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Working Paper

Foreign Firms and Their R&D in Finland

ETLA Discussion Papers, No. 689

Provided in Cooperation with:

The Research Institute of the Finnish Economy (ETLA), Helsinki

Suggested Citation: Pajarinen, Mika (2002) : Foreign Firms and Their R&D in Finland, ETLA Discussion Papers, No. 689, The Research Institute of the Finnish Economy (ETLA), Helsinki

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Keskusteluaiheita - Discussion papers

No. 689

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FOREIGN FIRMS AND THEIR R&D IN FINLAND

* Financial support from the National Technology Agency (Tekes) is gratefully acknowledged.

PAJARINEN, Mika. Foreign firms and their R&D in Finland. Helsinki: ETLA, Elinkeinoelämän tutkimuslaitos, The Research Institute of the Finnish Economy, 1999, 33 p. Keskusteluaiheita, Discussion Papers, ISSN 0781-6847; No. 689.

ABSTRACT: Foreign direct investments have increased quite substantially in Finland in the 1990s. The dominant methods of recent inward foreign direct investments have been mergers and acquisitions. Although foreign firms have increased direct investments in Finland, foreign-owned firms' shares of industrial production and R&D expenditure are still quite insignificant; in recent years the shares have been approximately 12-14 percent. The average ratio of R&D expenditure to turnover has been higher in foreign-owned firms than in Finnish-owned firms. This has been mainly due to foreign subsidiaries' more concentrated distribution in some relatively high technology sectors compared to Finnish-owned firms; at the industry level the differences in ratios have been small or even opposite. The average growth rate of R&D expenditure in the 1990s has been higher in Finnish-owned firms than in foreign-owned firms. In addition, we found a slight decrease in the average ratio of R&D spending to turnover after foreign takeovers, but in a majority of firms the changes in the ratios before and after the takeovers were quite small.

KEY WORDS: R&D, multinational companies, mergers and acquisitions.

PAJARINEN, Mika. Ulkomaiset yritykset ja niiden T&K-toiminta Suomessa. Helsinki: ETLA, Elinkeinoelämän tutkimuslaitos, The Research Institute of the Finnish Economy, 1999, 33 s. Keskusteluaiheita, Discussion Papers, ISSN 0781-6847; No. 689.

TIIVISTELMÄ: Sekä Suomeen että Suomesta tehdyt ulkomaiset suorat sijoitukset ovat kasvaneet merkittävästi 1990-luvulla. Suomeen suuntautuneet ulkomaiset suorat sijoitukset ovat viime aikoina olleet pääasiassa yritysostoja ja fuusioita. Vaikka ulkomaiset yritykset ovatkin lisänneet suoraa sijoitusta Suomeen, niiden tytäryhtiöiden osuus teollisuustuotannosta ja Suomessa tehtävästä tutkimuksesta ja tuotekehityksestä on pysynyt melko pienenä; viime vuosina osuudet ovat olleet noin 12-14 prosenttia. Ulkomaalaisomisteisissa yrityksissä T&K-menojen osuus liikevaihdosta on ollut korkeampi kuin Suomessa toimivissa T&K-yrityksissä keskimäärin. Tämä selittyy suurelta osin ulkomaalaisomisteisten T&K-yritysten painottumisella eräille suhteellisen korkean teknologian toimialoille. Toimialatarkastelut paljastivat, että useilla toimialoilla erot T&K-menojen suhteellisissa osuuksissa ovat olleet pieniä tai jopa vastakkaisia aggregaattitason vertailun kanssa. T&K-menot ovat kasvaneet 1990-luvulla suomalaisomisteisissa yrityksissä keskimäärin nopeammin kuin ulkomaalaisomisteisissä yrityksissä. Ulkomaisten yritysten ostamissa yrityksissä havaittiin pieni negatiivinen muutos keskimääräisessä T&K-intensiteetissä yrityskaupan jälkeen, mutta yritystasolla muutokset olivat useimmiten varsin vähäisiä.

AVAINSANAT: T&K, monikansalliset yritykset, yrityskaupat.

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1 INTRODUCTION

Background and objectives of the study

This study focuses on foreign-owned firms' research and development (R&D) activity in Finland. The study is one part of a larger research project in which we analyzed both Finnish firms' R&D activity abroad and foreign firms' R&D in Finland. The research team of the project consisted of three organizations – the Research Institute of the Finnish Economy (ETLA), the Technical Research Center of Finland (VTT) and Statistics Finland. In the project, ETLA focused on foreign companies' R&D in Finland and VTT on Finnish companies' R&D abroad. Statistics Finland was involved in both topics.

In this study we discuss the following issues:

- What is foreign-owned firms' contribution to R&D done in Finland?
- In which sectors and product groups do foreign-owned firms have the largest influence on R&D in Finland?
- Are there any significant differences in R&D activities (scale, scope, funding sources, etc.) between Finnish-owned and foreign-owned firms?
- What effects have mergers and acquisitions had on acquired firms' R&D activities?
- Are there any significant differences in the profitability and productivity performance between foreign-owned and Finnish-owned firms?

Previous studies on foreign firms and their R&D activity in Finland

There are only few previous studies which analyze foreign firms and their R&D activity in Finland. Pajarinen & Ylä-Anttila (1998) carried out a study on foreign-owned firms and on their relative economic performance in the Finnish economy, but the study did not directly focus on foreign firms' R&D activities.¹ According to the study foreign-owned firms' influence in the Finnish economy has been quite modest but has increased in the 1990s. Furthermore, an increasing number of foreign takeovers has taken place in relatively high technology sectors. In addition, according to the study the average financial performance of large foreign-owned manufacturing firms was better than the average performance of large Finnish-owned manufacturing firms in the 1990-1996 period. Moreover, the average growth of employment and value added was in the period of the study also larger in foreign affiliates than in the Finnish economy on average. This was the case even when mergers and acquisitions of new foreign entrants in the 1990s were excluded. Thus, according to the study foreign ownership seems to have had a positive influence on the development of the Finnish economy.

¹ Pajarinen & Ylä-Anttila (1998) include a more detailed review of studies on foreign-owned firms in Finland. In the current research review we refer only to some recent studies.

Luukkanen (1994) studied foreign-owned manufacturing firms' R&D activity in Finland in the 1984-1991 period. The study utilized the Statistics Finland data of manufacturing firms' R&D and the Business Register. According to the study the share of foreign-owned manufacturing firms of the total R&D in the manufacturing sector increased in the period of the study from some five to nine percent. In addition, foreign-owned manufacturing firms were more R&D intensive than Finnish-owned manufacturing firms, on average. Analyzed by industry, however, the situation was in many cases opposite. An explanation for this phenomenon was the relatively higher concentration of foreign-owned firms in high technology sectors than in the Finnish economy, on average. A shortcoming of the study was, as Luukkanen remarked, that the definition of a foreign-owned firm used in the study took into account only direct foreign ownership. This concept excluded some large, ultimately foreign-owned firms which were, e.g., owned by Finnish holding companies which, in turn, were owned by foreign multinational firms. For instance, according to Luukkanen (*ibid.*, 6-7) the large foreign-owned group, ABB, owned in the period of the study in Finland dozens of firms, of which in the Business Register only the non-manufacturing holding company, ABB Oy, was classified under the category of foreign-owned firm. This is why the results in the study probably underestimated the contribution of foreign firms to R&D activity in Finland.

Myllyntaus (1992) studied technology transfer into Finland in an historical perspective. According to his analysis the influence of inward foreign direct investment on technology transfer has been at the aggregate level in Finland quite insignificant. This has been primarily due to modest inward foreign direct investment activity. However, in some industries, like in the electrical engineering and electronics industry, inward foreign direct investments have been more influential, especially at the early stages of the development of the industries and, on the other hand, during the recent internationalization stage of the industries. This has been also emphasized by Lovio (1992) in his analysis of the effect of foreign firms on the development of the Finnish electronics industry.

The definition of a foreign-owned firm, main data sources and restrictions

In this study we utilize a somewhat different definition of foreign-owned firm than is used in traditional foreign direct investment (FDI) statistics. We are interested in ultimate beneficiary owners of firms whereas traditional FDI statistics only include data on immediate beneficiary owners.² This is to say that, in addition to direct investment flows of foreign companies, we try to also take into account holding company arrangements, takeovers carried out by foreign subsidiaries in Finland themselves and some other factors which may distort the view of foreign investment activity.³ The definition used in this study is in line with recent OECD recommendations of the concept of a foreign-owned firm. Compared to traditional FDI statistics, the definition of foreign-owned firm utilized in our analysis means, *first*, that the number of firms classified under the foreign-owned firms' category may differ from the traditional FDI statistics data and, *second*, that the investing country statistics may differ from the data of the traditional FDI statistics.

² However, due to data constraints we use traditional FDI statistics data and definitions (i.e., data on immediate beneficiary owners) in Section 2.1, which discusses general foreign direct investment trends.

³ Due to the complexity of cross border company arrangements there are, however, a number of cases in which we cannot define the ultimate beneficiary of investment. Furthermore, in some cases the ownership of investing companies is so diversified that we are unable to define who is the ultimate beneficiary.

We limit our analysis, however, only to subsidiaries of foreign firms, i.e., foreign firms have to own over 50 percent of the voting rights of the firms active in Finland (directly or via holding companies).⁴ Thus, in this study we do not classify under the foreign-owned firms' category such public companies in which total foreign ownership is high but also so highly diversified that no single foreign shareholder ultimately has over 50 percent of the voting rights. Such companies in Finland are, for instance, Nokia, UPM Kymmene and KCI Konecranes. In addition, companies which are jointly owned on a 50-50 basis by Finnish owners and foreign owners are not considered as foreign-owned companies. As the number of joint firms which had R&D activity in Finland was rather small in the period of the study, we excluded these firms from the study.⁵ This was done in order to preserve the confidentiality of company level data.

Extensive research has been conducted at ETLA on various aspects of internationalization of Finnish firms and industries.⁶ A part of the research has tackled the issue of foreign-owned firms in Finland. A considerable amount of information about foreign firms' activities in Finland has been accumulated during these studies.⁷ In the current project we have updated a part of this data and combined it with the data sources provided by Statistics Finland. The Statistics Finland data used in the study include the Business Register, the Industrial Statistics publications, the Foreign Affiliate Database (FATS) and the R&D surveys. Furthermore, we also utilized companies' annual reviews and other information provided directly by companies. The merging of different data sources and data analyses were conducted at the premises of Statistics Finland due to that organization's strict confidentiality rules regarding company level data.

