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INTERNATIONAL PATENTING STRATEGIES OF CHINESE RESIDENTS

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1. The Annex to this document contains a Study on International Patenting Strategies of Chinese Residents, prepared under the Project on Intellectual Property and Socio-Economic Development (CDIP/5/7 Rev.).

2. *The CDIP is invited to take note of the information contained in the Annex to this document.*

[Annex follows]

INTELLECTUAL PROPERTY AND SOCIO-ECONOMIC DEVELOPMENT: INTERNATIONAL PATENTING STRATEGIES OF CHINESE RESIDENTS

EXECUTIVE SUMMARY

This executive summary presents the results of the study on International Patenting Strategies of Chinese Residents.

Objective of the study

In terms of the number of its patent applications, in 2012 China has emerged as the country with the largest IP office in the world. The performance of the Chinese IP system is thus increasingly in the spotlight, a better understanding of the linkages between IP activity and socio-economic development in China is a priority.

As part of a broader series of studies addressing this topic, this study offers insights into the international patenting behavior of Chinese residents. Significant economic studies have been devoted to the rise of domestic patenting in China. Also Chinese companies, academic institutions and individuals have rapidly increased their patent filings abroad. Still, there is little systematic study of Chinese foreign-oriented patent families which would analyze the characteristics of Chinese patenting abroad. The objective of this work is thus to describe and analyze Chinese patenting abroad by using WIPO's foreign-oriented patent family dataset. It offers descriptive statistics and econometric evidence on the observed increase in Chinese foreign patenting and its drivers.

Main findings

The conclusions of this study are as follows:

1. THE RISE OF CHINESE FOREIGN-ORIENTED PATENT FAMILIES

- While in the beginning of the 1990s the total number of Chinese foreign-oriented patent families was on par with the those found in other fast-growing middle-income economies, by the turn of the century China decoupled from other fast-growing economies such as Brazil, Russia, India, and South Africa and started to emerge as major player in terms of international patenting.

- More specifically, the growth of Chinese patent filings abroad increased significantly after the year 2000, with a five-year average annual growth rate of 40% between 2000 and 2005, and of 23% since 2005.
- The share of Chinese patents which get filed abroad is still a fraction of total patents filed at home. Roughly speaking, for every 16 domestic families starting with an invention patent, there is one foreign-oriented patent family – of which each might contain several patents in multiple jurisdictions.
- When comparing to high-income countries such as Germany, Japan or the US it becomes apparent that these countries have significantly higher shares of foreign-oriented to total patent families than is the case in China.
- Relative to the growth of domestic patent families, the growth of foreign-oriented families has been much faster on average, admittedly from a lower level.

2. DESTINATION OF FOREIGN-ORIENTED PATENT FAMILIES BY CHINESE RESIDENTS

- Despite the apparent rise of foreign-oriented patent families by Chinese residents, still the majority, and thus about 70%, target only one foreign IP office.
- This is in contrast to Japan and the Republic of Korea where foreign-oriented families with two foreign offices have the largest shares among total foreign-oriented patent families. In the US and in Germany, respectively 39% and 38% of total foreign-oriented patent families target only one office.
- That said, over time, the share of Chinese families with more than one foreign office has increased – from about 5% in the 1970s to 36% in 2009. While among families with more than one foreign office, the majority still targets two patent offices (about 55% in 2009, or 1,848 patent families), and not more, a considerable share also targets three (23% in 2009, or 782 patent families) and four offices (13% in 2009, or 441 patent families).
- More than 80% of Chinese foreign-oriented patent families in 1970-2012 include at least one patent application with the United States Patent and Trademark Office (USPTO), the European Patent Office (EPO), or the Japanese Patent Office (JPO). The share of triadic patent families (USPTO, EPO, and JPO) is approximately 7% and the share of families

that include applications at five patent offices (USPTO, EPO, JPO, KIPO, and SIPO) is less than 3% for the same time span.

- In terms of absolute numbers, the majority of patent applications abroad by Chinese residents target the US with close to 50,000 patent applications based on available data between 1970 and 2012, followed by Europe, Japan, the Republic of Korea, and Canada. A significant number of families also target Australia, and the Russian Federation. Fewer Chinese patent applications are filed in Brazil or other Asian economies.

3. APPLICANT TYPES: ACTORS, TECHNOLOGY FIELDS AND SECTORS

- Almost 70% of foreign-oriented patent families by Chinese residents are owned by firms. The share of firms in total foreign-oriented patent families has indeed been growing rapidly between 1970 and 2009, more than doubling every decade. The share of universities and research institutes in total foreign-oriented patent families is about 6%, which is similar to the situation in the Republic of Korea (about 6%), and larger if compared to the US (about 2%), Japan (less than 1%), and Germany (about 1%).
- Chinese foreign-oriented patent families are concentrated in a few technology fields and their corresponding sectors. This concentration in a small number of technologies fields is actually increasing over time, and this despite the considerably increased volume of Chinese patents filed abroad.
- The share of “complex” technology fields among total Chinese foreign-oriented patent families has been growing between 1970 and 2009 to reach a 75%-share of total patents abroad on average per annum since 2000.
- Specifically, the ICT sector has the largest number of foreign-oriented patent families, with roughly one fourth of all patents filed abroad (25% within the whole period of 1970-2012, and 29% in 2005-2009). The “Electrical machinery, apparatus, energy” technology field has the biggest share in total families, followed by “Computer technology”, “Digital communication” and “Computer technology”.
- The top technology fields among foreign-oriented patent families and domestic patent families overlap only partially. Specifically, only four out of the top ten technology fields are the same among foreign-oriented and domestic patent families groups, i.e., “Electrical machinery, apparatus, energy”, “Measurement”, “Furniture, games,” and “Other consumer goods”. In recent years, “Digital communication” and “Computer technology” are among

the top domestic fields as well as top fields for foreign-oriented technologies suggesting some convergence.

- In terms of growth, “Digital communication” is the fastest growing field among Chinese foreign-oriented patent families between 2000-2009, followed by “Computer technology”, “Nanotechnology”, “Semiconductors” and “Telecommunications”. That said, some of these fastest-growing fields such as nanotechnology or semiconductors are growing fast only from a very low initial level.
- China has a very similar “portfolio” of foreign-oriented patent families when judged by technology field to those of the Republic of Korea and Japan, but quite a different one from those of Western high-income economies such as the US and Germany.

4. TOP APPLICANTS OF CHINESE ORIGIN

- When analysing foreign-oriented patent families of the top filers over time, one sees that the five most active filers increased their filing abroad considerably only after 2004. One can also show that the largest foreign-oriented patent family holders start close to all their foreign-oriented patent families by an invention patent as opposed to a utility model application.
- A few Chinese applicants are responsible for a large share of total Chinese patents filed abroad. Specifically, the patents filed abroad of the top 10 applicants make up for 35% of the total volume of foreign-oriented patent families by Chinese residents, and the top 100 for close to 50%.
- The top 10 list exclusively contains companies, except one university namely Tsinghua University. Aside from ICT and electronics companies, the top 10 list includes BYD Co Ltd which is a Chinese manufacturer of automobiles and rechargeable batteries, and China Petroleum & Chemical Corporation, or Sinopec Limited, a Chinese oil and gas company.
- Among the first top ten applicants several entities of “Foxconn International Holdings Limited”, one of the world’s largest electronics contract manufacturers, appear. Huawei Technologies Co., Ltd. and ZTE Corporation, both leading Chinese telecommunication equipment providers and major users of the patent system, feature prominently with almost identical international patenting portfolios in terms of technology field.

- Interestingly these top 10 applicants adopted different filing strategies. The Foxconn group files exclusively in the US; Huawei and ZTE file on average in two offices. The chemical and automotive firms in the top filer list, *i.e.* China Petroleum and BYD both have more offices and a broader geographical coverage than the firms in the electronics and the ICT sector.

5. CHINESE USE OF THE PATENT CO-OPERATION TREATY FOR FILING ABROAD

- One third of foreign-oriented patent families by Chinese residents have at least one PCT application. Indeed, the share of families with at least one PCT application has grown from 20% per annum in the 1990s to an average of 33% in 2000-09.
- The share of patent families with at least one PCT application among Chinese foreign-oriented patent families in 2000-2009 is somewhat smaller than is the case of the US (45% on average in 2000 to 2009) or Germany (40% on average in 2000-09). Yet it is larger as compared to the Republic of Korea and Japan, with 20% on average in 2000-2009.
- It must also be noted here that the Chinese use of the PCT system for filing abroad has intensified strongly since 2009, a trend not captured in the above data. In 2013, China surpassed Germany to become the third largest user of the PCT system, with Japan as the second-highest user. Indeed, ZTE Corporation with 2,309 PCT applications was the second most important PCT filer and Huawei Technologies, Co. with 2,094 PCT applications the third most important PCT filer in 2013. And in 2012, ZTE was the top PCT applicant with 3,906 published applications, the highest ever yearly number of PCT applications for one single firm.
- Interestingly, Chinese university and research institutes have the highest share of foreign-oriented patent families which use the PCT route. In turn, companies seem to have idiosyncratic strategies of PCT route usage, with some companies employing the PCT route for all filings abroad, others never using it, and yet others using the PCT selectively.
- Additional regression analysis finds that:
 - Research institutes are more likely to apply through the PCT route as compared to companies, universities and individuals.
 - Families originated through patent for invention applications are more likely to be applied through the PCT route.
 - The bigger the size of a family, the more likely it is to be applied through the PCT route.
 - Patent families that include applications with SIPO among other patent offices are more likely to use the PCT route.
 - Digital communication, biotechnology and pharmaceutical companies are more likely to use the PCT route compared to firms in other technology fields.

Some of these findings are obvious, for instance, the fact that larger patent families or patent invention triggered-families tend to make use of the PCT route more frequently.

Others are less obvious, and need more analytical work, for instance, why academic inventors would favor the PCT more than their counterparts based in companies. This will be subject to future research.

INTELLECTUAL PROPERTY AND SOCIO-ECONOMIC DEVELOPMENT: INTERNATIONAL PATENTING STRATEGIES OF CHINESE RESIDENTS

Introduction and background

The Committee on Development and Intellectual Property (CDIP) has mandated the Economics and Statistics Division of the World Intellectual Property Organization (WIPO) to carry out a series of studies under the Development Agenda project “Intellectual Property (IP) and Socio-Economic Development”.¹ These studies gather empirical evidence about the relationship between IP protection and economic performance in developing countries. Within this context, so far two studies are focused on the patent system of the People’s Republic of China are submitted to the thirteenth session of the CDIP.

In terms of the number of its patent applications, in 2012 China has emerged as the country with the largest IP office in the world. The performance of the Chinese IP system is thus increasingly in the spotlight; a better understanding of the linkages between IP activity and socio-economic development in China is a priority. Moreover, the rapid development of China’s IP system holds important lessons for other low- and middle-income countries.

The project

In 2011, the Chinese Government expressed interest for WIPO to conduct a joint study on IP, innovation, and economic development under Development Agenda project CDIP/5/7. Joint study work between the State Intellectual Property Office of The People’s Republic of China (SIPO) and WIPO has been initiated to this effect.

A first mission to launch the study took place from April 24 to 27, 2012 to understand respective data sources and to narrow down the scope of the research project. Technical discussions with SIPO were instrumental in better understanding the state of the Office’s existing data and research work.

On this basis, it was decided that the joint economic research work and its associated studies deliver answers to the following questions:

¹ http://www.wipo.int/edocs/mdocs/mdocs/en/cdip_5/cdip_5_7_rev_1.pdf.

1) What is behind China's rapid increase in patenting?

This part of the joint economic research work analyzes which factors have contributed to the fast growth of patenting in China, ranging from the growing innovative capacity of China's economy, policy reforms, to industry-specific business strategies. Drawing on national IP and other statistical data, broken down to the greatest extent possible, it seeks to quantify the importance of the different growth forces. The analysis distinguishes between the different types of patent rights (invention patents, design patents, utility models) and considers, in particular, the patenting behavior of foreign (both non-resident as well as foreign firms established in China) versus domestic applicants. To the extent available data allow, the analysis would also try to quantify the contribution of patenting firms to overall economic output.

2) What role does patent protection play in the business strategies of Chinese companies?

One key rationale for patent protection is to enable firms to appropriate their investments in research and development (R&D), by preventing the copying of inventions. However, many firm surveys from high-income countries have revealed that the importance of patent rights as an appropriation mechanism differs significantly across industries. In addition, evidence from high-income countries suggests that companies' strategies have much evolved in recent decades, including motivations of licensing, preempting litigation, blocking competitors, negotiating cross-licenses, and others. Drawing on the rich applicant surveys conducted by SIPO, this component of the study will seek to gain empirical insight into the patenting strategies of Chinese companies and, to the extent possible, compare the evidence for China to that available for other countries.

3) What determines patenting by Chinese companies abroad?

Chinese companies have rapidly increased their patent filings abroad. However, there is little systematic study of Chinese foreign-oriented patent families. Moreover, evidence on what determines Chinese companies' decisions to seek patent protection in different countries is missing. Drawing on national IP and other statistical data as well as WIPO's international patent family database, the objective is to map and explain Chinese patenting behavior abroad. The analysis will pay particular attention to the role of the Patent Cooperation Treaty System (PCT) in the overseas patenting strategies of Chinese applicants.²

² The PCT is an international treaty, administered by WIPO. The PCT system facilitates the filing of patent applications worldwide and makes it possible to seek patent protection for an invention simultaneously in each of a

The first two of the above research streams are the focus of the study "*Patents Role in Business Strategies: Research on Chinese Companies' Patenting Motives, Patent Implementation and Patent Industrialization*" prepared by the Intellectual Property Development and Research Center, SIPO which has also been submitted to the Thirteenth Session of the CDIP (CDIP/13/INF/8). Based on the patent surveys in China from 2008 to 2012, this research examines the role patents play in Chinese companies' business strategies and operations and attempts to identify the factors affecting patent application, implementation and industrialization.

The third research stream is the focus of this underlying study by WIPO's Economics and Statistics Division.

OBJECTIVE OF THIS STUDY

While significant economic studies have been devoted to the rise of domestic patenting in China, this is the first study of its kind focusing on Chinese patent filings across foreign IP offices.

The objective of this study is to describe and analyze Chinese patenting abroad by using WIPO's foreign-oriented patent family dataset (see Box 1 for an explanation of patent families versus foreign-oriented patent families). It offers descriptive statistics and econometric evidence on the observed increase in Chinese foreign patenting and its drivers.

The study has five parts uncovering the main trends of Chinese patent filings abroad, studying which foreign countries are mostly targeted, which applicants are most active, in which technology fields, and the role of the PCT in these patent filings abroad. A glossary in Appendix 3 describes the main technical terms in use.

large number of countries by first filing a single "international" patent application. The granting of patents, which remains under the control of the national or regional patent offices, is carried out in what is called the "national phase" or "regional phase". See <http://www.wipo.int/pct/en/> for more information on the PCT.

Box 1: Patent families explained

Patent family: A set of interrelated patent applications filed in one or more countries/jurisdictions to protect the same invention. Applicants often file patent applications in multiple jurisdictions, thus resulting in some inventions being recorded more than once. In order to take this factor into account, WIPO has developed indicators related to so-called patent families, which are defined as a set of patent applications interlinked by – or by a combination of – priority claim, PCT national phase entry, continuation, continuation-in-part, internal priority, addition or division. In this publication, patent families include both families associated with patent applications for inventions and patent families associated with utility model applications.

Foreign-oriented patent families: This is a special subset of patent families having at least one filing office that is different from the applicant's origin. Some foreign-related patent families include only one filing office, as applicants may choose to file directly with a foreign office. For example, if a Chinese applicant files a patent application directly with the USPTO (without previously filing with the SIPO), that application, and applications filed subsequently with the USPTO, form a foreign-oriented patent family. By contrast, domestic patent families are patent families that have only one filing office that is the same as the first-named applicant's country of origin.

