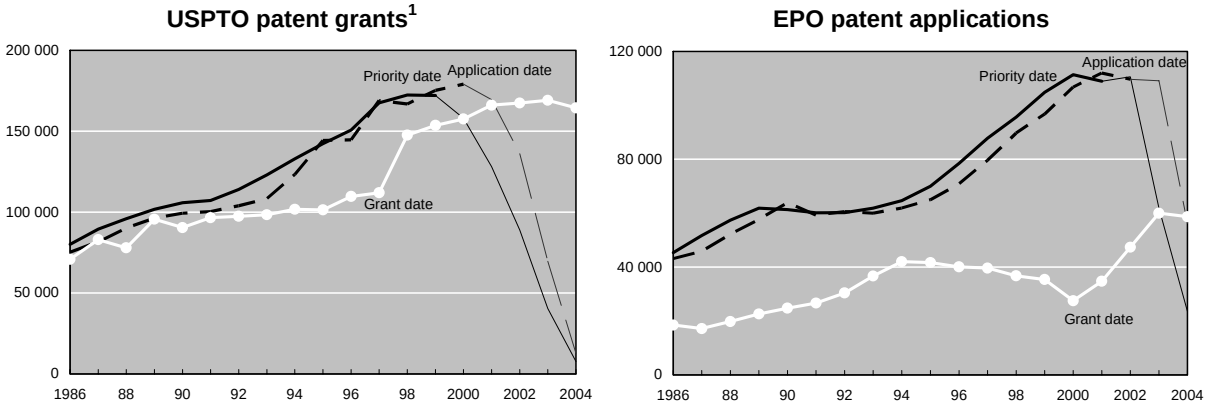
timeliness of OECD patent indicators, patents are "*nowcasted*" (*i.e.* forecasting the recent past) at an aggregate level on a regular basis.

The patent data in this compendium were updated in December 2005; patent indicators based on filings to the European Patent Office (EPO) are available up to 2002 (based on priority date). Data for 2003 and 2004 are available but are incomplete, because PCT applications which enter the EPO regional phase need to be included in the EPO data. The time lag between priority date and the date of the EPO regional phase entry of the PCT applications can be up to 30 months. The triadic patent families and USPTO grants data are available up to 2000 (based on priority date). Data on 2001 and 2002 triadic patent families and the USPTO patent grants data reported are therefore estimations.

The EPO and USPTO data can be reported up to 2005 when labelled according to grant date, but if the same data is labelled according to priority date, they can be reported up to 2002 for the EPO and 2000 for the USPTO. This is due to the time lag between priority date and the availability of information. Patent statistics reported in many publications are based on date of application or grant. Patent data reported based on the grant date (or application date) gives the impression to the reader that those data are more up to date than patent data based on the priority date. However, in reality they are not more up to date because the same data is reported with a different label. In many S&T publications patent indicators are reported based on application and/or grant date. However, these data suffer from a range of biases associated with the patent process: data are dependent on various administrative delays, strategic behaviour of the patentee, and the data are not comparable across countries as the lag between priority date and application (or grant) dates differs from country to country. Indicators based on application or grant date are important for addressing specific issues (*e.g.* monitoring the activity of a patent office), but they are not suitable for measuring inventive performance.

To assess inventive performance, indicators based on the priority date are the most appropriate, because this date is closest to the date of invention. Analysing inventive performance using indicators based on application or grant date may result in a misleading conclusion. This is illustrated by the figure below (Figure A3). The grant date data shows that the number of EPO patent applications followed a downward path during the 1994-2000 period. But in reality, the number of EPO patent applications, based on priority date, increased continuously during this time period. Similarly, the number of patents granted by the USPTO shows a steady increase during the period 1990-97 when the count is based on the grant date, whereas a sharp increase is observed for the priority date data.

Figure A3. Number of patents according to various dates



Note: Patent counts are based on the priority date.
1. Figures for 2000 to 2002 are estimates.

Source: OECD, Patent Database, December 2005.

ANNEX B

Patenting procedures

To obtain a patent for an invention, the inventor (applicant) has to file an application for a patent at a national or regional patent office. Once the application, with all the necessary documents and fees, is filed with the patent office, an examination will be performed to decide whether to grant or reject patent rights for the invention.