As the data sources list indicates, we mainly combine in this study various existing data banks, i.e., we have not carried out any own large-scale inquiries at foreign firms about their R&D and other activities in Finland. Due to the fact that we have relied on the existing data sources, we cannot explicitly study some specific issues related to foreign direct investments, such as the motives of foreign investors to establish production and R&D activities in Finland.⁸ Furthermore, due to the strict confidentiality rules of Statistics Finland related to information on, e.g., R&D and ownership of companies, we are unable to publish any company level characteristics which are based on the data banks of Statistics Finland. This is also why the level of aggregation of the findings is in some parts of the study as wide-ranging as it is. Nevertheless, the merging of different existing data sources offered us, in principle, a vast amount of interesting information on the activities of foreign companies in Finland.

In order to get sensible data for the analyses, we had to place quite a lot of effort in the early stages of the project on cross-checking different data sources. Insufficient documentation of some older data files and variation in the aggregation level of company information caused us some extra work during the merging process: for

⁴ In the traditional statistics, capital investment is classified under the foreign direct investment category if the ownership share exceeds 10 percent. See Box 2.1 for more details.

⁵ MeritaNordbanken and Genencor International are examples of jointly owned companies in Finland.

⁶ Pajarinen, et al. (1998) includes a review of some recent studies.

⁷ Many organizations, e.g., Invest in Finland Bureau and Talouselämä magazine have helped us to gather data for research projects.

⁸ The motives can be, however, analyzed indirectly by studying the investment behavior of foreign firms, i.e., the industry and company characteristics of foreign direct investments.

instance, detailed establishment level information on companies was available in some data sources, whereas in some other data banks only group level information was available. Moreover, in some data sources a mixed level of aggregation was used, i.e., the same data file included information on some companies at the group level, while the establishment level aggregation was available for some other companies. We tried to maintain the level of data as detailed as possible when we merged different data sources for the analyses. In addition, Statistics Finland has traditionally gathered data mainly in order to produce aggregate (cross-sectional) statistics, not for purposes of panel analyses which rely on detailed company level time-series data. This was reflected by some inconsistencies in the merged time-series data at the company level.

Structure of the study

Section 2 gives a short general review of foreign direct investment activity in Finland. Section 3 focuses on the R&D activities of foreign firms in Finland. In addition to a statistical review, in this section we discuss some specific issues, e.g., the effects of ownership and ownership changes on the scale of R&D activity. Section 4 concludes.

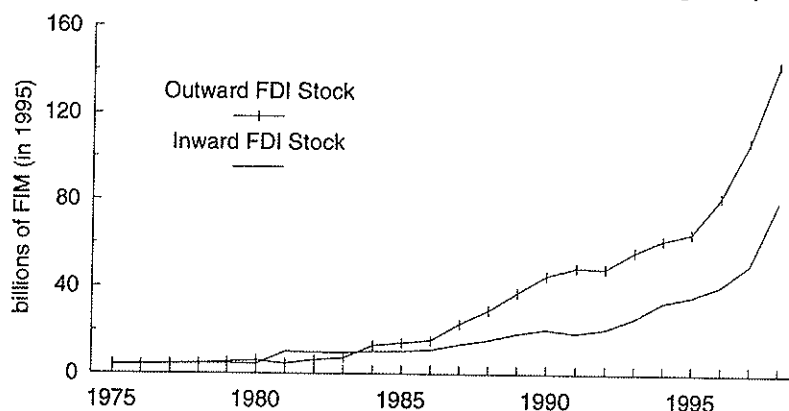
The study was carried out in cooperation with Statistics Finland. The author wishes to thank Mikael Åkerblom, Jussi Koskinen, Merja Kiljunen, Olavi Lehtoranta and Matti Okko from Statistics Finland for assistance and comments. In addition, Pekka Ylä-Anttila, Petri Rouvinen, Synnöve Vuori, Jyrki Ali-Yrkkö and Anthony de Carvalho from ETLA offered valuable comments during the project. Furthermore, the author wishes to thank participants in the workshop on “Internationalization of R&D, comparing small countries in a European perspective” held in Helsinki on September 9-10 for their comments on an earlier version of this paper.

2 FOREIGN FIRMS IN FINLAND – GENERAL TRENDS

2.1 Foreign direct investment in Finland – a macro perspective

As we can see from Figure 2.1, both inward and outward foreign direct investment activity was modest in Finland until the 1980s. In the second half of the 1980s both inward and outward foreign direct investment started to expand. This trend has intensified during the 1990s, although growth temporarily slowed down in the early 1990s.

Figure 2.1 Inward and outward FDI stocks (fixed prices) in 1975-1998



Sources: Etna Database - Bank of Finland.

Note: 1. Nominal FDI Stocks deflated by GDP deflator (1995=100).
2. The 1998 stocks were based on preliminary data.

Outward FDI flows have been dominated in Finnish industry by large manufacturing firms.⁹ These firms are today highly internationalized compared to firms in many other industrial countries. Especially in the engineering industry, the business operations of large Finnish firms have become markedly global. Forest industry firms have traditionally been more oriented towards Europe in their internationalization strategies, but in recent years large pulp & paper producers have also expanded outside their traditional geographical locations. Finnish firms' foreign direct investments seem to have followed more or less the growth pattern of other industrial economies, but the rate of growth during the last decades may have been even faster than on average.

There are several explanations for the increase in *inward FDI flows*. The removal of remaining restrictions on foreign ownership in 1993 made Finland a more potential destination for foreign firms' direct (as well as portfolio) investments. Furthermore,

⁹ Ali-Yrkkö & Ylä-Anttila (1997) have recently studied the foreign direct investments of large Finnish manufacturing firms.

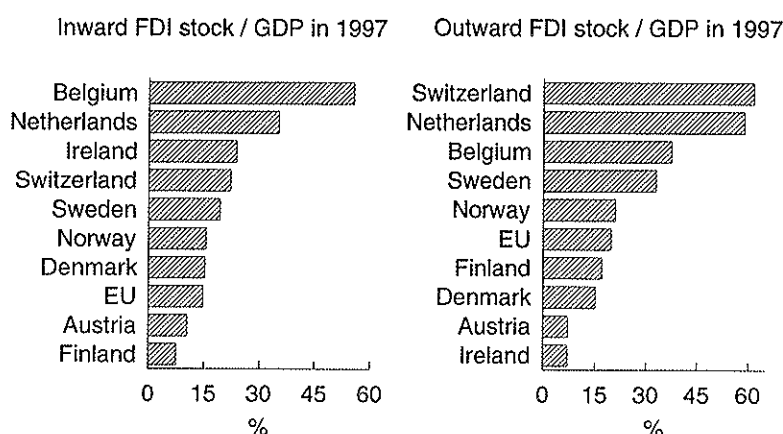
as technological knowledge of Finnish companies has improved during the last decades, acquiring one of the existing companies has become a more attractive option. The deep recession in the early 1990s paved the way for foreign firms' to enter Finland: some companies with sound business operations ran into financial difficulties and could be acquired at a reasonable price. Finnish membership in the EU and EMU has helped the matter, too.

The recent tendency of Finnish companies to focus on their core competencies contributes to both outward and inward FDI. Specialization in narrower segments requires a global presence and large market shares in order to reach profitable business volumes. On the other hand, Finnish companies are more willing to sell the divisions that are not considered to be of strategic importance: lately the buyers have often been foreign firms.

There is a clear imbalance between inward and outward foreign direct investment in Finland: in 1997, for example, the outward FDI stock was two times larger than the inward stock. This indicates an intense outward internationalization stage of large Finnish companies. On the other hand, one reason for the imbalance could be that, in addition to capital flows related to mergers and acquisitions, direct investment capital flow statistics also include capital flows related to financial operations between parent company and foreign affiliate. The proportion of intra-group financial flows has been quite substantial especially in the case of capital outflows (Ali-Yrkkö & Ylä-Anttila, 1997, 37–38). Thus, aggregate direct investment capital flow statistics may give us biased information on the actual scale of operations. In addition, in recent years there have been a couple of large cross border mergers which have increased significantly both inward and outward FDI stocks. The impact of these mergers on FDI stocks should be kept in mind when assessing the development of FDI.

Internationally compared, FDI activity in Finland still has growth potential. As we can see from Figure 2.2, in Finland the ratio of the inward FDI stock to GDP was in 1997 the smallest among a sample of small and medium-sized European countries. It was clearly smaller than the EU average, too. In the outward FDI stock comparison Finland was ahead of Denmark, Austria and Ireland but far behind highly internationalized countries, such as the Netherlands and Sweden.

Figure 2.2 Foreign direct investment in an international perspective



Sources: FDI stocks: UN(1998, annex tables B.3 and B.4), GDP: OECD Annual National Accounts (current exchange rates and prices).

Note: Data on Belgium also includes Luxembourg.

Box 2.1 A definition of foreign direct investment (FDI).

There are many different operational definitions of FDI, but all aim to encompass the desire of a home country firm to obtain and manage an asset in a host country. The ability to manage the acquired asset will depend in part on the financial structure of the companies concerned and also on the characteristics of the host country's legislation. There are internationally agreed guidelines for national balance of payments statistics that are reported to the IMF for its Balance of Payments Yearbook. However, it has to be accepted that the guidelines have not been fully implemented.

FDI includes three categories of capital:

Equity Capital: The value of the shares held in the foreign enterprise should exceed 10% of the shares with voting rights. This would include Greenfield investment as well as mergers & acquisitions. The latter is a major form of FDI in the developed world, although controversy remains over where it is appropriate to draw the dividing line between portfolio investment and FDI.

Reinvested Earnings: Retained profits by the affiliate are assumed to be reinvested in the affiliate. The proportion of reinvested earnings in long established investments may be substantial.

Other Capital: Short and long term borrowing between the parent company and its affiliates are also included in the stock of FDI, but these stocks could just reflect transfer pricing of assets, rather than real claims.

