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Does Ownership Matter? The Impact of Foreign Takeovers on Innovation and Productivity Performance

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Does Ownership Matter?

The Impact of Foreign Takeovers on Innovation and Productivity Performance

Hans Lööf, Bernd Ebersberger and Börje Johansson

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Abstract

Recent debate has focused on how foreign direct investments and foreign take-overs may affect growth and welfare. In this study we have methodologically approximated foreign-ownership by foreign take-over and raised the question: how would a firm's behaviour and performance have been if a foreign owner had not acquired the firm? The analysis is based on a sample of 5 186 firm-level observations in four Nordic countries, of which approximately 30 percent of the firms have foreign owners. Using an empirical approach that accounts for both selection bias and simultaneity bias, we establish some new findings regarding foreign ownership. First, no robust difference in the propensity to be innovative can be established. Second, the group of innovative firms, foreign-owned multinationals are generally outperformed by domestic multinationals in R&D and innovation engagement. Finally, the results on labor productivity are at variance with the findings in a large number of comparison studies. We find that foreign take-over of firms is neutral with respect to labor productivity, and hence the issue of welfare gain and welfare drain is turned into a non-issue.

Keywords: Multinational enterprises, Take-Over, Corporate governance, Cross-country comparison, Spillovers, R&D, Innovation, Productivity

JEL Classification: C31; D21, F23; G34; L22; O31; O33

1. INTRODUCTION

Foreign-owned firms are by definition multinational firms, and ownership in another country is a result of foreign direct investments, FDI, which can be divided into acquisitions and investment in new companies or units (Greenfield investments). In this study we will methodologically approximate foreign ownership by foreign take-over or acquisitions and ask: What would the firm's behaviour and performance have been if a foreign owner had not acquired the firm?

Since we cannot make such counterfactual observations, we are using two different categories of domestically owned companies as control groups. The possible differences between domestic and foreign-owned firms are reflected by observed *gaps* in propensity to innovate, R&D and other innovation expenditures, innovation output and finally labor productivity. If the ceteris paribus assumption is satisfied, a reasonable conclusion is that a superior performance indicates possible welfare gains from FDI, while inferior results in terms of innovation and productivity indicate the opposite.

The methodological approximation is motivated by the literature. It suggests that foreign acquisitions by far exceed new establishments. As an example U.S. data (Feliciano and Lipsey 2002) demonstrate that between 1988 and 1998, outlays for acquisitions accounted for 83% of outlays for acquisitions and new establishments. The Swedish Institute for Growth and Policy Studies (ITPS) presents similar figures. During the period 1996 and 2000, acquisitions accounted for 77% of the establishment of foreign ownership in Sweden and an additional 6% was as the result of mergers.

Over the last decades, FDI flows have increased dramatically (see, for example, Barrios et al 2004). Export from foreign affiliates of multinational corporations represent more than a third of total word trade. Between 1990 and 2001 production in FDI-firms (production in enterprises located outside the country of residence of the owners) increased from 6 percent to 11 per cent of world total output (Grossman et al 2003).

The process of growing involvement of foreign firms in domestic economies raises concerns about the impact on the host country, and still there is no general agreement on the issue of welfare gain or welfare drain. Empirical regularities or stylized facts, which have emerged from a large number of comparison studies on domestic and foreign-owned firms, give some suggestions to the "gain or drain" discussion. First, there is robust evidence that within countries, foreign-owned firms almost always pay higher wages than domestically owned firms. Second, foreign-owned firms generally have higher productivity then local firms. Third, the evidence for knowledge spillovers from foreign-owned firms to domestic firms is mixed. Fourth, the evidence for a general growth impact from foreign-owned multinationals on the host-country is mixed.

A great deal of the attention paid to the phenomenon of foreign direct investments is focused on efficiency comparisons between foreign-owned and domestically owned firms, frequently in terms of productivity. The underlying assumption is mainly that productivity differences indicate a technological gap. Some work in this research area, following Findlay 1978, argues that a superior performance of foreign-owned firms creates a potential for technology transfer to the domestic firms. Others support the hypothesis that the lower the technological gap between domestic and foreign firms, the higher the potential benefits in terms of technology transfer to domestic firms (Cantwell, 1989).

The literature suggests some alternative explanations for the differences in performance between domestic and foreign-owned firms. Some studies suggest that only firms with superior technology or superior productivity are candidates for acquisitions or mergers. Other studies find that FDI investment is oriented toward high productivity sectors. A third finding is that acquisitions and mergers have a positive impact on efficiency of firms *per se*. Finally, if FDI can be conceived as a strategy to exploit technological advantages created within home countries is correct, a higher productivity due to scale economics or other competitive advantages should be expected.

This paper adds to the growing FDI literature in three different aspects. First, it examines not just productivity differences between foreign-owned and domestically

owned firms, but also differences in the efficiency with which the two categories of firms can utilize internal and external knowledge. Although there is a vast literature on the importance of FDI and foreign-owned firms, much of it has focused on the productivity issue. The effects of a growing involvement of foreign-owned firms on R&D and innovation activities in the host country have been less scrutinized. Second, in order to include corporate governance in the analysis, we separate the foreign-owned firms into three categories of corporate style (Nordic, Anglo-Saxon and Rest of the world), and we divide the domestically-owned firmsinto two types of corporate structure (multinationals and uninationals, where the latter belong to a group with only domestic affiliates). Third, the study is an attempt to exploit the internationally harmonized Community Innovation Survey (CIS) data in order to compare the importance of foreign ownership in various countries, using uniform econometric frameworks. The authors address this issue from a large sample of 5 186 firm level observations over the four Nordic countries, Denmark, Finland, Norway and Sweden. The proportion of foreign-owned firms varies from 23% in Finland to 32% in Sweden. The average for the four countries is 28%.

The remaining part of this paper is organized as follows. Section 2 discusses the embeddedness of multinational firms in national innovation systems of home and host countries. It also addresses the issue of technology and productivity gaps. Section 3 presents the data. Section 4 introduces the methodological approach. Section 5 describes the results, and Section 6 provides some conclusions.