Source: WIPO (2013). See also the Glossary in Appendix 3.

This study has been prepared by the WIPO Secretariat in close coordination with SIPO. The study has been discussed by experts at two workshops. First, the participants in the WIPO “Experts’ Meeting on Intellectual Property and Socio-Economic Development”, December 3 and 4, 2013 provided feedback on a previous draft of the study.

Second, an “Experts’ Meeting on Intellectual Property and Socio-Economic Development” jointly organized by WIPO and SIPO has been organized in Beijing on March 25, 2014 to present the findings of this study in China to the relevant stakeholders and to obtain further feedback on the study’s preliminary findings (see Appendix 1 for the workshop agenda).³

In addition, in the context of this mission to China, meetings with Chinese IP-intensive firms in Shenzhen (China) took place to further deepen the analysis proposed in this study. By the help of a structured interview guide on international IP filing strategies, useful data and information could be garnered to validate and further deepen the analysis proposed in the WIPO study. The results of these company visits and the data they generated will inform a future version of this study.

³ http://www.wipo.int/meetings/en/details.jsp?meeting_id=32662.

METHODOLOGY

The international patenting behavior in China is analyzed by the construction and use of a dataset of foreign-oriented patent families by Chinese residents based on the WIPO IP Statistics Database and the PATSTAT database (April 2013 edition). Unpublished patent applications, e.g., patent applications withdrawn before publication, and provisional applications are not included in the patent family count. The dataset includes only “foreign-oriented” patent families with at least one patent application outside of SIPO within a family.

In addition the database has the following features: (i) each “first-filed” patent application forms a patent family; all subsequent patent filings are added to that family, and (ii) one patent application may belong to more than one patent family due to the existence of multiple priority claims. Moreover, PCT international filings are excluded, as they represent merely an interim step to secure protection abroad. Names of the first applicants are cleaned and harmonized to be able to group patent families under a specific name. Unique patent applicants are identified among companies, universities and research institutes, but not among individuals due to the prevalence of identical names among individual applicants. Finally, applications are grouped by WIPO’s International Patent Classification (IPC)-technology concordance (see part 4 for more details).

The final dataset covers the period of 1970-2012. Yet, given that there is a minimum delay of 18 months between the application and the publication date, and the maximum of 30 months delay before applicants file abroad through the PCT system, 2009 is the latest available year for which complete foreign-oriented patent family data exist. To calculate aggregate statistics we opt to include the years of 2010-2012 (approximately 10,000 patent families and about 1/6 of the dataset) together with the rest of the data on patent families because there is no reason to believe that a certain applicant or a group of applicants is more incomplete compared to others. However, when we calculate annual statistics we stop at the year 2009.

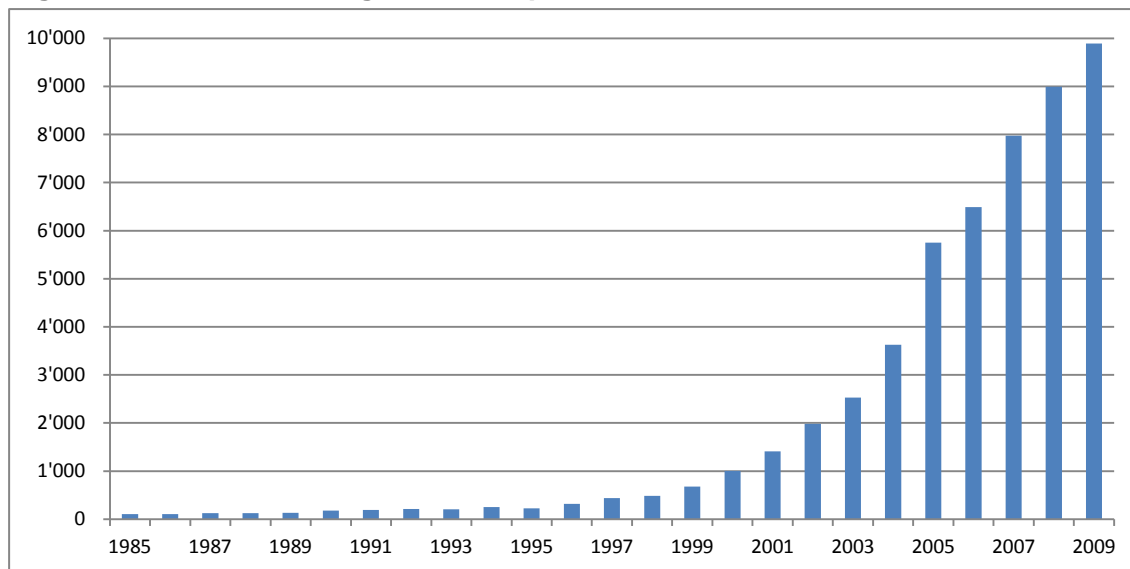
The following five sections present the results of this study so far.

1. THE SURGE OF CHINESE FOREIGN-ORIENTED PATENT FAMILIES AS OF 2004

The growth of Chinese patent filings abroad increased significantly after the year 2000 (see Figures 1.1 and 1.2). At that point the five-year average annual growth rate increased to almost 40% between 2000 and 2005, up from 24% between 1995 and 1999. Having reached significant levels, the five-year average growth rate of foreign-oriented patent families

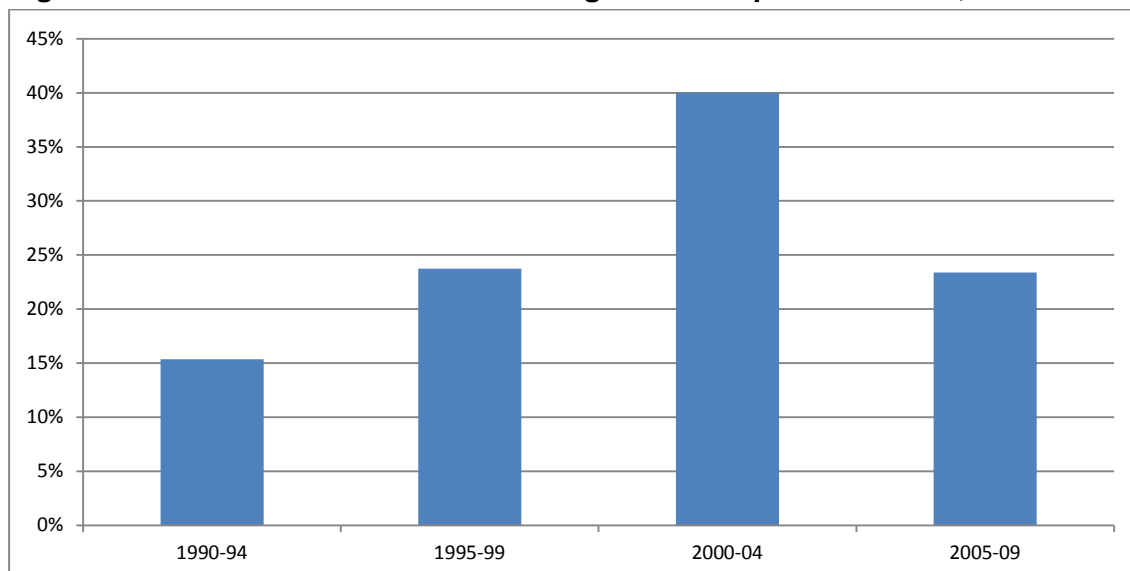
decreased to 23% since 2005. In absolute terms this still translates to an increase of these patent families by approximately 1,000 every year.

Figure 1.1. Chinese foreign-oriented patent families, 1985-2009



Source: WIPO IP Statistics Database.

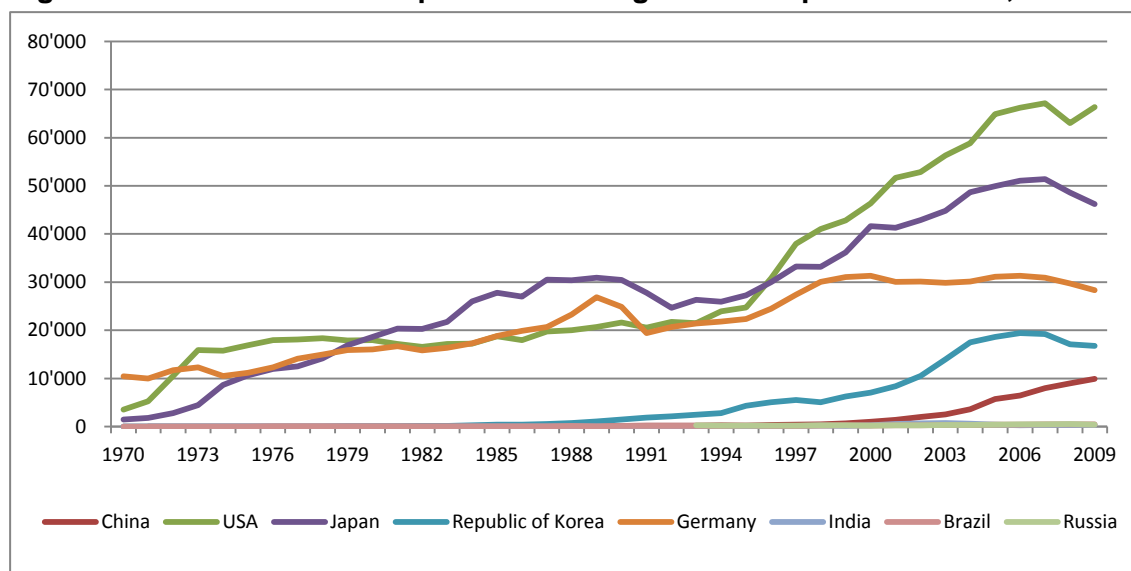
Figure 1.2. Growth rates of Chinese foreign-oriented patent families, 1990-2009



Source: WIPO IP Statistics Database.

While in the beginning of the 1990s the total number of Chinese foreign-oriented patent families was on par with the number of those of residents of other fast-growing middle-income economies, by the end of the 1990s China decoupled and started to emerge as major player in terms of international patenting as compared to, for instance, Brazil, Russia, India, South Africa and others (see Figure 1.3).

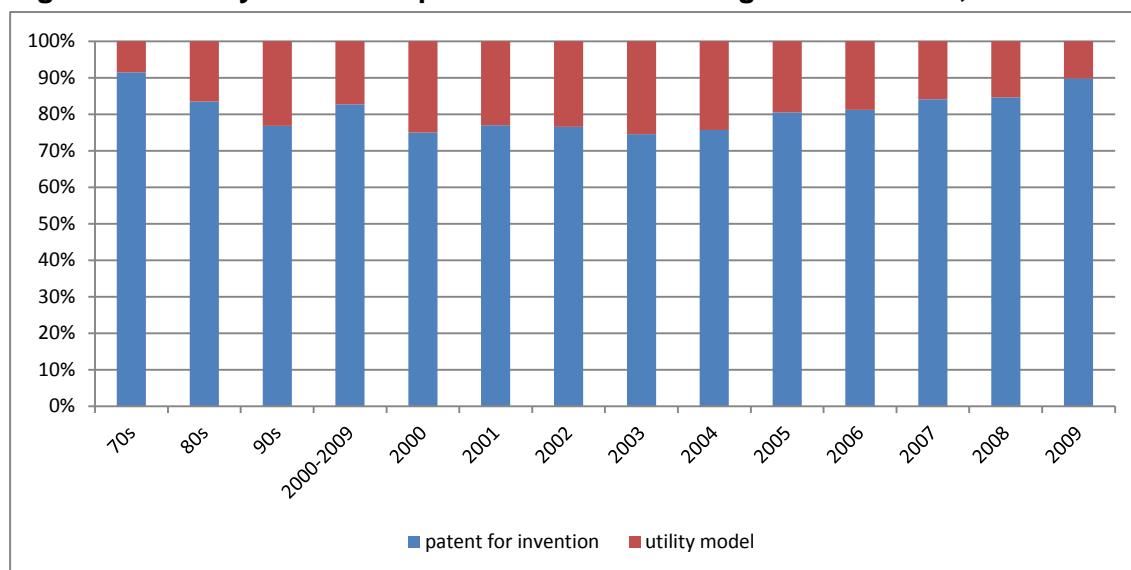
Figure 1.3. International comparison of foreign-oriented patent families, 1970-2009



Source: WIPO IP Statistics Database.

Today more than 80% of foreign-oriented patent families by Chinese residents are associated with invention patent applications (see Figure 1.4). The share of families associated with utility model (UM) applications had grown from less than 9% on average in 1970s to more than 23% on average in the 1990s. But from 2003 onwards the share of invention patent applications has grown, reaching almost 90% of total foreign-oriented patent family applications in 2009. This compares to 97% in the US, to 98% in the Republic of Korea, to 99% in Japan and to 94% in Germany. This also compares to the fact that the share of domestic patent families by Chinese residents associated with invention patents is only 40%, with the remainder being domestic patent families started through a UM application.

Figure 1.4. Utility model and patent for invention originated families, 1970-2009

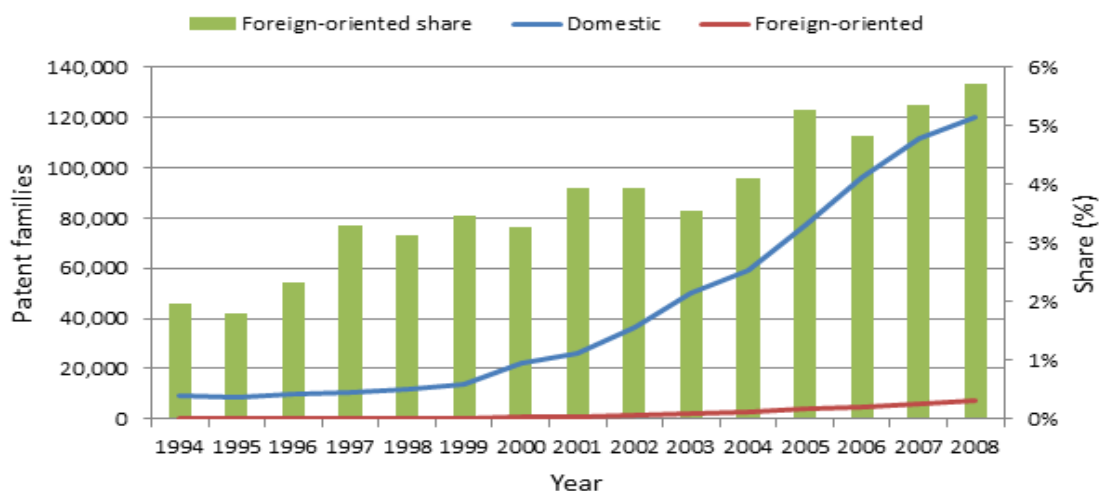


Source: WIPO IP Statistics Database.

That said, the share of Chinese patents which get filed abroad is still a fraction of total patents filed at home. According to the assembled data the total number of Chinese foreign-oriented patent families within the period of 1985-2012 equals 64,969. Within the same period there have been 2,604,707 domestic patent families applied by Chinese residents. In both cases, this includes UM-based applications.

