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Creation and Exploitation of Knowledge in Multinationals

The Importance of Local and Global Spillovers for Domestic and Foreign Exporters

Hans Lööf and Pardis Nabavi-Larijani

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Abstract

This paper examines the importance of localized knowledge for innovative exporters by observing their embeddedness in regional innovation systems and international knowledge flow by using trade data on openness. The study distinguishes between new competence creation as proxied by patent applications and new competence exploitation captured by the frequency of launching new products on the export market, and overall technical changes captured by total factor productivity growth. We compare the new knowledge creation in 1,000 domestically and foreign owned Multinational Enterprises (MNEs) in Sweden over the period 1997-2008, and new knowledge exploiting in 1,500 MNEs and technical change for both knowledge creators and knowledge exploiters. Our first total factor regression confirms the expected results that foreign MNEs are superior to their domestic counterparts in term of growth rate. We then try to explain this finding by their capacity to utilize local and global knowledge for creating and exploiting new knowledge.

JEL Classification Numbers: C23, F14, L25, O31, R32

Keywords: Innovation, Patents, Localized knowledge, MNE, Exports

1. INTRODUCTION

“...which firm can claim to harness the potential of its knowledge fully and effectively? Which organization does not re-invent the wheel almost on a daily basis? Which organization thoroughly exploits its ‘best practices’ or rejects its ‘worst practices’? Which firm can always find (within the organization or outside it) all the knowledge needed for innovation?”

(Paul Almeida and Anu Phene 2012)

A rather extensive body of literature has examined how innovation is affected by domestic and international transmission of knowledge by examining different channels such as foreign direct investment (FDI), trade, licensing, cross-patenting activities, input–output relations, labor mobility, strategic alliances, and regional and international R&D collaboration. This paper consider the role of localized knowledge for innovative exporting MNEs, and it distinguished between foreign and domestically owned firms, as well as between high and low technology firms.

The study uses subsets of all persistent manufacturing exporters in Sweden over the period 1997-2008. The dataset is restricted to MNEs that are defined as innovative. We distinguish between two types of innovators. The first is described as knowledge creators proxied by patent applicants. The second is knowledge exploiters proxied by their capacity to renew their export products. The first group consists of 993 firms and the other by 1,679 firms, after removing the overlapping groups. Estimating the first sample with patent applicants, we control for product renewal, while we control for patent application when estimating the sample with product renewals. In order to focus on the embeddedness in the local milieu the regressions also controls for international knowledge flow by using trade data on openness.

We consider the geography of innovation and the role of a particular location for both domestically and foreign owned MNE- exporters by identifying 35 different knowledge-intensive producer services at the 5-digit level in which the share of employees with a university degree is above 30 percent. These services include ICT, R&D-engineering, finance, brokerage and recruitment of personnel. For each local economy, our data contains information on the aggregate number and wage sum of these employees, as well as the time distance from each location to all other local economies, enabling us to calculate the accessibility of each firm to specialized business services.

This paper provides several contributions to the literature on innovation and knowledge. Innovative and exporting MNEs account for the bulk of all exports in the world. For Sweden the share is 70-90 percent of the export value in manufacturing, depending on the definition of innovation. But the understanding of how this knowledge is created and how it is exploited is limited, mainly because of the lack of data availability. This study adds to the literature by examining a data set which contains an abundant amount of information for a total population of innovative exporting MNEs, where we can identify both the ownership of that location. We can also classify the specific location based on its knowledge intensity. By using longitudinal data, we are able to identify both persistent exporters and persistent innovators.

The paper disentangles both similarities and differences between foreign and domestic MNEs regarding knowledge creation, knowledge exploitation and overall technical change. It also shows that this variation emerges primarily in the most knowledge-intensive regional environments and only for high technology firms.

The organization of this paper is as follows. The next section elaborates on the issue of internal and external knowledge for innovative firms, the role of international and local knowledge and different categories of knowledge. We then motivate our research topic and present the hypotheses to test. Sections 3 illustrate the data while Section 4 describes the modeling framework. In Section 5 the results are presented. We conclude with a discussion on the empirical findings, their implications and suggestions for further research.

