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R&D intensity for innovative and adaptive purposes in overseas subsidiaries: Evidence from Japanese multinational enterprises

Yasuyuki Todo^{a,*}, Satoshi Shimizutani^{b,c}

^a Graduate School of Frontier Sciences, University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8563, Japan

^b Institute for International Policy Studies, 3-2-2 Toranomon, Minato-ku, Tokyo 105-0001, Japan

^c Research Institute of Economy, Trade and Industry, Japan

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ABSTRACT

This paper investigates the causes of R&D activities of overseas subsidiaries using firm-level panel data for Japanese multinationals. We distinguish between overseas innovative R&D (basic and applied research) and adaptive R&D (development and design) and examine how the intensity of each type of R&D is determined, using Amemiya Generalized Least Squares estimation. Our findings suggest that overseas innovative R&D aims at the exploitation of foreign knowledge, whereas adaptive R&D has no such aim. In addition, the size of the host country's market positively affects both types, whereas geographic distance between the host and the home country has a negative impact. Finally, the parent firm's knowledge is found to increase the size of overseas adaptive R&D but not innovative R&D. Based on a theoretical model, we interpret this evidence as showing that knowledge of the parent firm is not fully utilized in innovative R&D of its subsidiary.

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1. Introduction

Overseas R&D activities by multinational enterprises (MNEs) have expanded significantly since the early 1990s (Kuemmerle, 1999; Granstrand, 1999; Patel and Vega, 1999; Pearce, 1999; Pearce and Papanastassiou, 1999; Le et al., 2002). The literature also indicates that there are two types of overseas

* Corresponding author. Tel.: +81 4 7136 4863.

E-mail addresses: yastodo@k.u-tokyo.ac.jp (Y. Todo), sshimizutani@iips.org (S. Shimizutani).

URL: <http://park.itc.u-tokyo.ac.jp/yastodo/> (Y. Todo).

R&D: one for the utilization and acquisition of foreign advanced knowledge that would otherwise be unavailable in the home country,¹ and another for the adaptation of existing technologies and products to the local conditions of the host country.² We will hereafter denote the former type of overseas R&D as innovative R&D and the latter as adaptive R&D.³

These two types of overseas R&D are quite different in nature and we would therefore expect that their causes are also quite different. For example, innovative overseas R&D is most likely to be performed in technologically advanced countries. In contrast, decisions on adaptive R&D probably depend less on the level of technology of the host country and more on its market size. However, such differences between the two types of overseas R&D are often ignored in the existing literature on causes of overseas R&D. The purpose of this study therefore is to examine how causes of overseas R&D differ between the two different types of overseas R&D. To address these issues, we take advantage of a rich firm-level panel dataset for Japanese parent firms in manufacturing industries and their overseas subsidiaries in both developed and developing countries for the period 1996–2001. An advantage of the dataset used in this study is that it contains information that allows us to classify each overseas subsidiary's R&D activities as innovative or adaptive R&D.

Using the ratio of expenditure on innovative and adaptive R&D to sales at the firm level, which we will hereafter denote as the overseas innovative and adaptive R&D intensity, respectively, we find wide discrepancies between overseas innovative and adaptive R&D. First, whereas the overseas innovative R&D intensity is positively correlated to the host country's total factor productivity (TFP), the adaptive R&D intensity is unrelated to the TFP level. Second, the host country's knowledge level has a positive and significant impact on the overseas innovative R&D intensity, while having no significant impact on the adaptive R&D intensity. The size of the host country's market is positively correlated with both the overseas innovative and adaptive R&D intensity.

These results suggest that overseas innovative R&D is mainly aimed at the exploitation of foreign advanced knowledge, whereas the primary role of overseas adaptive R&D is to contribute to adaptation of existing technologies and products required in the host economy market. In addition, overseas innovative R&D does not seem to utilize knowledge of the parent firm, suggesting that overseas innovative R&D activities are not closely linked with home R&D.

A number of studies, using Japanese firm-level data (Odagiri and Yasuda, 1996; Belderbos, 2001) or industry-level data for the United States and Japan (Kumar, 2001), examine what determines whether MNEs engage in overseas R&D without distinguishing between innovative and adaptive R&D. Ito and Wakasugi (2007) and Shimizutani and Todo (2008), who make such distinction and examine determinants of the two types of overseas R&D using Japanese firm-level data, are closely related to the present paper. However, a major difference between this study and the existing studies is that we use the overseas innovative/adaptive R&D intensity as the major dependent variable, while Ito and Wakasugi (2007) and Shimizutani and Todo (2008) rely on dummy variables that represent whether each firm perform the two types of overseas R&D. As we will show later in Table 4, there is substantial variation in the overseas R&D intensity among overseas R&D-performing MNEs. The use of dummy variables ignores the discrepancy in the R&D intensity and thus may lead to biased estimations. Another notable contribution of this paper is that our estimation strategy based on a theoretical model allows us to investigate whether home R&D and overseas R&D of each MNE are integrated with or independent of each other. This issue is not examined in the existing studies including Shimizutani and Todo (2008).

The remainder of the paper is organized as follows. Section 2 presents the theoretical framework to generate the equations used in the estimation. The equations themselves are presented in Section 3 together with an outline of the estimation method. Section 4 provides an explanation of the data and the variables used, while Section 5 reports our estimation results and relates them to preceding studies. Section 6 concludes.

¹ Jaffe et al. (1993) find that knowledge diffusion tends to be geographically localized.

² Examining U.S. MNEs, Teece (1977) finds that the costs of such adaptations account for 19 percent of total investment costs.

³ Existing studies typically denote the former type as demand-led, home-base-exploiting, or research-oriented R&D, and the latter as supply led, home-base-augmenting, or local-support-oriented R&D.

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