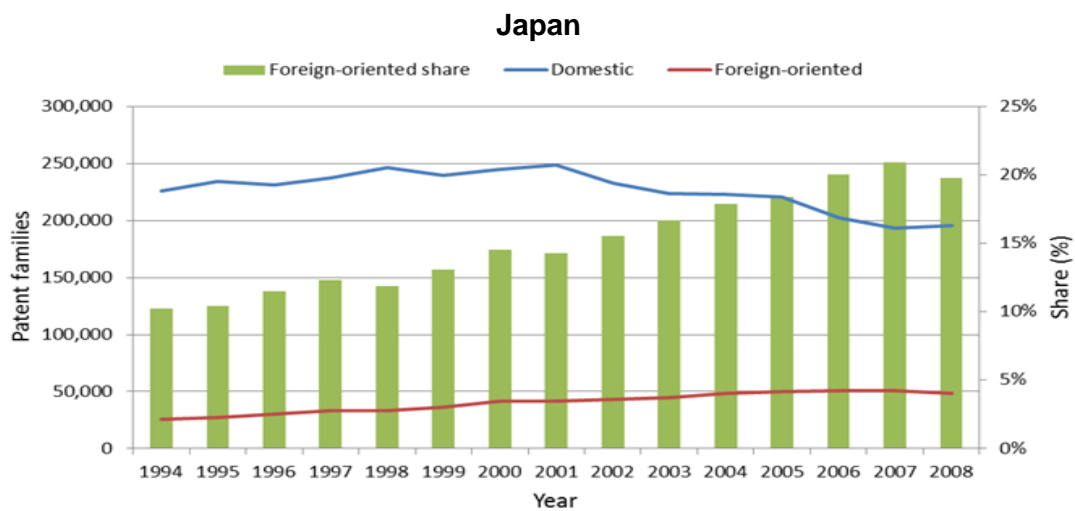
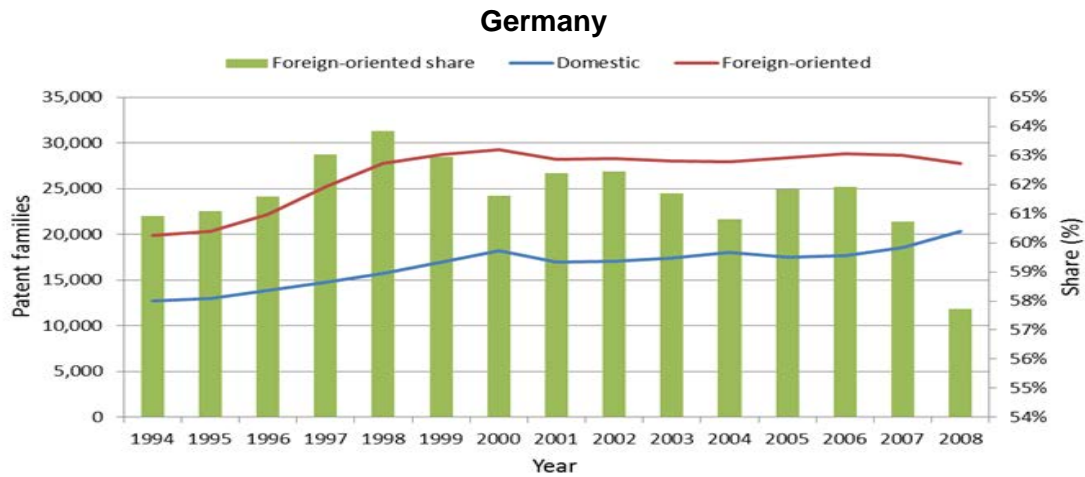
One can narrow this comparison down further to invention patents to have more comparable figures. As shown in Figure 1.5, roughly speaking, for every 16 domestic families starting with an invention patent, there is one foreign-oriented patent family – of which each might contain several patents in multiple jurisdictions. In other words, the share of foreign-oriented in all patent families by Chinese residents is between 5 and 6%. Relative to the growth of domestic patent families, the growth of foreign-oriented families has been much faster on average, admittedly from a lower level.

Figure 1.5. Growth rates of Chinese domestic patent families, 1994-2008



When comparing to high-income countries such as Germany, Japan or the US it becomes apparent that these countries have significantly higher shares of foreign-oriented to total patent families (see Figures 1.6-1.8). In the case of Germany with around 60%, and the US with around 50% – but less so Japan with less than 20% - the wedge between domestic and foreign-oriented patent families in terms of volume and growth is also significantly smaller in these high-income economies.

Figures 1.6-1.8. Domestic and foreign-oriented patent families compared, selected high-income countries, 1994-2008, left axis is the number of domestic and foreign-oriented patent families (blue and red line), right axis is the share of foreign-oriented in total families (green bars).



The next section describes the main destinations of Chinese patents abroad.

2. DESTINATIONS OF FOREIGN-ORIENTED PATENT FAMILIES BY CHINESE RESIDENTS

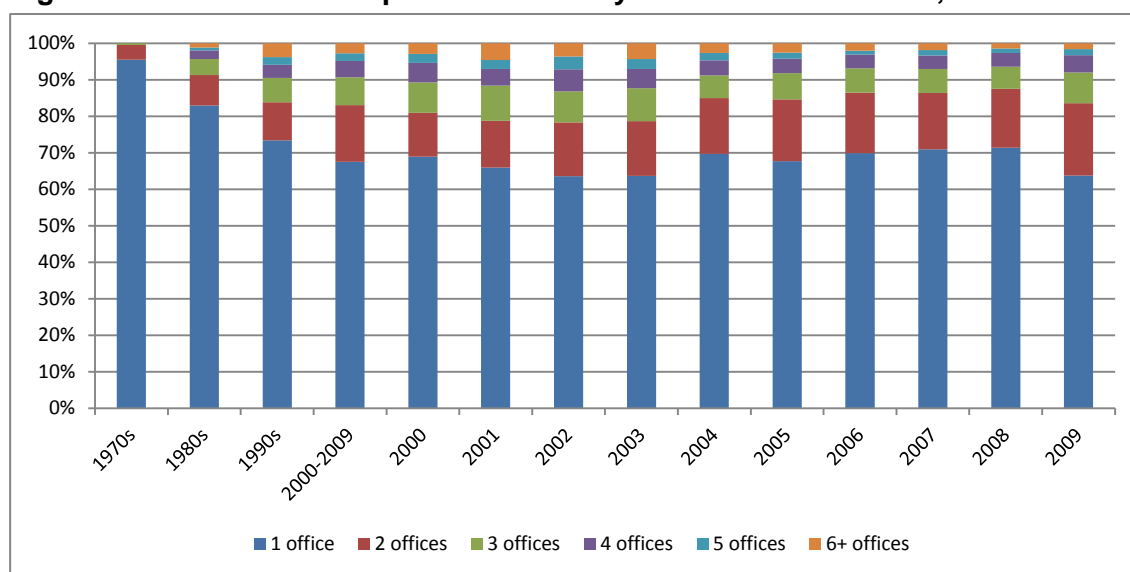
Foreign-oriented patent families can target one or several jurisdictions worldwide. The amount and location of foreign jurisdictions in which a firm or an inventor will file for patent protection depends on many factors, most notably on (i) where an inventor's main markets are, (ii) where an inventor's competitors and potential imitators are, (iii) where an inventor might decide to assemble his or her products, and other business and strategic considerations. Clearly, the industry sector or the technology field for which the patents are applicable matter greatly as well.

Despite the important rise of foreign-oriented patent families by Chinese residents, still the majority of foreign-oriented patent families by Chinese residents, and thus about 70%, target just one foreign IP office (see Figure 2.1).⁴ This is in contrast to Japan and the Republic of Korea where foreign-oriented families with two foreign offices have the largest shares among total foreign-oriented patent families, while the shares of patent families with just one foreign office are small (17% in Japan and 15% in the Republic of Korea). Foreign-oriented patent families emanating from the US or Germany with only one foreign office as target are also of lesser relative importance than in China with respectively 39% and 38% of total foreign-oriented patent families.

That said, over time, the share of Chinese foreign-oriented patent families with more than one foreign office has increased – from about 5% in the 1970s to 36% in 2009. While among these families, the majority is still with two patent offices (about 55%, or 1848 patent families), and not more, a considerable share also targets three (23%, or 782 patent families) and four offices (13%, or 441 patent families).

⁴ This figure excludes patents also filed in Hong Kong (China) and Taiwan (Province of China).

Figure 2.1. Distribution of patent families by the number of offices, 1970-2009



Source: WIPO IP Statistics Database.

More than 80% of Chinese foreign-oriented patent families in 1970-2012 include at least one patent application with USPTO, EPO, or JPO. The share of triadic patent families (USPTO, EPO, and JPO) is approximately 7% and the share of families that include applications at five patent offices (USPTO, EPO, JPO, KIPO, and SIPO) is around 3% (see Table 2.1 for details). Interestingly, more recently and for the time span 2005 to 2009, the above shares have rather dropped rather than increased. The share of patents offices with at least one application with USPTO, EPO or JPO has for instance dropped from about 81% to 72% (see Table 2.1). The same is true for the other IP office combinations seen in this table.

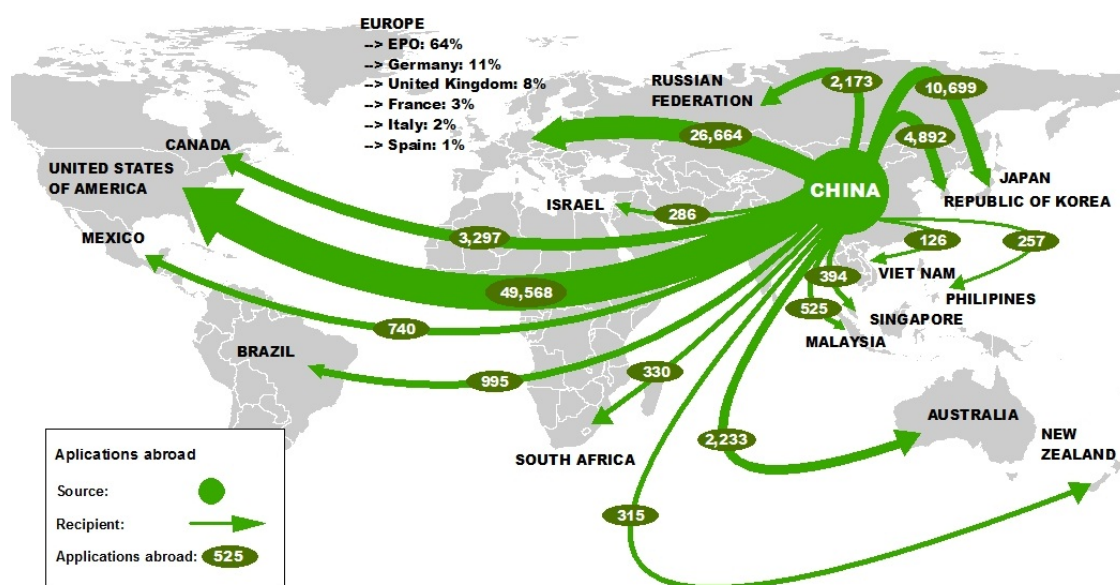
Table 2.1. Foreign-oriented Chinese patent families with a minimum of foreign IP offices, 1970 to 2012 and 2005-2009

Patent offices within a family	Number 1970-2012	Percentage share 1970-2012	Number 2005-2009	Percentage share 2005-2009
Triadic (USPTO, EPO, and JPO)	4,561	7.0%	1,770	4.5%
5-offices (USPTO, EPO, JPO, KIPO, and SIPO)	1,952	2.99%	584	1.5%
At least one application with USPTO, or EPO or JPO	52,828	80.9%	28,006	71.6%
Total	65,340	100.0%	39,098	100.0%

Source: WIPO IP Statistics Database.

In terms of absolute numbers, the majority of patent applications from China that form the foreign-oriented patent families in our dataset target the US with close to 50,000 patent applications based on available data between 1970 and 2012, followed by Europe, Japan, the Republic of Korea, and Canada (see Figure 2.2). A significant number of patent applications also target Australia, and the Russian Federation. In comparison fewer applications target Brazil or other Asian economies.

Figure 2.2. Chinese patent filings abroad, cumulated to top IP offices, 1970-2012



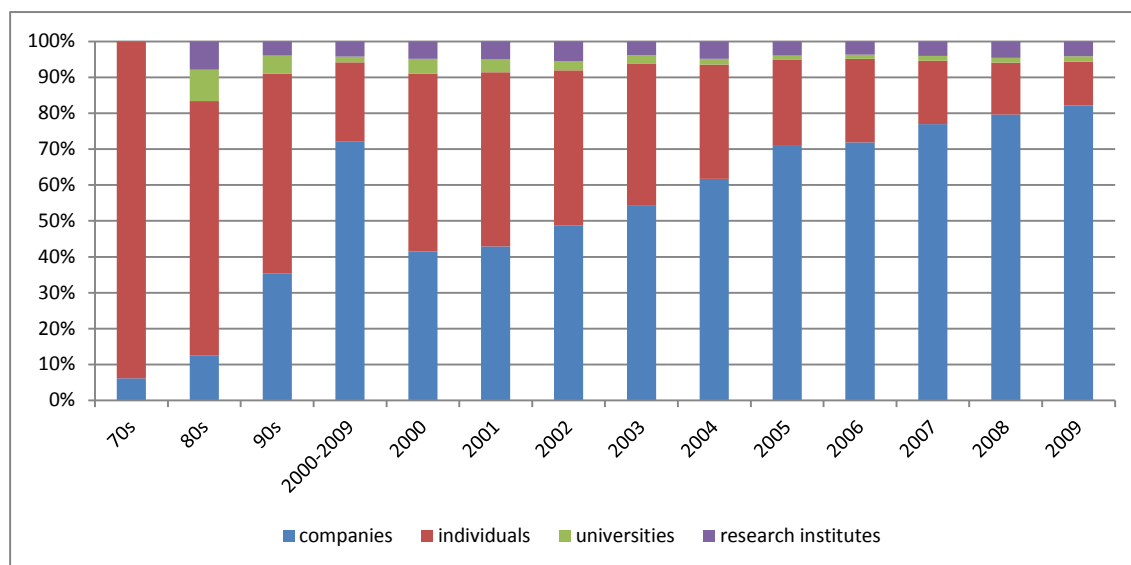
Source: WIPO IP Statistics Database.

To determine whether a certain group of patent applicants is responsible for the growth in foreign patenting from China, the next section divides the patent families by the type of applicants (i.e., company, individual, and university or research institute) and by field of technology.

3. APPLICANT TYPES: ACTORS, TECHNOLOGY FIELDS AND SECTORS

Almost 70% of foreign-oriented patent families by Chinese residents are owned by companies. As Figure 3.1 shows the share of companies in total foreign-oriented patent families has been rapidly growing between 1970 and 2009; indeed more than doubling every decade. At the same time, the share of individuals has been declining. The share of universities and research institutes in total foreign-oriented patent families is about 6%, which is similar to Republic of Korea (about 6%), and somewhat bigger if compared to the US (about 2%), Japan (less than 1%), and Germany (about 1%).

Figure 3.1. Distribution of Chinese foreign-oriented patent families by applicant type, 1970-2009



Source: WIPO IP Statistics Database.

In the next sections the foreign-oriented patent families by Chinese residents are analyzed as to their field of technology. The WIPO IPC-technology concordance table can be used to convert IPC symbols into corresponding fields of technology and sector.⁵ This concordance table helps determine which technology fields are the most represented in Chinese patent filings abroad. The 35 possible technology fields are grouped into the broad five technology classes: *Electrical engineering, Instruments, Mechanical Engineering, Chemistry, and Other fields*. One patent family can belong to more than one technology field.⁶ Also, there are 1,616 patent families in this dataset with missing information on their technology fields.