2. PREVIOUS RESEARCH

Much of the earlier economic literature on foreign direct investment explains variations in FDI levels by using the general theory of international capital movements, which focuses on the differences between countries in their abundance and cost of capital (Lipsey, 2002). In more recent literature, however, aspects such as the transmission of technology and knowledge, and the productivity performance dominate. One hypothesis is that foreign-owned firms possess superior technology and that some of that technological knowledge spills over into the economy of the host country (Lipsey, 2002). Partly following Dosi (1988), Porter (1990), Lundvall (1992) and Nelson (1992), one branch of FDI studies discusses the relationship between foreign-owned companies, national innovation systems, geographical

proximity, industrial clusters and global networks. See for example Jaffe et al (1993), Audretsch and Feldman (1996), Kuemmerle (1999), Pavitt and Patel (1999) and Cantwell and Janne (1999).

In the theoretical literature there are two broad classes of explanations for the sources and directions of the direct investment inflow. One is that foreign-owned firms wish to gain access to location advantages of the host country, based on the host country endowments or the host country's technological skills, i.e., skills that are specific to the host country in general or to specific locations in the home country. In that case, we would expect to find investments to be attracted to industries in which the host country has some comparative advantage in trade. The second explanation is that foreign-owned firms have built up firm-specific advantages in their countries, based on their home countries' current or past comparative advantages, and wish to exploit these in the host country, where established firms have lost or lack these skills. In that case we would expect to find that investments flow to industries with comparative disadvantages in the host country and originate from firms in industries in which their own home country has comparative advantages in trade.

Serapio and Dalton (1999) report that the growth of FDI investments in a country is closely associated with the growth of R&D in foreign affiliates in that country. In recent literature large multinationals are characterized as the main drivers of the globalization of R&D and other innovation activities (see for example Garybadze and Reger, 1999). According to Patel (1995) the main instrument for such multinational would be selective acquisitions.

Many empirical studies of the role of FDI and foreign ownership deal with the effect of possible superior technology. The prime underlying assumption is that productivity differences indicate a technological gap. Empirical regularities, which are reported in a large number of mainly productivity comparison studies on domestic and foreign-owned firms, indicate both positive and negative effects. There is robust evidence that within countries, foreign owned firms almost always pay higher wages than domestically owned firms. Foreign-owned firms generally have higher productivity then local firms. The evidence for knowledge spillovers from foreign-owned firms to domestic firms is mixed. Foreign-owned firms can also substitute local suppliers with

foreign one, disrupting existing linkages (Lall 1979), and monopolize markets and draw demand away from domestic firms, causing them to cut production and reduce their efficiency (Aitken and Harrison 1999).

In contrast to broad agreements in the literature on productivity differences between foreign owned firms and domestically owned firms, the attempts to explain the superiority of foreign-owned firms are less unanimous.

Investigating determinants to foreign direct investments Helpman et al (2003) and Melitz (2003) suggest that low-productivity firms serve only the domestic market while high-productivity firms also serve foreign markets; less productive firms export while the more productive ones engage in foreign direct investment. Other studies argue that only firms with superior technology or superior productivity are candidates for acquisitions or mergers. A study by Harris and Robinson (2002) on what kind of companies foreign firms choose, does indeed suggest that foreign-owned firms selected plants with a relatively high productivity. Each group of plants were compared with a reference group consisting of plants belonging to UK multiplant firms that did not sell any plants to foreign-owned firms during 1982-1992. At variance with these results, investigating foreign ownership in the Swedish manufacturing sector between 1990 and 2000, Karpaty and Lundberg (2004) rejected the hypothesis that foreign-owned companies had a relatively higher productivity before the takeover. Doms and Jensen (1998) concluded that foreign- owned plants in the U.S. were superior to uninational firms in both labor productivity and TFP[4]: However, foreign-owned firms and uninational firms in the U.S. were behind plants owned by U.S. multinationals.

Girma et al (2001) find in their data set that among firms with no change in ownership, foreign-owned firms in the United Kingdom had labor productivity about 10 per cent above that for domestically owned firms and total factor productivity about 5 per cent higher. Conyon et al (1999) find that the acquisition of UK firms by foreigners leads to increases in their productivity.

[4] Total factor productivity

A third finding is that FDI investments are oriented towards sectors with high productivity. A forth is that acquisitions and mergers have a positive impact on efficiency of firms *per se*. Moreover, if the hypothesis that FDI is a strategy to exploit technological advantages created within home countries is correct, a higher productivity due to scale economies or other competitive advantages should be expected.

Other empirical studies that attempt to explain observed differences between foreign and domestic firms, analyse spillover effects from multinational firms on the host country or taking the dynamics into account by examining not only firms that can be observed over a period but also firms that enter and exit.

Barrios et al (2004) is an example of a study trying to account for the dynamic aspect of foreign ownership. The focus is on two likely effects of FDI: a competition effect, which deters entry of domestic firms and an effect of positive markets externalities such as knowledge spillovers, which foster the development of local industry. Using plant-level data for the manufacturing sector in the Republic of Ireland over the period 1972 to 2000 the authors find that increasing the presence of foreign owned firms may initially harm the development of domestic firms due to increasing competitive pressure. However, after reaching a certain threshold value, the positive benefits of foreign-owned firms due to technological spillover outweigh the negative factors and contribute to the development of domestic firms.

Some recent studies have analyzed the importance of the innovation systems in the host country for the performance of subsidiary business. Furu (1999) suggests that the general competitiveness of foreign-owned firms requires two things: First, the subsidiary has to establish business relationship with local counterparts as well as suppliers, competitors, customers, government agencies, in order to be able to absorb meaningful knowledge from the local competitive environment. Second, investment in R&D is needed to support the development of new competence and learning. The results presented by Furu confirm previous finding by Andersson (1997) that the performance of foreign-owned firms is largely dependent on its embeddedness in the network of local firms, e.g., local customers, suppliers, research institutes, and competitors.

