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Market share and firms' patent exploitation

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ABSTRACT

As the current patent policy encourages the early stage of innovation but imposes hardly any regulations on how patent holders use their patents, an understanding of how firms use their patents is largely lacking. In this study, we seek to determine whether differences exist in firms' strategies for utilizing patents depending on their market share. Using a discrete choice model, the repeated multinomial logit model, we analyzed Korean firms' choices of patent use. Market share is found to positively influence three patent exploitation modes: own use, simultaneous exploitation of own use and licensing, and blocking. And the blocking use of patents is the most significant mode that is positively associated with market share. Our results provide a basis for understanding the effects of patent policy from the industrial perspective, such as industrial organization or competition policy. We discussed the implications for various actors related to patent systems, including researchers, policy-makers, and practitioners.

1. Introduction

Understanding on how firms utilize their patents is largely lacking, although a vast amount of data is available on how many patents companies hold or are filing (Danguy et al., 2014; Hall and Ziedonis, 2001). To improve this lack of understanding, this study addresses one understudied aspect of firms' patent use: the relationship between market share and firms' patent use.

The overall lack of analysis on firms' patent utilization, including the relationship between market share and patent use, is due largely to the nature of the patent system itself. The current patent policy is based on the reward theory (Sichelman, 2010), which hinges on the belief that the incentive to invent coupled with the legal right to exclude others from using the patented invention automatically leads to increased innovation in society. Therefore, the patent policy encourages the early stage of innovation (Cotropia, 2009), that is, invention. However, it imposes hardly any regulations on how patent holders should use their patents. Consequently, data on patent utilization have not been officially collected or disclosed, and analysis on patent utilization has been inevitably difficult.

With regard to the focus of our study, market share should be an important dimension to understand the effects of patent policy on companies within industries. As the patent system provides an innovation incentive in the form of an exclusive right, firms within an industry will attempt to acquire and exploit patents to protect or

expand their market dominance. Theoretical studies have raised the possibility of patent competition between market-dominant firms and new entrants (Gilbert and Newbery, 1982; Reinganum, 1983, 1985; Vickers, 1985) decades ago. However, as far as empirical analysis is concerned, let alone the verification of specific patent competition models, few studies have addressed even basic problems, such as how dominant firms capitalize on their patents and how they differ from firms that do not have a dominant position in markets.

In short, a large gap exists between theoretical research and empirical analyses on how companies with varying market dominance utilize patents differently. This study aims to contribute in closing this gap by identifying the differences in firms' patent use resulting from their market dominance as measured by market share. For this purpose, we conduct an empirical analysis on firms' patent utilization choices depending on their market share by using data from a survey on how Korean manufacturing companies exploit their own patents.

2. Literature review

As far as we know, few empirical studies have comprehensively analyzed the effect of market shares on firms' patent exploitation strategies. However, looking into existing research that is relevant to this study from a broader perspective can help to elucidate how this study can contribute to the ongoing discussion. We first introduce theoretical studies that analyzed the competition over patents among

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firms within an industry and then summarize the related empirical literature.

2.1. Theoretical research on patent competition

The probability of a patent system affecting patent competition within an industry began to be discussed as a research subject in the field of economics several decades ago. The topic has drawn considerable attention particularly from theoretical researchers (Gilbert and Newbery, 1982; Reinganum, 1983, 1985; Vickers, 1985) in the area of industrial organization (see also Gilbert (2006) for a review). Gilbert and Newbery (1982) showed that the incentive of a monopolist to bid for a patent is greater than that of a competitive firm. However, Reinganum (1983) argued that the monopolist's incentive for patent preemption disappears when the success of a drastic invention is uncertain. Theoretical models have also been extended to sequences of innovations (Reinganum, 1985) or oligopoly cases (Vickers, 1985).

Theoretical research on how a patent system affects competition within industry is still ongoing in industrial organization. For example, Gans and Persson (2013) recently suggested a dynamic model that shows how intellectual property protection influences entrepreneurs' commercialization strategy on whether to cooperate or compete with incumbents.

2.2. Empirical studies

Even though the theoretical models presented in 2.1 were proposed in the 1980s, to our knowledge, no study has conducted an empirical analysis by adopting these models as they were. Generally, empirical studies on firms' patent strategies have developed independently rather than keeping in line with a theoretical framework. Although it is difficult to affirm categorically why a gap exists between theoretical and empirical research, one of the main reasons is presumably the difficulty in obtaining data on firms' patent strategies. Firms are observed to apply for patents, but data that can show why they do so are generally scarce.

Most empirical analyses took the approach of obtaining data on firms' patent use strategies, mainly through surveys, and empirically finding major explanatory variables to explain the data effectively.