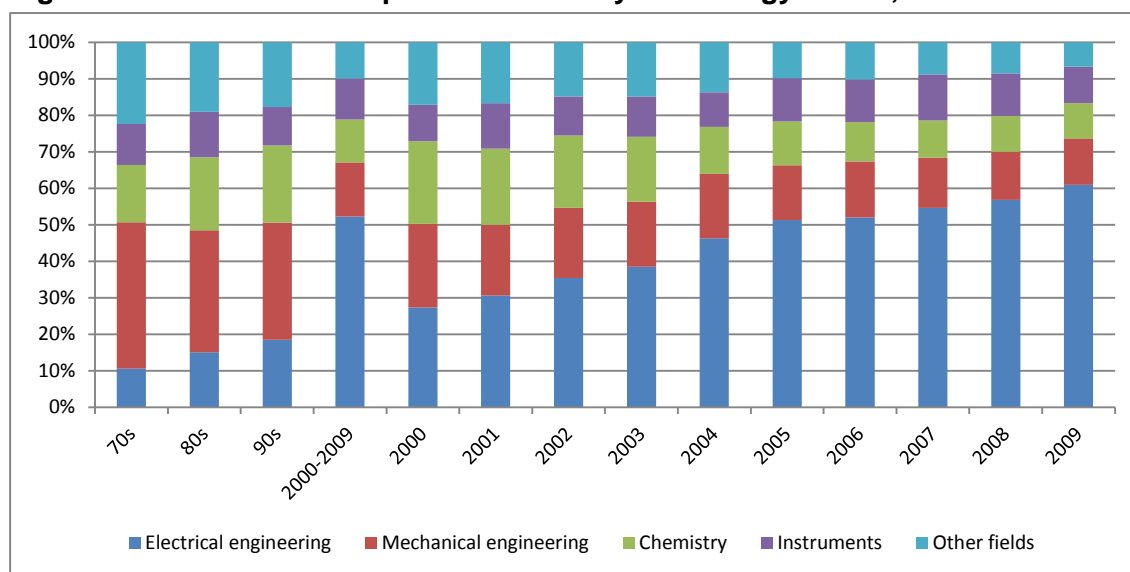
Based on this methodology it is found that more than 50% of foreign-oriented patent families by Chinese residents belong to the “Electrical Engineering”-class. Figure 3.2 shows that the “Electrical Engineering”-class had one of the smallest shares in earlier years. Nonetheless, it has since been growing steadily, making up for the biggest share of foreign-oriented patent families in 2000-2009. The shares of other technology classes have rather been declining over the last 10 years. This is valid except for the “Instruments”-class. And while “Mechanical engineering” and “Chemistry” have declined they still make up for a considerable share, almost 23% taken together in 2009 to be precise.

⁵ See the concordance table at

http://www.wipo.int/ipstats/en/statistics/technology_concordance.html and Schmoch (2008).

⁶ Fractional counting of technology fields is used for such families, where the percentage share of every field in a family is known.

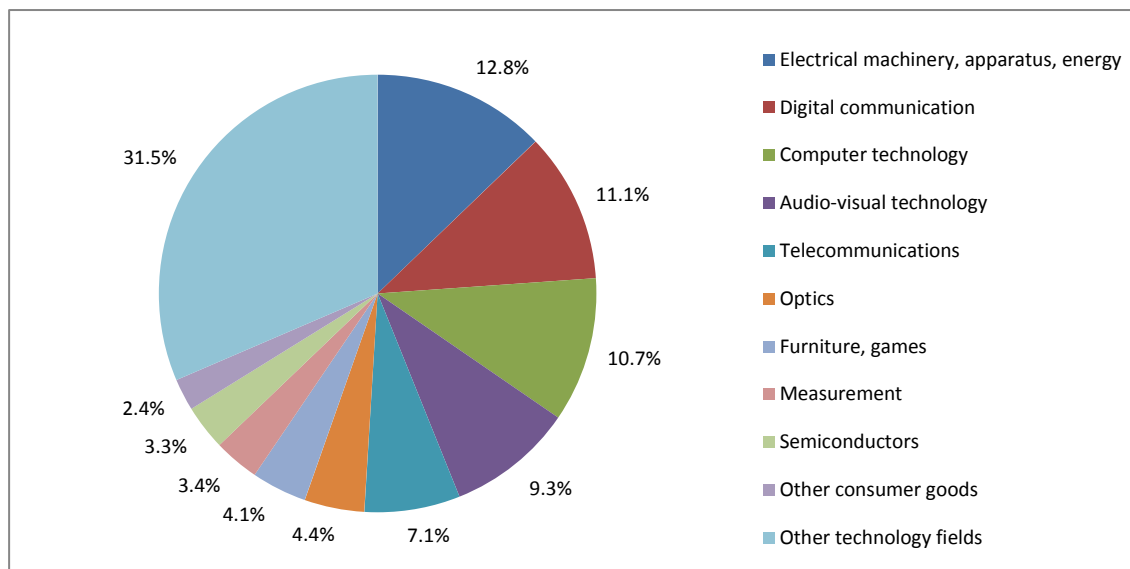
Figure 3.2. Distribution of patent families by technology sector, 1970-2009



Source: WIPO IP Statistics Database.

Going deeper, it is found that the ICT sector has the largest number of foreign-oriented patent families, with roughly one fourth of all patent families from China (25% within the whole period of 1970-2012, and 29% in 2005-2009). Figure 3.3 shows the top ten technology fields among foreign-oriented patent families by Chinese residents. The top five technology fields belong to the fastest growing “Electrical engineering”-class of patent families with “Electrical machinery, apparatus, energy” having the biggest share in total families (13%), followed by “Digital communication” (11%) and “Computer technology” (11%).

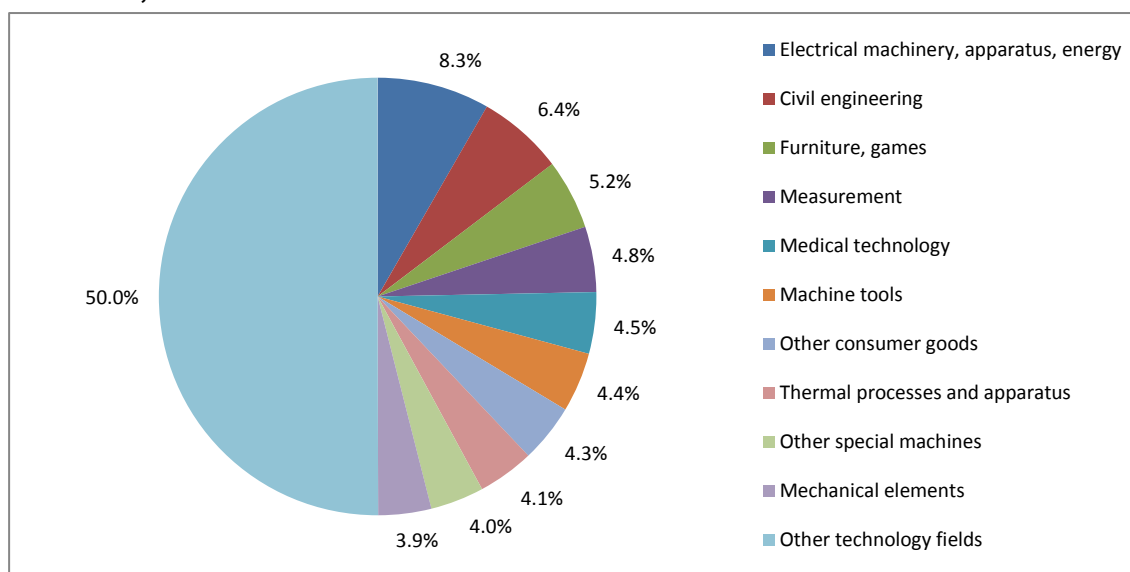
Figure 3.3. Top ten technology fields among foreign-oriented patent families by Chinese residents, 2005-2009



Source: WIPO IP Statistics Database.

The top technology fields among foreign-oriented patent families and domestic patent families overlap only partially. Specifically, only four out of the top ten technology fields are the same among foreign-oriented and domestic patent families groups (i.e., “Electrical machinery, apparatus, energy”, Furniture, games,” “Measurement”, and “Other consumer goods”) (compare Figures 3.3 and 3.4).

Figure 3.4. Top ten technology fields among domestic patent families by Chinese residents, 2005-2009

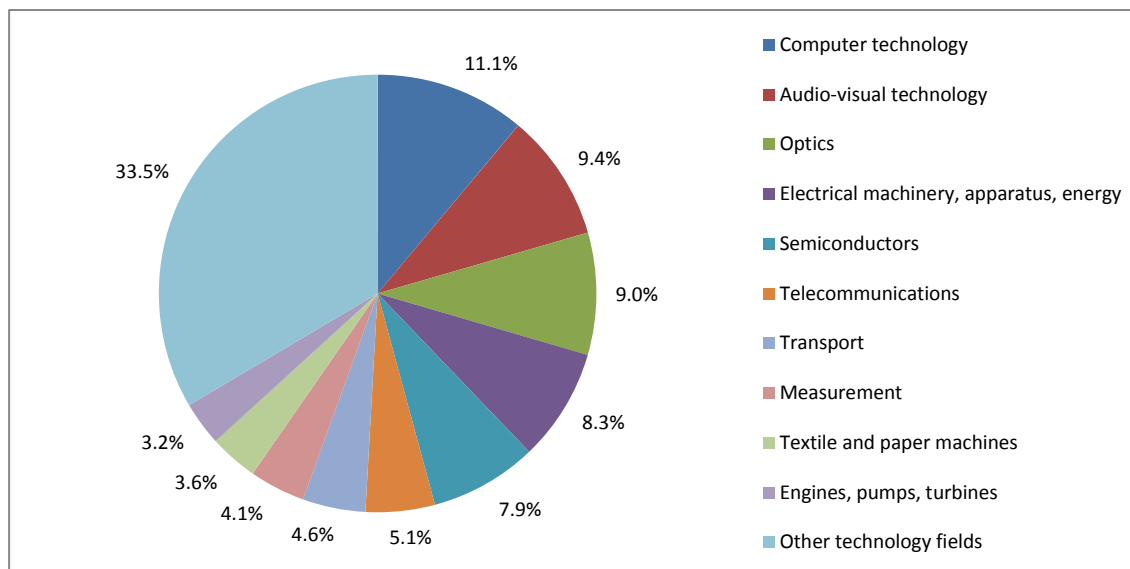


Source: WIPO IP Statistics Database.

Comparing to other countries again, China has a very similar “portfolio” of foreign-oriented patent families to those of the Republic of Korea and Japan, but quite a different from those of Western high-income economies such as the US and Germany (see Figures 3.5 –3.8).

Seven out of top ten technology fields for Chinese foreign-oriented patent families are also among top ten technology fields for Japanese foreign-oriented patent families (see Figure 3.5). The “Transport”, “Textile and paper machines”, and “Engines, pumps, turbines”-technology fields are among the top ten for Japan, but not for China.

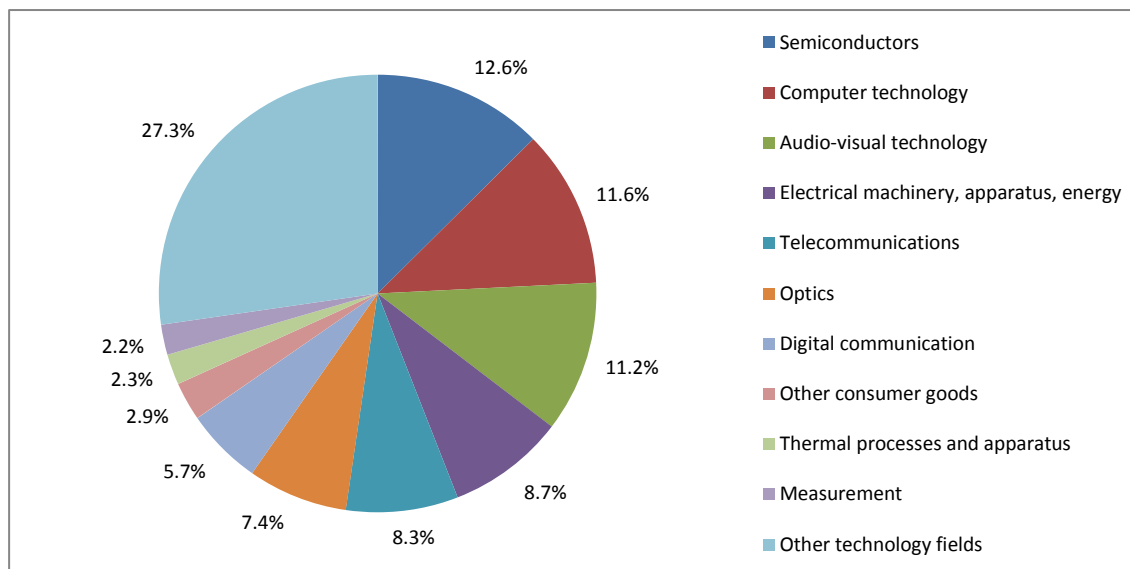
Figure 3.5. Shares of Japanese foreign-oriented patent families by technology field, 2005-2009



Source: WIPO IP Statistics Database.

Nine out of top ten technology fields for Chinese foreign-oriented patent families are also among top ten technology fields for foreign-oriented patent families of residents of the Republic of Korea (see Figure 3.6). Only the “Thermal processes and apparatus”-technology field is among the top ten for Republic of Korea, but not for China.

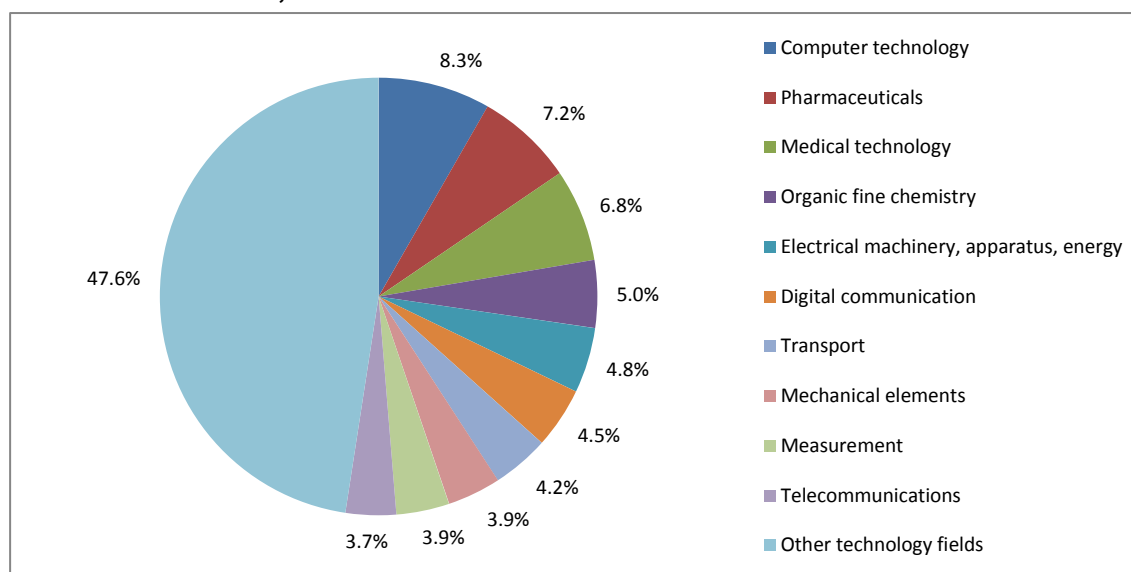
Figure 3.6. Share of Korean foreign-oriented patent families by technology field, 2005-2009



Source: WIPO IP Statistics Database.

