

The Distribution of the Value of Japanese Patents in the World*

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Understanding the geographic distribution patent value is important for patent owners, the industry, and a country. Before developing any patent strategies in the oversea market, it is important for patent owners to understand the distribution of their patent value. It is also important for Japanese government to know the potential opportunities for Japanese technologies in the world when the government encourages technology transfer and exports. This research is a dynamic study to understand the distribution of the value of Japanese patents by industry in the world across years as the fluctuation of the development of economy and technology. The research found that the number of patent claims is a critical indicator of patent value as citations for being contributed by both the applicants' patenting strategies and examiners.

I. Introduction

As the importance of patent valuation in finance, innovation and patent management, and litigation decisions, this research adopts forward citation, backward citation, and the number of patent claims to estimate the value of the Japanese patents, the applications of which were also filed in the U.S., China, South Korea, Germany, and Canada. It also explores the association between the patent value and the exports from Japan to the U.S. and China.

II. Background

The key indicators for patent valuation through patent applications include forward citations, backward citations,¹ number of patent claims,² age,³ granting stage,⁴ the length of the first claim,⁵

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¹ Gambardella, A., D. Haehoff & B. Verspagen, *THE VALUE OF PATENT* (2006).

² Lerner, *supra note 1*.

³ Lanjouw & Schankerman, *supra note 3*.

⁴ Sadao Nagaoka & Yoichiro Nishimura, *Acquisitions and Use of Patents: A Theory and New Evidence from the Japanese Firm Level Data*, IIR Working Paper WP#05-14 (2005).

⁵ Robert Fisher, *STRATEGIC PATENTING* (2007). See also Kuhn et al., *Measuring Patent Scope: What Works, What Doesn't, and How to Use It for Causal Inference*, available at http://www.neil-t.com/wp-content/uploads/2017/01/Measuring_Patent_Scope.pdf (last visited Aug. 6, 2018).

family size,⁶ or an integrated index of some of the mentioned indicators.⁷ This research directly adopts the indicators of forward citations and backward citations by examiners, the number of patent claims, and grants. Family is indirectly adopted when comparing the value of the patent applications that were only filed in Japan and the Japanese patent applications that were also filed in the U.S., China, and South Korea.

III. Data and Methodology

The research objects are the 1.2 million patent applications that were filed by Japanese applicants or the subsidiaries of Japanese companies with the JPO (Japan Patent Office) between 2011 and 2015. This project adopts three databases. The patent data except family information will be collected from the IIP Patent Database. The patent family data is provided by Incopat. The source of all types of economic data is the WTO (World Trade Organization). The patent family data and economic data are merged with the IIP patent data by application numbers.

There are three technology sectors that are mainly analyzed in this research, including the chemical, pharmaceutical, and electronics industries. The categorization of the technology sectors is through IPC classes.

The research methodology is qualitative, including summary statistics, descriptive analyses and comparative analyses. The qualitative analysis includes the correlation between patent value indicators and economic variables of exports or R&D ratio over GDP. Moreover, exports are regressed on the patent value indicators, forward citations and backward citations in OLS.

IV. The Geographic Distribution of Patent Applications by Japanese Companies

1. The Geographic Distribution of the Number of Patent Applications

The U.S., China, and South Korea are the top three destinations that Japan exports to.⁸ 2,174 of the patent applications that were filed by Japanese applicants or their subsidiaries in JPO and were also filed in the U.S. 1,658 of the patent applications were also filed in China and 1,196 of the patent applications were also filed in South Korea. All of the Japanese patent applicants who filed patent applications in other countries in addition to JPO were companies.

The data show that there were consistently more Japanese patent applications that were filed

⁶ Lanjouw & Schankerman, *supra note 3*.

⁷ *Id.*; See also, Ginarte & Park, Determinants of patent rights: A cross-national study, 26 RES. POL'Y 283 (1997); See Also, Yasuyuki Ishii, *Determinants of Patent Rights: A Cross-National Study*, 29 J. JAPAN ASS'N FOR MGMT. SYS. 225 (2013).

⁸ OEC, *Japan*, available at <https://atlas.media.mit.edu/en/profile/country/jpn/>. (last visited Aug. 04, 2018).

in the U.S. than in China between 2011 and 2015, when the ratio of R&D over the US GDP was also higher than the ratio of China. However, the number of Japanese patent applications that were filed in the USPTO in addition to JPO was negatively correlated to the ratio of R&D over US GDP (p-value=0.04), suggesting a decrease of the Japanese patent applications that were filed in the U.S.