There is a small but growing empirical literature on foreign ownership and innovation relying on the same type of CIS-data as the present paper (See Tether 2000, Tether 2001, Baclet and Evangelista 2003 and Sadowski and Van Beers, 2003.) A common research topic in these studies is the innovativeness of foreign-owned firms versus domestically owned firms. Using a dataset of 1,115 observations from CIS 2, Balcet and Evangelista (2004) show that foreign- owned firms were more innovative than domestic firms in Italy during the period 1994-1996. The authors explain this greater innovativeness of foreign-owned firms by their larger concentration in science-based sectors and by their larger size compared to domestic firms. However, in the majority of technology-intensive sectors, domestic firms outperform foreign-owned firms, especially in terms of R&D intensity, whereas pattern characterizes industries with lower innovation intensity.

Frenz and Ietto-Gillies (2004) used a data set from the U.K. containing 679 observations from CIS 2 and CIS 3 test the hypothesis that multinationality, per se, affects the propensity to innovate. Comparing domestic and foreign-owned firms belonging to a multinational company with firms belonging to a uninational company, they find that those CIS firms that belong to a multinational corporation are more likely to engage in innovation activities and that this engagement is enduring rather than occasional.

3. DATA AND DESCRIPTIVE STATISTICS

3.1 Data

The data used in this studywas obtained from the internationally harmonized Community Innovation Survey III conducted by statistical agencies in Finland, Iceland, Norway and Sweden, and from a research institute in Denmark in 2001. It covers the years 1998 to 2000. In Norway the survey is compulsory which explains the large number of observations. In the other four countries the response rate was about 50 percent. The focus is on both manufacturing and service firms. As this analysis endeavors to establish the difference between foreign-owned and domestically owned firms, we constrained the set of firms in our sample to those firms that belonged to a corporate group.

In order to include corporate governance in the analysis, we have separated the firms into three different groups. The first consists of firms belonging to aset with only domestic affiliates. These firms are labelled uninationals. The second group is domestic multinationals. The foreign firms are classified into three: Nordic, Anglo-Saxon and other multinationals. Based on the literature corporate governance styles, we suspect that the home country of a corporate group can have a distinct influence the innovation activities of the firms. Hence, we include information about the home country of the corporate group in the analysis. Ex ante, we build country groups that are to yield similar corporate governance styles, or that are of particular interest in the analysis. All other home countries in the sample are grouped into the category European and others, where European countries clearly dominate in number.[5]

Community innovation survey data is increasingly being used as a key source in the study of innovation at the firm level in Europe. Data based on the CIS questionnaire is not only available for the EU member states. Norway and Iceland also participate in the CIS initiative.[6] CIS surveys follow the 'subject-oriented' approach because they ask individual firms directly whether they were able to produce an innovation. The CIS is based on previous experience with innovation surveys, including the Yale survey and the SPRU innovation database (Klevorick et al, 1995; Pavitt, Robson and Townsend, 1987). Compared to the R&D and patent data, innovation output indicators in the CIS have the advantage of measuring innovation directly (Kleinknecht et al 2002). The new indicators in the CIS capture the market introduction of new products and services and their relative importance for the innovators' sales. n addition, it contains information on the innovation process and in particular on innovation collaboration and knowledge sources.

[5] It should be noted that we are aware of the fact that our method of defining the home-country of a firm after the location of its headquarter is somewhat arbitrary. However, the CIS-questionnaire gives no alternative options.

[6] Although the Iceland is a Nordic country, and conducted an innovation survey in 2001, Iceland will not be included in the analysis. The results from a recent report by Ebersberger and Lööf, however, suggest that the involvement of foreign companies in the Icelandic economy reflects the findings for the other Nordic countries, see http://www.step.no/foton/reports/foton3.pdf

3.2 Descriptive statistics

The distribution of the sample and ownership distribution is described in Table 1. The four countries are all small economies with a large dependence on the international economy in terms of import and export and an extensive presence of foreign-owned firms. In total the data consists of 5,186 observations, of which 3,423 are uninational firms (firms belonging to a group with only domestic affiliates), 532 Nordic multinationals, 329 Anglo-Saxon multinationals, and 645 are other multinationals (dominated heavily by firms from Continental Europe). The proportion of foreign-owned firms ranges from 22.5% in Finland up to 32.0% in Sweden. The average for the Nordic counties is 28,4%. (See Table 1).

A prominent feature in all Nordic countries, shown in Table 2, is that the domestic multinational firms are significantly larger than the domestic uninational firms and foreign- owned firms. Domestic multinational firms are 4-5 times larger than the two other groups.

Table 3 indicates that the most significant market for uninational firms is the domestic market, while multinationals focus on the global market. Interestingly, foreign-owned firms strongly focus on the national markets, whereas their focus on the local markets is considerably lower that of the domestic uninationals.

Table 4 shows firm's characteristics for the five different categories of firms investigated in the study. Looking firstly at sales reported in the four left columns in Panels A-D, the largest average figures are found among domestic multinationals, in all Nordic countries, and the lowest among domestic uninationals. Comparing the aggregates of domestically owned and foreign-owned firms, respectively, the table shows only minor differences in Denmark and Finland, while the average foreign firm in Norway and Sweden outperforms the average domestic firm. Column 2 in Table 4 depicts average labour productivity. Here we see that the average value for foreign-owned firms in Denmark, Finland and Sweden is higher than that of both multinational and uninational domestic firms. In Norway, Nordic multinationals and Anglo-Saxon multinationals have higher labour productivity than domestic firms, even though continental European firms are less productive than Norwegian

multinationals. The descriptive statistics on gross investment and human capital do not reveal any clear patterns.

Table 5 describes the innovation input and the innovation output of innovating firms. Both are expressed here as a fraction of sales. The average uninational firm and the average Anglo-Saxon, European and other multinational firms invest about seven to eight percent of sales income in innovation activities including R&D. The innovation input is considerably larger in the average domestic multinational firm, whereas the foreign-owned firms and the domestic uninational firms are comparable in terms of innovation input. Also for innovation output measured by the fraction of sales generated from new products and services, we find that domestic multinationals reveal a higher intensity than both the domestic uninationals and the foreign-owned firms.

