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How Absorptive Capacity is Formed in a Latecomer Economy: Different Roles of Foreign Patent and Know-how Licensing in Korea

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Summary. — Different from previous studies that tend to use in-house research and development (R&D) as a proxy for absorptive capacity but fail to reveal the origins of this R&D ability, this paper attempts to determine the origin of absorptive capacity (AC) after defining such concept as the capability of a firm to conduct in-house R&D and to generate innovation outcomes. This paper distinguishes three forms of foreign technology acquisitions based on unique data from Korea, namely, know-how-only licensing, know-how-and-patent licensing, and patent-only licensing. An econometric analysis demonstrates that a firm tends to involve know-how licensing before it starts in-house R&D, whereas patent licensing is not significantly related to conducting R&D. Therefore, a substitution effect is found between foreign patent licensing and conducting in-house R&D, which is in contrast to the inducing effect of know-how licensing for in-house R&D. It is also found that conducting in-house R&D, and know-how licensing by a firm, respectively, is significantly related to a generation of innovations or patent applications in next periods. This study shows that a learning process that involves foreign technology, especially tacit knowledge in the form of know-how, occurs before firms can conduct in-house R&D and innovations.

Key words — absorptive capacity, tacit knowledge, licensing, foreign technology, Korea, in-house R&D

1. INTRODUCTION

The concept of absorptive capacity (AC) has been introduced and defined in the influential article of Cohen and Levinthal (1989, 1990) as the ability of a firm to identify, value, assimilate, and exploit knowledge from the environment. AC is also recognized as an important binding constraint in the development of latecomer economies. Borensztein, Gregorio, and Lee (1998) perform a country panel regression and find that foreign direct investments will produce a growth effect only if a country has a certain level of AC. Fagerberg (1988, chap. 20) as well as Fagerberg and Verspagen (2002) present similar arguments by stating that AC is proxied by the total research and development (R&D) of a country as a fraction of its gross domestic product (GDP). Hammerschmidt (2009) and Griffith, Redding, and Van Reenen (2003) consider AC as a function of total R&D efforts at the firm or sector levels.

Although several empirical studies emphasize the importance of absorptive capacity by considering in-house R&D or human capital as proxy (Keller, 1996; Mowery & Oxley, 1995), a recent finding indicates that AC cannot be appropriately proxied by R&D or staff quality alone (Flatten, Engelen, Zahra, & Brettel, 2011; Lane, Koka, & Pathak, 2006). Moreover, the earlier studies fail to disclose the origin of AC aside from formal R&D or education. This recognition introduces two important questions: What is the origin of AC? How can we tell whether this capacity is established in a firm? These questions are particularly relevant in the context of latecomer countries in which firms are usually uncertain about conducting their own R&D and continue to rely on imported technology by specializing in assembly-type productions. By taking Korea as an example of a successful latecomer economy, scholars have emphasized the importance of AC in enabling Korean firms to learn and assimilate external knowledge inflow (Evenson & Westphal, 1995; Keller, 1996; Pack, 1992).

The two-step approach of Zahra and George (2002) to AC is relevant and useful in addressing the preceding questions. Such approach differentiates "potential" from "realized" AC, in which the former involves the acquisition and assimilation of externally generated knowledge, whereas the latter guarantees the successful application of such knowledge for transformation and exploitation. The application of this two-step approach in a latecomer economy allows this paper to answer the two questions by performing a two-step quantitative analysis. In the first step, we seek the origin of AC by investigating the factor that encourages a latecomer firm to conduct its own in-house R&D. In the second step, we determine whether or not a firm establishes AC in-house by investigating the factors that drive such firm to generate its own innovation outcomes. In other words, the successful consolidation of AC is verified by seeking the factors that determine the capacity of firms to innovate and by exploring the link between conducting in-house R&D and filing patent applications.

This two-step approach is similar to that of Kim (1998), who observes that AC requires learning capability and problem-solving skills, in which the former refers to the capacity to assimilate knowledge (for imitation), whereas the latter refers

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to the capacity to create new knowledge (for innovation). However, these definitions of AC may overlap with the general definition of technological capabilities, which is defined as knowledge, skills, and even experience required to acquire, assimilate, use, adapt, change, and create technologies or, in short, to generate and manage technical change (Bell & Pavitt, 1993; Dosi, 1988). As observed by some scholars including Cohen and Levinthal, [1] the AC of a firm can be regarded as part of its technological capability, and the key difference lies in its origins or sources; a firm can build its technological capability by investing either in generating new knowledge or in expanding its capacity to absorb knowledge that already exists in its surrounding environment. Given that AC includes the ability of firms to exploit knowledge from the environment (Cohen & Levinthal, 1989), one means of confirming whether or not a firm has AC is to check if such firm generates any outcomes from its exploitation activities. This paper measures such outcomes based on the generation of patents. In this sense, the empirical exercise in this paper is to assess how a latecomer firm forms AC or the technological capability that is formed via licensing of external (foreign) technologies.

