



Patent, R&D and internationalization for Korean healthcare industry



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ABSTRACT

Using panel data, this study investigates how Patent and R&D expenditures affect internationalization in Korean healthcare industry. Korean healthcare industry is designated as one of the core bread and butter industries. Tremendous government investments in Korean healthcare industry are expected to increase Patent and R&D expenditures, causing internationalization for Korean healthcare industry. In material way, this study focuses on testing spillover effects between Patent and R&D expenditures on internationalization.

Empirical analysis is done by the panel GLS estimation using 47 Korean healthcare firms' 7 years' panel data. As empirical results, we find internationalization of Korea healthcare industry is positively affected by Patent and R&D expenditures but their impacts are limited. In addition, we find there is a non-linear relation between Patent and R&D expenditures on internationalization measured by exports so that spillover effects are significantly confirmed.

We propose several suggestions that government lead R&D policy does not effectively increase internationalization, and spillover effects of Patent and R&D expenditures differently affect internationalization following internationalization phase. Practically, government lead R&D investments should be disseminated to private sector to vitalize internationalization of Korean healthcare industry.

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1. Introduction

In industrial economics, Patent and research and development (hereinafter R&D) expenditures lead firms to internationalization because they improve firm's innovation activities (Bleaney and Wakelin, 2002; Penner-Hahn and Shaver, 2005). As a result of high level of innovation caused by Patent and R&D expenditures, firms compete in export market and become internationalization (Aw et al., 2007, 2011).

In reality, however, the relationship between internationalization and Patent and R&D expenditures has remained little empirical findings or a puzzle. Ample previous studies do not clarify the distinction between government and firm level R&D expenditures effects on internationalization. García-Quevedo (2004) argues that public R&D differs from private R&D and Griliches (1981) criticize that examination of R&D effects mainly focus on firm level and US firms. Outstanding feature of Patent and R&D expenditures in emerging countries are that government designate strategic industry considered as a high value-added business such as healthcare industry. In emerging countries, tremendous capital investment and cutting-edge technology of high value-added business depends heavily on government sector's Patent and R&D expenditures requires.

Furthermore, many previous studies focus on the impact of R&D expenditures on Patent application (Cincera, 1997) or spillover effects of Patent (Bottazzi and Peri, 2003) and exports (Girma et al., 2008). However, we know little about that the spillover effects of Patent and R&D expenditures are differently applied in internationalization since Patent duration and the speed of R&D spillover. Our contribution stems from the investigation of these arguments and the purpose of study is to investigate the impact of Patent and R&D expenditures on internationalization of Korean healthcare industry using panel data.

The Korean healthcare industry provides an excellent circumstance to test the purpose of this study. The healthcare industry in Korean is rapidly increasing the importance. The size of healthcare industry in Korea is estimated as 18.6 billion dollars which accounts for 1.8 per cent of R&D expenditures in the world as of 2009. Specifically, healthcare expenditures amounts of Korea ranked the highest within OECD countries. This is because the Korean healthcare industry has been considerably implemented by information technology (IT) development as well as tremendous Korean government's investments of Patent and R&D expenditures for healthcare industry. Furthermore, the Korean government designates healthcare industry as future bread and butter and expects to be core exports industry. This part is very critical for the development of national healthcare industry and sustainable internationalization.

The effectiveness of government-driven investments of Patent and R&D expenditures in an emerging country such as Korea highly propose

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two interesting questions that we address in this study. The first question we propose in this study is that does the government sector's contribution of Patent and R&D expenditures expect to increase internationalization by stimulating innovation of Korean healthcare industry?

Generally, Patent and R&D expenditures of most emerging countries such as Korea, China and Taiwan are led by government rather than privates. However, the effects of government-driven Patent and R&D expenditures on exports are controversial. Government-driven Patent and R&D expenditures encourage R&D activities for private sectors by complementing insufficiency (An and Ahn, 2016), thus positively affect exports as a proxy of internationalization. On the contrary to this positive view, government-driven Patent and R&D expenditures negatively affect exports because they act as "crowding-out effect", causing underinvestment in Patent and R&D for private sector and misallocation of resources (Wallsten, 2000). Based on controversial views of government-driven Patent and R&D expenditures on exports, this study examines whether Korea's large Patent and R&D expenditures driven by government positively affect exports as a measure of internationalization or not.

The second question we propose in this study is that how spillover effects of Patent and R&D expenditures affect internationalization of Korean healthcare industry? In general, the establishment of intellectual property such as Patent promotes knowledge innovation and encourages faster economic growth and exports. Patent is special means for spillover of R&D and innovation as well as R&D expenditures increase Patent. There are two conflicting views of Patent on R&D. The longer the Patent duration is, the faster R&D spillover is because Patent registration means innovation itself whereas the shorter the Patent duration is, the higher the speed with R&D spillover is since public can use technology without payment after expiration of Patent. Even though R&D expenditures and Patent are closely related, their impacts differently affect internationalization as a measure of exports. Hsu et al. (2015) find a curvilinear U-shaped relationship between R&D and innovation in Taiwan high-tech firms, suggesting that the fruit of R&D is shown after critical levels of intensity and diversity.