As we discussed in section 2, recent literature emphasizes the importance of innovation systems for the performance of individual firms. Table 6 reports the percentage of companies, which embed their R&D efforts in domestic networks. We report collaboration relationships with science partners to proxy the companies' utilization of the domestic infrastructure. We also report the companies' embeddedness in vertical networks with suppliers and customers as their embeddedness in horizontal networks with competitors. We observe that the domestic multinationals are most embedded in the domestic networks. Foreign-owned companies, however, seem to be slightly more embedded in the domestic networks than their domestically owned uninational counterparts.

4. EMPIRICAL MODEL AND IMPLEMENTATION

A common empirical approach for analyzing the relationship between R&D, innovation and productivity is a parametric model of Cobb-Douglas form. Many recent versions of this standard model include techniques to correct for selection bias. When only the innovation sample is used in some parts of the model, the firms are not randomly drawn from the larger population, and selection bias may arise. The innovation literature (see, seminal papers by Pakes and Griliches 1984) has also suggested that, due to the complicated process from new ideas to innovation output or productivity growth, a knowledge production function should be estimated not as a

single equation but as a system of equations. However, when several links of the process of transforming new ideas to productivity are considered in a simultaneous equation framework, one possible problem is that some explanatory variables are not exogenously given, and this leads to simultaneity bias. Crépon, Duguet and Mairesse (1998) launched an empirical model (CDM), which both relates innovation input to innovation output accounts for both selectivity and simultaneity issues. The analysis in this paper applies the Lööf-Heshmati (2002) modification of the original CDM-model.

4.1 Formulation of the model

The general structure of the empirical model can be interpreted as a three-step model consisting of four equations. , firms decide whether or not to engage in innovation activities (selection equation), and then a selective group of the firms decide how much they will invest in R&D. This is specified by a Heckman selection model. The second part of the model can be formulated as an instrumental variable equation or a three-stage ordinary least square equation. We employ the instrumental variable equation, which relates innovation input to innovation output, and innovation output to productivity. More specifically, the model is given by the following four equations:

$$y_{0i} = \begin{cases} 1 & \text{if} \quad y_{0i}^{*} = X_{0i}\beta_0 + \varepsilon_{0i} > 0 \\ 0 & \text{if} \quad y_{0i}^{*} = X_{0i}\beta_0 + \varepsilon_{0i} \le 0 \end{cases} \tag{1}$$

$$y_{1i} = y_{1i}^{*} = X_{1i}\beta_1 + \varepsilon_{1i} \quad \text{if} \quad y_{0i} = 1 \tag{2}$$

$$y_{2i} = \alpha_{21} y_{1i} + \alpha_{23} y_{3i} + X_{2i}\beta_2 + \varepsilon_{2i} \quad \text{if} \quad y_{0i} = 1 \tag{3}$$

$$y_{3i} = \alpha_{32} y_{2i} + X_{3i}\beta_3 + \varepsilon_{3i} \quad \text{if} \quad y_{0i} = 1 \tag{4}$$

where y^{*}_{0i} is a latent innovation decision variable measuring the propensity to innovate, y_{0i} is the corresponding observed binary variable being 1 for innovative firms. y_{1i}, y_{2i} and y_{3i} describe innovation input, innovation output and productivity, respectively. X_{0i}, $X_{1i,}$ X_{2i} and X3i are vectors of various variables explaining innovation decision, innovation input, innovation output and labor productivity. The predicted inverse Mills' ratio (Heckman, 1979) is included in X_{2i} and X3i to correct for possible selection bias. The β's and α's are the unknown parameter vectors. $\varepsilon_{0i,}$ $\varepsilon_{01,}$ ε_{02} and ε_{3i} are i.i.d. drawings from a multivariate normal distribution with zero mean.

We start with the 5 186 observations in equation (1), but the number of observations are restricted to the 2 723 innovative firms (53% of the observed firms) in equations 2-4.

4.2 Specification of the model

In equation (1), depicting the decision to be engaged in innovation activities, we first investigate the possible difference between domestically owned firms and foreign owned firms. The additional explanatory variables are firm size, human capital, merger and acquisition, labour productivity, gross investment, the firms' most important market and six dummy variables for sector classification: high technology manufacturing, medium high technology manufacturing, medium low technology manufacturing, low technology manufacturing, knowledge intensive and other services. The classification of industry sectors follows Hatzichronoglou (1997).

The innovation input equation (2) explores the importance of corporate ownership by comparing domestic uninationals, domestic multinationals, Nordic MNE, Anglo-Saxon MNE and MNEs from the rest of the world. In addition to sectors dummies, following control variables are included: R&D stock, public R&D support, market orientation, innovation orientation (process or product) and firm size.

Equation (3), reflecting innovation output, compares the five categories of ownership. Moreover, we include predicted labor productivity (from equation 4), and predicted innovation input (from equation 2), and the predicted inverted Mills' ratio (from equation 2) among the exogenous variables. The remaining 4 control variables are: firm size, public R&D support, human capital and a composite variable aimed to capture the diversity of external collaboration on innovation. The six sector dummies are also included.

Equation (4), finally, investigates the relationship between labor productivity and the five categories of ownership. We also control for innovation output (that is sales income from new products, predicted from equation 3), process innovation, gross investment, human capital, firm size and sector classification. To provide an overview, the endogenous and exogenous variables are defined in the Appendix, Table A and B.

5. RESULTS

The regression results for the selection model are presented in Table 7, while 8 provides the estimates from the two parts of the multistep model, i.e. the selection equation and the instrumental variable estimation.

5.1 Innovative firms and R&D intensity

Panel 1 of table 7 depicts the results from the estimated propensity to carry out innovations. This is also the first step in the selection equation. The most interesting finding is that no differences can be found between foreign-owned firms and domestically owned firms for three of the Nordic countries. Norway, however, deviates from the general Nordic pattern. For Norway, domestic firms have a significantly higher likelihood of being innovative than other firms.