The decision on where to apply for patent protection is dependent on the applicants' business strategies. But in most cases, a patent application is filed at a national patent office of the inventor (applicant) to protect the invention in the domestic market, followed by foreign filings to protect the invention in foreign markets. Patent rights awarded by a patent office provide protection for the invention within the jurisdiction of that specific patent office and do not provide patent protection across the world. For example, a patent granted by the USPTO will only provide patent rights within the United States. If the inventor (applicant) wishes to protect the same invention in Japan, then a separate patent application has to be filed at the JPO (either directly to JPO or via PCT). A patent application can be filed using the various patenting procedures and the most frequent methods in use for filing patent applications are as follows:

Applications at the national patent office

Once an inventor (individual, firm, public body, university) decides to protect an invention, an application for a patent will be filed at the national patent office. The first world-wide application date is commonly referred to as the priority date (*i.e.* the first date of filing of a patent application, anywhere in the world). The national patent office will examine the application to decide whether to grant a patent for the invention. If the inventor (applicant) wishes to protect the invention in countries apart from the domestic country, he can file for a patent in each country in which protection is desired, or to a regional office (*e.g.* EPO) or file an international application under the Patent Co-operation Treaty (PCT) procedure. The applicant has the right to the priority date under the Paris Convention[10] if the application is filed elsewhere within 12 months of the first filing. A considerable amount of harmonisation of patent rules across countries took place during the 1990s (*e.g.* TRIPs agreement). However, there are still important differences in rules and regulations for granting patent rights (see Table A1). For illustrative purposes, the USPTO and the JPO patent granting procedures are outlined below:

USPTO: When an application is filed at the USPTO and accepted by the USPTO as a complete application, it is assigned to a patent examiner for examination. An application at the USPTO is automatically regarded as a request for examination. On the expiration of the 18th month from the priority date, the application is published (*i.e.* information about the application is available to the general public). It is possible for an applicant to request that the application not be published, but only

10. The Paris Convention (the Paris Convention for the Protection of Industrial Property, 1883) established the system of priority rights. Under the priority rights, applicants have up to 12 months to extend the initial patent applications to other member countries and claim the earliest priority date. The priority date is used to determine the novelty of the invention, which implies it is an important concept in patent procedures.

if the invention has not been and will not be the subject of an application filed in a foreign country. The examination process consists of checks for compliance with the legal requirements and a search through US patents, publications of patent applications, foreign patent documents, and available literature, to see if the claimed invention is new, useful and non-obvious. If a patent cannot be granted in the form as filed, the applicant is notified in writing. The applicant has the opportunity to rebut the grounds on which the application was rejected and or make amendments to the application within a prescribed time limit. The application will be examined again and if the examiner's decision on patentability is favourable, a patent is granted. Unlike the situation at EPO, there is no opposition system at the USPTO. However, at any time during the enforceability of a patent any person may file a request for the USPTO to conduct a second examination of any claim of the patent on the basis of prior art patents or printed publications which that person states to be pertinent and applicable to the patent and believes to have a bearing on the patentability. To keep the patent in force, maintenance fees have to be paid within certain time periods. Failure to pay the maintenance fees may lead to loss of patent rights.

JPO: The grant process at the JPO is similar to the USPTO grant procedure. However, there are a few major differences. On receiving an application, a formality check is conducted to see if all the necessary procedural and formal requirements are satisfied. The application does not proceed to the examination process automatically. A request for examination has to be filed within 3 years of the application date to start the substantive examination process. The time limit for the request for examination was reduced in 2001 from seven years to three years (three years for patents filed since October 2001 and seven years for patents filed before October 2001). If the applicant fails to file the request for examination within the time limit, the application is regarded as withdrawn. All pending patents will be published in the official gazette after 18 months from the priority date. If no reasons for refusal have been discovered during the substantive examination process, a patent is granted. After a patent has been granted and published in the patent gazette, anyone can file to invalidate the patent if it is deemed to be flawed. An appeal examination is conducted to decide whether to maintain or invalidate the patent.

European Patent Convention (EPC)

As a result of the EPC[11], the European Patent Office (EPO) was created to grant European patents based on a centralised examination procedure. By filing a single European patent application in one of the three official languages (English, French and German)[12], it is possible to obtain patent rights in all the EPC countries. However, at the time of the EPO application, the applicant has to specify (designate) the EPC member countries and "extension" countries in which protection is being sought[13]. Patents granted by the EPO have the same legal rights and are subject to the same conditions as national patents (granted by the national patent office) in each EPC country for which the patents have been granted. A European patent is a "bundle" of national patents, which must be validated at the national patent office to be effective in EPC member countries. The validation process, amongst others, includes submitting all the necessary

11. The European Patent Convention (EPC) was signed in 1973 and entered into force in 1977. Currently, 31 countries are party to the treaty. In addition, the EPO has an "extension agreement" with five countries, which allows the possibility of extending European Patents to those countries upon request at the time of European patent application. The EPO is not an institution of the European Union.

