

SKILL UPGRADING AND PRODUCTION TRANSFER WITHIN SWEDISH MULTINATIONALS*

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Abstract

This paper studies the link between production transfer within Swedish-headquartered multinational enterprises (MNEs) and skill upgrading in Swedish manufacturing MNE parents in the 1990s. The analysis distinguishes between horizontal and vertical foreign direct investment (FDI). The increased employment share in the affiliates in non-OECD countries (vertical FDI) has a non-trivial, significantly positive effect on the share of skilled labor in the Swedish parents. On the other hand, the parents' skill upgrading are unrelated to employment changes in their affiliates in other OECD countries (horizontal FDI). The latter is consistent with implications of the newly developed horizontal MNE models.

Key words: Multinational enterprises, skill upgrading, horizontal foreign direct investment, vertical foreign direct investment

JEL classification: F21, F23, J31

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I. Introduction

Increased international integration affects the labor market in various ways. One channel is through international trade. Basically, the idea is that increased trade with less-developed countries, intensively using low-skilled labor in their export, displace less-skilled labor intensive production in the developed countries and thereby reduce the demand for low-skilled labor in these countries. There is by now a significant amount of studies looking at the impact of international trade on the relative demand for skills.¹ Another, less explored channel, through which increased international integration may influence the relative demand for skilled labor is foreign direct investment (FDI).

Swedish-headquartered multinational enterprises are dominating employers in Swedish manufacturing and reasonably their localization behavior have an impact on the demand for skills in manufacturing. Newly developed theories on multinational enterprises (MNEs) distinguish mainly between vertical and horizontal MNEs.² Horizontal MNEs produce roughly the same product or service with similar factor intensities in different locations. In vertical MNEs the production process is divided into various production stages where the stages use factors of production in different proportions. The driving force behind the emergence of vertical MNEs is an endeavor to exploit factor price differences across countries. Accordingly, we would expect Swedish MNEs to invest horizontally, particularly, in other developed countries, whereas vertical FDI take place in low-income countries.

The purpose of this paper is to analyze the link between production transfer within Swedish manufacturing MNEs and skill upgrading in their parents. My approach has close similarities to Slaughter (2000) and Head and Ries (2002), which in turn are based on a

¹ See, e.g. Wood (1998) and Johnson and Stafford (1999) for overviews.

² Examples of models with vertically integrated MNEs are Helpman (1984) and Feenstra and Hanson (1996), whereas Markusen, (1984), Horstmann and Markusen (1992) and Markusen and Venables (1998) represent models with horizontally integrated MNEs.

commonly employed method by Berman, Bound and Griliches (1994). Slaughter (2000), which studies production transfer in US-headquartered MNEs, draws no distinction between horizontal and vertical FDI and his analysis is solely carried out on industry level. Head and Ries (2002) is based on data from Japanese manufacturing firms. They take alternative types of FDI into account and investigate whether investment in countries with various levels of per capita income affect the domestic skill intensity differently. By looking at employment changes in Swedish MNE parents and their affiliates, and by distinguishing between the affiliates' employment changes in OECD and non-OECD countries, I am also able to assess the differential impact horizontal and vertical FDI is expected to have on skill upgrading. Moreover, the data I am using give me an opportunity to perform the analysis on firm level.

My period of analysis, 1990-97, is interesting because it covers the years after the iron curtain was lifted. This is a period where we, in contrast to the pre-1990 period, can observe a significant increase of the non-OECD employment share in Swedish MNEs. In the paper I show that the increased non-OECD share, above all, is a result of relatively large Swedish FDI in the Central and Eastern European Countries, the CEECs. A rationale of this development is that Swedish MNEs have tried to utilize the large supply of cheap labor in the immediate neighborhood the transition in the CEECs has given rise to. Thus, it seems that, in contrary to the period before 1990, a considerable element of vertical FDI has occurred in Swedish MNEs. One of the paper's main purposes is to examine to what extent this has affected skill upgrading in Swedish MNE parents.

A highly topical question is whether, in recent years, Swedish MNEs have transferred their more skilled operations abroad, while keeping their less-skilled operation in Sweden.³ If this is the case it may have strong policy implications since that would indicate severe shortcomings in the conditions for highly advanced production in Sweden. I review the facts put forward in favor of such an assertion and discuss some objections that can be raised

against this evidence. I also carry out my own analysis; I examine whether production transfer within Swedish MNEs to affiliates in other OECD countries has affected the skill upgrading in their parents negatively.