Moreover, for the four different samples it is found that the likelihood of being an innovative firm is an increasing function of firm size, the fraction of employees with a university education and a global market orientation. With regard to M&A, labor productivity and gross investments, the results are somewhat mixed. Productivity is significantly and positively associated with innovative firms in Denmark, Finland and Norway, but just outside the weakest acceptable level of significance in Sweden. The point estimate for gross investments is significant and positive in Finland and Norway, but not in Denmark and Sweden. The results give some support for the hypothesis that innovative firms in Denmark, Norway and Sweden have a greater probability . In Finland the relationship between M&A and innovative firms is negative, but insignificant.

Panel 2 of Table 7 presents the determinants of the amount of R&D and other innovation expenditures per employee. The evidence is compelling that domestic multinationals in Finland and Sweden outperform foreign-owned firms and uninational firms regarding R&D investments, everything else being equal. In Norway domestic multinationals and Anglo-Saxon multinationals have significantly higher R&D intensity than other firms. Notable is that Denmark deviates strongly, with a pattern where domestic multinationals and Nordic multinationals (at the 10% level of significance) have a lower R&D intensity than uninational Danish ll as Anglo-Saxon and continental European firms.

It is shown that the R&D-intensity is an increasing function of the stock of R&D, proxied by whether or not the firm is conducting R&D on a continuous basis. Interestingly, we also see that the R&D-intensity is closely associated with public R&D subsidies. In all Nordic countries, except Denmark, the R&D-intensity is a decreasing function of firm size. For other determinant variables, there is no common pattern of association with R&D among the different countries.

5.2 Innovation output and labor productivity

The literature surveyed in Section 2, in combination with the descriptive statistics presented in Table 4, suggests that foreign firms tend to have higher levels of technology and productivity than domestically owned firms. One contribution of the present article is that we qualify the analysis somewhat by including corporate governance and differentiate between multinational firms and uninational firms as well as between categories of foreign-owned firms. Another distinctive feature of our analysis is that the regressions only consider innovative firms (although information from the total sample is used in the selection equation). A third aspect is that we only compare firms belonging to a group. Finally, we apply a multistep model, which captures not only one single relationship, but also the complete process from the decision to invest in R&D all the way to effects on labour productivity.

The results presented in Panel 1 of Table 8 show the elasticities of innovation sales with respect to corporate ownership. First, in Norway no difference between domestic and foreign firms can be established. In Denmark, it is only the estimated Anglo-Saxon innovation-sales parameter that is significantly larger than the parameter of other firms. With regard to Sweden, the estimate for domestic multinationals is positive and quite sizable (0.5), but significantly different from zero only at the 10 % level. However, the elasticity of innovation sales, with respect to Nordic multinationals, is highly significant. he Finnish result reveals that the point estimate for Anglo-Saxon firms has a low level of significance. However, since the elasticity of innovation sales is significant for Finnish multinationals, we conclude that Finland is different from other Nordic countries the direct economic impact of innovation; domestic multinationals outperform foreign-owned firms.

In Panel 2 of Table 8 the productivity estimates are presented. with Denmark and Sweden, it is apparent that there are no differences in labour productivity between foreign and domestic firms. Looking at the Finnish sample, there is some evidence that Nordic firms have higher labour productivity than other firms. However, the estimate is significant only at the 10% level. The results for Norway show that the average Nordic multinational firm has a higher level of labour productivity than domestic multinationals and uninationals. The test also shows that no significant difference can be found between Norwegian firms, Anglo-Saxon firms and Continental European firms.

In summary, for domestic multinationals in each of the Nordic countries, an indication of an *innovation-paradox* despite advantages from the embeddedness in scientific and vertical innovation systems, Danish multinationals do not have higher innovation sales per capita than any other firms. On the contrary, the point estimate for Anglo-Saxon firms is significantly larger than for Danish multinationals. In Norway, domestic multinationals are also more embedded in national systems of innovation and have a larger propensity to receive governmental R&D subsidies than other firms. However we find no impact on the relative innovation output. In Sweden, domestic multinationals collaborate more on innovation than other firms, and have the propensity to be granted governmental R&D support. This dominating position on the input-side of R&D and innovation does not manifest itself in any superiority on the output side. Only in Finland, there is some association between the advantages of embeddedness and public R&D support and the relative innovation output among domestic multinationals.

Furthermore, we have estimated the elasticity of labor productivity with respect to corporate ownership controlling for factors such as R&D-investments, innovation orientation (product or process innovations), physical investment, human capital, firm size, market orientation and sector classification. Just as with the case of innovation output results, we do not find that the advantage of domestic multinationals on the innovation input side, manifests itself in a superior productivity performance. On the one hand side, the results are at variance with those studies suggesting that foreign-owned firms are more efficient than domestic firms in terms of productivity. On the

other, the embeddedness of the domestically owned MNEs in regional and local systems of innovation does not seem to generate any productivity advantages.

6. SUMMARY AND CONCLUDING REMARKS

This paper has examined the innovation behaviour and productivity performance of foreign takeovers by comparing foreign-owned firms and domestically owned firms in the Nordic region. For companies that have been taken over, however, we cannot observe their behaviour and performance in the counterfactual state. In other words, we have no direct answer to the question: "What would the innovative activities have been, had the companies not been taken over?" In the study the domestically owned companies serve as a proxy for the companies in the state of no takeover. The paper also poses the following question: does it matter if a Nordic, Anglo-Saxon or any other MNE makes a take-over?

The descriptive statistics, which do not consider any firm-specific or industry-specific differences, show a robust pattern of superiority for foreign-owned firms across all four Nordic countries. The foreign-owned firms in the Nordic countries are distinguished by having a larger proportion of innovative firms, higher R&D intensity, higher level of innovation sales per employee, and larger export intensity. The findings on embeddedness in national innovation systems were somewhat more mixed.

The econometric approach used intends to explore whether foreign-owned firms perform or behave differently than domestic firms *ceteris paribus*? If the ceteris paribus condition is satisfied, a reasonable conclusion is that a superior performance indicates possible welfare gains while inferior results in terms of innovation and productivity indicate the opposite.