Several studies have observed that the access to external knowledge is especially important in the technological development and AC of latecomer firms (Bell & Pavitt, 1993; Kim, 1997; Laursen & Meliciani, 2002; Lee, 1996; Park & Lee, 2006). Using the data of Japanese firms, Kiyota and Okazaki (2005) examine the effect of foreign technology acquisition (formal licensing) on the commencement of own R&D and the generation of own patent applications. In Korea, Lee (1996) conducted cross-section analysis of the effect of technology import as represented by the level of "technological cooperation with developed countries," which is a broad concept.

The current study is distinctive in terms of its emphasis on the role of know-how acquisition, which involves technical services and training that are bundled with relevant documents on basic operational skills and elementary process technology. Many foreign technology licensing contracts in Korea, especially during the early days, involve know-how (a form of tacit knowledge), which is different from the licensing of patent rights (a form of codified or explicit knowledge) to advanced technologies. Furthermore, we perform a dynamic analysis of the effects of foreign technology acquisition over time, as we have unique data set of 3,141 foreign technology acquisition contracts that are filed during 1970–93, [2] classified into three categories, namely, know-how-only, know-how-and-patent-rights, and patent-rights-only acquisitions.

This paper contributes several new findings. First, we find that know-how licensing, rather than patent licensing, encourages firms to start their in-house R&D. Second, we find that both in-house R&D and know-how licensing, rather than patent licensing, help these firms to file their patents successfully for the first time, which we take as an evidence of consolidation of AC. This paper quantitatively verifies the notion that the building of AC involves a learning process that cannot be confined to R&D (Lane *et al.*, 2006). The current findings are consistent with those of other qualitative studies that find that leading firms in Korea generally begin learning operational skills and elementary process technologies before starting their own relevant capital investment (Enos & Park, 1988; Kim, 1997) and that these companies learn, assimilate, and adopt foreign technologies before starting with their in-house R&D since the mid-1980s.

The rest of this paper is divided into several sections. Section 2 discusses the institutional context of foreign technology acquisition in Korea. Section 3 explains the three types of foreign technology acquisitions (i.e., know-how-only, know-how-patent-rights, and patent-rights-only) and relates them to the specific empirical hypotheses that are to be tested. Section 4 discusses the data and estimation method. Section 5 presents the results and the corresponding interpretations. Section 6 concludes the paper.

2. FOREIGN TECHNOLOGY ACQUISITION IN KOREA

Cohen and Levinthal (1989, 1990) introduce AC as an important concept in management studies as well as consider such concept as a by-product of the R&D efforts of a firm. However, given that the formation of AC involves more processes aside from formal R&D, the requirements for conducting in-house R&D and generating innovative outcomes (patent applications) must be thoroughly investigated. This question is particularly relevant in the context of latecomer countries in which the building of independent capacity and relinquishing dependence on foreign technology pose a great challenge to firms. Cohen and Levinthal (1990) as well as Kim (1998) identify two important elements of AC, namely, prior knowledge base and intensity of effort, in which the former consists of knowledge that is available within the organization. The access of latecomer firms to a foreign knowledge base is critical considering their scarcity of prior knowledge. Therefore, this study attempts to determine the origin of AC in a latecomer economy based on its acquisition of foreign technologies.

As a latecomer economy, Korea has successfully transformed itself from a technology-importing to a technology-generation country; thus, the AC in Korea is worth investigating. Korean firms only began to conduct in-house R&D in the mid-1980s after undergoing a period of learning, assimilating, and adapting foreign technologies (Lee, 2013; OECD, 1996). Figure 1A shows that the number of foreign technologies that are acquired by Korean firms has increased from as early as the late 1960s, which is followed by an increasing trend of private R&D after two decades. In other words, a significant increase in foreign technology inflow has preceded the local R&D efforts and innovation outcomes in Korea. Many researchers assert that the access to external knowledge is especially important in the development of latecomer firms (Bell & Pavitt, 1993; Kim, 1997; Laursen & Meliciani, 2002; Lee, 1996; Park & Lee, 2006).

Leading firms in Korea generally learned various forms of know-how, such as operational skills and elementary process

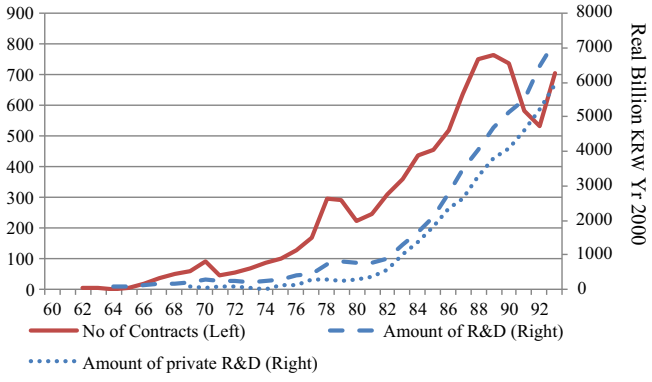

Figure 1A. *Foreign technology acquisition and R&D trends in Korea. Sources: Korea Industrial Technology Association (1995); National Science and Technology Information Service Web page (http://sts.ntis.go.kr); Tables 1A and 1B.*