To preview my results I find a non-trivial, significantly positive, impact on skill upgrading in Swedish MNE parents between 1990-97 of the increased employment share in their affiliates in non-OECD countries. On the other hand, I observe no effect on parent skill upgrading of shifts in employment within Swedish MNEs towards other OECD countries.

The plan of the paper is as follows. Section II serves as background to the empirical analysis. It gives a brief overview of the new theories on MNEs trying to identify some empirical implications. Moreover, it surveys a few, closely related, empirical studies on the effects of FDI on home country employment in Swedish manufacturing. Section III presents some facts on Swedish MNEs in the 1990s. Section IV contains an econometric analysis of the impact of production transfer within Swedish MNEs on skill upgrading. Section V concludes.

II. Theoretical Background and Related Empirical Work

A Brief Theoretical Overview

The theoretical foundation to the empirical analysis has its origin in a number of articles trying to integrate MNEs into general equilibrium models.⁴ A characteristic feature of MNEs is that their parents are often firms intensive in the use of knowledge capital. Knowledge capital can be the human capital of the employees, patents, blueprints, procedures and other proprietary knowledge or marketing assets such as trademarks and reputation. These firm-

³ See, e.g. Blomström (2000) and Jakobsson (1999).

specific assets have within-firm public good properties. This means that even though the knowledge capital is very costly to produce, once created it can be transported to affiliates (abroad) at a relatively low cost. In a world with trade costs this give rise to firm-level multi-plant economies of scale and involve incentives for MNEs to export services of their knowledge-based assets, e.g. managerial and engineering services, financial services, reputations and trademarks.

The sources of localization advantages from establishing units in different countries depend on whether the firm is a horizontal or a vertical MNE. Horizontal MNEs are firms that produce roughly the same product or service in multiple locations, whereas vertical MNEs are firms that fragment production into stages geographically. Horizontal MNEs may exist if trade costs outweigh plant-level scale economies. Otherwise the production would be concentrated to one single plant serving other locations with exports. Also following from an assumption of plant-level scale economies is that the market of the host country has to be large enough. If the market is too small it will be more profitable to service that market with export rather than establish a local plant. Generally, horizontal MNEs set up new affiliates producing the same product or service in other countries with more or less the same relative factor endowments as in the home country. Consequently, production transfer within horizontal MNEs implies no impact on skill upgrading within the parent firms.

In vertical MNEs the stages of production have different factor intensities. By locating skilled-labor intensive activities in skilled-labor abundant countries and less-skilled intensive activities to less-skill labor abundant countries, these MNEs exploit factor-price differences across countries. We can think of a MNE exporting the services of its knowledge capital and intermediate skill intensive inputs to final assembly in a plant located in a less-skilled labor abundant country and then ship the final product back to the MNE's home country or to another country. This means that, unlike horizontal MNEs, vertical MNEs are

⁴ For a comprehensive survey see Markusen (2002).

encouraged by lower trade costs, but also, in contrary to horizontal MNEs, production transfer within vertical MNEs generate skill upgrading within the parent firms in skill-labor abundant home countries.

Empirical Studies of FDI on Parent Employment in Swedish MNEs

Home country employment effects of FDI by Swedish MNEs have been the focus of two recent studies. Both studies use a database collected by the Research Institute of Industrial Economics (IUI) that surveys Swedish manufacturing MNEs at six times over the period 1970-94. The first is Blomström, Fors and Lipsey (1997) (hereafter BFL), which has attracted much attention. They run some descriptive regression equations showing the relationship within Swedish MNEs between foreign production and employment in the parent firm given the level of parent production. BFL find that Swedish parents employ more labor at home, given the size of home production, when they produce more abroad. Their interpretation of this result is that there seems to be a need in Swedish MNEs with more activities abroad to have more supervisory and auxiliary employment in the parent at home to coordinate and support the activities in foreign affiliates. Moreover, BFL assert that their result is inconsistent with a significant allocation of labor-intensive production to low-wage countries.

