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Relationship between utilization of acquired technology by patent acquisition and subsequent patent production¹

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Introduction

Recent studies have investigated the factors determining patent trade such as age, number of citations, technological generality, and trade experience of the patent (Serrano, 2010), and the factors affecting firm's decision for patent acquisition and sale (Figuerola & Serrano, 2013). However, research on the utilization of the acquired patent and its impact to the subsequent patent production is relatively lacking. One of the previous studies regarded patenting after a merger as an evidence of leveraging the acquired firm's technology (Puranam & Srikanth, 2007). Similarly, citing the acquired patent may be regarded as an evidence of leveraging the acquired patent's technology.

Among the various reasons for patent acquisition, the authors have focused on the aspect of an acquirer's accessing to external technologies (Cavaggioli, 2013). This study investigates whether the technology acquired by the patent acquisition leads to improvement of technology of the acquirer in terms of patent production by exploring the relationship between citation of the acquired patent and subsequent increase in patent production of the acquirer.

Data

A new dataset was prepared by merging PATSTAT (EPO) and patent assignments (USPTO) on 10,375 patentees who have ever acquired patents through the market for technology or the merger of organizations in the period 2007-2011 and also have patents granted in the first periods (2007-2011) and the second period (2012-2016). The dataset covers only US patent grants. Table 1 describes the data and summary statistics. G1, G2 indicate the numbers of granted patents to a patentee in the first and second periods, respectively. A1 indicates the numbers of acquired patents by the patentee in the first period. ExtR measures the ratio of acquired patents to the total obtained patents either by grant or acquisition in the first period. AbsR is defined as the ratio of patent cited by acquirer after acquisition to the all acquired patents. GR_INC measures the quantitative increase of patent production between the first period and the second period.

The acquirers are categorized into four sector-groups according to the definition by EPO: company, government or non-profit organization (Gov./Non-Prof.), university and hospital. The acquirers are also categorized into three size-groups as suggested by Serrano (2010): small (≤ 5 grants per year), medium (≤ 100 grants per year) and large (> 100 grants per year). The patents are assigned to one or more technology fields among 35 EPO technology classifications.

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Table 1. Variables: descriptions and summary statistics

Variable	Definition	Obs.	Mean	Std.dev	Min.	Max.
G1	The number of granted patents per patentee and technology field in 2007-2011	30,686	32.37	182.79	1	16,296
G2	The number of granted patents per patentee and technology field 2012-2016	30,686	44.78	266.86	1	25,966
A1	The number of patent acquired from outside per patentee and technology field in 2007-2011	30,686	14.11	85.83	1	7,810
GR_INC	Increase of the number of patents granted : $G2/(G1+G2)$	30,686	0.159	0.265	0	0.999
AbsR	The ratio of patents cited by acquirer to the acquired patents	30,686	0.216	0.331	0	1
ExtR	The ratio of acquired patents to the all the patents that assigned to the acquirer: $A1/(G1+A1)$	30,686	0.393	0.262	0.001	0.998

Patent utilization differences in the type of buyers and technology field

Figure 1 shows the number of granted patents, the number of acquired patents, the ratio of acquired patents to the total obtained patents (ExtR) and the ratio of self-cited patents to the acquired patents (AbsR) by the type and size of patentees. ExtR values are generally higher in small organizations than in large organization. AbsR value seems to be more dependent on the type of organization rather than size. In particular, it seems that the AbsR value is higher in hospitals and universities than other patentee types.