Source: Pajarinen, et. al (1998, 49) - adapted from Barrel & Pain (1997, 64).

Box 2.2 Arguments for and against inward and outward foreign direct investment.

In this box we discuss positive and, on the other hand, some negative effects of outward and inward FDI. *Knowledge* has an essential role here: it comes up in every one of the groups we discuss in one form or another. Furthermore, the effects of FDI partly depend on *how* the investments are made, i.e., whether an existing firm is acquired, or whether a new one is established (a 'Greenfield' investment).

Potential Benefits of Outward FDI

One justification for a Greenfield investment may be the need to defend market position in a foreign market. Alternatively, an existing foreign company can be bought, in which case market share is acquired directly. Local presence increases creditability, lowers transportation cost, and makes it possible to circumvent existing trade restrictions. Furthermore, some goods and services, e.g., accommodation, cannot be transported, and thus FDI is perhaps the only viable alternative to be present in the market.

By being the earliest MNF to make a Greenfield investment in a given market, the firm has a first mover advantage: it can gain a foothold before others, and it may even attempt saturating the market and become the sole provider. Besides increasing monopoly power, a large global market share also gives a firm an important role in establishing worldwide product standards. Also, access to international capital markets improves with global presence. Diversifying production and input sources across countries obviously smoothes a firm's cash flow.

Outward FDI may provide the company with strategically important resources: examples are acquisitions of technologically intensive firms or setting up subsidiaries in areas of dynamic resource creation and upgrading.

Possible Drawbacks of Outward FDI

There has been some discussion on what is the effect of outward FDI on domestic employment and capital stock, even though causality is highly questionable (WEF, 1997, 38). It is plausible to argue that foreign direct investment may crowd out home-country investments and thus affect adversely domestic capital formation and employment. There seems to be little empirical evidence, however, at least for major home countries, that such crowding out takes place. FDI also transfers some domestic knowledge to the host country; it is sometimes feared that the host countries will eventually catch up in the industries where the home country may currently be the technology leader. This argument ignores the fact that FDI is by no means the only channel of spillovers.

Potential Benefits of Inward FDI

The World Bank argues that "foreign direct investment can bring substantial gains to recipient economies, contributing to physical capital formation, human capital development, transfer of technology and know-how (managerial skills), and expansion of markets and foreign trade." (WB, 1997, 31).

A host country benefits from knowledge spillovers, which almost unavoidably accompany inward FDIs. MNEs' effect on local human capital development takes place through, e.g., local hiring and training. The effect may also be indirect as the subsidiary has local suppliers, distributors, etc. MNEs' 'expand markets and foreign trade' by opening channels to previously untapped markets. Thus, FDI may contribute to national welfare through an increased volume of exports.

There have been some concerns about the decreased savings rate in the industrial countries – to the degree that there has been discussion about the 'global capital shortage' (OECD, 1995). If a country cannot make the needed investment with domestic funds, inflows of FDI are crucial in maintaining the domestic capital stock.

As inward FDI decreases transportation costs, domestic customers may benefit through lower prices of previously imported goods. In addition, increased competition on the domestic market may have a similar effect.

Possible Drawbacks of Inward FDI

In a highly industrialized country the benefits from knowledge spillovers through FDI are less obvious, although, it should be kept in mind that any country in the world will always depend on imported technology to some extent. The accumulated knowledge also flows out of the country and in advanced countries there have been fears that the domestic technology base is somehow 'stolen' through inward FDI.

Note that inward FDI may eventually decrease domestic competition, if MNEs' production in the host country drives domestic suppliers out of business. Market power transfers to higher prices and thus harms domestic consumers. This could also have detrimental effects on the national innovation system.¹⁰

Source: Adapted from Pajarinen, et al. (1998, 54-55).

¹⁰ "... an MNC acquires technology and R&D resources in a foreign country for less than their local opportunity cost and uses these resources to outcompete the local industry with no positive restructuring effects on the local economy. This could for instance happen if the host country supply of qualified scientists and engineers is scarce and local competitors are small but growing." (Granstrand et al., 1992, 244)

2.2 Foreign-owned firms in Finland – a firm level perspective

In 1997 there were approximately 1,800 foreign-owned firms in Finland. This was less than one percent of all companies in Finland. Foreign affiliates employed over 100,000 employees. Their share of the total business sector employment in Finland was approximately nine percent. The higher employment share than the share of companies indicates that the average size of foreign-owned firms was larger than the average size of firms in Finland. This can be noticed also from Table 2.1 which shows foreign subsidiaries' proportion of the number of companies and employment in three size categories. We can see that foreign affiliates' shares are significantly higher among large companies than among small companies.

Over half of foreign affiliates were active in 1997 in the wholesale and retail trade sectors. The total foreign affiliates' employment share in these sectors was 18 percent. In the manufacturing industries, the employment share of foreign-owned firms was approximately 12 percent and the share of value added 14 percent. By country of origin, Swedish firms have clearly been the largest group of foreign direct investors in Finland (see Figure 2.3). Measured by employment, Swedish firms are followed by firms from the USA, Switzerland and Denmark.

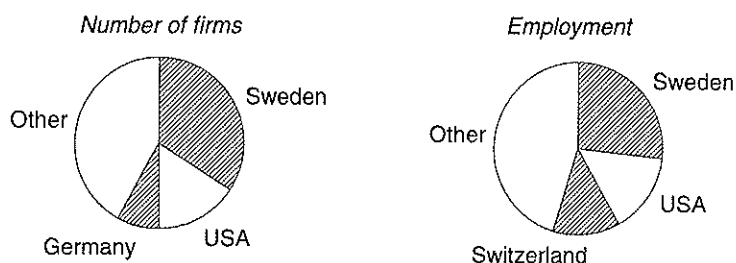
The proportion of firms in the relatively high technology industries is larger among foreign-owned firms than among other firms in Finland, on average. This can be seen from Figure 2.4, in which we have divided manufacturing firms in Finland into four technology intensity categories. In addition, the figure shows that in 1997 over 10 percent of the employees of foreign-owned manufacturing firms worked in the high technology industries and about 60 percent in the high or medium-high technology industries. These shares were higher than in Finnish-owned firms, on average. Foreign-owned firms' proportion of high technology industries' production and employment in Finland was in 1997 approximately 14-15 percent. Their estimated share of exports of high technology industries was somewhat less than their production and employment shares. However, our data on exports at the company level was not as detailed as the data on production and employment, which may be one reason for the lower proportion in the case of exports.

Table 2.1 Foreign subsidiaries in Finland: shares of companies and their employment by size categories in 1997

Company size (number of employees)	Foreign owned firms' share of	
	number of firms	employment
1-49	< 1 %	3 %
50-99	11 %	11 %
100-	18 %	14 %
All firms in Finland	< 1 %	9 %

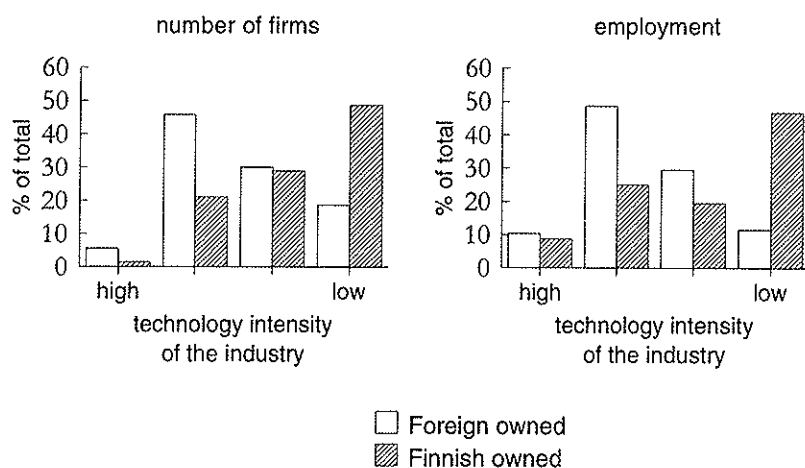
Sources: Etila and Statistics Finland; author's calculations.

Figure 2.3 Foreign affiliates in Finland by ultimate beneficiary owner country in 1997



Sources: Etna and Statistics Finland; author's calculations.

Figure 2.4 Distributions of foreign-owned and Finnish-owned manufacturing firms by technology intensity in 1997



Sources: Etna and Statistics Finland; author's calculations.

Note: Firms were grouped into the four technology intensity categories according to classification used by OECD. (Details of classification, see, e.g., Statistics Finland (1996))

Compared to Finnish-owned manufacturing firms, the average financial performance of foreign-owned manufacturing firms has been quite good in recent years. This can be noticed from Table 2.2, which summarizes the average performance of large foreign-owned and Finnish-owned manufacturing and construction sector firms in the 1988-1998 period. The table shows that large foreign-owned manufacturing firms have been more profitable and productive than Finnish-owned firms, on average. On the other hand, foreign subsidiaries have not invested in fixed assets as much as Finnish-owned firms. In fact, one reason for the better average profitability of foreign subsidiaries (measured by return on investment) is that in foreign subsidiaries the amount of capital invested relative to value added is typically less than in Finnish-owned firms. Thus, it seems that capital is more productive in foreign affiliates than in Finnish-owned firms.

The results of the comparison of average financial performance are biased by the fact that productivity and profitability levels differ also by industries. As we have noticed from Figure 2.4, foreign affiliates are more concentrated in the relatively high

technology industries than Finnish-owned firms.¹¹ In these industries new innovations and rapid product development usually yield, at least temporarily, higher profits than in the mature industries. This may have contributed to the better average performance of foreign-owned firms. In order to cope with the industry distribution bias, we analyzed the financial data also by main industries. The results of these analyses showed, typically, smaller average profitability and productivity performance differences than in Table 2.2. In some cases performance differences even disappeared or were opposite. In electrical engineering, for instance, there were no significant differences in the average profitability or in the average labor productivity performance. However, even in this case differences in average fixed asset investment activity and in capital productivity remained.