BFL also divide the Swedish parent employment into white-collar and blue-collar employees and distinguish between affiliate production in developed and developing countries. In accordance with a hypothesis that developing country operations require parent supervision they find that more production in developing countries is associated with higher parent white-collar employment. Interestingly, parent blue-collar employment also appears to increase with production in developing countries. Whether this results in skill upgrading is not discussed by BFL. However, my result in section IV shows that this, in fact, may be the case.

BFL observe that between foreign production in developed countries and parent white-collar employment there is no relationship (or a negative association), whereas blue-collar parent employment is positively related to foreign production in developed countries.⁵ They mean “this could be an indication that skilled based production stages in Swedish MNEs are increasingly located abroad, while the unskilled stages are retained and expanded in Sweden” (p.1794). Yet this suggestion appears inconsistent with their interpretation that supervisory and auxiliary employment (expected to be skilled) has increased when Swedish MNEs expanded production abroad. A general demur at BFL is that a panel approach, rather than running a number of cross-section regressions, would have been more appropriate to study the dynamic process of how production expansions in affiliates abroad influences parent employment at home. Moreover, the result in BFL would have been easier to interpret if the estimated regressions had been derived from a production (cost) function.

Braconier and Ekholm (2000) (hereafter BE) is the second study looking at how parent employment is affected by FDI in Swedish manufacturing MNEs. They estimate a labor demand function assessing the effects on employment in the Swedish parents of wage changes in the affiliates in high-wage and low-wage locations.⁶ BE find some evidence of a substitutionary relationship between parent firm employment in Sweden and affiliate employment in other high-income locations. No relationship, neither substitutionary nor complementary, is detected between Swedish parent employment and affiliate employment in low-income locations. From this they conclude that competition from low-wage countries does not seem to have had a negative impact on employment in Sweden through the activities of MNEs. Yet one should keep in mind that BE focus solely on total parent employment and

⁵ Blomström, Fors and Lipsey (1997) Table 2 and 3.

⁶ Brainard and Riker (1997) employ a similar approach and find that employment in U.S. parents and foreign affiliates are substitutes. Hatzius (1998) obtains the same result for Sweden using the IUI database. Unlike BE, he does not examine the differential effect wages in high-wage and low-wage countries may have on parent employment.

they do not disaggregate employment into skilled and less-skilled labor. Consequently, they cannot tell us anything about skill upgrading.

Based on, i.a. the result in BFL, suggesting that the skill intensity may have risen faster in the high-income foreign locations than in Sweden,⁷ some strong policy conclusions have been drawn.⁸ As I argue above the conclusions in BFL are not without objections and in section IV I carry out another test of whether Swedish MNEs has substituted skilled labor in their parents with skilled labor in their affiliates in other high-income countries. Before I present the result from my regression analysis let me discuss the data I am using, and show some descriptive statistics on the employment in Swedish-headquartered manufacturing MNEs in the 1990s.

III. Some Facts on Swedish Manufacturing MNEs in the 1990s

My data is mainly from two sources. The employment in the Swedish parents and in the affiliates abroad are from Statistics on International Business (SIB) that is compiled by Statistics Sweden and consist of the 80 largest Swedish-headquartered manufacturing MNEs. The data on parent employment and their earnings divided into skilled and less-skill labor comes from Statistics Sweden, Register-based Labor Statistics. My definition of skilled labor rest on educational attainment and I define skilled labor as employees with post-secondary education, i.e. with more than 12 years of education.⁹

Table 1. Employment in Swedish manufacturing MNE parents, in their affiliates in OECD and non-OECD countries, and in overall Swedish manufacturing 1990-97.

⁷ Other evidence put forward, e.g. in Blomström (2000) and Jakobsson (1999), and objections to them are presented in Hansson (2001).

⁸ “Taxes must be cut and it must be possible to give key groups (persons) significant wage increases without having to compensate the rest of the society” (Blomström 2000 p.200).

⁹ Most likely, such a division into skilled and less-skilled is more appropriate than the often used, e.g. in Slaughter (2000) and Head and Ries (2002), non-production/production worker classification.

Table 1 reveals that Swedish MNEs have a dominating role as employers in Swedish manufacturing. Even though their share of total manufacturing employment has declined between 1990 and 1997, still in 1997 it is over 36 percent. The main explanation to the drastic fall in the MNEs' employment share in Swedish manufacturing between 1993 and 1997 is that, due to mergers and acquisitions, some large, formerly, Swedish-owned MNEs shifted to foreign ownership.

