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Effects of R&D and networking on the export decision of Japanese firms

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Abstract

This paper examines how internal R&D intensity and external networking channels are related with the firm's export decision, based on a large firm-level data set covering all manufacturing industries in Japan without any firm-size threshold. Internal R&D is not the only determinant of exporting, while it is strongly related with exports in the science-based sector. Collaborations with other firms on joint projects and operations of subsidiaries overseas are significantly linked to exports of large-sized firms, while affiliations with business associations and R&D intensity are critical for small-sized firms to export. Connections with computer networks have a weaker impact.

Keywords: Exporter; R&D; Networking; Firm-level data

1. Introduction

The role of innovation in exporting has been of particular interest in many countries. As the competition with low-wage developing countries has become more intense, manufacturers in industrialized countries need to exert more effort to maintain their international competitiveness. However, R&D spending within a firm is not the sole solution. Firms can gain ideas or information through direct contacts or computer connections with customers or other firms. This paper examines how internal R&D and external networking are related with the firm's export decision.

Two lines of literature are closely related with this paper. First, accumulated census-based studies since Bernard and Jensen (1995) have established that exporters are distinctively more productive than non-exporters, but the effect of innovation on exporting has been investigated only among a severely limited number of firms (e.g. Sterlacchini, 1999; Wakelin, 1998). Second, internal R&D activities and external knowledge networks have been contrasted as the potential sources of innovations (e.g. Criscuolo et al., 2005; Freel, 2003; Rogers, 2004; Schmidt, 2005). Combining these two strands of research, this paper compares the importance of R&D and networking for exporting based on a large firm-level data set.[1]

This paper derives firm-level data from a survey covering 118,300 Japanese manufacturers. A wide range of

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[1] As a rare example, Nassimbeni (2001) included innovation and consortia affiliation in his analysis of exporting, but concentrated on a limited number of small-sized Italian firms in particular sectors.

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data are included, such as sales, employment, capital, export, R&D, patents, subcontracting, foreign subsidiaries, computer network connections, collaborations with other firms, and affiliation with business associations. Furthermore, since firms of any size in all manufacturing industries are included without any firm-size threshold applied, the survey is a relatively accurate representation of the manufacturing as a whole, and suitable for examining whether R&D is critical for small firms to export. These firm-level investigations will have important policy implications for innovation, export promotion, and small and medium-sized enterprises (SMEs).

This paper is organized as follows. Section 2 describes the firm-level data, and summarizes descriptive statistics comparing exporters versus non-exporters. Section 3 explains the regression specification. Section 4 reports estimation results. Section 5 concludes.

2. Descriptive statistics

2.1. Description of data

All the data used for this paper are derived from *The Basic Survey of Commercial and Manufacturing Structure and Activity* (Sho-Kogyo Jittai Kihon Chosa in Japanese).[2] The survey contains basic data, such as employment, sales, capital, and exports, as well as a range of corporate variables, such as R&D expenditure, the number of patents, and the number of subsidiaries overseas.[3] The firms are surveyed without any firm-size thresholds irrespective of their involvement in exporting or in R&D.

The sample size, 118,300 firms, is considerably larger than those previously used for the export-innovation analysis (e.g. 4005 Italian firms by Sterlacchini, 2001; 320 U.K. firms by Wakelin, 1998; 271 Japanese firms by Ito and Pucik, 1993; and 165 Italian firms by Nassimbeni, 2001). This large sample size combined with a wide coverage of firms of any size in all manufacturing industries ensures that this survey provides an accurate representation or replication of all manufacturing in Japan, and is suitable for discussing national innovation or export promotion policies.

[2] Any researcher can access the same firm data as long as one obtains individual permission from the government in advance.

[3] Japan's *Census of Manufacturers* contains no export data. *The Basic Survey of Business Structure and Activities* contains export data, but the sample size is around one-tenth of our survey, covering only firms with more than 50 employees and more than 30 million yen of capital.

Table 1
Comparisons of exporters vs. non-exporters

	Exporters	Non-exporters
Firm size		
Employment L	445.8	42.3
Sales Q (billion ¥)	22.94	1.26
Productivity (per-worker sales) Q/L	29.5	17.7
Capital–labor ratio K/L	9.50	6.48
R&D		
Intensity R&D/Q (%)	3.60	2.52
% of firms conducting R&D	46.7	14.3
Patents		
Number owned by a firm	217.5	20.4
% of firms owning patents	36.2	7.1
Computer network (% of connected firms)	56.26	20.59
Collaboration with other firms (% of firms)	64.84	8.89
Business associations (% of affiliated firms)	65.01	9.77
Subsidiaries overseas		
% of operating firms	27.7	1.5
Number of subsidiaries	18.96	13.47
Subcontractors (% of firms)	17.74	39.67
Export intensity (% in sales)	10.84	0

Notes: The mean is calculated over firms of which the respective data are available. The original data, except employment or explicitly specified, are in millions of yen.

Although their sample size is large, the census-based plant-level data such as those from U.S. *Census of Manufacturers* by Bernard and Jensen (1995, 1999) contain no innovation data.[4] The main topic in their studies has been the exporter's productivity premium relative to non-exporters, but the innovation as a source of exporter's advantages has not been investigated. This paper instead evaluates the effects of internal and external sources of innovations to reveal factors behind the high productivity of exporters.

2.2. Comparisons of exporters versus non-exporters

Table 1 summarizes descriptive statistics comparing exporters with non-exporters. Several important points emerge from this table.

First, exporters are on average far larger than non-exporters. The number of workers (regular employees) is around ten times larger for exporters, in a comparable

[4] A Taiwanese data set used by Hwang (2003) covers 123,412 firms, but contains no innovation data. As a rare exception, Aw et al. (2005) used both export and R&D data in Taiwan, but their purpose is to examine their complementarity in productivity growth.