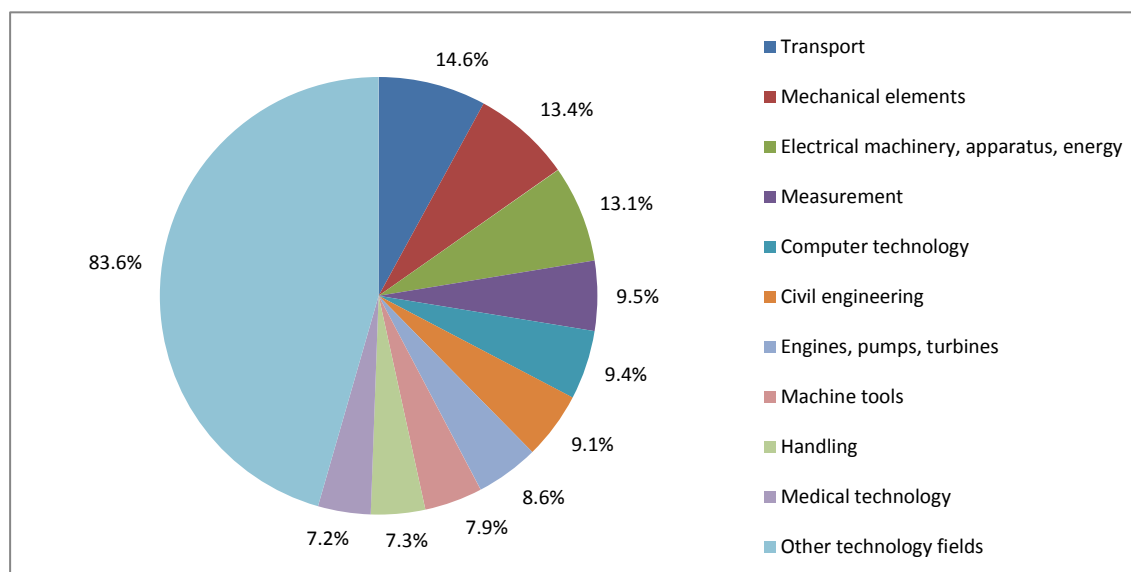
Only five out of top ten technology fields for Chinese foreign-oriented patent families are also among top ten technology fields for the US, namely “Computer technology” “Electrical machinery, apparatus, energy”, “Digital communication”, “Measurement”, and “Telecommunications” (see Figure 3.7). Only three technology fields among top ten technology fields are the same for Germany and China (i.e., “Electrical machinery, apparatus, energy”, “Measurement”, and “Computer technology” fields) (see Figure 3.8).

Figure 3.7. Top 10 technology fields among foreign-oriented patent families by the residents of the US, 2005-2009



Source: WIPO IP Statistics Database.

Figure 3.8. Share of German foreign-oriented patent families by technology field, 2005-2009

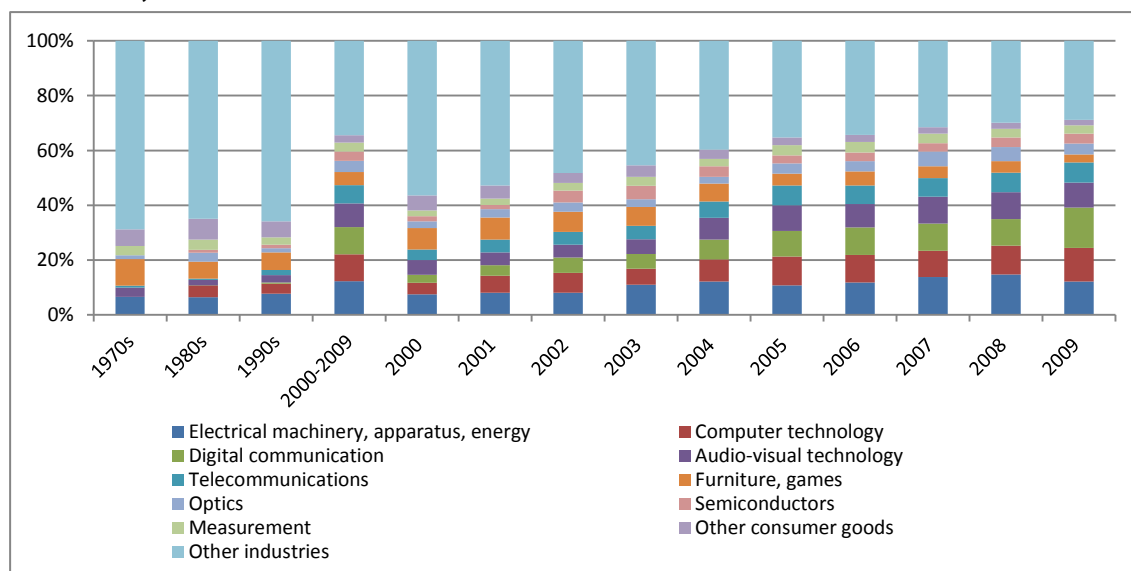


Source: WIPO IP Statistics Database.

In the case of Chinese patents filed abroad, the share of the top ten technology fields among total patent families almost doubled in the last decade (from 34% in the 1990s to 66% in the decade following) with “Electrical machinery, apparatus, energy”, “Digital communication”, “Telecommunications”, “Audio-visual technology” and “Computer technology” having the highest annual growth in 2000-2009. In other words, Chinese foreign-oriented patent families are ever more concentrated in a small number of technologies fields, and this despite the considerably

more important volume of total Chinese patents filed abroad in recent years (see Figure 3.9 and Table 3.1 for the growth rates of technology fields among foreign-oriented patent families).

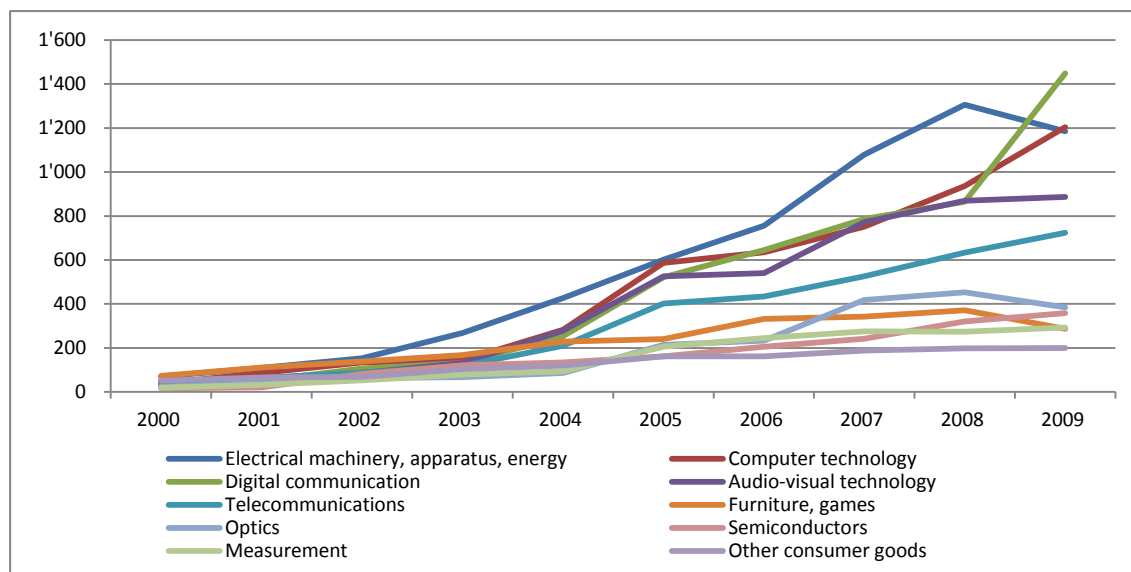
Figure 3.9. Top 10 technology fields among foreign-oriented patent families by Chinese residents, 1970-2009



Source: WIPO IP Statistics Database.

In terms of growth, “Digital communication” is the fastest growing technology field among Chinese foreign-oriented patent families between 2000-2009, followed by computer technology, nanotechnology, semiconductors and telecommunications (see Figure 3.10. and Table 3.1). That said, some of the fastest-growing fields such as nanotechnology or semiconductors are growing fast only from very low initial levels.

Figure 3.10. Annual number of patent families for the top ten technology fields, 2000-2009



Source: WIPO IP Statistics Database.

Table 3.1. Compound annual growth rate (CAGR), technology fields of foreign-oriented patent families of Chinese residents, 2000-2009

technology field	Number of families in 2000	Number of families in 2009	CAGR (2000-2009)
Digital communication	27	1449	55.4%
Computer technology	39	1204	46.5%
Micro-structural and nano-technology	1	19	44.0%
Semiconductors	17	358	40.3%
Telecommunications	37	724	39.2%
Audio-visual technology	50	887	37.6%
Electrical machinery, apparatus, energy	70	1186	36.9%
Optics	23	385	36.8%
Surface technology, coating	10	157	35.8%
Basic communication processes	8	121	35.2%
Measurement	20	293	35.0%
Control	10	151	34.7%
Materials, metallurgy	8	94	30.9%
Textile and paper machines	5	57	30.2%
Mechanical elements	27	222	26.4%
Handling	27	168	22.7%
Chemical engineering	25	152	22.2%
Machine tools	36	214	21.7%
Thermal processes and apparatus	33	189	21.4%
Engines, pumps, turbines	21	110	20.2%
Other special machines	31	159	19.9%
IT methods for management	7	35	19.1%
Analysis of biological materials	4	18	19.0%
Civil engineering	36	166	18.6%
Organic fine chemistry	23	107	18.5%
Basic materials chemistry	23	90	16.6%
Transport	35	135	16.4%
Furniture, games	74	287	16.3%
Other consumer goods	52	199	16.2%
Medical technology	37	134	15.4%
Food chemistry	6	21	15.0%
Pharmaceuticals	40	135	14.3%
Environmental technology	13	40	13.5%
Macromolecular chemistry, polymers	28	58	8.4%
Biotechnology	34	69	8.2%

Source: WIPO IP Statistics Database.

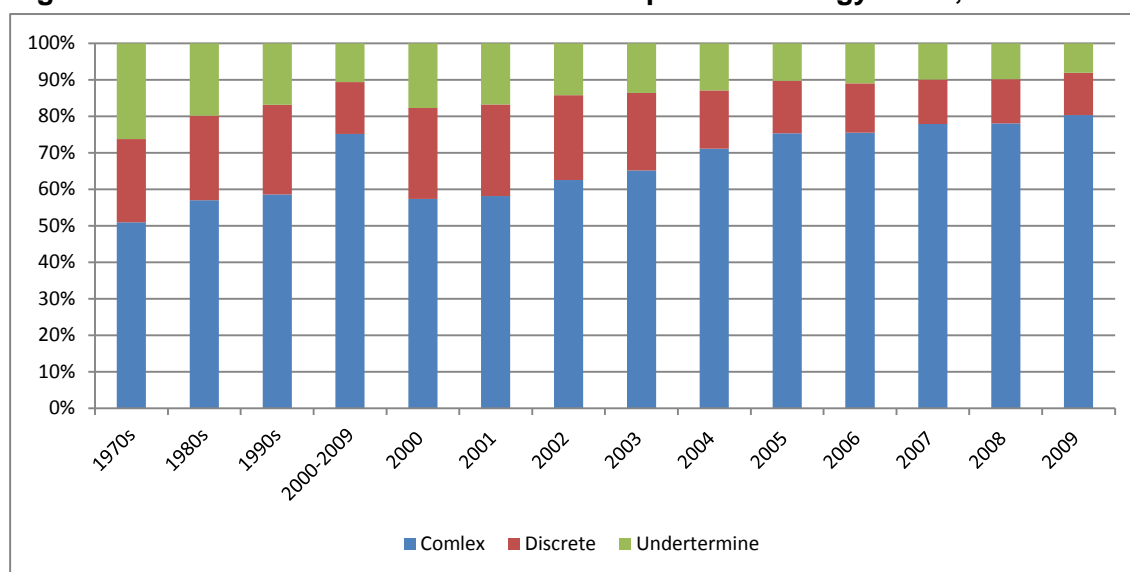
Patent data can be broadly categorized as complex or discrete technologies.⁷ Complex technologies are usually defined as those for which the resulting products or processes consist

⁷ For a definition of complex and discrete technologies, refer to Annex A of the World Intellectual Property Indicators Report 2011, see WIPO (2011), available at: www.wipo.int/ipstats/en/wipi/.

of numerous separately patentable elements and for which patent ownership is typically widespread. Discrete technologies, in turn, describe products or processes that consist of a single or relatively few patentable elements and for which patent ownership is more concentrated. For example, smartphones fall into the category of complex technologies, whereas pharmaceuticals are considered a discrete technology.

The share of “complex” technology fields among all foreign-oriented patent families by Chinese residents has been growing between 1970-2009 making up a 75%-share of total patents abroad on average per annum since 2000 (see Figure 3.11). To the contrary, the share of “discrete” technologies has been shrinking.

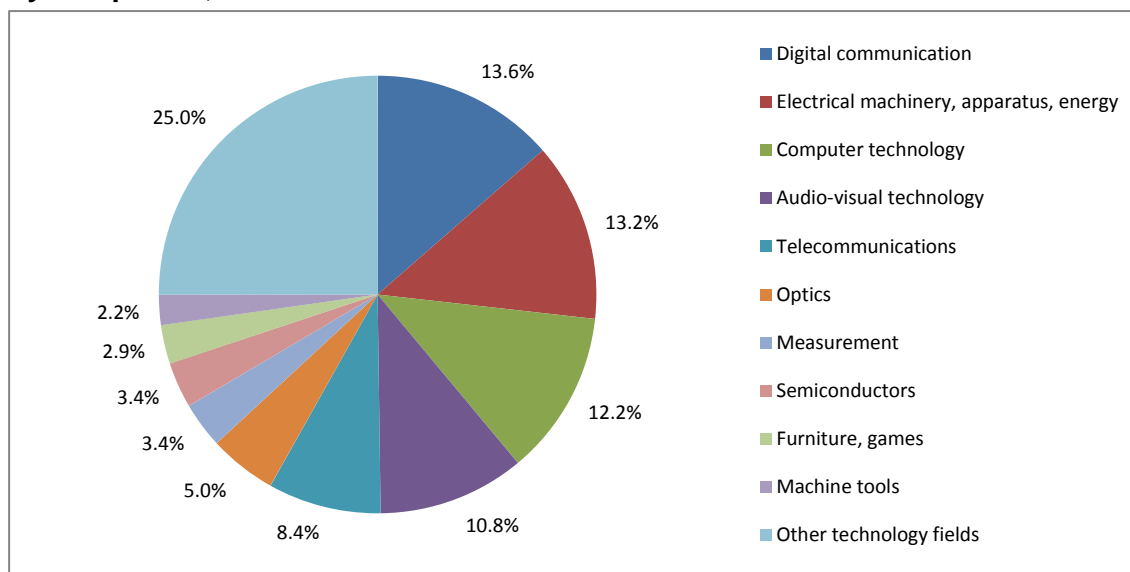
Figure 3.11. Distribution discrete versus complex technology fields, 1970-2009



Source: WIPO IP Statistics Database.