Table 1 also shows that the bulk of the employees in Swedish MNEs are employed abroad and a decreasing share is working in Sweden. Apparently, Swedish MNEs are getting more involved in foreign production and their activities are increasing abroad. The employment share in their foreign affiliates has increased from just less than 58 percent in 1990 to almost 64 percent in 1997. This provides evidence of transfer of production within Swedish MNEs.

Table 2. Employment of affiliates in non-OECD country groups 1990-97.

Another striking feature is that it is in the non-OECD affiliates the employment has increased, both in absolute level and in terms of the worldwide MNE activity, while the share in the OECD affiliates is unchanged. In this respect the development in the 1990s differs from the trends in the 1970s and 80s. Before 1990 the employment in foreign affiliates also grew, both in absolute and in relative terms to the Swedish parents.¹⁰ However, the increase was then, particularly in the 1980s, concentrated to the affiliates in OECD.¹¹ This indicates that, in the 1990s, vertical MNE transfer may have been of greater importance. A closer inspection of the non-OECD group, in Table 2, shows that it is in affiliates in the CEECs the employment has been growing, both in absolute and in relative terms, while it has fallen in Latin America.

¹⁰ Hatzius (1998) Table 2.

¹¹ Braunerhjelm and Ekholm (1998) Table A.9.

Relatively, the employment in Asian affiliates has decreased too, and if it were not for China we would have seen an absolute decline in employment in Asia as well.

Table 3. Skilled and less-skilled employment in MNE parents, non-Swedish MNE affiliates, and other non-MNE firms in Swedish manufacturing 1990-97.

In Table 3, I compare the employment of skilled and less-skilled labor in MNE parents, non-Swedish MNE affiliates, i.e. foreign-owned firms, and other non-MNE manufacturing firms. Unfortunately, I have no information about the kind of jobs that has been created in Swedish MNE affiliates abroad.

First, we notice the pattern I indicated above, that is, between 1993 and 1997 the employment share in non-Swedish MNE affiliates has increased at the expense of the share in MNE parents. The employment share in other non-MNE firms has been almost constant.

Second, we observe that over the period 1990 to 1997 the MNE parents shifted their employment mix sharply towards skilled labor; they shed less-skilled workers and roughly maintained the same number of skilled jobs. As a matter of fact, this pattern appears to be more pronounced in the MNE parents than in foreign-owned firms and in other non-MNE firms. In Table 3, this can be seen when we compare the skill employment share among the various groups of firms. More appropriately, the last two columns of Table 3, where I take firm size and the industry of a firm into account, shows that, in 1990, the share of skilled labor employment is about 4 percentage points higher in MNE parents and in non-Swedish MNE affiliates than in other non-MNE firms, and the difference is clearly significant. In 1997, the difference is more than 7 percentage points higher in MNE parents, while still it is around 4 percentage points higher in foreign-owned firms. In fact, the skill employment share is significantly higher in the MNE parents than in the foreign-owned firms. Also, it appears that using the skilled-labor wage-bill share instead of the employment skill share gives similar results.

This section indicates that Swedish MNEs have changed their localization pattern and increased their employment share in the CEECs. The more marked skill upgrading in the MNE parents than in other firms in Swedish manufacturing throws some doubts on the assertion that Swedish MNEs has substituted skilled workers at home with skilled workers in their affiliates in other high-income countries. Yet to obtain direct evidence on the effect of production transfer within Swedish MNEs on home country employment requires regression analysis.

IV. Econometric Analysis of MNE Transfer on Skill Upgrading

Analytical Framework

To analyze the link between MNE transfer and within-industry (firm) shifts in the labor demand of Swedish manufacturing MNE parents in a regression model I apply a method that originates from Berman et al. (1994) and that is frequently used in this types of studies. This means that I derive my econometric specification from a non-homothetic translog cost function. Skilled labor and less-skilled labor are variable factors and physical capital is treated as a fixed factor. Cost minimization leads in each industry (firm) to the following equation explaining the level of change over some time period in that industry's (firm's) skilled labor share of the total wage bill.

$$\Delta P_{it}^W = \delta + \alpha \Delta \ln(w_s / w_u)_{it} + \beta_1 \Delta \ln K_{it} + \beta_2 \Delta \ln Y_{it} + \beta_3 \Delta T_{it} + \varepsilon_{it} . \quad (1)$$

Let i index industries (firms) and t index time. ΔP_{it}^W is the level change in the skilled-labor share of the total wage bill and captures skill upgrading. K_{it} is physical capital, Y_{it} is real

value added, and T_{it} is an index of the state of technology. δ is the intercept and ε_{it} is an error term.