Thus, in addition to rather conservative fixed asset investment activity, a significant explanation for the better average profitability and productivity performance of foreign-owned manufacturing firms is the industry distribution. There are also other factors which may have contributed to the good performance of foreign affiliates: Foreign affiliates in Finland are often a part of large multinational companies. This is likely to contribute to scale advantages, e.g., in input purchases and in corporate financing. Moreover, in some cases foreign multinational parent firms may have contributed to improvements and innovations in production technologies. Furthermore, instead of building and maintaining international marketing channels, as a part of multinational companies Finnish subsidiaries may have utilized existing cross border marketing channels of parent firms, which may have facilitated international market penetration with reasonable investment efforts (see also Box 2.3 for some company cases).

Table 2.2 The average performance of large manufacturing and construction sector firms by owner in 1988-1998

	Owner	
	Foreign	Finnish
Profitability		
Return on investment, %	17	12
number of observations	338	1797
Productivity		
Value added per invested capital	0.8	0.6
number of observations	339	1798
Value added per employee; FIM 1,000	332	269
number of observations	365	1912
Investment activity		
Fixed asset investment per turnover, %	7	11
number of observations	403	1937

Source: The 500 largest firms in Finland database provided by Etlatiето ltd. and Talouselämä magazine; author's calculations.

Note: 1. Differences in the means are statistically significant at the five percent level.
2. Nominal variables were deflated by the producer price index (1990=100).

¹¹ This is true also in the case of large companies, although, their classification under a certain industry is in many cases more difficult than in the case of small companies.

Box 2.3 Cases of foreign-owned firms in Finland.

In this box we review five cases of foreign firms' subsidiaries in Finland. The cases are ABB Finland, LM Ericsson, Tellabs, Leiras and i2 Technologies Finland. The first four companies were chosen because they are quite large foreign-owned firms which can be assumed to have an influence on the development of the industries and clusters in which they are located. Of these firms, only the Finnish subsidiary of LM Ericsson was originally a greenfield foreign direct investment, the others are cases of foreign takeovers. The fifth review, the case of i2 Technologies, illustrates one possible growth path for a small technology-based company.

ABB Finland Group

ABB Finland is the largest foreign-owned group in Finland. Moreover, it is one of the largest companies in the whole economy. The group consists of a holding company and a number of its subsidiaries. The companies of the group basically operate in the field of electrical engineering, although some other industrial activities can be identified, too. Until the mid-1980s, ABB Finland was known as Strömberg Oy. The company is one of the oldest still operating companies in Finland; it was founded in the 19th century. In the history of the company, foreign competitors have tried to acquire it several times. The main motive for the early attempts was to buy the Finnish company out of the market, later the company's reputation for product innovations increased its attractiveness in the eyes of foreign investors. One of the most eager of the competitors was the Swedish firm ASEA, which finally in 1986 succeeded to take over Strömberg. Quite soon after the takeover, ASEA merged with the Swiss company Brown, Boveri & Cien. Consequently, the name of the Finnish subsidiary became ABB Finland.

The performance of ABB Finland has been favorable during the last decade. The ownership change had a clear positive impact, e.g., on foreign sales. In addition, the company has continued intensive investments in R&D. Due to the restructuring of the group's operations, some activities have been moved away from Finland to other locations but, on the other hand, the competence areas of ABB Finland have strengthened.

Sources and more detailed case studies: Annual reviews of the ABB Group and ABB Finland, Hernesniemi & Viitamo (1999, 165-172), Hoffman (1989) and Pajarinen & Ylä-Anttila (1998, 47-48).

Oy LM Ericsson Ab

LM Ericsson established a subsidiary in Finland in the early twentieth century. Nowadays the activities of the Finnish subsidiary include the selling of the group's telecommunications products and providing after sales services. Furthermore, although only some three percent of the R&D staff of the group works in Finland, the Finnish R&D center is, according to company information, one of the most important R&D centers of the group. The R&D of the Finnish subsidiary is focused especially on mobile telecommunications systems, network signaling and Internet solutions. LM Ericsson employs more than 1,100 employees in Finland. Of these, the proportion of R&D staff is over half. Moreover, LM Ericsson is also one of the largest software developers and exporters in Finland.

Sources: Annual reviews of LM Ericsson and its Finnish subsidiary, WWW pages of the subsidiary (<http://www.ericsson.fi>) and an article in the Tekniikka & Talous magazine (4.3.1999, "Teema: elektroniikka").

Tellabs Oy

Tellabs Inc. is a global supplier of digital systems to voice and data communications service providers. It acquired Martis Oy (today called Tellabs Oy) in 1993. Martis Oy was a technology-based firm with a reputation for high quality and product innovation. Martis had developed an advanced product in the telecommunications field. The acquisition gave Tellabs a partner in the European market, access to a sophisticated technology and a potential international flagship product in the telecommunications equipment market. Martis, on the other hand, got access to marketing channels of Tellabs. According to a former owner of Martis, one justification for the sale of the company was that without it Martis would not have been able to grow in international markets as rapidly as the growth potential of the company implied.

Since the ownership change, Tellabs Oy has grown rapidly. In 1993 the company employed some 120 employees, today the number is over 1,000; net sales have had double-digit annual growth rates. In addition, its international customer network has experienced a huge increase: in 1993 the company had under ten customers in five countries, today it has some 160 telecommunications operator customers in more than 60 countries. Nowadays almost all production is exported to the international market. Moreover, in spite of the rapid growth the company has been very profitable. The parent company, Tellabs Inc., has also been highly profitable in recent years. The profits have been mostly reinvested in production facilities and R&D; the policy of the company is that it does not pay cash dividends to its shareholders. Instead, shareholders have been compensated by the good performance of the company on the NASDAQ stock exchange. On the other hand, employees of the company have got a part of the compensation via a stock option compensation system. The option compensation system includes the whole staff, including new recruits, which is rather exceptional even in the USA. The system has been carried out in order to reinforce entrepreneurial spirit in the company and in order to attract qualified personnel.

The flagship product of Tellabs in the international telecommunications market, *MartisDXX*, is still developed and produced by the Finnish affiliate. Furthermore, since its launch the *MartisDXX* system has been developed in close connection with various network operators and suppliers. One of these partners has been LM Ericsson which uses *MartisDXX* in its mobile phone network systems. Recent large investments in new R&D and production facilities indicate that Tellabs has been satisfied with locating in Finland.

Sources: The WWW pages of Tellabs Oy (http://www.tellabs.com/world/emea/tellabs_oy.htm), the WWW pages of the Invest in Finland Bureau (<http://www.investinfinland.fi/casetell.htm>), an article in the *Talouselämä* magazine (16/98) and a number of newspaper articles.

Leiras Oy

Leiras Oy is the second largest manufacturer in the pharmaceuticals branch in Finland. It employs more than 1,000 employees. Leiras is a research-based company which has a high level of expertise especially in the development and production of non-oral delivery systems for fertility control and hormone therapy. Typical to pharmaceutical firms in general, Leiras also invests heavily in R&D. In recent years its R&D spending has been approximately 15-20 percent of net sales.¹²

Until 1996 Leiras was a part of the large diversified Finnish group, Huhtamäki Oy. Huhtamäki has streamlined its business focus during the 1990s. The decision to divest the pharmaceuticals business area was a part of the restructuring process. Due to this

¹² R&D intensity was calculated from the published annual reviews of Leiras.

strategic change, Leiras was sold to the German-based pharmaceutical company Schering AG. Schering was not totally unfamiliar to Leiras: they have had business relations since the 1950s.

Sources: Annual reviews of Huhtamäki, Leiras and Schering and the Finnish Mergers & Acquisitions CD-rom published by the Talouselämä magazine.

i2 Technologies Finland Oy

i2 Technologies is a fast growing US-based software company. It focuses on computer software used in managing and optimizing product supply chains. In 1998 the company acquired a small technology-based firm located in Finland, Innomat Oy (nowadays called i2 Technologies Finland).

Innomat specializes in software products which are utilized in managing sales activities. It has been a very R&D intensive company; in recent years it has spent some 40-50 percent of its turnover in R&D. Innomat employed in the year of the foreign takeover some 30 employees. The managing director of the company expects that in 1999 the number of employees will double.

The former owners of Innomat were the entrepreneur, the personnel of the company and two Finnish venture capital funds. The company had reached the early growth stage and it searched for a suitable strategic partner company which would facilitate growth in foreign markets and which would have the same kind of business values as Innomat: the important role of R&D and a clear business focus. Following the intensive negotiations, the owners of Innomat decided to sell the company to i2 Technologies. As a result of the ownership change, the R&D resources of Innomat tripled and it joined the company that is one of the most dynamic actors in the global software industry. The managing director of the Finnish subsidiary, the former entrepreneur, expects substantial growth in sales in the near future. The vision of the Finnish affiliate is that it will grow to become a significant player in the field of configuration technology.

The case of i2 Technologies includes two quite recent features related to growth patterns of small technology-based companies and inward foreign direct investment. *First*, private venture capital funds for early growth stage companies are quite a recent feature in Finland: they first emerged on a larger scale only in the late 1980s.¹⁵ *Second*, although there have also been foreign takeovers in past decades, in the 1990s this activity has increased substantially. Especially US-based firms have searched for promising technology-based firms. This has diversified somewhat the ultimate beneficiary country distribution, too: in past decades foreign direct investors were mainly from other European countries, particularly from the Scandinavian countries.

Source for the case: SFK Finance News 3/98.

¹⁵ Some foreign venture capital funds have also done investments in Finland. Most of them have been from the other Nordic countries and the UK. A recent study by Cardwell, et al. (1999) discusses inward foreign investments in small technology-based firms and foreign venture capital activity. In addition, it compares the case of Finland to the case of Israel.

3 FOREIGN FIRMS' R&D ACTIVITY IN FINLAND

In this section we analyze the R&D activities of foreign-owned firms during the last decade. We begin by studying the general characteristics of foreign affiliates' R&D in Finland. Then we continue the analysis by comparing foreign-owned firms' and Finnish-owned firms' R&D activity in the main industries. After that, we analyze the influence of ownership changes on R&D activity.

The primary data source of firms' R&D activities used in this section are regular R&D surveys made by Statistics Finland. Large R&D surveys have been carried out every second year, i.e., we have data from 1989, -91, -93, -95 and -97. We had the pleasure to also utilize some parts of the latest survey which dealt with R&D activity in 1998. Unfortunately, due to the fact that we got the survey for analysis purposes at the end of the project, we were unable to utilize the 1998 data in full scale. This is why we report findings that are partly based on the older data. In addition, the latest survey questionnaire was not fully compatible with the earlier ones.