In the econometric analysis we find that the propensity be in R&D and innovation activities does not differ between foreign-owned firms and domestically owned firms in the Nordic region, with the exception of Norway. In Norway, the group of foreign firms have a significantly lower likelihood to be innovative than Norwegian firms.

Among innovative firms though, the results regarding R&D-intensity (R&D per employee), are somewhat mixed across the countries. In Finland, Sweden and Norway, the R&D-intensity of domestic multinationals is larger compared to all other corporate styles, however the result is statistically significant only for Sweden. The deviating country in this respect is Denmark. The Danish multinationals have a lower R&D intensity than both uninational firms and foreign-owned firms.

The evidence regarding embeddedness in the four countries' systems of innovation is presented in the descriptive statistics is quite evident. Domestic multinationals play a dominant role in the three sub-systems of innovation, scientific, vertical and horizontal. The combined effect of higher R&D-intensity, and technological spillovers through various systems of innovation, suggests that domestic multinationals outperform other categories of domestic and firms concerning the sales income from new products and also labor productivity

Controlling for R&D intensity (which is significantly lager for domestic MNEs), but not for embeddedness in the systems of innovation, we find that the domination of domestic in the systems of innovation manifests itself in a distinct output superiority over foreign-owned firms.

The results for the innovation output equations are mixed between countries between measures. Only in Finland do domestic multinationals have larger income from innovation sales. In Sweden, the regression results indicate that Nordic multinationals outperform other firms. For Norway, the analysis cannot establish any robust evidence of systematic differences between domestic and foreign firms. The Danish results indicate that foreign-owned companies are more innovative than domestic firms.

A possible interpretation of the seemingly paradoxical results regarding innovation output (innovation sales) is that multinational companies tend to utilize R&D laboratories in the home country for the development of assets which are exploited by affiliates abroad. Correspondingly, the innovation performance attributed to foreign-owned multinationals in the Nordic region partly represents returns to R&D-investments in their home countries. It should be noted that we have found that both foreign-owned and domestically owned multinationals exploit knowledge for

innovation from affiliates within their own group to a significantly larger extent than uninational companies do.

Concerning the finding that foreign-owned firms do not have higher productivity, our results support recent findings by Doms and Jensen (1998) and Pfaffermayr and Bellak (2002) on performance differences between foreign and domestic firms. Hence, take-over of firms in the Nordic region is neutral with respect to labor productivity, and hence the issue of welfare gain and welfare drain is turned into a non-issue.

The following tentative conclusions can be drawn from the study. Firstly, there are some significant differences between multinational and uninational firms. We found that both foreign-owned and domestically owned multinationals y larger extent than uninational companies exploit knowledge for innovation from affiliates within their group. Hence, if the firms that have been taken-overare former uninational firms, we can expect increased global knowledge spillovers. Thirdly, we believe that the R&D-strategy of foreign-owned firms has a significant influence on innovation behaviour. If the foreign direct investments are of the home-base-exploiting type, this can reduce the firms' incentive to sustain or increase the R&D-intensity and to collaborate on innovation with various partners within the national innovation systems. However, a home-based-augmenting strategy can be have the opposite effect. In this case, acquiring technological spillovers from agglomerative effects in specific sectors, specific firms, and public infrastructure in the host country are of essential importance. Thus, take-overs can have two diametrically opposite motives, and this may help to explain why some of our empirical findings differ across the four host countries and across the home countries of foreign-owned firms.

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DESCRIPTIVE STATISTICS, ALL FIRMS

Table1: Sample size and the distribution of ownership

	Domestic uninational	Domestic multinational	Foreign multinational	Total	Foreign, Fraction	Innovative, fraction
Denmark	574	47	223	844	26.4	50.8
Finland	541	93	184	818	22.5	63.0
Norway	1, 556	55	685	2 327	29.8	48.1
Sweden	752	62	383	1 197	32.0	58.0
Total	3, 423	257	1 475	5, 186	28.6	55.0

Table 2: Firm size distribution (employment)

	Domestic uninational		Domestic multinational		Foreign multinational	
	Mean	Median	Mean	Median	Mean	Median
Denmark	292	62	1 975	600	210	83
Finland	316	85	1 835	407	180	89
Norway	150	61	406	133	222	82
Sweden	276	50	1 277	355	348	105
Average	259	65	1 373	374	240	90

Table 3: Firms' most significant market (Percentage of firms).

	Domestic uninational			Domestic multinational			Foreign multinational		
	Local	National	Global	Local	National	Global	Local	National	Global
Denmark	21.1	43.4	35.5	10.6	31.9	57.5	12.6	52.9	34.5
Finland	25.4	47.9	26.6	1.1	21.5	77.4	3.8	53.3	42.9
Norway	39.4	40.4	20.2	5.5	23.6	70.9	28.3	47.0	24.7
Sweden	27.4	42.3	30.3	6.5	24.2	69.4	8.9	41.5	49.6

DESCRIPTIVE STATISTICS, ALL FIRMS

Table 4: Firms characteristics

Panel A. Denmark

	Sales	Labor Product.	Export	Gross investment	Human capital
Domestic UNI	9.89	5.18	1.03	0.57	0.08
Domestic MNE	11.24	4.97	1.77	0.72	0.12
Foreign MNE	9.98	5.27	1.63	0.78	0.14
- Nordic	9.96	5.33	1.51	0.78	0.11
- Anglo-Saxon	9.87	5.03	1.97	0.81	0.19
- Rest of world	10.06	5.38	1.54	0.77	0.14

Panel B. Finland

	Sales	Labor Product.	Export	Gross investment	Human capital
Domestic UNI	9.35	4.84	2.27	1.52	0.33
Domestic MNE	11.30	5.24	4.06	1.98	0.43
Foreign MNE	9.69	5.26	3.92	1.28	0.38
- Nordic	9.45	5.12	3.05	1.11	0.35
- Anglo-Saxon	10.06	5.49	3.97	1.75	0.40
- Rest of world	9.64	5.24	2.94	1.03	0.40