The relative wage regressor $\Delta \ln(w_s / w_u)_{it}$ accounts for changes in P^W due to substitution away from a more expensive factor. However, in my estimations I will follow the practice in most other similar studies and omit the relative wage regressor because cross-sectional relative wage variation might be a result of compositional change rather than exogenous wage differences.¹² If we assume perfect inter-industry labor mobility, no cross-sectional wage variation arises and $\Delta \ln(w_s / w_u)_{it}$ is a constant and could then be picked up by time dummies $(TD)_t$.¹³

A positive coefficient of $\Delta \ln K_{it}$ ($\beta_1 > 0$) indicates that skilled labor is complementary to physical capital in the production process. The estimate of β_2 shows whether the growth in value added is related to the skilled labor share of the total wage bill and if $\beta_2 = 0$ we cannot reject the hypothesis that the production function is homothetic. Finally, I expect ΔT_{it} to pick up the effect of technological change on the demand for skills. If we assume that technology innovations alter the demand in favor of better-educated workers, β_3 is positive. As a measure of ΔT_{it} I employ the R&D intensity RD/Y , i.e. R&D expenditures as a share of value added; new technologies are continuously introduced at a high rate in R&D intensive industries (firms). An alternative measure of ΔT_{it} is computer use CU , the share of the employed in an industry using a computer at work in 1989 and 1995.¹⁴

¹² Preferably, one would like to control for, e.g. changes in the employees age structure and the firm composition of industries.

¹³ Nevertheless, I have experimented with inclusions of relative wage changes on industry level $\Delta \ln(w_s / w_u)_{it}$ and lagged changes in relative wages. In neither case does this alter my main results to any appreciable extent.

¹⁴ Computer use is another frequently used technology indicator, e.g. in Autor et al. (1998) for the US and in Haskel and Heden (1999) for the UK.

To analyze the effect of MNE transfer on skill upgrading I follow the approach by Slaughter (2000) and Head and Ries (2002) and append regressors measuring MNE transfer to equation (1). Thus, my basic regression model is given by equation (2):

$$\Delta P_{it}^W = \delta_i(TD)_i + \beta_1 \Delta \ln K_{it} + \beta_2 \Delta \ln Y_{it} + \beta_3 \Delta T_{it} + \gamma_j \Delta(MNE)_{it}^j + \mu_{it}, \quad (2)$$

where $\Delta(MNE)_{it}^j$ is a measure of MNE transfer and μ_{it} is an error term. MNE_i^j is the ratio of the employment in foreign affiliates in country group j , $j = OECD, Non-OECD$, to total employment (parents and affiliates) and $\Delta(MNE)_{it}^j$ is the change in MNE_i^j over the time period t .¹⁵ I assume that increased overseas employment in non-OECD countries

$\Delta(MNE)_{it}^{Non-OECD}$ is an indicator of vertical FDI. A higher level of vertical MNE transfer is associated with greater parent skill upgrading, and thus I expect $\gamma_{Non-OECD} > 0$. With horizontal FDI I anticipate no relationship between the MNE transfer and parent skill upgrading, i.e. $\gamma_{OECD} = 0$.¹⁶

*Empirical Results*¹⁷

The econometric analysis is carried out both on industry and on firm level and the data is combined from different sources.¹⁸ One drawback to perform the analysis on industry level is

¹⁵ Slaughter uses a slightly different measure on MNE transfer. He employs the change in the ratio of overseas employment to domestic employment. Head and Ries have only access to data on foreign affiliates' employment of Japanese MNEs in one year, the year after their studied period ended. By making the strong assumption that affiliates are born at their final size they are able to obtain annual time series on the employment in a country at time t if they combine that data with information on the year each affiliate began operations or was acquired by the Japanese parent firms.