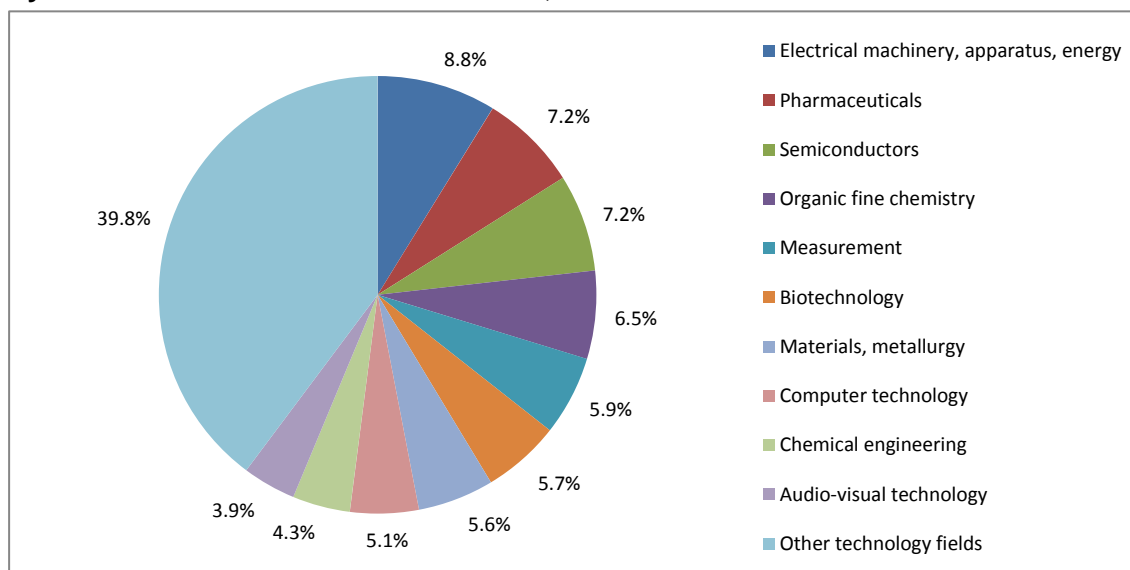
The top ten technology fields of patents filed abroad vary according to the type of Chinese applicants (see Figures 3.12 – 3.15). For companies, “Digital communication”, “Electrical machinery, apparatus, energy”, and “Computer technology” are the most important technology fields in terms of volumes between 2005 and 2009 (see Figure 3.12). This is not surprising given that these are now the fastest-growing technology fields with Chinese companies competing with foreign companies (see Section 4 for the discussion on top patent applicants of Chinese origin). In terms of volume, and with a 25% cumulative share between 2005 and 2009, universities and research institutes in turn have their most important technology fields in “Pharmaceuticals”, “Organic fine chemistry”, “Biotechnology”, “Materials, metallurgy” and “Chemical engineering”, all of which belong to the “Chemistry” class (see Figure 3.13). Remarkably, none of these technology fields makes the top ten technology fields for companies or individuals. As for individuals, while they accumulated large shares in fastest-growing technology fields as well. However, they majority of their foreign-oriented patent families focused on “Other fields” of technology, with “Furniture, games”, “Other consumer goods” and “Civil engineering” all being in the top ten technologies for individual applicants (see Figure 3.14).

Figure 3.12. Top ten technology fields among foreign-oriented patent families originated by companies, 2005-2009



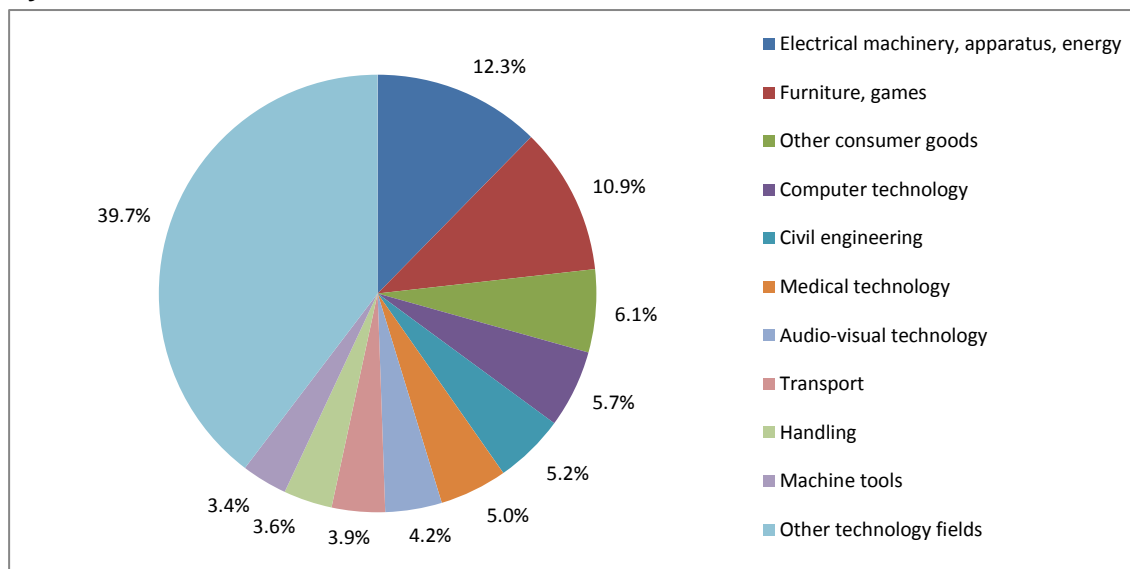
Source: WIPO IP Statistics Database.

Figure 3.13. Top 10 technology fields among foreign-oriented patent families originated by universities and research institutes, 2005-2009



Source: WIPO IP Statistics Database.

Figure 3.14. Top 10 technology fields among foreign-oriented patent families originated by individuals, 2005-2009



Source: WIPO IP Statistics Database.

4. TOP APPLICANTS OF CHINESE ORIGIN

Few Chinese applicants are responsible for a large share of all foreign-oriented Chinese patent families. Specifically, the patents filed abroad of the top 10 applicants make up for 35% of the total volume of foreign-oriented patent families by Chinese residents between 1970 and 2012 (see Table 4.1). If one adds the next 40 top applicants, this percentage increases to close to 45% only, showing the relative importance of these top 10 applicants. If one adds another 50 top applicants, reaching the top 100, this figure only increases to 49%. Moreover, the more recent the years under consideration the more concentrated foreign-patent families are with a few top applicants.

Table 4.1. Concentration ratios for top applicants of foreign-oriented patent families by Chinese residents, 1970-2012 and 2005-2009

Top applicants	Number of families, 1970-2012	Percentage share, 1970-2012	Number of families, 2005-2009	Percentage share, 2005-2009
top 10 applicants	22,925	35.1%	16,925	43.3%
top 20 applicants	25,468	39.0%	18,620	47.6%
top 50 applicants	29,098	44.5%	20,994	53.7%
top 100 applicants	31,688	48.5%	22,597	57.8%
top 500 applicants	37,758	57.8%	26,440	67.6%
total number of families	65,340	100.0%	39,098	100.0%

Source: WIPO IP Statistics Database.

Table 4.2 shows the top 10 applicants by the total number of foreign-oriented patent families. It can be noted that this top 10 list exclusively contains companies, except one university namely Tsinghua University, one of the top research universities of China located in Beijing. Aside from ICT and electronics companies, the top 10 list includes BYD Co Ltd which is a Chinese manufacturer of automobiles and rechargeable batteries based in Shenzhen and China Petroleum & Chemical Corporation, or Sinopec Limited, a Chinese oil and gas company based in Beijing.

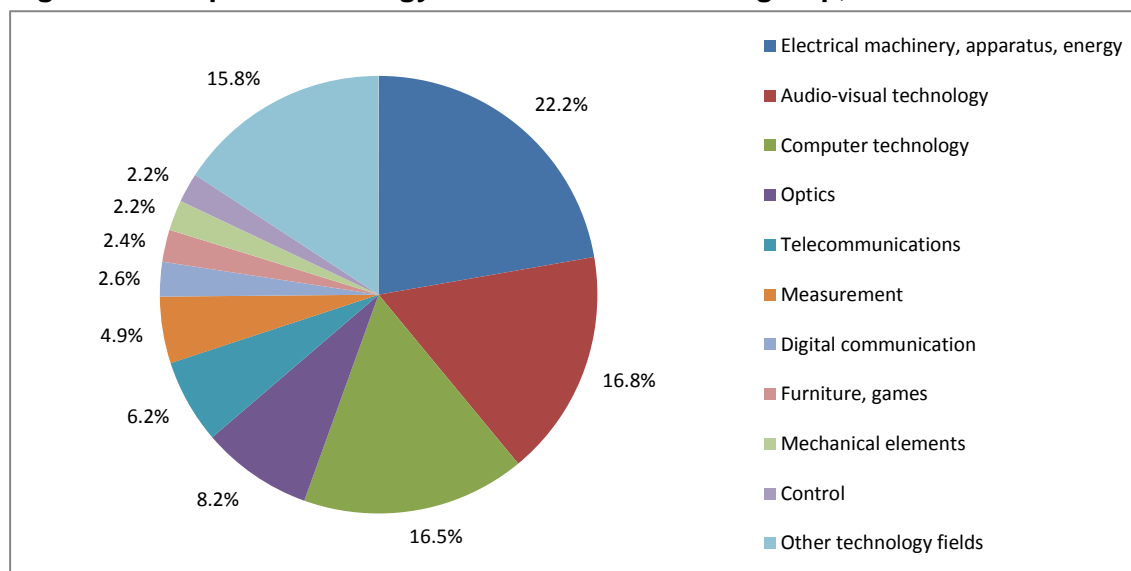
Table 4.2. Top 10 patent applicants by the total number of foreign-oriented patent families, 1970-2012

Rank	Applicant	Category	Number of families
1	HONGFUJIN PRECISION INDUSTRY (SHENZHEN) CO., LTD.	Company	9,076
2	HUAWEI TECHNOLOGIES CO., LTD.	Company	4,729
3	ZTE CORPORATION	Company	2,480
4	SHENZHEN FUTAIHONG PRECISION INDUSTRY CO., LTD.	Company	1,574
5	FOXCONN (KUNSHAN) COMPUTER INTERFACES CO., LTD.	Company	1,529
6	FUZHUN PRECISION INDUSTRY (SHENZHEN) CO., LTD.	Company	1,296
7	TSINGHUA UNIVERSITY	University	955
8	CHINA PETROLEUM & CHEMICAL CORPORATION	Company	543
9	BYD CO., LTD.	Company	387
10	SILITEK ELECTRONIC (GUANGZHOU) CO., LTD.	Company	356

Source: WIPO IP Statistics Database.

Among the first five top applicants, “Hongfujin Precision Industry (Shenzhen) Co., Ltd”⁸, “Shenzhen Futaihong Precision Industrial Co., Ltd”⁹ and Foxconn (Kunshan) Computer Interfaces Co., Ltd are the entities of “Foxconn International Holdings Limited”.¹⁰ Foxconn is one of the world’s largest electronics contract manufacturers. Only within 2005-2009 this holding company accumulated 6,611 patent families in a wide spectrum of technology fields, with more than 50% of its patents in “Electrical machinery, Apparatus, Energy”, “Computer technology” and “Audio-video technology”. Figure 4.1 shows the top 10 technology fields for the largest holder of foreign-oriented patent families, the Foxconn group; “Hongfujin Precision Industry (Shenzhen) Co., Ltd”, “Shenzhen Futaihong Precision Industrial Co., Ltd” and Foxconn (Kunshan) Computer Interfaces Co. are grouped in this graph.¹¹

Figure 4.1. Top 10 technology fields for the Foxconn group, 2005-2009



Source: WIPO IP Statistics Database.

Huawei Technologies Co., Ltd. and ZTE Corporation, both leading Chinese telecommunication equipment providers and major users of the patent system, have similar international patenting strategies (see Figure 4.2). Nevertheless, the number of accumulated patent families differs substantially between the two companies, with as many as 3,526 patent families for Huawei

⁸ Hongfujin Precision Industry Co., a subsidiary of Foxconn, is a company which manufactures Apple's iPhone 5, iPod as well as other products for multinational corporations.

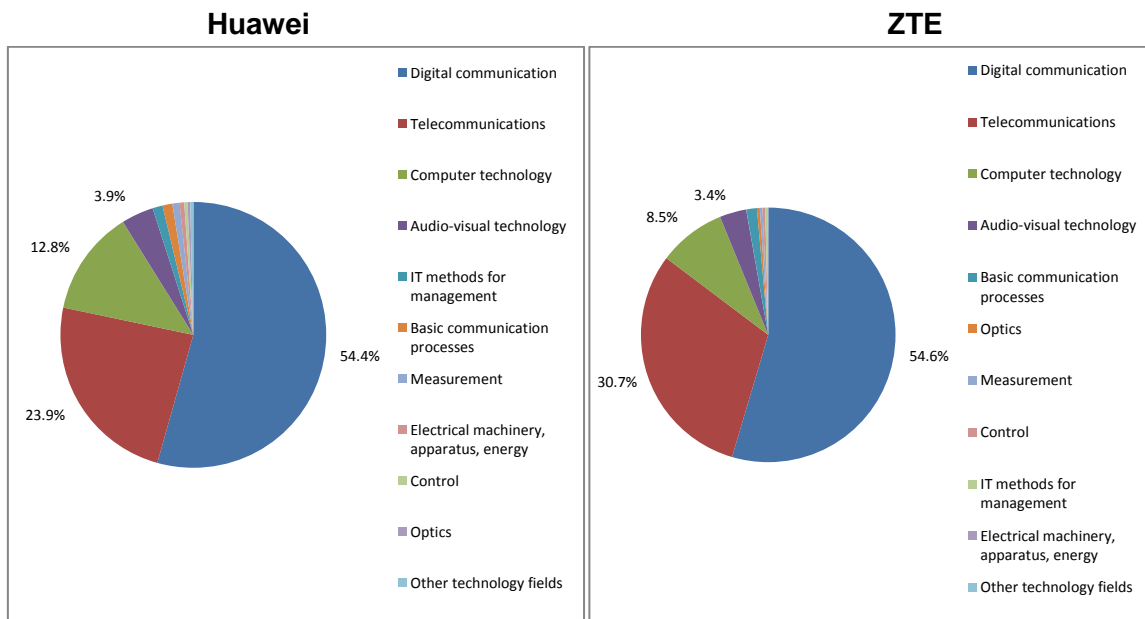
⁹ Shenzhen Futaihong Precision Industrial Co., Ltd. manufactures communication and consumer electrical products.

¹⁰ It must be noted here that this analysis might miss additional internationally-oriented patent families by the Foxconn conglomerate, as the organizational and financial structure, and the ensuing names of all subsidiaries, is not easily available to fully assign all patents back to his holding company. The entities of Foxconn group are marked in grey in the Table 4.2.

¹¹ *Ibid.*

Technologies Co., Ltd. in 2005-09 and 1,687 patent families for ZTE Corporation within the same period. The number of foreign-patent families with at least one PCT filing is 4,373 for Huawei and 2,422 for ZTE within the whole period 1970-2012. It is 3,285 for Huawei and 1,658 for ZTE between 2005-2009. As noted before however, this difference in overall total stocks of PCT filings is decreasing, with ZTE filings more PCT patents than Huawei in recent years. In 2012, ZTE was the top PCT applicant with 3,906 published applications, the highest ever yearly number of PCT applications for one single firm.

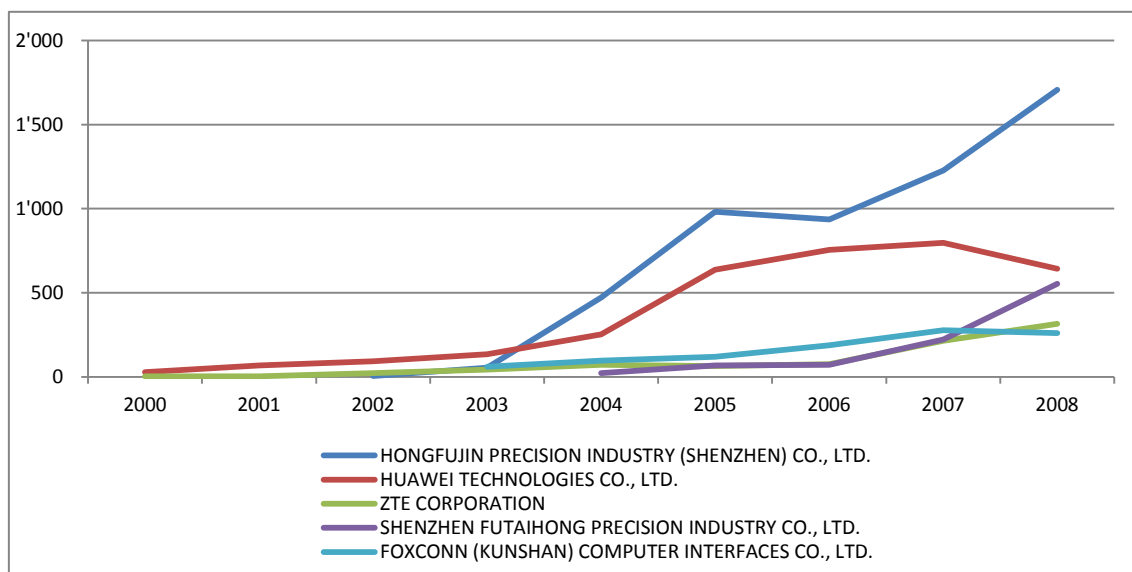
Figure 4.2. Top 10 technology fields for Huawei Technologies Co. and ZTE Corporation, Ltd., 2005-2009



Source: WIPO IP Statistics Database.