The business unit in the R&D inquiries has been the firm, although in some cases answers aggregated at the group level have been accepted. In order to analyze foreign-owned firms' R&D activity we merged the ownership information of firms (foreign/Finnish-owned, year of takeover or establishment, etc.) with R&D survey information. The merging of the data and analysis were conducted at the premises of Statistics Finland due to that organization's strict confidentiality rules regarding company level data. In addition to the R&D survey data, we also utilized annual reports and other published information of companies in the field in order to get a deeper insight and case examples of R&D activities of foreign-owned companies.

3.1 General characteristics

In 1997 there were some 140 foreign affiliates in Finland which reported in the R&D survey that they performed R&D in Finland. This was about 8 percent of all foreign affiliates. R&D activity was concentrated in manufacturing firms; in the manufacturing sector the share of foreign affiliates which had R&D was over one third. To compare, according to Statistics Finland in 1997 there was a total of about 2,000 firms in Finland which had regular R&D activity. This was less than one percent of all firms in Finland. In the manufacturing sector there was a total of some 1,100 firms which had R&D activities. Their proportion of the total number of manufacturing sector firms was roughly four percent. These comparisons indicate that foreign-owned firms perform R&D more often than firms in Finland, on average.

Analyzed by investor country, the largest foreign R&D investors in recent years have been Swedish firms followed by US, Swiss and German firms. The share of US-owned R&D companies, in particular, has increased in recent years; in 1998 the number of US-owned companies was almost equal to the Swedish-owned companies.

As in the case of allocation of R&D spending in general, the R&D spending of foreign-owned firms is also quite heavily concentrated in large firms. In addition, the

R&D activity of foreign-owned firms is primarily focused on product development. In 1997 the average proportion of R&D expenditure allocated for product development was nearly 90 percent in foreign affiliates. The average proportion of process development was some ten percent and the share of basic research less than one percent. In Finnish-owned firms the average shares were 77, 16 and 7 percent, respectively. Thus, these shares indicate that foreign affiliates allocate only minimal funds for long-term basic research and that the focus of R&D is on the development of products.

Table 3.1 shows that in foreign-owned firms the focus of product development is also quite highly concentrated: over half of R&D expenditure in 1997 was allocated for the development of telecommunications and other electrical engineering products. The foreign affiliates' proportion of total R&D spending in Finland in this product group was about 14 percent in 1997. It is also worth mentioning that foreign affiliates' R&D expenditure in electronics and other electrical engineering products was quite highly concentrated in large R&D companies. Furthermore, in this product group R&D seems to be oriented towards the global market, not to adapt multinational firms' products to the Finnish market. The Finnish subsidiaries of Tellabs and LM Ericsson, for instance, have worldwide responsibilities within the groups for R&D in the specific telecommunications technologies.¹⁴

The second largest R&D product group in 1997 was the machinery and equipment excluding electrical machinery and equipment. Measured by the number of firms, it was even larger than the electrical engineering product group: approximately 30 percent of foreign-owned R&D firms reported R&D expenditure in this product category, while the proportion of the electronics and other electrical engineering product group was 25 percent. However, the average R&D expenditure per company was significantly smaller in the machinery and equipment product category than in the electrical engineering product group. This is why the share of this product category in total foreign affiliates' R&D expenditure was less than the proportion of the number of R&D firms in the category.

The foreign share of total R&D expenditure is also quite significant nowadays in the product groups of chemicals and pharmaceuticals and construction-related products and services. This is largely due to recent cross-border mergers and acquisitions activity. In the chemicals and pharmaceuticals product group, for instance, large diversified Finnish groups have sold business units not belonging to their strategic core competence areas.

Foreign parent companies are, on average, important funding sources of foreign affiliates' R&D expenditure. This can be noticed from Table 3.2 which shows the allocation of funding sources of R&D expenditure in foreign-owned and Finnish-owned firms. In addition, the table shows that the average share of public funding of R&D done in foreign-owned firms does not differ significantly from the Finnish-owned firms' case.

¹⁴ See Box 2.3 for the company reviews and references.

Table 3.1 Foreign firms' R&D expenditure by main product category in 1997

Product category	Foreign affiliates' proportion	
	of total foreign affiliates' R&D expenditure	of total R&D exp. in the product category in Finland
electrical and electronics	60 %	14 %
other machinery & equipment	17 %	11 %
other	23 %	12 %

Sources: Etla and Statistics Finland; author's calculations.

Note: 1. In the 1998 R&D survey questionnaire the question related to the topic of this table was excluded.

2. NACE Rev. 1 classes:

Electrical and electronics products and services: 30, 311-316, 321-323, 333, 64, 72.

Other machinery and equipment: 29, 331, 332, 334, 335, 34, 35.

Table 3.2 Funding sources of R&D by company owner

	Owner	
	Foreign	Finnish
<i>Source of funding:</i>		
Own internal funding	69 %	85 %
Finnish parent company or other Finnish firms within the group	2 %	4 %
Foreign parent company or other foreign firms within the group	21 %	0 %
Other Finnish or foreign firms	1 %	3 %
Public funding (loans, subsidies, etc.)	6 %	7 %
Other sources	1 %	1 %
Total	100 %	100 %

Sources: Etla and Statistics Finland; author's calculations.

Note: Average shares of the total R&D expenditure in 1997-1998.

In addition to the above discussed characteristics, we also briefly studied R&D employment characteristics in foreign-owned firms. We found that at least in recent years the average education level of R&D staff has been slightly higher in the group of foreign affiliates than in the group of Finnish-owned firms: in 1998, for instance, approximately 43 percent of the R&D personnel in the foreign affiliates' group had a university degree, while the share was 38 percent in the Finnish-owned firms' group. Yet, there were no differences in the share of staff which had a Ph.D. or equivalent degree (about four percent in both company groups). In addition, the average share of labor compensation in the total allocation of R&D spending was higher in the group of foreign affiliates than in the group of Finnish-owned firms (52 and 46 percent of total R&D spending, respectively). An explanation for this may be the higher average education level of R&D staff in the group of foreign affiliates.

In sum, the R&D spending of foreign subsidiaries in Finland seems to be quite highly concentrated in a few firms and a few product categories. The largest proportion of R&D expenditure is allocated for the development of electrical engineering

products. This is in line with the total allocation of R&D in Finland: the electrical engineering product group has a dominant role in R&D. In addition, we found that foreign parent companies are an important source of R&D funds for foreign affiliates and that foreign affiliates employ a highly educated R&D staff, on average. In the following section we'll continue the analysis by studying the industry level characteristics of foreign affiliates' R&D activity.

Box 3.1 Motives for internationalization of R&D.

Internationalization of firms' research and development activities is quite a recent phenomenon compared to, e.g., internationalization of sales and production. Even multinational firms (MNFs) have traditionally performed most of the R&D in their home countries. The reasons mentioned in the literature for the slower internationalization pace of R&D compared to the other functions of firms have been, among other things, economies of scale in R&D, spillover effects of related research projects and the desire to maintain strategically important research knowledge near company headquarters. In addition, R&D performed in foreign subsidiaries has been found to be primarily oriented toward adapting products and production technologies to local conditions, whereas R&D performed by MNFs in their parent countries has been more basic and long term in character (see, e.g., Caves (1996, 162-166) and Fors (1998, 117-118)).

However, the share of overseas R&D has increased in recent decades. An increased scale of foreign production has required the setting up of local R&D facilities in order to transfer effectively the parent companies' technology to host countries, to solve production problems and to adapt products for host country markets. In addition, it is assumed that MNFs increasingly establish or expand overseas R&D facilities in order to gain access to highly sophisticated knowledge and to obtain high-skilled research personnel in foreign centers of competence. Furthermore, foreign R&D facilities are established in order to benefit from local R&D spillovers.

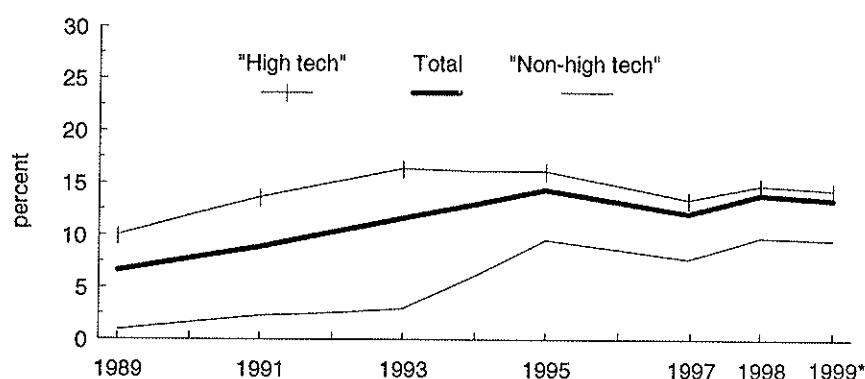
As noted above, we can recognize basically two broad motive categories for establishing R&D facilities abroad: one is to adapt products and production technologies to local conditions and the other is to accumulate knowledge and benefit from local R&D spillovers. As Fors (*ibid.*, 123-124) remarks, the following three factors mainly relate to the adaptation motive for foreign R&D. *First*, as mentioned, foreign production may require R&D in order to adapt products and technologies to local conditions. This means that there should be a positive relationship between foreign production and foreign R&D. *Second*, a positive relationship is expected between the market size of the host country and foreign R&D: the large host country market size should give incentives to perform adaptive R&D which may not be worthwhile in the case of a small host country. *Third*, high technology firms with technologically advanced products should have a greater need for adaptive R&D than lower technology firms. Thus, we should observe more foreign affiliate R&D in high technology industries than in low technology industries.

The other broad motive category for establishing foreign R&D facilities, knowledge seeking R&D, is supported by two empirical findings. *First*, knowledge spillovers seem to increase with proximity. A natural explanation for this is, for instance, contacts between R&D personnel of different companies. *Second*, R&D spillovers tend to increase if the potential recipient of the spillover undertakes its own R&D. Several empirical studies have suggested that the knowledge seeking motive has become more and more important in recent years (see, e.g., Fors (*ibid.*, 124-125) and references therein).