2. BACKGROUND, MOTIVATION AND HYPOTHESES

2.1 Motivation

Systematic empirical evidence on the local sourcing by multinational firms is scarce in the literature, not least because comprehensive representative longitudinal data have become available only recently and only for a limited number of countries. Do multinational firms use their home market to create new knowledge, while their foreign subunits are combining this core knowledge from the parent firms with localized knowledge and creating new exploiting knowledge? In this case we can expect to see systematic differences between domestically and foreign owned firms in a particular country. Are more science based MNEs sourcing their knowledge in a similar way irrespectively of ownership? If this is the case, no large difference

in innovation and performance should be found between domestic and foreign MNEs. Are domestic firms more embedded in national and regional innovation systems? Is high technology or low technology specialization more important for a foreign firm's innovative performance?

The answers to these questions, central to the theory on innovation and growth, depends in part to the geographical patterns of knowledge diffusion, and in part also to whether firms are persistent innovators or not, and also the geographical patterns of the firms' market.

In order to increase the focus of the study, we restrict the analysis to only persistent exporters and innovators. A large body of the literature has documented that exporters are superior to other firms in terms of innovation, productivity and growth. The literature has also shown that this performance gap tend to remain over long time sequences. Thus, the emphasize of the study is on the ownership of the firms and the geography of innovation and we investigate high technology sectors and low technology sectors separately.

2.2 Corporate ownership

Our study is a comparison of domestic and foreign owned MNEs persistently engaged in innovative activities and exports. The justification for including corporate ownership structure in the analysis can be traced back to the literature on the globalization of R&D, which identifies different behaviors of MNE innovative activities depending on the nature of the technological activities and technological objectives of the parent company. If knowledge spillover is related to a particular innovation strategy of the MNE, such as science R&D (new knowledge creation) or applied R&D (knowledge exploitation), one may expect that the association between R&D collaboration and innovation tends to differ between domestic and foreign firms.

2.3 Geography of innovation

There is also a broad agreement in the literature that firms benefit not only from favorable internal conditions. Many early studies have examined how aggregate knowledge sources and R&D activities inside an urban region generate spillovers and affect innovation activities and innovation outcome of firms located in the region.

This paper studies systematic differences in firm productivity and relates these differences to the combined effect of internally cumulated knowledge and external knowledge that can be accessed in the firm's environment. The internal accumulation of knowledge and capabilities is assumed to rely on an innovative firm's strategy to recurrently engage in R&D and innovation efforts. At the same time a firm's external knowledge milieu is measured by its accessibility to supply of knowledge-intensive producer services.

2.4 Hypotheses

The paper considers four different hypotheses

H1: Knowledge creation in exporting MNEs is positively related to the accessibility of local knowledge, but the association is stronger for domestic firms

H2: Knowledge creation in exporting MNEs is positively related to the accessibility of global knowledge, but the association is stronger for foreign firms

H3: Knowledge exploitation in exporting MNEs is positively related to the accessibility of local knowledge, but the association is stronger for foreign firms

H4: Knowledge exploitation in exporting MNEs is positively related to the accessibility of global knowledge, but the association is stronger for foreign firms

3. DATA AND DESCRIPTIVE EVIDENCE

This study is based on register data on exporting manufacturing firms in Sweden from Statistics Sweden, and the EPO Worldwide Patent Statistical Database (PATSTAT). Both databases contain annual firm observations over the period 1997-2008. The register data covers 100% of Swedish manufacturing export from firms with 10 or more employees, and provides information on the firms' value added, exports, employment, human capital (university educated employees), physical capital, ownership, geographical location and industry classification. By merging PATSTAT with the register data we receive information on all firms in Sweden that have applied for a patent nationally or internationally during the period we study.

Although we have access to all firms in Sweden in master data, we restrict the analysis to only persistent innovators (they are exporting all years they are observed), and only firms that engage in innovation activities. The motivation is provided in section 2.

Two different samples are exploited in the study. The first is aimed to study knowledge creation and here we merged the dataset from Statistics Sweden with the PATSTAT data. This resulted in 7,047 observations on 993 unique firms with patent activities. A majority, 60% are domestically owned. The second sample is from Statistics Sweden and here we identify knowledge exploiters by new export products. . This sample is larger and contains 17,495 observations on 5,595 unique firms. Since almost all firms in the first sample are included in the second, we restricted this sample to those firms that do not have any patent activities. So, our final sample covers 1,679 unique firms which 56% are domestically owned.