12. An application can be submitted in any official language of any EPC Member States. However, within three months of filing the application, but no more than 13 months after the earliest priority date, a translation of the application into one of the official EPO languages (English, French or German) is required.

13. If the applicant pays designation fees for seven countries, then it is considered that the designation fees for all the EPC Member States have been paid and all the countries will be automatically selected.

documents (*e.g.* a translation in one of the official languages of the State in question of the original text of the European patent application) and a national application fee.

Three different routes are used to file EPO patent applications: direct EPO application (*i.e.* first filing); national patent application extended to EPO application within 12 months of the first filing; and international application filed under PCT route entering the EPO regional phase (see below).

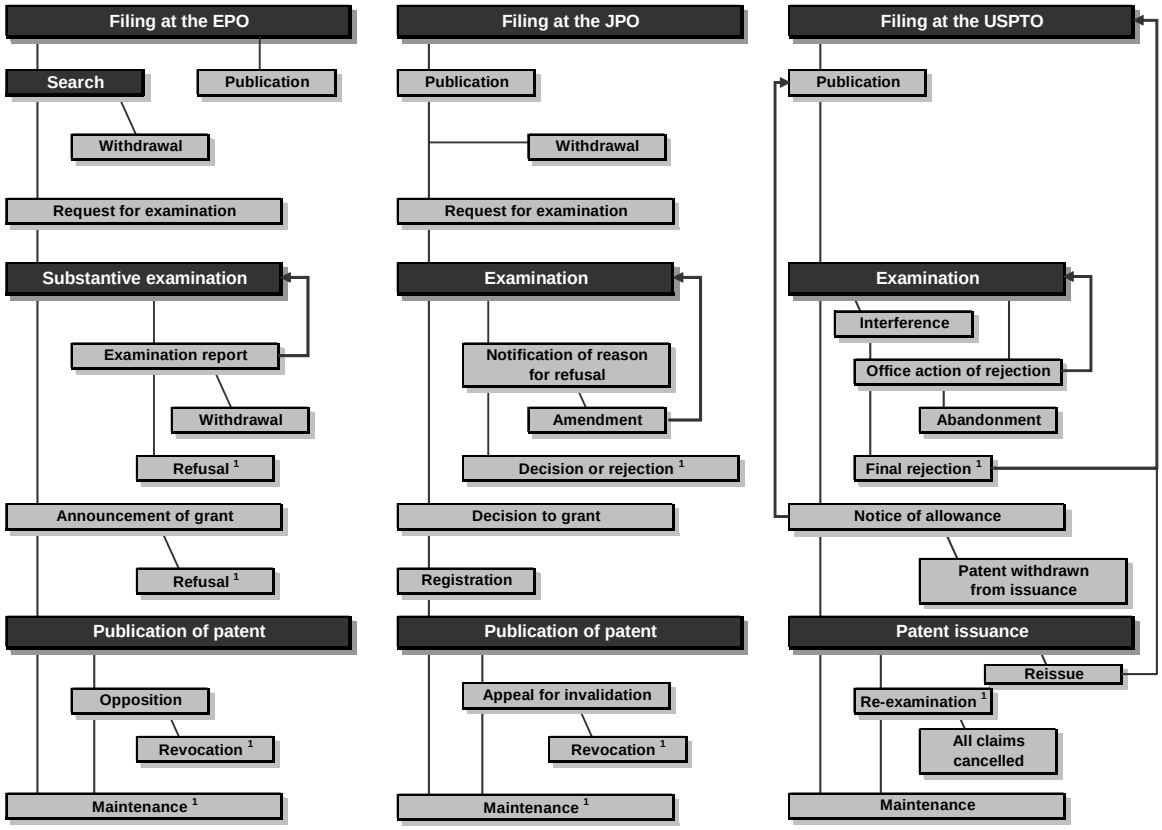
Once an application has been filed at the EPO it will enter the examination procedure, which consists of two phases. In the first phase of the examination process a (mandatory) European search report will be drawn up by an EPO patent examiner. This report describes the state of prior art regarded as relevant to the patentability of the invention. The European patent application, along with the search report[14], is published 18 months after the priority date. Once the European search report has been published, the applicant has six months to file a request for examination (otherwise the application is deemed to be withdrawn). After receiving the request for examination, a substantive examination is performed to decide whether to grant or reject a European patent. Within nine months of a European patent grant, anyone can file an opposition to the grant of a European patent.[15] Successful opposition can lead to revocation of the patent or maintenance in an amended form.