Thus, we expect there is a non-leaner relationship between the spillover of Patent and R&D expenditures, and internationalization. Further, it is worth to distinguish the spillover effects of them for internationalization. Based on that, we explore that the non-linear relationship between Patent and R&D expenditures on internationalization to test spillover effects.

We find that government-driven Patent and R&D expenditures do not increase internationalization of Korean healthcare industry. This result implies that success of internationalization should be driven by private sector or firm level as well as government sector. We find that spillover effects (nonlinear relationship) exist in both Patent and R&D expenditures with internationalization. However their spillover effects have different influence on internationalization stage due to two-way relationship between Patent and R&D expenditures.

The findings of this study provide important implications with researchers and policy makers. First, the importance of R&D expenditures has been recognized as a consequence of growing firm value and innovation. However, despite the importance of Patent and R&D expenditures, existing studies largely ignored the impact of Patent and R&D expenditures on internationalization. The case of Korean healthcare industry provides an excellent opportunity to examine the role of Patent and R&D expenditures on internationalization due to rapidly increased national exports. Second, Korea, as a late industrialized country, is one of the few nations that has successfully transformed from imitator to innovator (Amsden, 1992; Kim, 1998). Korea is one of the highest R&D investments countries in the world. Specifically, Korea was ranked the second highest expenditures-to-GDP ratio country which was 4.36 per cent in the world following Israel R&D as of 2012 (Ministry of Science, 2013). Thus, this study provides good opportunity how increased Patent

and R&D expenditures driven by government efficiently affect internationalization of Korean healthcare industry.

This paper starts with this introduction section, which provides the purpose of this study and contribution. Section 2 reviews the literature and addresses the research question. Then Section 3 discusses the methodology. In Section 4, the empirical results begin with panel data analysis. Finally, Section 5 presents conclusions relevant to fulfill the purpose of the paper.

2. Literature review and research question

In this era, many firms are getting their resource invest in R&D activities more and more because the technical revolution and the patent management are core elements to strengthen their competitiveness and sustainable growth. Investment in R&D represents an activity that can increase the value of a firm's intangible assets. The market value of a firm represents the market valuation of expected future profit streams generated from investment in R&D. These, in turn, are based on an assessment of the market return to the firm's tangible and intangible assets. While not all investments in R&D generate profits (Jensen, 1986), on average, any investment in a firm's intangible assets should be expected to increase the firm value (Bosworth and Rogers, 2001).

The primary research question addressed by the previous research is that the larger the potential growth opportunities, the higher the potential profits from developing the product and hence the greater the incentive to invest in R&D. Moreover, the development of R&D is increasingly in many industries, and R&D activities enhance firm value since innovation resulted from Patent and R&D increase firm's excessive returns and stock price (Griliches, 1981; Hirschey and Weygandt, 1985; Bublitz and Ettredge, 1989; Chaney and Devinney, 1992). Ballester et al. (2003) imply that R&D expenditures are critical factor for management to reinforce firm value because R&D expenditures stimulate innovation. Many domestic researches support R&D expenditures create firm's future economic benefits (Paek et al., 2004; Choi et al., 2007).

In line with the arguments of innovation, the growth and firm value will be improved, if they take the patent by investing in R&D. Lev (2001) argues that high technology is a value driver in innovative and leading industry such as healthcare industry so that Patent through R&D activities is the most important factor for firms to increase their earnings. Amin and Thrift (1984) and Lall (1985) argue that capabilities of R&D facilitate increasing of export and Dhanaraj and Beamish (2003) support positive impact of R&D expenditures on return at international market. More recently, Ruff (2015) argues that the investment of Patent and R&D enable firms to achieve sustainable management after tracing current state of practice of a corporate foresight unit of a multinational automotive company. Cin et al. (2016) find positive effects of the public R&D expenditure on the productivity for Korean small and medium sized firms. Hence, increased productivity of firms leads firm to competitor exporter.

The general consensus is that innovation stimulates exporting and also exporting is supported by innovation (Girma et al., 2008). Therefore, we turn to the previous researches to test the positive effects of innovation measured as Patent and R&D on internationalization. With this building around these prior works, we propose research question that how government driven Patent and R&D expenditures would result in internationalization of Korean healthcare industry.

The spillover of Patent and R&D expenditure is critical factor to increase firm value or internationalization. According to Sougiannis (1994), R&D expenditures increase firm's earnings and stock price but their effects are indirect and take long time because of lagged R&D spillover. Cincera (1997) and Bottazzi and Peri (2003) investigate spillover with Patent and R&D expenditures using panel data. They find technological spillovers are due to new knowledge and innovation based on Patent and R&D. Pakes (1985), Griliches (1980) and Oguamanam (2010) suggest that Patent as output of R&D expenditures positively

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