3.2 Industry level characteristics

The foreign-owned firms' share of R&D expenditure in Finland has increased during the last decade. Figure 3.1 illustrates foreign-owned firms' share of R&D spending in the 1989-1999 period. In addition to the total share, the figure shows the development in two industry groups. The 'high tech' industry group includes some relatively high technology industries, such as electrical engineering and manufacturing of chemicals and pharmaceuticals. This group of industries contributes a major share of R&D spending; in 1998, for instance, this group accounted for approximately 80 percent of the total R&D expenditure in Finland. The 'non-high tech' industry group includes the rest of the business sector.

Figure 3.1 Foreign-owned firms' proportion of R&D expenditure in Finland in 1989-1998 and an estimate for 1999



Sources: Etla, Statistics Finland and annual reviews of companies; author's calculations.

- Note:
1. R&D data includes only activity in Finland, not R&D abroad.
 2. The curves are based on observations from the years shown on x-axis.
 3. The proportions for 1999 are preliminary estimates based on the 1998 R&D survey information.
 4. In addition to the manufacturing sector the data also includes a sample of the trade and service sectors' companies. The 'high tech' industry group consists of manufacturing of chemicals and pharmaceuticals, mechanical and electrical engineering, telecommunications, electronic data processing and research centers (NACE Rev. 1: 24, 29-34, 64, 72-73). The 'non-high tech' industry group includes the rest of the business sector.

We can see from Figure 3.1 that the foreign-owned firms' total share of R&D increased quite steadily during the early 1990s; during the second half of the 1990s the increase of the total share has slowed down. However, we can notice that the total share was in the last year of observation (1999) still higher than in the beginning of the 1990s. The total share was the highest in 1995, accounting for more than 14 percent of the total R&D expenditure in Finland. Since 1995 the proportion has varied between 12-14 percent; in 1998 it was almost 14 percent. Nevertheless, the total sum of R&D spending of foreign-owned firms has increased also in recent years: in 1995 the sum of R&D expenditure of foreign-owned firms was about FIM 1.2 billion, in 1998 the sum was approximately FIM 1.9 billion.

There are basically two main reasons for the stagnating foreign-owned firms' proportion of R&D expenditure during the second half of the 1990s. *First*, Finnish-owned firms' share of R&D expenditure especially in the metals, engineering and electronics industry has increased in recent years: in the 1995-1998 period Finnish-owned firms' R&D expenditure in fixed prices increased in the industry by over 20

percent whereas in foreign-owned firms the average increase was less than 10 percent. Due to this, foreign-owned firms' proportion of R&D spending in the metals, engineering and electronics industry decreased from almost 20 percent in 1995 to approximately 14 percent in 1998. *Second*, in the first half of the 1990s there were a couple of firms which were under foreign ownership for only a few years. These firms were typically spin-offs of large Finnish groups. Foreign owners in these firms were usually venture capitalists, whose motive for investment was that the acquired companies should be ready for new owners in a few years period after the takeover (by listing on the stock exchange, management buy-out or some other method). In the second half of the 1990s, some of these firms have listed on the stock exchange and foreign venture capitalists have sold their stake in the companies. These firms were dropped from the foreign-owned firms' group after the diversification of ownership structure, which had a negative effect on foreign-owned firms' proportion of R&D expenditure.

Furthermore, we can notice from Figure 3.1 that foreign-owned firms' proportion of R&D expenditure in the relatively high technology industry group has been higher than the total share. This supports the view that foreign-owned firms' R&D is concentrated in relatively high technology sectors. In addition, we can see that the gap in foreign-owned firms' shares between the two industry groups has decreased during the 1990s. This trend has been due to the recent slightly downward trend in the foreign subsidiaries' proportion of R&D expenditure in the 'high tech' industry group and, on the other hand, due to some large mergers & acquisitions in the 'non-high tech' industry group.¹⁵ It is quite difficult to present more detailed industry level analyses of the development of foreign affiliates' R&D due to the fact that there are in many industries a few firms which account for major share of R&D expenditure. When we categorize companies in the industries by their ownership, the concentration of R&D is an even more serious problem due to the confidentiality rules of company level information.

Nevertheless, we can say that during the last decade the foreign-owned firms' share of R&D has been the largest in the metals, engineering and electronics industry. On the other hand, in the food, textiles and forest industries foreign-owned firms' influence has been insignificant. However, in these industries the foreign share has increased due to some recent large mergers and acquisitions, too. Furthermore, the growth of the foreign-owned firms' share of R&D expenditure has also been significant in the chemical industry and in the construction-related sector¹⁶. Similar to the food, textiles and forest industries, the primary explanation for the increase in the chemical and construction sectors has been recent mergers and acquisitions. In the construction sector, for instance, there were no major foreign-owned firms in Finland in the late 1980s, but during the 1990s foreign firms have acquired many Finnish construction sector firms.

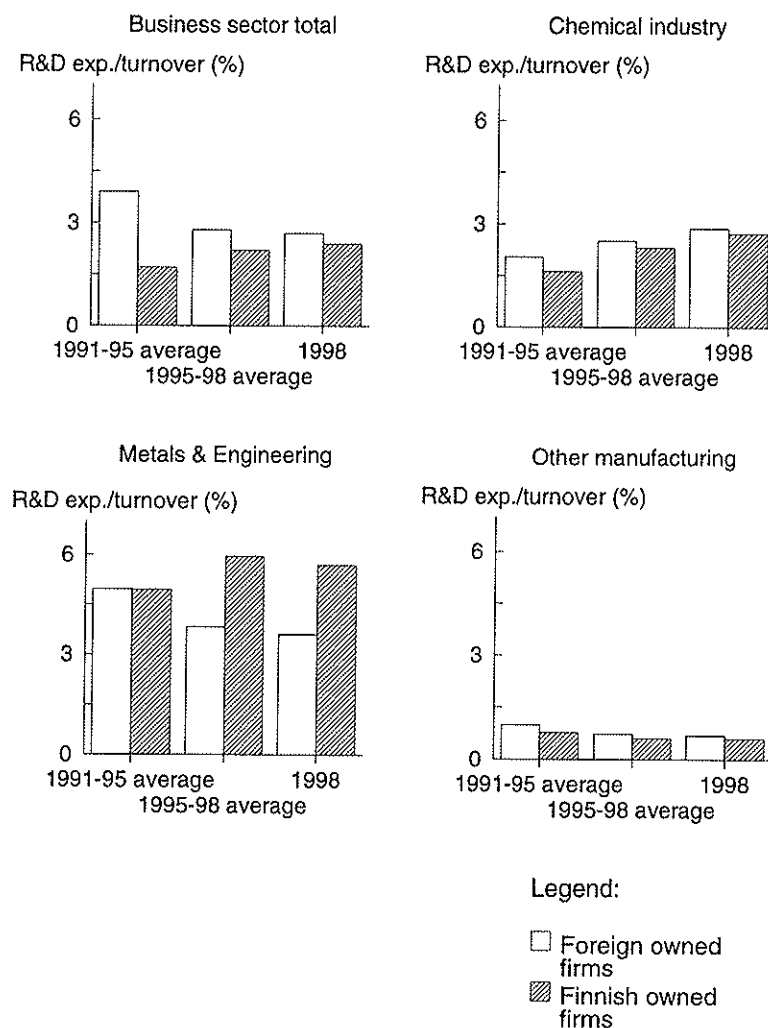
We also analyzed whether there have been any significant differences in the ratios of R&D to turnover between firms in the two owner categories. Our sample was quite large; the sample firms' total sum of R&D expenditure accounted in each year

¹⁵ In addition, there have been some inter-temporal changes in the industry codes at the company level due to, e.g., changes in the focus of economic activity. This has changed in some cases the reference groups of companies. We took into account some inconsistencies in the industry codes in the R&D data which did not seem to have any relationship with changes in the real economic activity of companies.

¹⁶ Construction and manufacture of construction sector products.

for major share of the total R&D expenditure reported in the R&D statistics. Figure 3.2 provides a summary of the analysis. It illustrates the average ratios of R&D expenditure to turnover in the foreign subsidiaries' group and the Finnish-owned firms' group in the 1990s.

Figure 3.2 The average ratios of R&D expenditure to turnover by owner category in 1991-1998



Sources: Etna and Statistics Finland; author's calculations.

Note: 1. A sample of firms which have had R&D and which have been included in the R&D surveys carried out by Statistics Finland.

2. Chemical industry: NACE Rev. 1: 23-25. Metals & Engineering includes, basically, NACE Rev.1: 28-35, i.e., manufacture of basic metals was excluded

We can see from the figure that when we study the whole sample without taking into account any industry distribution effects, the average ratio of R&D spending to turnover has been higher in foreign affiliates than in Finnish-owned firms. However, during the 1990s the difference in ratios has decreased due to the increased share of R&D expenditure to turnover in the Finnish-owned firms' group and the reduced

share in the foreign affiliates' group; in 1998 the average ratios at the total level were almost equal. The industry level analysis gives us a more diversified view. As we can see from Figure 3.2, in the chemical industry as well as in the aggregated group of other manufacturing industries the ratio of R&D spending to turnover has been slightly higher in the foreign-owned firms' group. In metals & engineering, the average ratios were equal in the first half of the 1990s.¹⁷ However, in the second half of the 1990s the ratios in the industry have diverged. This has been due to the increasing ratio in the Finnish-owned firms' group and, on the other hand, to the decreasing ratio in the foreign-owned firms' group.