The major phases of the grant procedures of the three large patent offices (EPO, JPO and USPTO) are outlined in Figure A5.

14. If the European search report is not ready at that time, it is published later on.

15. Opposition can be filed on the grounds that: the patent's subject matter is not patentable, the patent does not disclose the invention clearly and completely, and the patent's subject matter extends beyond the content of the application filed.

Figure A5. Patent procedures in the three major offices



1. Decision may be appealed.

Source: EPO, JPO and USPTO, Trilateral Statistical Report, 2003.

International applications filed under the Patent Co-operation Treaty (PCT)

The PCT[16] provides the possibility to seek patent rights in a large number of countries by filing a single international application (PCT application) with a single patent office (receiving office). However, it should be noted that PCT applications do not result in the issuance of "international patents". The decision on whether to grant or reject patent rights rests with national or regional patent offices and the rights are limited to the territory under the governing authority's jurisdiction.[17] The PCT procedure consists of two main phases: *a)* "international phase"; and *b)* PCT "national/regional phase". The PCT procedure starts with the international phase and concludes with the national/regional phase. The advantage of the PCT system is that it provides the applicant with more time (up to 30 months, rather than 12 months) to decide whether or not to seek a national or regional patent (see Figure A6). PCT applications also automatically generate an international search report (ISR)[18] which lists references to published patent documents and technical journal articles that might affect the patentability of the invention. In addition to the ISR, a detailed written opinion on the patentability of the claimed invention is produced. The written opinion is a

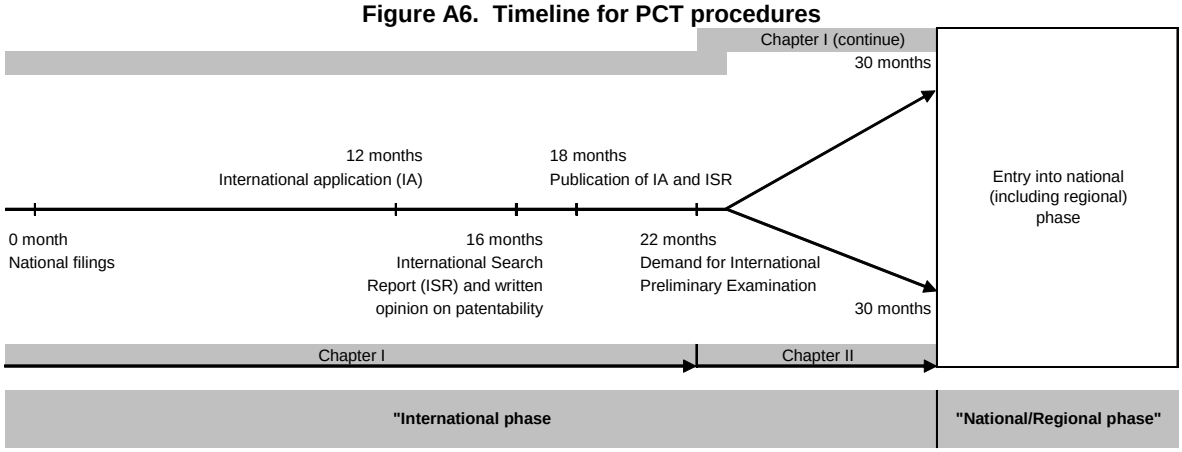
16. The Patent Co-operation Treaty (PCT) was signed in 1970 and entered into force in 1978. Currently there are 128 (July 2005) countries party to the treaty.