2.2.1. Patent motives

As we can surmise from the fact that Hall and Ziedonis (2001) used the term "patent paradox" even in the 2000s, the empirical understanding of why firms apply for a great number of patents and how they exploit their patents is still lacking. To overcome such a shortage of the data, Hall and Ziedonis (2001) interviewed representatives of the U.S. semiconductor industry to offer profound insight into the industrial effect of the patent system.

Some studies conducted large scale surveys covering a wide range of industries to discover the reasons why firms file patents comprehensively. Cohen et al. (2000) surveyed 1478 research and development (R&D) laboratories in the United States about their appropriability mechanisms. They also investigated various patenting motives, which include licensing revenue, using in negotiation, preventing lawsuits, preventing copying, blocking, and enhancing reputations, and their relative importance. Blind et al. (2006) considered even more diverse, 15 types in total, patenting motives and grouped them into five major motives: protection, blockade, reputation, exchange, and incentive. Both studies found that differently sized firms have different patenting motives but aspects of industry structure such as market share are not considered. Graham et al. (2009) introduced the patent motives of high-technology entrepreneurs based on the 2008 Berkeley Patent Survey.

2.2.2. Patent use

Some studies conducted surveys mainly on the results of firms' patent exploitation instead of their intention to use the patents. As we can

imagine from the diversity of patent motives, firms use their patents through various modes.

However, most empirical studies usually focus on specific types of patent use. Licensing is one typical mode of patent use that has attracted the attention of many researchers (Adam et al., 1988; Arora and Ceccagnoli, 2006; Caviggioli and Ughetto, 2013; Fosfuri, 2006; Gambardella et al., 2007; Kim and Vonortas, 2006) (see Caviggioli and Ughetto (2013) for a review).

Empirical studies that comprehensively analyzed firms' diverse patent use would be more relevant to this study, but such studies are relatively rare. Motohashi (2008) used the data acquired from the Survey on Intellectual Property-Related Activities (SIPA) conducted by the Japan Patent Office. In 2004, the questionnaire was sent to 12,300 patent applicants, including firms, individuals, and research institutes, and about 5300 of them replied. Using this dataset, Motohashi (2008) analyzed five modes of patent use: no use, use, block, licensing, and cross-licensing. These five modes are not mutually exclusive and they study estimated each patent use separately.

Giuri et al. (2007) conducted the PatVal-EU survey in 2003 by sending questionnaires to the inventors of 27,531 patents. This questionnaire asked whether each patent had been commercially exploited or not and about the motives behind each patent. The researchers grouped the modes of patent use into six categories: internal use, licensing, cross-licensing, licensing and use, blocking patents, and sleeping patents. Nagaoka and Walsh (2009) conducted the inventor survey that examined patent commercialization and non-use in Japan and the US and compared the statistics from the two countries. Torrisi et al. (2016) undertook a large-scale survey (InnoS&T) of inventors in Europe, the US, and Japan who filed patent applications at the European Patent Office in the priority years of 2003–2005. Based on the survey data, they analyzed the reasons for patenting and how the patents were utilized. They also investigated how the usage of patent is associated with the patent features such as family size, scope, and type of applicant, among others.

Similar to the studies addressing firms' patent motive, explanatory variables related to the industry structure are in most cases not used in the research on firms' patent use. The only exception is the licensing literature (Arora and Fosfuri, 2003; Arora et al., 2001b; Fosfuri, 2006; Gambardella et al., 2007; Motohashi, 2008), in which market share is suggested as one of the main explanatory variables. However, no comprehensive research has been conducted on how market share is associated with the various modes of patent use.

3. Hypothesis development

3.1. Classification of patent use for the analysis

Firms can use their patents through different modes. In this study, we categorize the patent utilization alternatives into five different modes: own use, simultaneous exploitation of own use and licensing, licensing only, patent blocking, and non-use. Although there are other various types of patent use such as patent transfer (Serrano, 2010), new firm formation from patents (Shane, 2001), and others, these five modes are among the most frequently adopted patent strategies.

Own use of patent is defined as the use of patents for protecting products or processes manufactured and commercialized by companies. The licensing-only mode refers to cases in which patent holders grant licenses to other firms instead of commercializing their own patent rights. The cases in which patent holders commercialize their own patents for themselves and concurrently grant licenses to other firms are referred to as simultaneous exploitation of own use and licensing. The common feature of the three abovementioned alternatives is that patent is used for commercialization. However, these three strategies differ in who implements the commercialization.

Patent blocking and non-use are the modes that do not involve direct commercialization. Patent blocking is intended to prevent others

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