A comparison of pairwise foreign and domestic firms in the three various locations in row 1 and row 3 of Table 1 shows that the foreign firms have higher value added and total factor productivity (TFP) than the domestic counterparts. This finding is consistent with the literature, which shows that, within countries, foreign-owned firms generally have higher productivity than local firms (see Ebersberger and Lööf 2005). The literature suggests some alternative explanations for the observed difference in performance between domestic and foreign firms. For instance, (1) only firms with superior technology or superior productivity are candidates for mergers and acquisitions through inward FDI, (2) inward FDI is oriented toward high productivity sectors, and (3) M&A has a positive impact on firm efficiency per se.

Looking at the TFP growth, the pairwise comparison shows higher annual average figures for domestic firms local milieus with high and low knowledge intensity. The average TFP-growth is about the same for domestic and foreign firms in areas with medium accessibility to external knowledge. Interestingly, this pattern is not the same for knowledge exploiters. Foreign firms embedded in innovation systems with high accessibility to specialized business services and other types of external knowledge are growing faster than all other combinations of firms and locations.

In the regression analysis, we try to isolate the impact of international knowledge spillovers by using information on openness of the local economy. We follow Cantwell and Picitello

(2012)¹ and use the export share in the municipalities as a control variable. This variable is almost identical across the 12 columns. The export intensity is about 40 percent in both low-, medium-, and high accessibility areas.

Knowledge creating firms are larger than knowledge exploiting firms, and a pairwise comparison reveals that foreign owned firms in Sweden are larger than domestic MNEs. As could be expected, the human capital intensity within the MNEs increases with the accessibility to external knowledge.

The data on innovation activities gives some important information on the difference between the two samples. Firms in the knowledge creation sample are observed to apply for patent 4-5 years. The number of application per firm is substantially larger in areas with high accessibility to knowledge, and in particular for foreign MNEs in these milieus. This pattern remains also if we normalize for firm size. Number of new products is an increasing function of firm size. The bottom part of Table 1 shows high technology firms are located in areas with high accessibility to knowledge; other firms are more equally distributed.

4. METHODOLOGY

The analysis relies on non-linear count data estimators estimator for estimating number of new patents and number of new products with the following specifications:

Count data model 1

*New knowledge creation*_{it} = α_i + *MNE Domestic*_{it} + *MNE Foreign*_{it} + *Openess local economy*_{r,t-1} + *Openess local industry*_{r,j,t} + *Log New Knowledge creation proximity*_{r,t} + *Log New Knowledge exploitation proximity*_{r,t} + *Share Human capital*_{it} + *Log Physical capital*_{it} + *Log firm size*_{it} + *Industry dummies* + *Year dummies* + ε_i

Count data model 2

*New knowledge exploitation*_{it} = α_i + *MNE Domestic*_{it} + *MNE Foreign*_{it} + *New knowledge creation*_{i,t-1} + *Openess local economy*_{r,t-1} + *Openess local industry*_{r,j,t} + *Log New Knowledge creation proximity*_{r,t} + *Log New Knowledge exploitation proximity*_{r,t} + *Share Human capital*_{it} + *Log Physical capital*_{it} + *Log firm size*_{it} + *Industry dummies* + *Year dummies* + ε_i

i=firm, r=region, j=industry, t=time

¹ Cantwell and Piscitello measure local openness by the export share of the local industry

New Knowledge creation proximity

Number of patent applications by MNEs over the period 1997-2006 (or patent application totally) in the local economy j where the firm i is located. The applications by the observed firm are excluded

New Knowledge exploitation proximity

Number of new export products by MNEs over the period 1997-2006 (or export products totally) in the local economy j where the firm i is located. The new export products by the observed firm are excluded

Openness of the local economy

Export share of the local economy where the firm is located (FA-region) divided by the export share of the whole economy

Openness of the local industry

Export share of the local industry (the FA-region industry to which the observed firm belongs) divided by the export share of this industry in the whole economy