3.3 Ownership changes and R&D activity

There were over 170 foreign affiliates in 1998 which had R&D expenditure in Finland. About 70 percent of these firms were taken over or established in the 1990s and nearly 50 percent in the second half of the 1990s. Thus, it seems that the interest of foreign firms in acquiring Finnish R&D firms has increased. On the other hand, it is noteworthy that inward FDI activity has increased substantially in the 1990s and only a part of this increase has focused on R&D intensive firms. In addition, we can notice from Table 3.3 that although more than 70 percent of foreign-owned R&D firms have been taken over or established in the 1990s, the share of these firms in total foreign affiliates' R&D expenditure in 1998 was only slightly over 60 percent. This indicates that mature foreign-owned firms invest somewhat more in R&D than the firms acquired in the 1990s, on average.¹⁸ While analyzing this point further, we noticed that the average ratio of R&D to turnover was higher in mature foreign affiliates than in the firms that were acquired in the 1990s. Thus, this information does not support the hypothesis that foreign firms acquired more R&D intensive firms in the 1990s than earlier. In fact, in our sample of foreign-owned R&D firms the industry distribution has diversified during the 1990s: in past decades foreign R&D affiliates in the manufacturing industries were quite concentrated in the metals, engineering & electronics industry, more recently foreign firms have acquired more and more companies also in the food, forest and chemical industries. In these industries the ratio of R&D expenditure to turnover is typically smaller than, for instance, in electrical engineering. This partly explains the result that, in the 1998 data, the average ratio of R&D expenditure to turnover was higher in mature foreign affiliates than in more recently acquired firms.

Table 3.3 The foreign-owned R&D firms in 1998 by ownership change

	Foreign affiliate established or acquired			
	before 1990	1990-1994	1995-1998	total
Share of foreign owned R&D firms	28 %	24 %	48 %	100 %
Share of foreign affiliates' R&D exp.	38 %	22 %	40 %	100 %

Sources: Etna and Statistics Finland; author's calculations.

¹⁷ The manufacture of basic metals was excluded from the metals & engineering because in our sample all firms in the industry were Finnish-owned and the ratio of R&D spending to turnover in the industry deviates quite significantly from other sub-industries in the metals & engineering industry.

¹⁸ By mature foreign affiliates we refer to firms in which foreign takeover has occurred before the 1990s.

So, we have noticed above that the average ratio of R&D expenditure to turnover has not been higher in firms in which foreign takeover has occurred in the 1990s than in mature foreign affiliates. In the following, we analyze whether there has been in the 1990s any differences in R&D efforts of Finnish-owned firms, mature foreign affiliates and recently acquired affiliates. Table 3.4 gives a summary of the average changes in R&D efforts of these company groups in 1991-1998. In addition to the overall development, we have divided the period of study into two sub-periods. The panels only include firms from which we had regular R&D data. Let us begin to study the table by discussing the trends which took place in the 1991-1998 period.

As we can see from Table 3.4, in the 1991-1998 period the average growth of R&D expenditure of all the sample firms was approximately 14 percent. The growth was clearly the largest in the group of firms which have remained Finnish controlled. Furthermore, we can notice that in the group of foreign affiliates and foreign takeovers the growth of R&D expenditure was the most significant in mature foreign-owned firms, i.e., in firms which were foreign-owned already before the 1990s. Average R&D expenditure decreased most dramatically in the group of firms in which foreign takeover occurred in the second half of the 1990s. However, in this group the largest decrease in R&D spending took place in the early 1990s, i.e., in the period when these firms were still Finnish-owned.

Table 3.4 The average growth of R&D expenditure in the 1990s by owner and period of takeover

	Average annual growth of R&D exp.		
	1991-1998	1991-1995	1995-1998
Finnish owned firms	16 %	11 %	18 %
Number of firms	167	260	613
Foreign affiliates and foreign takeovers (total)*	7 %	5 %	7 %
Number of firms	47	53	102
Foreign owned firms by period of takeover:			
before 1990	9 %	11 %	8 %
Number of firms	18	27	32
1990-1994	3 %	3 %	11 %
Number of firms	14	12	30
1995-1998	-6 %	-17 %	1 %
Number of firms	15	14	40
Total (all firms in the sample)	14 %	9 %	16 %
Number of firms	214	313	715

Sources: Etna, Statistics Finland and annual reviews of companies; author's calculations.

Note: 1. Sample of firms from which we had regular data on R&D.

2. * Foreign affiliates and foreign takeovers total includes the whole sample of foreign affiliates and firms in which foreign takeover took place during the 1990-98 period.

3. R&D expenditure was deflated by the GDP deflator (1995=100).

In the first half of the 1990s Finland experienced a severe period of economic recession. This may explain some companies' large decreases in R&D expenditure in

this period. The largest average decrease was observed in the group of firms in which foreign takeover occurred in the 1995-1998 period. However, the dramatic decrease was primarily due to the development of a few large firms. Without these firms the average increase of R&D expenditure in this group was about five percent, which was equal to that of the whole sample of foreign takeovers and affiliates. In addition, we can notice from Table 3.4 that the growth rate of R&D expenditure was quite modest in the group of firms in which foreign takeover took place in the first half of the 1990s. Instead, in the group of mature foreign affiliates the average growth rate of R&D spending was in the first half of the 1990s quite high; it was at the same level as in the group of Finnish-owned firms. One explanation for the high average growth of R&D spending in these two groups is that the groups included some large companies in the field of electrical engineering which accounted for quite a large share of the total growth of R&D expenditure within the groups.

The last column in Table 3.4, which shows the development in R&D efforts in the second half of the 1990s, is maybe the most interesting because the number of observations in each group of companies is significantly larger than in other periods. We can see that in the second half of the 1990s the average efforts in R&D intensified in Finnish-owned firms compared to the first half of the 1990s. The second largest average increase was recorded in the group of companies in which ownership change took place in the first half of the 1990s. In addition, in mature foreign-owned companies the average growth was also quite substantial, although, it was significantly smaller than in the group of Finnish-owned firms. Furthermore, we can see that also in the group of companies where foreign takeover has occurred recently the growth of R&D spending was positive but significantly smaller than in other groups.

So, we can notice the following three features from Table 3.4. *First*, we can see that in the 1991-1998 period the average growth of R&D expenditure was in the groups of foreign-owned firms smaller than in the group of Finnish-owned firms. *Second*, even though the average growth of R&D expenditure was smaller in mature foreign-owned firms than in Finnish-owned firms, it was still quite high. This indicates that companies which have for quite a long time been subsidiaries of foreign firms still do R&D in Finland and that they have even increased their efforts in R&D. *Third*, the average growth rate in the group of firms which were acquired in the first half of the 1990s indicates that after the ownership change average R&D spending increased, although the average rate of growth has been somewhat slower than in firms which have remained Finnish-owned.

Thus, we can conclude that after foreign takeovers the development of R&D spending in our sample has been quite favorable. On the other hand, Table 3.4 reports only the development of average R&D spending, and we do not know whether there have been changes in the allocation and objectives of R&D activities of companies which were taken over. Furthermore, we did not take into account industry distribution effects; there may have been some differences in the focus of economic activities between the groups of companies. This may partly explain the differences in the growth patterns of R&D. Moreover, the number of firms in the foreign-owned groups was rather small especially in the first two columns in Table 3.4. Thus, the results are quite sensitive to a few companies' developments. In addition, there may have been some changes in corporate structures (mergers and acquisitions, divestments, etc.) which our data did not take into account. These points should be taken into account when interpreting the results.

In addition to the above analysis, we also studied whether there have been significant changes in R&D intensities in firms in which foreign takeovers have taken place. R&D intensity was estimated by the ratio of R&D expenditure to turnover. We had two samples in this analysis: the first one consisted of firms from which we had more than one observation both before and after the foreign takeover. The number of firms in this sample was 27. The second sample included only observations from the year of takeover (or the nearest year before takeover) and the following years. This sample was larger (52 firms) than the first one. In both samples the ownership change took place in the 1986-1996 period. We had R&D expenditure and net sales data from the 1985-1998 period. We analyzed the first sample by calculating average ratios of R&D to turnover for each company before and after the ownership change and then compared the averages. In a majority of firms (17) the difference in average ratios of R&D expenditure to turnover before and after the takeover was less than one percentage point; the ratio increased more than one percentage point in two cases after the takeover and decreased more than one percentage point in eight cases. The median value for the average ratio of R&D expenditure to turnover before the takeover was 2.3 percent and after the takeover 2.0 percent.

So, after the foreign takeover the average ratio of R&D spending to turnover slightly decreased in our first sample of firms but in a majority of cases the changes were quite small. The second sample supported this finding. This larger sample was analyzed by comparing the ratio of R&D expenditure to turnover in the year of foreign takeover (or the nearest year before the takeover) to the average of post-acquisition ratios. The ratio of R&D spending to turnover increased more than one percentage point in two cases and decreased more than one percentage point in 14 cases after the takeover. The changes were less than one percentage point in 36 cases. The median value for the ratio of R&D expenditure to turnover was in the benchmark (the year of takeover or the nearest year) 1.8 percent and a few years after the takeover 1.5 percent.

Thus, it seems that in a majority of firms which were acquired by foreign firms the changes in the ratios of R&D to turnover were quite small. On the other hand, in firms in which changes were larger it was more common that the ratio of R&D spending to turnover decreased rather than increased after the foreign takeover. As we studied the sample firms closer we noticed that this development was mainly explained by the higher average growth rate of turnover than that of R&D spending. This was especially the case in some smaller companies which had very high ratios of R&D to turnover before the takeover: R&D expenditure typically increased also after the takeover but turnover increased even more rapidly and thus the ratio of R&D spending to turnover decreased. In general, it is quite typical that the ratio of R&D spending to turnover decreases as the size of the company increases. In addition, there are likely to also be factors other than ownership change which explain the development of the ratios of R&D expenditure to turnover. These factors are, among other things, companies' financial performance and general economic trends.

In sum, it seems that Finnish-owned firms have had a larger influence on the growth of R&D expenditure in the Finnish economy in the 1990s than mature foreign-owned firms or firms in which the foreign takeover has taken place in the 1990s. On the other hand, the average growth rate of R&D expenditure in foreign-owned companies has been quite high. In addition, we found that in firms in which the foreign takeover occurred during the first half of the 1990s average R&D spending increased after the ownership change. We also found that in the short run the changes

in the average ratios of R&D expenditure to turnover before and after foreign takeovers have been in a majority of companies quite small. However, in cases in which changes were larger it was more typical for the ratio to slightly decrease rather than increase after the foreign takeover. One explanation for this phenomenon was that particularly in smaller companies net sales increased after the foreign takeover more rapidly than R&D spending.