¹⁶ Admittedly, this is a rough classification of FDI and certainly some FDI in large non-OECD countries are horizontal, while there exist vertical FDI in OECD countries too. To distinguish between the effect of vertical and horizontal MNE transfer Head and Ries include the overseas employment share together with an interaction

that there are few numbers of observations. In the industry analysis I pool observations from three years, 1990, 1993 and 1997 for 15 industries covering the whole manufacturing. By doing the analysis on firm level I increase the degrees of freedom substantially. Furthermore, I can avoid some of the problems with MNEs disappearing from the sample owing to changed ownership, e.g. switching from Swedish to foreign ownership. In the industry analysis skill upgrading may, in industries where this happens, be due to changes in firm composition.

Industry Level Analysis

Table 4. Industry level wage bill share equations in Swedish manufacturing 1990-97.

Table 4 gives the result from the analysis carried out on industry level. Column (i) presents the result from the estimation of the preferred industry specification of the model in (2) and I focus solely on MNE parents.¹⁹ The coefficient on vertical MNE transfer $\Delta(MNE)^{Non-OECD}$ is positive and significant on 5 percent level. A back-of-the-envelope calculation shows that, between 1990-97, vertical MNE transfer “explains” 15 percent of the overall skill upgrading in Swedish manufacturing MNE parents.²⁰ As we expect from the new, theoretical MNE models horizontal MNE transfer has no effect on skill upgrading in the MNE parents; the estimate on $\Delta(MNE)^{OECD}$ is insignificant.

variable between the overseas share and the income of the host country into their model specification; the coefficient on the latter is expected to be negative (p.96-97).

¹⁷ From now on I suppress industry (firm) i and time t indexes.

¹⁸ The main sources are: Statistics on International Business, Register-based Labor Statistics and Financial Statistics, all from Statistics Sweden. The Appendix in the working paper version, Hansson (2001), gives a comprehensive description of the data. It can be downloaded from swopec.hhs.se or www.fief.se.

¹⁹ Slaughter (2000) examines whether MNE transfer give rise to skill upgrading in MNE parents and other firms together. Yet he admits “Ideally I would test whether MNE transfer triggers skill upgrading in US parents only” (p.461).

²⁰ Such a computation simply involves taking the mean of the independent variable $\Delta(MNE)^{Non-OECD}$ multiplying it with its regression coefficient and take that as a percentage of the mean of the dependent variable ΔP^W .

In column (ii), I check whether the significant correlation between vertical MNE transfer and skill upgrading in the MNE parents might be a spurious one. To that end I estimate the same model as in column (i) using data for foreign-owned firms and other non-MNE manufacturing firms²¹ (except for the MNE transfer variables $\Delta(MNE)^j$). The coefficient on $\Delta(MNE)^{Non-OECD}$ is insignificant, which makes it more comfortable to assert that FDI in non-OECD countries has had positive impact on skill upgrading in Swedish MNE parents.

The coefficient on R&D intensity RD/Y in MNE parents, in column (i), is positive and strongly significant, indicating that technological change is an important driving force behind skill upgrading in Swedish MNE parents. In contrast, the R&D intensity in other manufacturing firms, in column (ii), seems to be unrelated to skill upgrading in these firms.²² In column (iii), I replace R&D intensity in MNE parents with computer use on industry level CU .²³ The estimate on computer use is positive, yet not even significant on 10 percent level. We also notice that the coefficient on $\Delta(MNE)^{Non-OECD}$ in column (iii) is insignificant. Since there are large heterogeneities between firms within the highly aggregated industries I consider MNE parent R&D intensity to be a more appropriate indicator on technology than industry level computer use CU . CU is an average measure for all firms within an industry, MNE parents as well as other firms. Hence, the results in Table 4 suggest that to obtain the significant effect of vertical MNE transfer requires a proper control for technology.²⁴

²¹ I aggregate data on industry level using a database containing all manufacturing firms larger than 20 employees, where I can identify MNE parents, foreign-owned firms and other non-MNE firms (see Table 3).

²² Since other manufacturing firms, on average, are smaller than MNE parents it is reasonable to expect R&D expenditure to be measured poorly compared to in MNE parents. This is because R&D expenditure in small firms tends to be understated.

²³ Data on R&D expenditure is only available every second year. I use R&D intensity in 1991 and computer use in 1989 for the period 1990-93 and the average R&D intensity in 1993 and 1995 and computer use in 1995 for the period 1993-97.