17. PCT applications are administered by the World Intellectual Property Organisation (WIPO).

18. An international search report is prepared by one of the appointed International Search Authorities (ISA).

preliminary and non-binding opinion on whether the invention appears to meet the patentability criteria in light of the search report results. The international application and the international search report are published after the expiration of 18 months from the priority date (the written opinion is not published). The applicant can also request an international preliminary examination (IPE)[19], which will generate an international preliminary report on patentability (IPRP). IPRP is a second evaluation of the potential patentability of the invention. The request for an IPE must be filed within 22 months of the priority date (or 3 months after the issuance of the ISR). This will provide the applicant with additional information on the patentability of inventions; therefore applicants are in a better position to decide whether it is worthwhile to proceed to the PCT national/regional phase. If the applicant wishes to proceed further with the international application, the application has to enter the national or regional (*e.g.* EPO) phase within 30-months from the priority date. The competence is transferred to the national or regional patent office(s) on the entry of the international application into the national or regional phase.

Figure A6. Timeline for PCT procedures



Patent applications can be filed using various procedures. There are various factors (*e.g.* costs of patenting, time taken to grant patents, differences in national patent office rules regarding the scope of patents, etc.) that will influence the decision on whether to follow one procedure or another. To calculate and interpret patent statistics in an accurate manner, it is essential to understand the procedures that are used to file patent applications.

19. If the applicant does not request an international preliminary examination, then the written opinion on the patentability criteria established by the ISA will be converted into an IPRP.

Table A1. Main differences between the three main patent offices

	EPO	JPO	USPTO
Patent grants are based on:	First to file	First to file	First to invent
Patent duration:	20 years	20 years	20 years
Application language:	English, French or German [a]	Japanese [b]	English [c]
Area covered:	EPC Member and "extension" countries [d]	Japan	The United States
Request for examination:	Yes, within 6 months	Yes, within 3 years [e]	No
Publication of application:	18 months from the priority date	18 months from the priority date	18 months from the priority date [f]
Are there some subject matters excluded from patentability or not considered to be inventions?	Yes [g]	Yes [h]	Yes [i]
Opposition system:	Yes [j]	No	No

a. An application can be submitted in any official language of any EPC Member States. However, within 3 months of filing the application, but no more than 13 months after the earliest priority date, a translation of the application into one of the official EPO languages (English, French or German) is required.

b. It is possible to file the patent request in Japanese and the specification, claims, drawings, and the abstract in English. A Japanese translation of the English documents must be filed within two months of the initial filing date.

c. Possible to file in any language other than English provided that English translation is submitted within 2 months.

d. A European patent does not automatically provide protection in all EPC Member countries (and the extension countries). The applicant has to select the countries in which protection is being sought and once a European patent has been granted, it has to be validated at the national patent offices for the patent to be effective in those countries.

e. Request for examination period: 3 years for patents filed since October 2001 and 7 years for patents filed before October 2001.

f. An application that has not and will not be the subject of an application filed in foreign countries does not need to be published if an applicant so requests.

g. Subject matters not considered to be inventions are: discoveries, scientific theories and mathematical methods; aesthetic creations; schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers; and presentations of information. Subject matter excluded from patentability: plant or animal; and methods for treatment of the human or animal body by surgery or therapy and diagnostic methods practised on the human or animal body.

h. Subject matters not considered to be inventions are: discoveries; scientific theories and mathematical methods; mental acts; presentation of information; business methods; isolated parts of human beings; and diagnostic, therapeutic and surgical methods for the treatment of humans and animals.

i. Subject matters not considered to be inventions are: scientific theories and mathematical methods; mental acts; presentation of information; and traditional knowledge.

j: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Opposition can only be filed on the following grounds: the patent's subject matter is not patentable; the patent does not disclose the invention clearly and completely; and the patent's subject matter extends beyond the content of the application as filed.

ANNEX C

List of top-IPC classes in EPO patent applications (1997-2002)