4 SUMMARY AND CONCLUSIONS

In this study we focused on foreign firms' direct investments and especially on their research and development activity in Finland during the last decade. We had three main objectives in the study: *first*, to analyze the scale and scope of foreign companies and their R&D activity in Finland, *second*, to study whether there are any significant differences in foreign-owned firms' R&D activities compared to other firms in Finland and, *third*, to evaluate the effects of foreign takeovers on R&D activity. We restricted the analysis to subsidiaries of foreign firms, i.e., we analyzed firms whose foreign parent companies owned over 50 percent of the voting rights. However, we tried to take into account holding company arrangements and other factors which could potentially distort the distribution of *ultimate* beneficiary owners of firms. In addition, joint R&D firms owned on a 50-50 basis by Finnish firms and foreign firms were excluded from the study because the number of these firms was too small to preserve the confidentiality of company level data. Thus, we had two groups of companies in the study: Finnish subsidiaries of foreign companies and Finnish-owned firms.

During the last decade both inward and outward foreign direct investment (FDI) activity has intensified in the Finnish economy. Explanations for this increase include the liberalization of FDI policies both in Finland and in other industrial countries and the tendency of firms to focus on their core competencies. However, compared to some highly internationalized economies, such as the Netherlands and Sweden, FDI activity in Finland still has growth potential.

Nowadays there are approximately 2,000 foreign-owned firms in Finland. They employ a total of more than 100,000 employees, accounting for some nine percent of the total business sector employment. Over half of foreign affiliates are in the wholesale and retail trade sectors, some 15-20 percent in the manufacturing sector and the rest in the service sector. By country of origin, clearly the largest direct investors have been Swedish firms. Measured by employment, Swedish firms have been followed by firms from the USA, Switzerland and Denmark. The largest foreign R&D investors, measured by their R&D expenditure in Finland, have been Swedish firms, followed by US, Swiss and German firms.

The average financial performance of foreign-owned manufacturing firms has been quite satisfactory. At the manufacturing total level both the average profitability and productivity have been higher in foreign affiliates than in Finnish-owned firms. Yet, at the more detailed industry level the performance differences have been more moderate or even opposite. Nevertheless, we can conclude that the average financial performance of foreign manufacturing affiliates has been quite satisfying even if we take into account the industry distribution effect. The factors that may have contributed to the good average performance of foreign manufacturing affiliates are, among other things, well performed takeovers of selected Finnish firms and scale advantages of large multinational companies, e.g., in input purchases, marketing activities and corporate financing.

In the manufacturing industries foreign-owned firms have been more often located in the relatively high technology industries than firms in Finland on average: in 1997, for instance, about half of foreign-owned firms were active in the high or medium-high technology industries, whereas the proportion in Finnish-owned firms was a bit over 20 percent. The foreign-owned firms' total share of employment in the high technology industries was about 15 percent in 1997. This was slightly higher than the foreign-owned firms' average employment share in the manufacturing industries.

Basically, we can recognize two main characteristics of recent inward foreign direct investment. *First*, there are nowadays some relatively high technology clusters and centers of competence in Finland which have attracted inward foreign direct investment. One of these clusters is the information and communications technology cluster, which has grown rapidly during the 1990s.¹⁹ The aim of foreign companies for direct investment in this category is to acquire innovative firms which have advanced knowledge in some technology or business area. The performance of firms after foreign takeovers has been in most cases favorable; foreign owners have noticed that it is profitable to keep acquired firms alive in Finland and even to make additional investments.

Second, the removal of remaining barriers to foreign direct investment and the liberalization of competition policies have also contributed to takeovers in many relatively low technology industries and in the service sector. These industries include, e.g., construction and manufacturing of construction cluster products, manufacturing of food and beverages, transport and forwarding, and security services. In addition, most of the older as well as more recently established foreign affiliates in the wholesale and retail trade sectors can be included in this category, too. The principal aim of foreign companies for direct investments in these sectors is to utilize their own company specific advantages, such as size and/or organization specific knowledge in the host markets. This means, among other things, that they are interested in increasing their market shares in the host markets and reducing the number of competitors in the field. Due to this, the development of acquired companies can be more insecure than in the first category, especially if there already exists a subsidiary of an acquiring foreign firm in the host country. Nevertheless, the average development of firms in this category in Finland has been quite good, although, there have also been cases in which production and other facilities have been closed down quite soon after the takeover.

More than one third of foreign affiliates in the manufacturing sector do R&D in Finland. This share is larger than in Finnish industry, on average. In addition, we found that at the aggregated level the ratio of R&D expenditure to turnover seems to have been higher in foreign R&D affiliates than in Finnish-owned R&D firms. However, at the industry level the relationship was in many cases opposite. The difference between the aggregated and industry level results was due to the larger weight of some relatively R&D intensive industries, such as electrical engineering, in the foreign-owned firms' group than in the Finnish-owned firms' group.

¹⁹ The largest company in this cluster is Nokia, but there are a number of other companies in the field, too. The largest *foreign-owned companies* which also have significant R&D efforts in the cluster are LM Ericsson and Tellabs. LM Ericsson established a subsidiary in Finland several decades ago, while Tellabs (former Martis) was acquired in the first half of the 1990s by the US-based Tellabs Inc. See Pajarinen & Ylä-Anttila (1998, 49-52) and Hernesniemi, et. al. (1995, 184-216) for a more detailed review of the ICT cluster.

The largest proportion of foreign affiliates' total R&D expenditure is allocated for development of telecommunications and other products in the field of electrical engineering. This is in line with the total allocation of R&D spending in Finland: R&D related to the electronics and other electrical engineering products has a dominant role in R&D spending. The influence of foreign-owned firms on R&D expenditure in Finland is nowadays quite significant in the product groups of chemicals and pharmaceuticals and construction sector related products and services, too. Principally, this is due to foreign takeovers of some large Finnish firms which do R&D in these fields.

In the 1990s R&D spending has increased in Finland quite rapidly. In the early 1990s it accounted for about two percent of GDP, nowadays the proportion is already some three percent. In the business sector the decomposition of R&D spending growth in the 1990s by owner type revealed that the average R&D spending growth rate has been higher in Finnish-owned firms than in mature foreign affiliates or in firms in which the foreign takeover has taken place in the 1990s. On the other hand, the average growth rate of R&D expenditure has been quite high in foreign-owned companies. In addition, we found that in firms in which foreign takeover occurred during the first half of the 1990s average R&D spending increased after the ownership change. This indicates that foreign owners are willing to invest in the R&D activities of acquired firms. We also found that in the short run the changes in the average ratios of R&D expenditure to turnover before and after foreign takeovers have been in a majority of cases quite small. However, in cases in which the changes were larger it was more typical for the ratio to slightly decrease rather than increase after the foreign takeover. One explanation for this phenomenon was that, especially in smaller companies, net sales increased after the foreign takeover more rapidly than R&D spending.

To summarize, the influence of foreign-owned firms in Finland is still not very significant. Their shares of R&D expenditure and industrial production have been approximately 12-14 percent in the second half of the 1990s. However, inward foreign direct investments have often been directed to relatively high technology sectors, such electronics and other electrical engineering. In many cases these investments have had a positive impact on the development of firms and industries. In addition, inward foreign direct investments in the relatively high technology sectors have also benefited highly qualified employees because the supply of well-paid positions has diversified. Moreover, foreign firms' presence has, in general, many potential positive spillover effects, such as technology transfer, competition effects and new forms of knowledge which can stimulate growth and productivity in the whole economy.

So, we can conclude that at least so far the impact of inward foreign direct investment on the Finnish economy has been quite positive. On the other hand, one should keep in mind that increasing cross-border investment activity can also have some negative aspects associated with it from the national economy point of view, such as hostile takeovers in which firms take over rivals in the field and then shut down the activities of acquired firms even if they were quite profitable units. Moreover, the development of firms acquired by multinational companies depends, at least partly, on the development and strategies of parent companies; the growth of subsidiaries can be negatively affected by parent companies' financial difficulties or decisions of the management of parent companies. In addition, multinational companies optimize their location of production, R&D, marketing and other activities at the

global level, i.e., an activity is located in a country where it is the *most* profitable at the group level. This means that even the activities of profitable Finnish subsidiaries can be moved to other subsidiaries of the group if those activities can be done in other locations more profitably than in Finnish subsidiaries.

Thus, foreign ownership can also include some negative aspects. On the other hand, one can say that especially in skill intensive companies the most important asset is human capital. The nationality of this asset is, even in foreign-owned companies, still Finnish since R&D employees in these companies are mostly Finns. It is not very likely that the Finnish economy would lose this human capital stock even if some foreign companies were to decide to close their Finnish subsidiaries. Moreover, due to the rapid growth of skill intensive industries in Finland, the demand for qualified employees in the skill intensive industries would still remain strong even if some foreign firms divested their activities in Finland.²⁰ The risk of R&D divestments can also be reduced by still increasing the attractiveness of Finland as the location of R&D activities.

The private sector has contributed to the attractiveness of Finland as the location of R&D by increasing R&D investments and by showing innovative efforts in many fields (e.g., in information and communications technology and in biotechnology). As these efforts are likely to continue to increase, there will be many interesting partners in Finland for foreign firms to develop products and technologies with. The development of new products and technologies is quite expensive and there is a good possibility of failure during the development processes. Thus, foreign partners are also welcomed in order to share the costs and risks involved in R&D projects. On the other hand, one could prefer partnerships in cross-border cooperation more than before. Partnerships give Finnish innovators better possibilities to influence decisions related to the location and focus of R&D than in the case of majority foreign ownership. Partnership types of cooperation have better chances nowadays to come about than in past decades due to an increasing stock of intangible assets in many Finnish companies.

The public sector has already implemented many positive measures in order to increase the attractiveness of Finland as the location of R&D, too. These actions include, e.g., the removal of regulatory barriers to foreign direct investments, efforts to sustain a stable macroeconomic and social environment, and investments in human capital and R&D infrastructure. Other positive steps could still be taken, e.g., by promoting cross-border networking of R&D firms and by stimulating the growth of national innovative clusters and centers of competence, which are likely to also attract foreign R&D investments.²¹

²⁰ See Pajarinen, et al. (1998,116) for trends in manufacturing employment in Finland by industry type.

²¹ See also OECD (1999, 63-68).

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