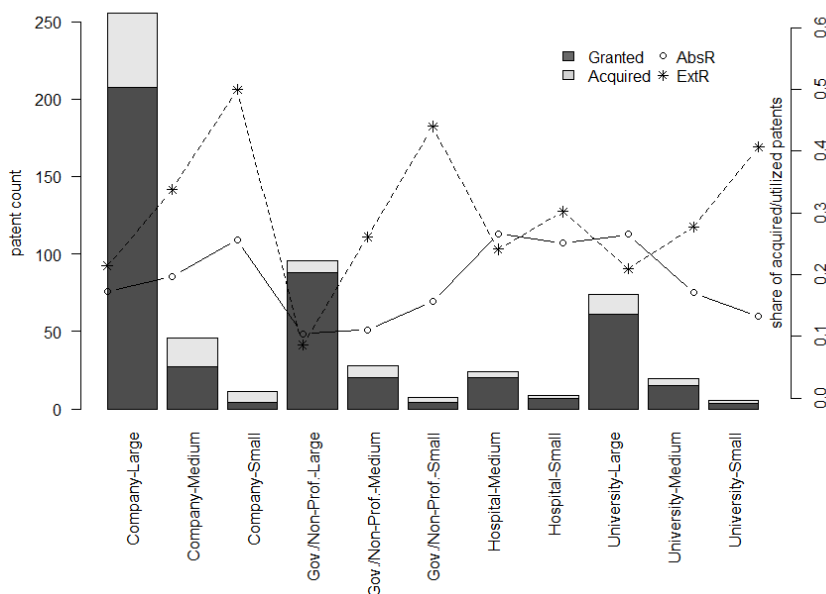


Figure 1: The mean value distribution of variables by the acquirer types and sizes

Similarly, Figure 2 shows that the number of granted/acquired patents and ExtR/AbsR values varies by technology fields. The pairwise comparison test in the analysis of variance according to Scheffé method was performed to find out statistically significant differences among mean values of AbsR. The result of Scheffé test shows significant differences between the following pairs of groups in terms of:

- 1) Size : small – large, small – medium
- 2) Sector: Gov./Non-Prof. – Company, University – Company
- 3) Technology field: Audio-visual technology – Medical technology, Audio-visual technology – Pharmaceuticals, Audio-visual technology – Civil engineering; Telecommunications – Medical technology, Telecommunications – Pharmaceuticals, Telecommunications – Civil engineering; Digital communications – Medical technology, Digital communications – Pharmaceuticals, Digital communications – Civil engineering; Basic communication processes – Medical technology, Basic communication processes – Pharmaceuticals, Basic communication processes – Civil engineering; Computer technology – Pharmaceuticals

The first results mean that small-size organizations show higher AbsR values than medium or large size organizations. The second item of the results shows that private companies show higher AbsR values than universities or government/non-profit organizations. In the third of the above results, two groups are found. The first group includes audio-visual technology, telecommunications, digital communications and basic communication processes and the second group includes medical technology, pharmaceuticals, and civil engineering. The mean AbsR values in the first group are significantly different from that in the second group. The mean AbsR of computer technology significantly differs only from that of pharmaceuticals.