A61K	***Human necessities***	Medical or Veterinary Science ; Hygiene - *Preparations for medical, dental, or toilet purposes*
G06F	***Physics***	Computing; Calculating; Counting - *Electric digital data processing*
H04L	***Electricity***	Electric Communication Technique - *Transmission of digital information, e.g. Telegraphic communication*
H01L	***Electricity***	Basic Electric Elements - *Semiconductor devices; electric solid state devices not otherwise provided for*
C12N	***Chemistry ; Metallurgy***	Biochemistry; Beer; Spirits; Wine; Vinegar; Microbiology; Enzymology; Mutation or Genetic Engineering - *Micro-organisms or enzymes; compositions thereof; Propagating, preserving, or maintaining micro-organisms; mutation or genetic engineering; culture media*
H04N	***Electricity***	Electric Communication Technique - *Pictorial communication, e.g. Television*
C07D	***Chemistry ; Metallurgy***	Organic Chemistry - *Heterocyclic compounds*
G01N	***Physics***	Measuring; Testing - *Investigating or analysing materials by determining their chemical or physical properties*
A61B	***Human necessities***	Medical or Veterinary Science ; Hygiene - *Diagnosis; surgery; identification*
H04Q	***Electricity***	Electric Communication Technique - *Selecting*
H04B	***Electricity***	Electric Communication Technique - *Transmission*
C07C	***Chemistry ; Metallurgy***	Organic Chemistry - *Acyclic or carbocyclic compounds*
G02B	***Physics***	Optics - *Optical elements, systems, or apparatus*
G11B	***Physics***	Information Storage - *Information Storage based on relative movement between record carrier and transducer*
A61F	***Human necessities***	Medical or Veterinary Science ; Hygiene - *Filters implantable into blood vessels; prostheses; orthopaedic, nursing or contraceptive devices; fomentation; treatment or protection of eyes or ears; bandages, dressings or absorbent pads; first-aid kits*
B65D	***Performing operations ; Transporting***	Conveying; Packing; Storing; Handling Thin or Filamentary Material - *Containers for storage or transport of articles or materials, E.g. bags, barrels, bottles, boxes, cans, cartons, crates, drums, jars, tanks, hoppers, forwarding containers; accessories, closures, or fittings therefor; packaging elements; packages*
A61M	***Human necessities***	Medical or Veterinary Science ; Hygiene - *Devices for introducing media into, or onto, the body; devices for transducing body media or for taking media from the body; devices for producing or ending sleep or stupor*
B60R	***Performing operations ; Transporting***	Vehicles in general - *Vehicles, vehicle fittings, or vehicle parts, not otherwise provided for*
B01D	***Performing operations ; Transporting***	Physical or Chemical Processes or Apparatus in general (furnaces, kilns, ovens, retorts, in general) - *Separation*
C07K	***Chemistry ; Metallurgy***	Organic Chemistry - *Peptides*
B29C	***Performing operations ; Transporting***	Working of Plastics; Working of Substances in a Plastic State in general - *Shaping or joining of plastics; shaping of substances in a plastic state, in general; after- treatment of the shaped products, e.g. repairing*
C12Q	***Chemistry ; Metallurgy***	Biochemistry; Beer; Spirits; Wine; Vinegar; Microbiology; Enzymology; Mutation or Genetic Engineering - *Measuring or testing processes involving enzymes or micro-organisms ; compositions or test papers therefor; processes of preparing such compositions; condition-responsive control in microbiological or enzymological processes*
H01R	***Electricity***	Basic Electric Elements - *Line connectors; current collectors*
H04M	***Electricity***	Electric Communication Technique - *Telephonic communication*
H01M	***Electricity***	Basic Electric Elements - *Processes or means, e.g. batteries, for the direct conversion of chemical energy into electrical energy*
C08F	***Chemistry ; Metallurgy***	Organic Macromolecular Compounds; Their Preparation or Chemical Working-up; Compositions based thereon - *Macromolecular compounds obtained by reactions only involving carbon-to-carbon unsaturated bonds*
G06K	***Physics***	Computing; Calculating; Counting - *Recognition of data; presentation of data; record carriers; handling record carriers*
C08G	***Chemistry ; Metallurgy***	Organic Macromolecular Compounds; Their Preparation or Chemical Working-up; Compositions based thereon - *Macromolecular compounds obtained otherwise than by reactions only involving carbon-to-carbon unsaturated bonds*
H01J	***Electricity***	Basic Electric Elements - *Electric discharge tubes or discharge lamps*
B41J	***Performing operations ; Transporting***	Printing; Lining Machines; Typewriters; Stamps - *Typewriters; selective printing mechanisms, i.e. mechanisms printing otherwise than from a forme; correction of typographical errors*
B01J	***Performing operations ; Transporting***	Physical or Chemical Processes or Apparatus in general (furnaces, kilns, ovens, retorts, in general) - *Chemical or physical processes, e.g. catalysis, colloid chemistry; their relevant apparatus*

Source: WIPO, International Patent Classification, 7th edition *www.wipo.int/classifications/fulltext/new_ipc/index.htm*.