Panel C. Norway

	Sales	Labor Product.	Export	Gross investment	Human capital
Domestic UNI	11.39	7.22	2.56	3.04	0.24
Domestic MNE	12.35	7.41	6.13	3.72	0.42
Foreign MNE	11.78	7.33	3.33	3.11	0.31
- Nordic	11.82	7.43	2.81	2.99	0.29
- Anglo-Saxon	11.90	7.50	4.19	3.30	0.40
- Rest of world	11.71	7.22	3.39	3.12	0.28

Panel D. Sweden

	Sales	Labor Product.	Export	Gross investment	Human capital
Domestic UNI	11.36	5.00	1.87	3.49	0.17
Domestic MNE	13.18	5.17	3.61	3.78	0.21
Foreign MNE	12.17	5.30	3.21	3.59	0.18
- Nordic	12.09	5.32	3.06	3.46	0.14
- Anglo-Saxon	12.31	5.36	3.76	3.75	0.21
- Rest of world	12.14	5.25	2.96	3.60	0.20

Note: Sales, labour productivity, export and gross investment are all expressed in per capita terms and in logs. The currency unit is Euro in Denmark, Finland and Sweden and Norske Kroner for Norway. Human capital is expressed as the fraction of the work force with higher education.

DESCRIPTIVE STATISTICS, INNOVATIVE FIRMS

Table 5: Innovation input and Innovation sales, as a fraction of sales. Standard deviation in parentheses.

	Domestic uninational		Domestic multinational		Foreign multinational	
	Innovation input	Innovation sales	Innovation input	Innovation sales	Innovation input	Innovation sales
Denmark	8.6 (21.3)	24.8 (27.0)	14.1 (24.9)	27.0 (25.8)	8.8 (21.0)	25.7 (24.0)
Finland	6.1 (14.9)	16.2 (23.6)	9.1 (15.7)	25.6 (27.5)	6.9 (15.6)	18.4 (23.6)
Norway	7.1 (16.8)	20.5 (24.6)	16.7 (26.3)	30.8 (28.5)	8.8 (19.7)	22.6 (26.3)
Sweden	8.4 (19.4)	15.2 (24.2)	15.0 (25.7)	23.9 (28.0)	6.2 (14.1)	18.8 (24.4)

Table 6: Embeddedness in national innovation systems. Fraction of firms.

	Domestic uninational			Domestic multinational			Foreign multinational		
	Sci	Ver	Hor	Sci	Ver	Hor	Sci	Ver	Hor
Denmark	15.7	24.7	6.4	50.6	70.2	12.8	16.0	24.0	3.2
Finland	41.9	46.5	11.9	95.7	91.4	34.4	49.6	53.8	9.2
Norway	18.3	27.2	4.7	65.4	65.4	7.3	22.2	28.1	5.5
Sweden	17.9	23.4	5.9	69.3	82.2	20.9	29.8	34.6	4.8

REGRESSION RESULTS

Table 7: Selection model

Panel 1: Dependent variable: Propensity to be engaged in innovation activities

	Denmark		Finland		Norway		Sweden	
	Coeff	St.err.	Coeff	St.err.	Coeff	St.err.	Coeff	St.err.
Domestically owned	Reference		Reference		Reference		Reference	
Foreign-owned	- 0.104	0.109	- 0.115	0.121	- 0.283***	0.061	0.053	0.086
Firm size	0.164***	0.367	0.223***	0.038	0.165***	0.024	0.198***	0.029
Human capital	0.984***	0.269	0.361*	0.184	0.994***	0.134	0.579***	0.204
M&A	0.462***	0.211	- 0.125	0.149	0.350***	0.082	0.216*	0.120
Labor product	0.050**	0.022	0.167***	0.060	0.059**	0.025	0.078	0.051
Gross invest	0.045	0.472	0.096***	0.039	0.130***	0.014	0.049	0.149
Local market	Reference		Reference		Reference		Reference	
National market[2]	0.174	0.128	1.144***	0.143	0.299***	0.063	0.307***	0.108
Global market [2]	0.274**	0.141	0.789***	0.162	0.503***	0.078	0.585***	0.118
Six sector dummies	Included		Included		Included		Included	

Note: *** (**, *) indicates significance at the 1% (5%, 10%),

Panel 2: Dependent variable: Log investments in R&D and other innovation activities per employee

	Denmark		Finland		Norway		Sweden	
	Coeff	St.err.	Coeff	St.err.	Coeff	St.err.	Coeff	St.err.
Domestic UNI	Reference		Reference		Reference		Reference	
Domestic MNE	- 0.077***	(0.009)	0.510***	(0.178)	0.613***	(0.215)	0.687***	(0.229)
Nordic MNE	- 0.322 *	(0.189)	0.234	(0.212)	- 0.318**	(0.151)	0.009	(0.193)
Anglo-Saxon MNE	0.336*	(0.176)	0.471**	(0.235)	0.538***	(0.186)	0.103	(0.213)
Rest of world MNE	0.011	(0.174)	0.445*	(0.254)	0.257*	(0.142)	0.150	(0.188)
R&D stock	0.415***	(0.050)	1.046***	(0.149)	1.162***	(0.101)	0.143***	(0.137)
Firm size	0.057	(0.055)	- 0.413***	(0.048)	- 0.472***	(0.042)	- 0.310***	(0.062)
R&D subsidies	0.396***	(0.088)	0.622***	(0.130)	0.448***	(0.106)	0.425***	(0.176)
Prod orientation	0.315***	(0.005)	0.723***	(0.244)	0.216	(0.152)	0.343*	(0.208)
Process orientation	0.165	(0.185)	1.247***	(0.149)	0.456***	(0.153)	0.131	(0.243)
Local market	Reference		Reference		Reference		Reference	
National market	0.239	(0.214)	- 0.131	(0.245)	- 0.170	(0.120)	0.336	(0.232)
Glob market	0.480	(0.234)	- 0.232	(0.373)	0.028	(0.148)	0.730**	(0.285)
Six sector dummies	Included		Included		Included		Included	

Note: *** (**, *) indicates significance at the 1% (5%, 10%),

REGRESSION RESULTS

Table 8: Two stage least square model

Pane1 1: Dependent variable: Log innovation sales per employee.