When plotting foreign-oriented patent families of the top filers over time, one sees that the five most active filers increased their filing abroad considerably only after 2004 (see Figure 4.3).

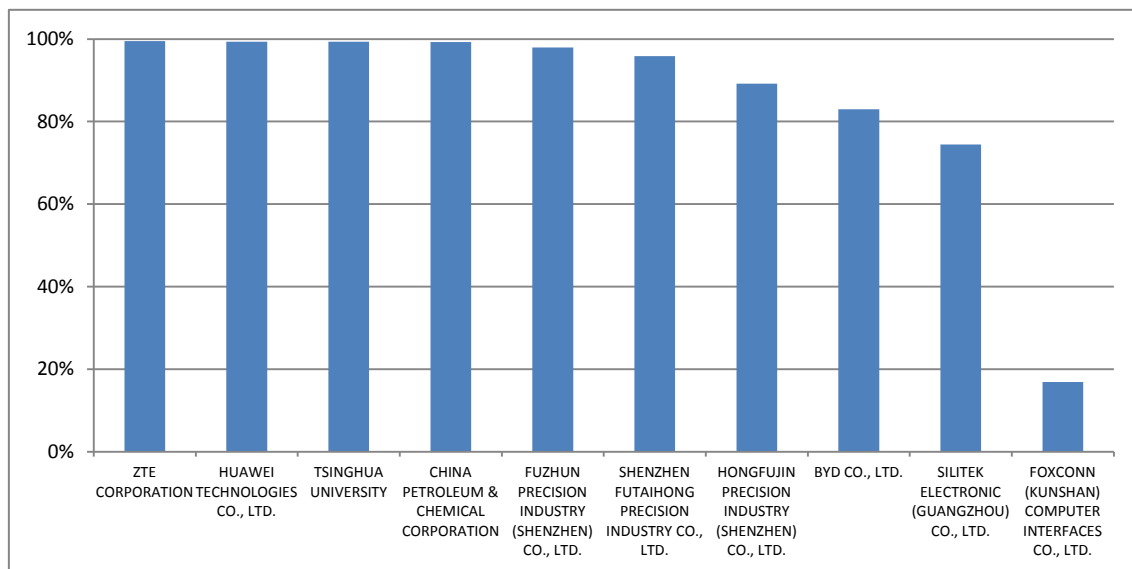
Figure 4.3. Top 5 foreign-oriented family holders among Chinese residents, 2000-2009



Source: WIPO IP Statistics Database.

One can also show that the largest foreign-oriented patent family holders have almost exclusively patent for invention-originated families (Figure 4.4), rather than those families originated by UM. Interestingly the percentage is much smaller for one Foxconn subsidiary listed here (Foxconn Kunshan) which uses the UM system more. BYD, the only automotive manufacturer in the top 10 list also seems to rely more on the UM system as entry point for foreign-oriented patent families.

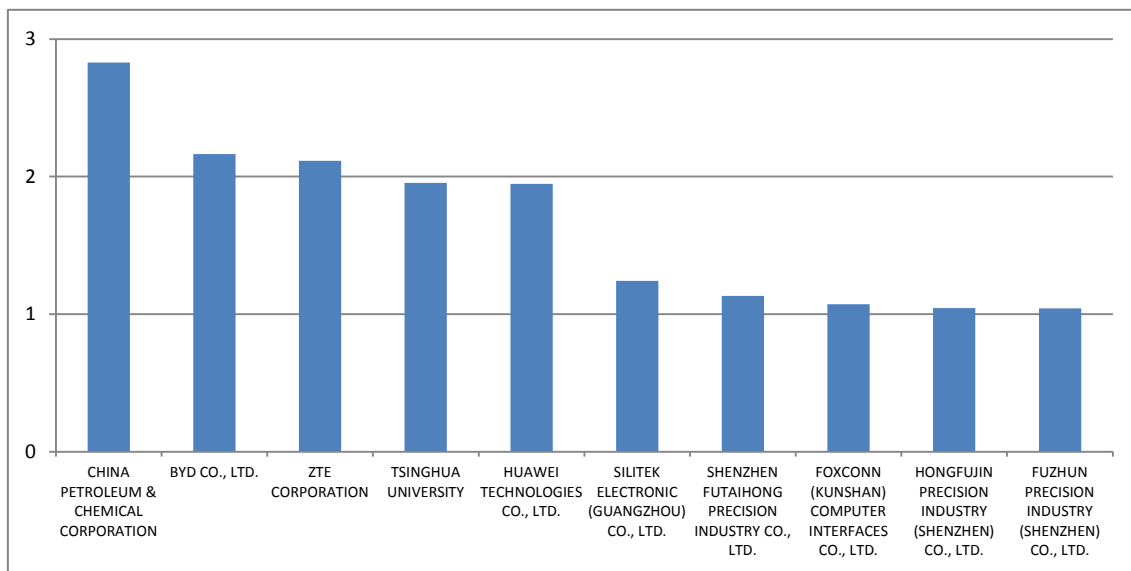
Figure 4.4. Share of patent for invention families among top 10 applicants, 1970-2012



Source: WIPO IP Statistics Database.

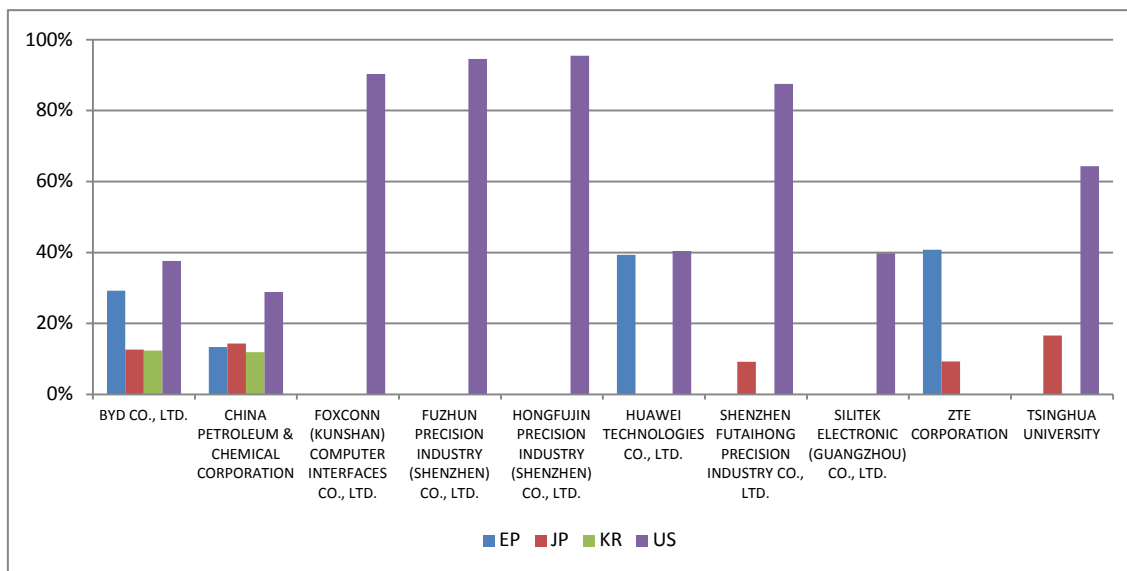
Interestingly even these top 10 applicants protect the majority of their patentable inventions only in one or two jurisdictions, with USPTO receiving the majority of applications (see Figure 4.5 and Figure 4.6). This compares to the more aggregate trend in Figure 2.1. That said, this initial analysis seems to show that the chemical and automotive companies in the top list, namely BYD and China Petroleum target more IP offices on average and that they aim for a broader geographical patent coverage than the companies in the electronics and the ICT sector.

Figure 4.5. Average number of foreign offices per family for top 10 applicants, 1970-2012



Source: WIPO IP Statistics Database.

Figure 4.6. Share of total patent applications abroad among top patent applicants, 1970-2012



Source: WIPO IP Statistics Database.

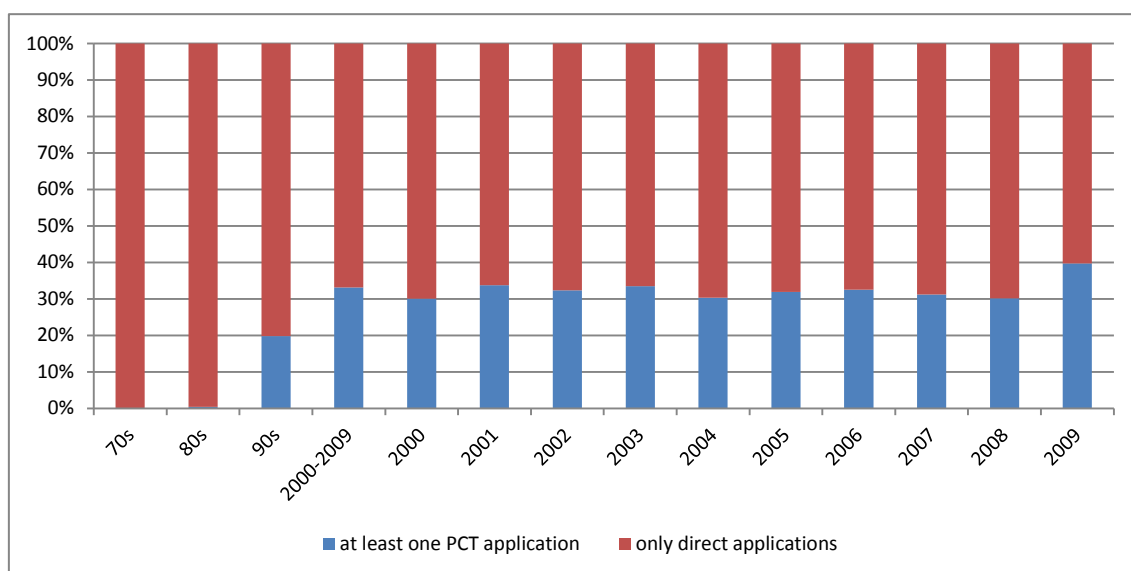
Note: The graph only displays the top IP offices, i.e. those that have more than a 9% share.

5. CHINESE USE OF THE PATENT CO-OPERATION TREATY FOR FILING ABROAD

One third of foreign-oriented patent families by Chinese residents have at least one application via the PCT. Figure 5.1 shows that the share of families with at least one PCT application has grown from an average 20% per annum in the 1990s to an average of 33% between 2000 and 2009. Nonetheless, the share of patent families with at least one PCT application among Chinese foreign-oriented patent families between 2000 and 2009 is somewhat smaller than is the case for the US (45%) or Germany (40% on). Yet, it is larger when compared to both, the Republic of Korea and Japan (20%).

Besides, the Chinese use of the PCT system for filing abroad has intensified strongly since 2009, a trend not captured in the above data. In 2013, China surpassed Germany to become the third largest user of the PCT system, with Japan as the second-highest user.¹² Indeed, ZTE Corporation with 2,309 PCT applications was the second most important and Huawei Technologies, Co. with 2,094 PCT applications the third most important PCT filer in 2013.

Figure 5.1. PCT usage among Chinese foreign-oriented patent families, 1970-2009



Source: WIPO IP Statistics Database.

¹² Press release “US and China Drive International Patent Filing Growth in Record-Setting Year”, Geneva, March 13, 2014, PR/2014/755.

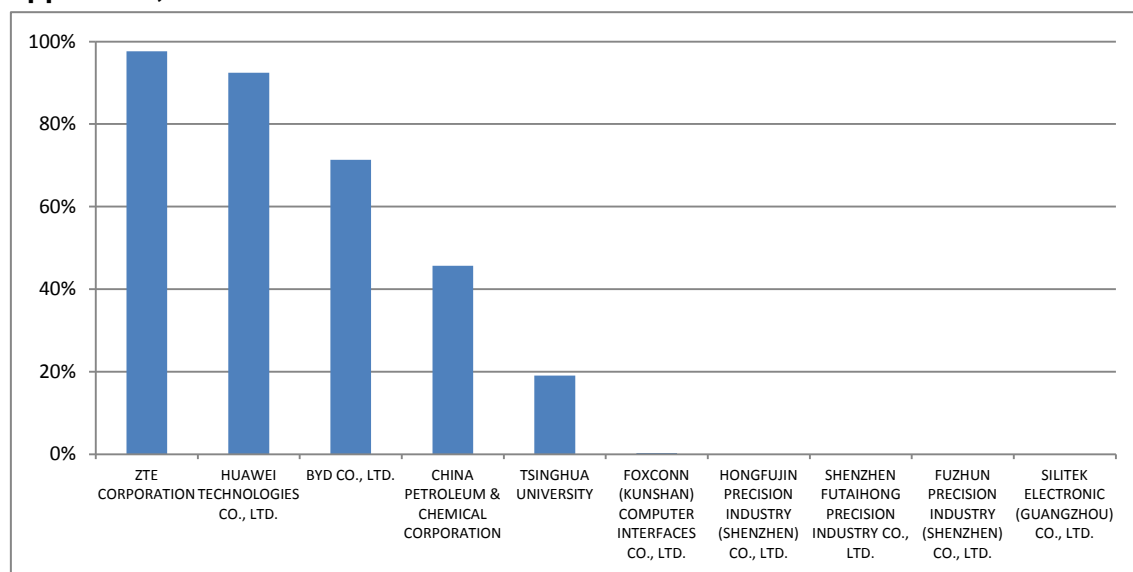
Interestingly, Chinese university and research institutes have the highest share of foreign-oriented patent families applied through the PCT route. This must be interpreted by keeping in mind their relatively small number of accumulated patent families in total volume. Individuals have the lowest share of families originated via PCT applications. In turn, companies seem to have idiosyncratic strategies of PCT route usage, with some companies employing the PCT route for all filings abroad, others never using it, and yet others using the PCT selectively (see Table 5.1 and Figure 5.2).

Table 5.1. The share of foreign-oriented families via the PCT route for applicant types, 1970-2012

Type of applicant	% share of PCT families	% share of non-PCT families	Number of PCT families	Number of non-PCT families	Number of families
Company	32.3%	67.7%	14,554	30,493	45,047
Individual	27.4%	72.6%	4,411	11,693	16,104
University	42.3%	57.7%	1,236	1,685	2,921
Research institute	65.1%	34.9%	826	442	1,268
total	32.2%	67.8%	21,027	44,313	65,340

Source: WIPO IP Statistics Database.

Figure 5.2. Share of families applied through the PCT route among top 10 applicants, 1970-2012



Source: WIPO IP Statistics Database.