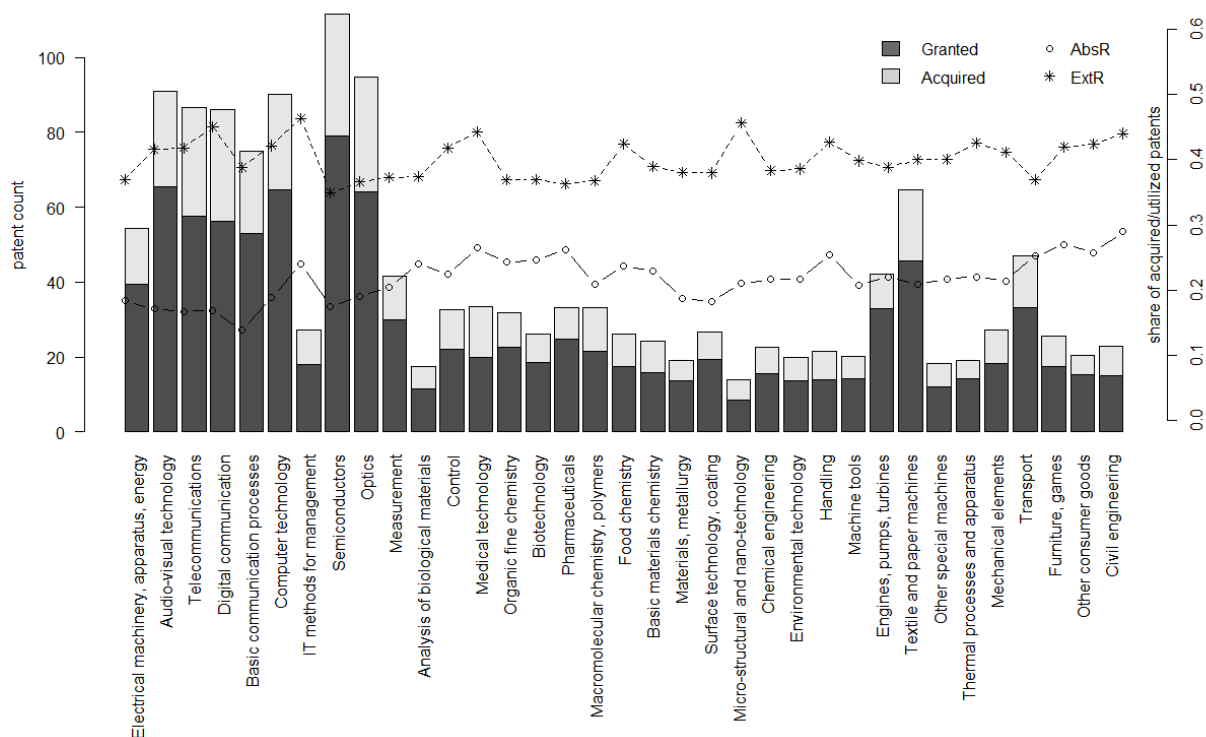


Figure 2: The mean value distribution of variables by the technology fields

Considering that the characteristics of the patent activity vary according to the type and size of an organization and the technology field of acquired patent, it will be meaningful to examine how the subsequent patent production increases (GR_INC) according to the degree of utilization of the acquired patent. The next section explores the relationship between AbsR and GR_INC with controlling the influence of organization type and size and technology field.

Relation between patent production and utilization of acquired patents

Figure 3 describes that there are differences in patent growth between the groups with higher and lower rate of self-citation (citations of acquired patent by acquirer after acquisition) than technology-average rate of self-citation. The patent growth is high when the self-citation rate is high in the all company groups, large/medium Gov./Non-Prof. groups and medium/small university groups. In other groups, the differences are in the opposite direction or not significant. The t-test results² showed that the differences are significant except for small Gov./Non-Prof., small hospital and large university.

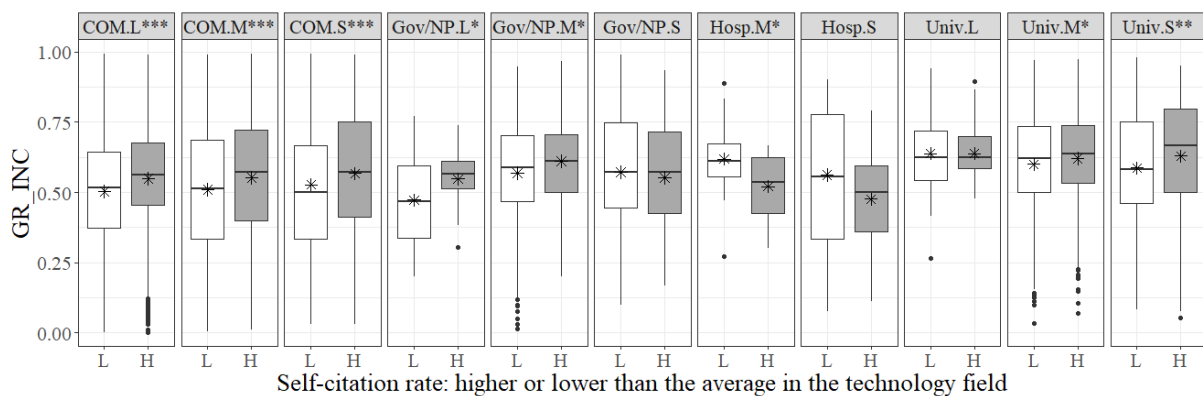


Figure 3: Differences in patent growth by self-citation rate and buyer types (with significance code)

Conclusion and discussion

This study shows that the utilization of technology acquired by patent acquisition affects subsequent patent production in the associated technology field of the organization. The result shows that for more active organizations in self-citing acquired patents produce more subsequent patents than less active organizations after controlling the characteristics of the acquiring organization and the technology field of an acquired patent.

Among the various ways to utilize technology acquired by patent acquisition, self-citation enhances the appropriability of innovation protected by acquired patent (Trajtenberg et al. 1997). The attempt to increase the appropriability of acquired technology by patent acquisition is believed to be the reason that self-citing an acquired patent is more active in the private sector, small-scale, and medical/pharmaceutical sectors as suggested in the results of the Scheffé test. An interesting follow-up study could be a comparative analysis on how the way of utilizing technology acquired by patent acquisitions varies depending on the sector and size of an organization and technology field.

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² ‘***’ p < 0.001, ‘**’: p < 0.01, ‘*’ p < 0.05

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