	Denmark		Finland		Norway		Sweden	
	Coeff	St.err.	Coeff	St.err.	Coeff	St.err.	Coeff	St.err.
Domestic UNI	Reference		Reference		Reference		Reference	
Domestic MNE	0.290	0.227	0.496**	0.224	- 0.475	0.386	0.524*	0.268
Nordic MNE	0.286	0.320	0.294	0.259	0.488	0.298	0.592***	0.209
Anglo-Saxon MNE	0.673**	0.342	0.545*	0.294	- 0.478	0.351	0.362	0.257
Rest of world MNE	0.192	0.252	0.238	0.310	- 0.018	0.273	0.306	0.226
Labour productivity (pred)	0.436**	0.194	0.328	0.278	- 0.363	0.414	0.529*	0.293
Innovation intensity (pred)	0.276	0.310	0.225	0.175	0.677***	0.138	0.331***	0.122
Inverted Mills' ratio (pred)	- 0.707	1.393	- 0.873*	0.742	0.996	0.702	- 0.894	0.799
Firm size	- 0.034	0.126	- 0.153	0.111	0.027	0.108	- 0.093	0.113
Public funding for R&D	- 0.222	0.217	- 0.396*	0.230	- 0.668***	0.222	0.545***	0.198
Collaboration diversity	0.667	0.418	1.555***	0.349	2.398***	0.529	1.044***	0.385
Human capital	0.485	0.536	- 0.553	0.371	0.704	0.501	0.830*	0.469
Six sector dummies	Included		Included		Included		Included	

Note: *** (**, *) indicates significance at the 1% (5%, 10%),

Pane1 2: Dependent variable: Log sales per employee (gross labor productivity)

	Denmark		Finland		Norway		Sweden	
	Coeff	St. err	Coeff	St. err	Coeff	St. err	Coeff	St. err
Domestic UNI	Reference		Reference		Reference		Reference	
Domestic MNE	- 0.070	0.318	- 0.084	0.111	- 0.056	0.160	- 0.103	0.156
Nordic MNE	0.484	0.302	0.174*	0.101	0.197**	0.092	0.013	0.113
Anglo-Saxon MNE	0.209	0.476	0.122	0.159	0.069	0.106	0.160	0.131
Rest of world MNE	0.266	0.276	0.107	0.159	0.085	0.085	- 0.051	0.112
Predicted innov. output	0.404	0.385	0.202**	0.086	0.064	0.051	0.221**	0.087
Gross invest per employee	0.360***	0.109	0.269***	0.038	0.208***	0.019	0.183***	0.050
Process innovation	- 0.072	0.168	- 0.101	0.159	- 0.036	0.085	- 0.021	0.075
Size	0.352***	0.117	- 0.009	0.070	0.043*	0.024	0.006	0.026
Human capital	1.199*	0.626	0.639***	0.035	0.308	0.187	- 0.357	0.243
Six sector dummies	Included		Included		Included		Included	

Note: *** (**, *) indicates significance at the 1% (5%, 10%),

APPENDIX: Definition of the variables

Table A: The dependent variables in equations 1-4.

Endogenous variables	**Definition**
Innovative firm	Innovative firms are firms reporting a product and/or process innovation and/or report ongoing innovation activities.
Innovation input	The firm's expenditures on R&D and other innovation activities per employee (log).
Innovation sales	The return on innovation investments. Innovation sales per employee (log).
Labor productivity	Sales per employee (log).

Table B: The independent variables in the equations 1-4

Exogenous variables	**Definition**
Domestically owed firm	Firms with headquarter in Sweden
Foreign-owned firm	Firms with headquarters in a foreign country are used as a proxy for foreign-owned firms
Uninational Enterprises	Domestically-owned firms belonging to a group with only domestic affiliates
Domestically-owned multinational enterprises	Domestically-owned firms belonging to a group with foreign affiliates
Nordic-owned multinational enterprises	Multinational firm with the headquarters in some of the Nordic neighbouring countries
Anglo-Saxon owned multinational enterprises	Multinational firm with the headquarters in USA, United Kingdom, Ireland, Canada or South Africa
Rest of the world multinational enterprises	Multinational firm with the headquarter in continental European countries or other countries
Product oriented innovation strategy	Composite variable composed by variables “Increased range of goods or services”, “Increased market or market share” and “Improved quality in goods or services” as expected effects of innovation
Process oriented innovation strategy	Composite variable composed of variables “Improved production flexibility”, “Increased production capacity” and “Reduced labor costs per produced unit” as expected effects of innovation
Continuous R&D	Continuously R&D engagement
Diversity	Domestic and global cooperation on innovation
Firm size	Employment (log).
Human capital	The fraction of employment with a university education is used as a proxy for human capital
Recent history of merging and acquisition	The enterprise has been merged or acquired during the last three years
Productivity	Value added per employee (log). Indicates financial means for R&D investments.
Gross investment	Gross investment per employee (log)
Significant market area - local	The firms’ most significant market
Significant market area - national	The firms’ most significant market
Significant market area - global	The firms’ most significant market
High technology manufacturing sector	Nace 353, Nace 2423, Nace, 30, Nace 32, Nace 33
Medium high technology manufacturing sectors	Nace 24 excl Nace 2423, Nace 29, Nace 31, Nace 34, Nace 352, Nace 359
Medium low technology manufacturing sectors	Nace 23, Nace 25, Nace 26, Nace 37, Nace 28, Nace 351, Nace 354
Low technology manufacturing sectors	Nace 15, Nace 16, Nace 17, Nace 18, Nace 19, Nace 20, Nace 21, Nace 36, Nace 37
Knowledge intensive services	Nace 64, Nace 65, Nace 66, Nace 67, Nace 71, Nace 72, Nace 73, Nace 74
Other services	Services other than Knowledge intensive services