2. The Geographic Distribution of the Patent Value

The indicator of grants for patent valuation is divided into four parts regarding to the process of a patent application, including pending before the request for examination, pending for examination, rejection or withdraw before issuance, and issuance.

The claim counts of the Japanese patent applications with various families were different over granting stages. The patent applications filed only in Japan had a lower degree of claim counts at the examination pending stage, compared to the pending stage before the examination. The Japanese patent applications that were also filed in the U.S., China, and South Korea had a higher number of patent claims at the examination pending stage than the number at the pending stage before the request for examination, but the number decreased to a much lower degree at the granted stage. Those differences and variations suggest that Japanese applicants were more likely to burden higher risks and add patent claims before the request for examination when they have a propensity over internationally filing patents.

V. The Geographic Distribution of Patent Applications and Their Value by Industries

1. The Geographic Distribution of Patent Applications and Their Value in the Chemical Industry

On average, the chemical patent applications in JPO by Japanese applicants have 2.61 backward citations and 0.19 forward citations, which were similar across the different families. Both forward citations and backward citations of the Japanese patent applications that were also filed in the U.S. were positively correlated to the total amount of the chemical exports to the U.S. and its annual growth, suggesting a positive association between patent value and the exports to the U.S. in the chemical industry.

The variation of the patent value with respect to the number of claims in the chemical industry was consistent to the overall case discussed in Section IV: The patent applications filed in Japan only on average had a smaller number of patent claims after the request for examination, compared to

their early pending stage before submitting the request. The Japanese patent applications that were also filed in the U.S., China or South Korea added patent claims after the request for examination, suggesting a stronger propensity on the priority rights than the applicants who only filed their patent applications in Japan.

2. The Geographic Distribution of Patent Applications and Their Value in the Pharmaceutical Industry

The patent value with respect to claim counts in the pharmaceutical industry was different from the chemical industry over granting stages: The patent applicants in the pharmaceutical industry were less sensitive to examination fees than the chemical patent applicants were when they only filed the patent applications in Japan.

Both the patent applications filed in Japan only and the Japanese patent applications that were also filed in the U.S., China, and South Korea had a higher number of patent claims after the request for examination, even though the claim counts decreased to a much lower level after granting. The patent applications with the highest number of claims were the Japanese patent applications that were also filed in the U.S. The average number of those patent claims at the granting stage was higher than the stage when the Japanese applications were initially filed in JPO.

3. The Geographic Distribution of Patent Applications and Their Value in the Electronic Industry

The patent value of the Japanese electronic patent applications filed by Japanese applicants with respect to forward citations and backward citations was extremely different from the patent applications in the chemical and pharmaceutical industries. Among the Japanese patent applications that were filed by Japanese applicants and pending for examination, the patent applications that were only filed in Japan on average had 4.66 backward citations, which were the highest among the Japanese patent applications that were also filed in the U.S., China, or South Korea. The forward citations of the patent applications that were only filed in Japan on average were also the highest among the Japanese patent applications, including the applications also filed in those three other countries.

The empirical results show the importance of patent value in the electronics industry to economic growth. The forward citations received by the Japanese electronic patent applications that were also filed in China were positively correlated to the integrated circuit exports to China and the annual growth of the exports. Both the backward citations and forward citations received by the

Japanese electronic patent applications that were also filed in the U.S. were positively correlated to the total exports from Japan to the U.S. and the annual growth of the total exports. Moreover, the value of patent applications with respect to forward citations and backward citations was positively correlated to the total exports from Japan to the world and its annual growth.

VI. Concluding Remarks and Limitations

The data shows that Japanese patent applicants were sensitive to the examination fees, but they were less sensitive to the examination fees when they also file the patents in other countries. Alternatively, the Japanese patent applicants who file patents in other countries value the scope of patent protection and priority rights more than the examination fees, regardless of the value or quality of the technology.

Moreover, there is a synchronized pace of patenting abroad by Japanese applicants and their oversea market size, but the effects of valuable patent applications on exports is limited.

The future studies can extend the duration of the study, expand the sample to include all the patents that are valid during the study duration, and apply firm-level data. The division issue in patent application, selection bias, and truncation bias should also be considered.