To understand the idiosyncrasies in the use of the PCT route among applicants regression techniques are used in what follows (see Appendix 2 for more details). A baseline regression model is constructed which controls for the type of a family, i.e., whether a family is originated via patent for invention or via utility model application, the type of an applicant, i.e., whether it is a company, individual, university or research institute, the size of a family and whether a family has an application with SIPO among other applications within a family. The estimation results of the baseline specification model with the year fixed effects included are presented in column (1) of Appendix Table 1 in Appendix 2. This Appendix also provides further details on the regression techniques employed. All the explanatory variables are statistically significant signifying the strength of the baseline model. The mains findings of these calculations are:

- Research institutes are more likely to apply through the PCT route compared to companies, universities and individuals.¹³
- Families originated through patent for invention applications are more likely to be applied through the PCT route.
- The bigger the size of a family, the more likely it is to be applied through the PCT route.
- Patent families which include applications with SIPO among other patent offices are more likely to use the PCT route.
- Digital communication, biotechnology and pharmaceutical firms are more likely to use the PCT route compared to companies in other technology fields.

Some of these findings are obvious, for instance, the fact that larger patent families or patent invention triggered-families tend to make use of the PCT route more frequently.

¹³ On this point compare the Special theme on the use of the PCT by universities and research institutes, in the upcoming 2014 edition of the PCT Yearly Review published by WIPO. See also Chapter 4 “Harnessing public research for innovation – the role of IP” of the WIPO World Intellectual Property Report 2011 at http://www.wipo.int/econ_stat/en/economics/wipr/wipr_2011.html.

Others are less obvious, and need more analytical work, for instance, why academic inventors would favor the PCT more than their counterparts based in companies. This will be subject to future research.

CONCLUSION

This study is the first of its kind analyzing foreign-oriented patent families by Chinese residents. It generates a number of interesting findings which are discussed succinctly in the Executive summary of this study.

Future work will have to elaborate more on the detailed drivers of Chinese filing abroad, and on understanding the potential for the future of such filings, including from firms, sectors and in technology fields which currently file much less frequently abroad than the most active firms in the ICT sector, although they have a sizeable domestic patent stock and active domestic filing behavior.

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WIPO (2011): World Intellectual Property Indicators 2011, Geneva.

WIPO (2013): World Intellectual Property Indicators 2013, Geneva

[Appendices follow]

APPENDIX 1: WORKSHOP AGENDA

Experts' Meeting on Intellectual Property and Socio-Economic Development

Jointly organized by

World Intellectual Property Organization (WIPO)

and

State Intellectual Property Office of the People's Republic of China (SIPO)

Beijing

March 25, 2013

9.00 – 9.10 Opening Ceremony

Welcome addresses by:

Ms. YANG Zhe, Deputy Director General, Intellectual Property
Development Research Center, SIPO

Mr. Wu Kai, Director General, International Cooperation
Department, State Intellectual Property Office of the People's
Republic of China (SIPO), Beijing

Mr. Zhou Hao, Head, Data Development Section, Economics and
Statistics Division (ESD), World Intellectual Property Organization
(WIPO), Geneva

Session 1

Moderator: Ms. YANG Zhe

9.10 – 9.50 **Topic 1: Roles of Patents in Corporate Strategies**

Speaker: Mr. Hao Mao, Associate Professor, SIPO, Beijing

Commentator: Mr. Albert Guangzhou Hu, Associate Professor of
Economics, China Europe International Business
School and National University of Singapore

9.50 – 10.10	Discussion
10.10 – 10.30	Coffee Break
10.30 – 11.10	Topic 2: Foreign-Oriented Patent Families by Chinese Residents Speakers: Mr. Zhou Hao Mr. Sacha Wunsch-Vincent, Senior Economic Officer, Economics Section, ESD, WIPO Mrs. Liudmila Kashcheeva, WIPO Consultant
11.10 – 11.30	Discussion
11.30 – 14.00	Lunch
14.00 – 16.30	Session 2 Moderator: Mr. Zhou Hao
14.00 – 14.20	Topic 3: Determinants of Quadric Patenting: Market Access, Imitative Threat, Competition and Strength of Intellectual Property Rights Speaker: Mr. Can Huang, Professor, School of Management, Zhjiang University, Hangzhou, China
14.20 – 14.30	Discussion
14.30 – 14.50	Topic 4: Key Issues and Policies Promoting Transformation of Intellectual Property under the Strategy of Innovation-Driven Development: A Case from Chinese Academy of Sciences

Speaker: Mr. Hefa Song, Professor, Director of Division of Intellectual Property and Science and Technology Law of Institute of Policy and Management, Chinese Academy of Sciences, Beijing

14.50 – 15.00

Discussion

15.00 – 15.20

Coffee Break

15.20 – 15.40

Topic 5: Emerging Technology Development in China and Ownership of Higher Valued Patents Distribution

Speaker: Mr. Xiangdong Chen, Professor, The School of Economics and Management, Beihang University, Beijing

15.40 – 15.50

Discussion

15.50 – 16.10

Topic 6: Does the Increase of Patent in China Means the Improvement of Innovation Capability? The New Progress and Challenge

Speaker: Mr. Zheng Liang, Associate Professor, School of Public Policy and Management, Tsinghua University, Beijing

16.10 – 16.20

Discussion

16.20 – 16.30

Closing Remarks

[Appendix II follows]

APPENDIX 2: REGRESSION ANALYSIS

In order to control for potential heterogeneity in the use of the PCT route among different industries 35 industry dummy variables are included. The results of the regression with industry dummy variables included are presented in column (2). The explanatory power of the model increases (the Pseudo R^2 rises from 0.33 to 0.44) signifying a good addition to the baseline model.

Patent applicants appear to have heterogeneous strategies in their use of the PCT route. Given that Probit estimation results in inconsistent estimates when too many fixed effects are used, first dummy variables for only the top 100 patent applicants are included. These applicants are responsible for about 50% of all patent families by Chinese residents. The results are presented in column (3). As a robustness check an additional 200 dummy variables are included for the top patent applicants. Results are presented in column (4).

Appendix Table 1. Probit analysis of the PCT system usage

	Probit (1)		Probit (2)		Probit (3)		Probit (4)	
IPR type	0.227***	(0.004)	0.184***	(0.005)	0.163***	(0.009)	0.171***	(0.010)
Applicant (Company)	-0.293***	(0.016)	-0.305***	(0.017)	-0.106***	(0.017)	-0.050***	(0.017)
Applicant (Individual)	-0.106***	(0.013)	-0.089***	(0.014)	-0.034**	(0.014)	0.003	(0.017)
Applicant (University)	-0.178***	(0.008)	-0.166***	(0.010)	-0.049***	(0.015)	-0.010	(0.021)
Family size > 5	0.574***	(0.018)	0.550***	(0.036)	0.440***	(0.012)	0.438***	(0.013)
Family domestic	0.411***	(0.005)	0.393***	(0.005)	0.340***	(0.012)	0.348***	(0.017)
Tech_id_2	-	-	-0.129***	(0.005)	-0.052***	(0.007)	-0.041***	(0.008)
Tech_id_3	-	-	0.050***	(0.008)	-0.001	(0.008)	0.007	(0.009)
Tech_id_4	-	-	0.507***	(0.007)	0.101***	(0.011)	0.109***	(0.012)
Tech_id_5	-	-	-0.030**	(0.014)	-0.048***	(0.014)	-0.053***	(0.014)
Tech_id_6	-	-	-0.063***	(0.005)	-0.007	(0.007)	0.003	(0.007)
Tech_id_7	-	-	0.045**	(0.023)	0.015	(0.022)	0.005	(0.022)
Tech_id_8	-	-	-0.025***	(0.009)	0.001	(0.010)	0.005	(0.012)
Tech_id_9	-	-	-0.086***	(0.007)	-0.025**	(0.010)	0.023**	(-0.023)
Tech_id_10	-	-	-0.047***	(0.008)	0.014	(0.010)	0.022**	(0.011)
Tech_id_11	-	-	0.083***	(0.029)	0.069**	(0.027)	0.062**	(0.029)
Tech_id_12	-	-	-0.042***	(0.011)	0.010	(0.013)	0.002	(0.014)
Tech_id_13	-	-	0.103***	(0.013)	0.072***	(0.012)	0.063***	(0.013)
Tech_id_14	-	-	0.092***	(0.016)	0.059***	(0.014)	0.049***	(0.014)
Tech_id_15	-	-	0.180***	(0.019)	0.129***	(0.019)	0.106***	(0.019)
Tech_id_16	-	-	0.206***	(0.016)	0.130***	(0.016)	0.129***	(0.016)
Tech_id_17	-	-	0.114***	(0.021)	0.073***	(0.019)	0.076***	(0.020)
Tech_id_18	-	-	0.033	(0.025)	-0.005	(0.019)	-0.018	(0.019)
Tech_id_19	-	-	0.018	(0.014)	-0.003	(0.012)	0.0001	(0.013)
Tech_id_20	-	-	-0.029**	(0.013)	-0.015	(0.012)	-0.015	(-0.015)
Tech_id_21	-	-	-0.090***	(0.009)	-0.024**	(0.011)	-0.025**	(0.012)
Tech_id_23	-	-	0.038***	(0.012)	0.020*	(0.011)	0.021*	(0.011)
Tech_id_24	-	-	0.109***	(0.021)	0.043**	(0.018)	0.037**	(0.018)
Tech_id_25	-	-	0.006	(0.013)	0.028**	(0.013)	0.028**	(0.014)
Tech_id_26	-	-	-0.044***	(0.010)	-0.021**	(0.010)	-0.020*	(0.011)
Tech_id_27	-	-	0.035**	(0.016)	0.059***	(0.017)	0.051***	(0.017)
Tech_id_28	-	-	0.062***	(0.018)	0.035**	(0.016)	0.001	(0.016)
Tech_id_29	-	-	-0.011	(0.011)	0.014	(0.012)	0.005	(0.012)
Tech_id_30	-	-	0.023*	(0.012)	0.024**	(0.012)	0.026**	(0.013)
Tech_id_31	-	-	-0.017	(0.010)	0.029**	(0.012)	0.031**	(0.012)
Tech_id_32	-	-	0.069***	(0.014)	0.014	(0.012)	0.001	(0.012)
Tech_id_33	-	-	0.012	(0.010)	0.012	(0.009)	0.001	(0.009)
Tech_id_34	-	-	0.017	(0.012)	-0.016**	(0.009)	-0.006	(0.010)
Tech_id_35	-	-	0.071***	(0.012)	0.016***	(0.009)	0.060***	(0.013)
Year FE	Yes		Yes		Yes		Yes	
Firm FE	No		No		Top 100		Top 300	
Pseudo R ²	0.329		0.436		0.598		0.611	
Observations	64,555		63,066		57,299		55,672	

Notes: The table reports marginal effects after the Probit regressions where the dependent variable equals 1 if there are PCT applications within a patent family, and the dependent variable equals 0 otherwise. Standard errors are reported in the parentheses. *IPR_type* equals 1 if an application type is patent for invention, and *IPR_type* equals 0 if an application type is utility model. The dummy variable for *Research institute* applicant type is omitted from the

regressions. For the description of 35 technology fields see

http://www.wipo.int/ipstats/en/statistics/technology_concordance.html and Schmoch (2008).

Since a family can include several technology fields at the same time, the dummy variable *Tech_id_i* equals 1 if the technology field *i* is presented in a family, and it equals 0 otherwise.

The dummy *family_domestic* equals 1 if there is SIPO application within a family and it equals 0 otherwise. *Tech_id_1* and *Tech_id_22* are omitted from the regressions because of collinearity.

[Appendix III follows]

APPENDIX 3: GLOSSARY

This glossary provides definitions of key technical terms and concepts.

Applicant: An individual or other legal entity that files an application for a patent, utility model, trademark or industrial design. There may be more than one applicant in an application. For the statistics presented in this publication, the name of the first-named applicant is used to determine the owner of the application.

Application: The procedure for requesting IP rights at an office, which examines the application and decides whether to grant or refuse protection. Application also refers to a set of documents submitted to an office by the applicant.

Application abroad: For statistical purposes, an application filed by a resident of a given state/jurisdiction with an IP office of another state/jurisdiction. For example, an application filed by an applicant domiciled in France with the Japan Patent Office (JPO) is considered an “application abroad” from the perspective of France. This differs from a “non-resident application”, which describes an application filed by a resident of a foreign state/jurisdiction from the perspective of the office receiving the application.

Application date: The date on which the IP office receives an application that meets the minimum requirements. Application date is also referred to as the filing date.

Direct filing: See “National route”.

European Patent Office (EPO): The EPO is the regional patent office created under the EPC, in charge of granting European patents for EPC member states. Under Patent Cooperation Treaty (PCT) procedures, the EPO acts as a receiving office, an international searching authority and an international preliminary examining authority.

Filing: See “Application”.

Foreign-oriented patent families: A patent family having at least one filing office that is different from the office of the applicant’s origin. (See “Patent family”.)

Grant: A set of exclusive rights legally accorded to the applicant when a patent or utility model is “granted” or “issued”. (See “Patent” and “Utility model”.)

International Patent Classification (IPC): The IPC provides for a hierarchical system of language-independent symbols for the classification of patents and utility models according to the different areas of technology to which they pertain. The symbols contain information relating to sections, classes, subclasses and groups.

Invention: A new solution to a technical problem. To obtain patent rights, the invention must be novel, involve an inventive step and be industrially applicable, as judged by a person skilled in the art.

National Phase Entry (NPE): See “National phase under the PCT”.

National phase under the PCT: This follows the inter- national phase of the PCT procedure, and consists of the entry and processing of the international application in the individual countries or regions in which the applicant seeks protection for an invention.

National route: Applications for IP protection filed directly with the national office of, or acting for, the relevant state/jurisdiction (see also “PCT route”).

Patent Cooperation Treaty (PCT): The PCT is an international treaty, administered by WIPO. The PCT system facilitates the filing of patent applications worldwide and makes it possible to seek patent protection for an invention simultaneously in each of a large number of countries by first filing a single “international” patent application. The granting of patents, which remains under the control of the national or regional patent offices, is carried out in what is called the “national phase” or “regional phase”.

Patent family: A set of interrelated patent applications filed in one or more countries/jurisdictions to protect the same invention.

PCT application: A patent application filed through the WIPO-administered Patent Cooperation Treaty (PCT).

PCT route: Patent applications filed or patents granted based on PCT international applications.

PCT system: The PCT, an international treaty administered by WIPO, facilitates the acquisition of patent rights in a large number of jurisdictions. The PCT system simplifies the process of multiple national patent filings by reducing the requirement to file a separate application in each jurisdiction. However, the decision on whether or not to grant patent rights remains in the hands of national and regional patent offices, and patent rights remain limited to the jurisdiction of the patent-granting authority. The PCT international application process starts with the international phase, during which an international search and possibly a preliminary examination are performed, and concludes with the national phase, during which national and regional patent offices decide on the patentability of an invention according to national law.

Priority date: The filing date of the application on the basis of which priority is claimed.

Publication date: The date on which an IP application is disclosed to the public. On that date, the subject matter of the application becomes “prior art”.

Resident: For statistical purposes, a “resident” application refers to an application filed with the IP office of or acting for the state/jurisdiction in which the first-named applicant in the application has residence. For example, an application filed with the Japan Patent Office (JPO) by a resident of Japan is considered a resident application for the JPO. Resident applications are sometimes referred to as domestic applications. A resident grant/ registration is an IP right issued on the basis of a resident application.

Utility model: A special form of patent right granted by a state/jurisdiction to an inventor or the inventor’s assignee for a fixed period of time. The terms and conditions for granting a utility model are slightly different from those for normal patents (including a shorter term of protection and less stringent patentability requirements). The term “utility model” can also describe what are known in certain countries as “petty patents”, “short-term patents” or “innovation patents”.

[End of Annex and of document]