Tables

Table 1. Summay Statistics

	I. At least 1 year of Patenting						II. New export products (removing the patenting firms)					
	Swedish MNEs 60.3%			Foreign MNEs 39.7%			Swedish MNEs 55.9%			Foreign MNEs 44.1%		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Spillover												
Level, log VA	17.67 (1.22)	17.86 (1.55)	17.99 (1.74)	18.25 (1.17)	18.18 (1.31)	18.70 (1.63)	17.20 (1.15)	17.10 (1.12)	17.30 (1.35)	17.60 (1.27)	17.42 (1.29)	17.63 (1.43)
Growth, log VA	3.4% (0.40)	2.0% (0.47)	4.9% (0.52)	-0.6% (0.41)	0.0% (0.47)	2.2% (0.47)	1.4% (0.35)	2.3% (0.34)	0.3% (0.61)	0.1% (0.39)	0.5% (0.43)	3.4% (0.47)
Level, log TFP	15.16 (0.60)	15.29 (0.89)	15.36 (0.89)	15.38 (0.62)	15.34 (0.62)	15.68 (0.90)	14.99 (0.63)	14.93 (0.56)	15.02 (0.75)	15.17 (0.64)	15.08 (0.66)	15.21 (0.78)
Growth, log TFP	2.2% (0.39)	0.5% (0.48)	3.2% (0.51)	-1.4% (0.34)	0.7% (0.46)	2.6% (0.51)	1.1% (0.35)	1.4% (0.34)	0.7% (0.61)	-0.2% (0.39)	1.2% (0.43)	3.3% (0.46)
Exports per sale, Muni	0.39 (0.14)	0.41 (0.17)	0.44 (0.17)	0.42 (0.16)	0.44 (0.17)	0.40 (0.16)	0.38 (0.16)	0.40 (0.16)	0.39 (0.16)	0.40 (0.17)	0.43 (0.18)	0.38 (0.16)
EMP	181 (281)	335 (885)	582 (1854)	276 (309)	340 (655)	648 (1932)	113 (170)	104 (178)	177 (462)	175 (292)	147 (202)	234 (573)
PC, log	16.25 (1.83)	16.05 (3.32)	16.00 (3.02)	16.81 (1.68)	16.57 (1.99)	17.07 (3.01)	15.66 (2.54)	15.27 (2.94)	15.22 (2.92)	16.35 (2.48)	15.74 (3.08)	15.90 (2.87)
HC	6.9% (0.08)	9.8% (0.11)	19.2% (0.16)	7.6% (0.06)	9.6% (0.08)	19.4% (0.13)	4.0% (0.05)	5.9% (0.08)	11.6% (0.13)	4.3% (0.05)	6.8% (0.07)	12.6% (0.12)
Patenting Years	3.8 (3.1)	4.4 (3.1)	4.8 (3.6)	4.6 (3.5)	4.6 (3.5)	5.1 (3.9)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total Patent Appl.	17 (60)	32 (127)	102 (546)	18 (31)	24 (47)	181 (1157)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total New Product	3.8 (4.84)	4.3 (7.6)	6.8 (16.9)	4.2 (5.4)	5.1 (10.6)	5.9 (11.8)	2.9 (3.7)	3.1 (3.8)	3.7 (9.0)	3.2 (4.7)	3.4 (4.2)	3.6 (6.9)
High Technology	0.04	0.09	0.30	0.04	0.11	0.31	0.04	0.07	0.15	0.03	0.06	0.10
High Medium Tech	0.46	0.48	0.43	0.54	0.48	0.39	0.30	0.31	0.35	0.29	0.35	0.40
Low Medium Tech	0.37	0.26	0.16	0.28	0.25	0.20	0.33	0.26	0.18	0.33	0.32	0.24
Low Technology	0.13	0.17	0.11	0.14	0.16	0.10	0.33	0.36	0.32	0.35	0.27	0.26
<i>Sum</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>
Unique firms	173	218	208	110	121	163	339	316	284	238	218	284
Obs, total	1,228	1,599	1,450	800	839	1,131	2,243	2,126	1,732	1,565	1,374	1,816
Obs, fraction	0.17	0.23	0.21	0.11	0.12	0.16	0.21	0.19	0.16	0.14	0.13	0.17