²⁴ Excluding the technology indicator, as in Slaughter (2000) and Head and Ries (2002), result in an insignificant coefficient on $\Delta(MNE)^{Non-OECD}$. Also, worthy of note is that inclusion of the technology indicator does not eliminate any observations, neither in the industry-level analysis in Table 4, nor in the firm-level analysis in Table 5 below.

The coefficient on changes in physical capital $\Delta \ln K$ is insignificant both in MNE parents, column (i), and in other firms, column (ii). Interestingly, however, is that in column (i) the estimate on growth in value added $\Delta \ln Y$ is negative and significant, whereas in column (ii) the coefficient is positive and significant. In industries where value added in non-MNE parents is growing non-MNE parents' relative demand for skills is increasing, while, on the contrary, in MNE parents there are skill upgrading in industries where Swedish MNEs reduce their production in Sweden. The latter is consistent with MNEs engaging in vertical investment or a knowledge capital MNE model. In an extreme version of such a model a fixed amount of skilled labor is required to generate knowledge. Knowledge is produced in the parent (home) country and serves as an input in the goods production at home and abroad. Both skilled and less-skilled labor is required in goods production. This means that decreased goods production at home leads to skill upgrading in the MNE parent.²⁵

Firm Level Analysis

I continue then and estimate the model in (2) on firm level. I run the regression model there on a balanced and an unbalanced sample of firms. My balanced sample consists of 27 Swedish manufacturing MNEs, for which there is data in 1990, 1993 and 1997. The unbalanced sample includes, in addition to the MNEs in the balanced sample, another 35 firms where observations solely exist in 1990 and 1993 and 11 firms for which I only have observations in 1993 and 1997.²⁶ Table 5 reports the results of the estimations on firm level.

²⁵ See the discussion in Head and Ries (2002) p.84-85. Markusen (2002) chapters 7 and 8 contain an extensive description of the knowledge capital model.

²⁶ For a few firms I have no observations in 1993 and 1997 but for 1992 and 1996. In these cases I impute to the longer time periods, 1990-93 and 1993-97, the annual average changes I get from using the 1992 and 1996 figures. Notwithstanding, many among the 80 MNEs originally included in the industry analysis have disappeared. Yet, on average, the balanced sample consists of 64 percent and the unbalanced sample of 79

Table 5. Firm level wage bill share equations on Swedish manufacturing MNE parents 1990-97.

In column (i), I use the balanced sample and the results suggest that neither horizontal MNE transfer $\Delta(MNE)^{OECD}$, nor vertical MNE transfer $\Delta(MNE)^{Non-OECD}$, have any impact on skill upgrading in Swedish MNE parents.²⁷ However, if we go back and take a closer look at Table 1 again we discover that it is not until 1993 the Swedish FDI in non-OECD countries takes off and Figure 1 shows that the employment share in the CEEC goes up substantially after 1993. Consequently, a reasonable hypothesis would then be that it is particularly in the 1993-97 period we would observe a significant effect of vertical FDI on MNE parent skill upgrading in Swedish manufacturing. Therefore, in columns (ii) and (iii) I let the coefficient of vertical MNE transfer $\Delta(MNE)^{Non-OECD}$ vary between the two periods by interacting $\Delta(MNE)^{Non-OECD}$ with a time dummy. The coefficient then turns out to be positive and strongly significant in the 1993-97 period – in the balanced sample, in column (ii), as well as in the unbalanced sample, in column (iii) – while it is insignificant in the 1990-93 period.

Figure 1. The employment share of Swedish MNEs in the CEECs 1990-97.

Columns (ii) and (iii) are my preferred specifications and columns (iv) to (vi) show various robustness checks. To ensure that the result for $\Delta(MNE)^{Non-OECD}$ is not spurious I also allow, in column (iv), the coefficient on horizontal MNE transfer $\Delta(MNE)^{OECD}$ to vary

percent of the employment in the industry analysis. This means that it is mostly small MNEs that have been lost in the firm level analysis.

²⁷ I obtain similar results using the unbalanced sample.

between the two periods. The estimate on $\Delta(MNE)^{OECD}$ is insignificant in both periods and the coefficients on $\Delta(MNE)^{Non-OECD}$ do not changed to any substantial extent.

One might be concerned that there are some industry-specific shocks driving the results. Unfortunately, too few observations make it unsuitable to include a full set of industry dummies.²⁸ As an alternative specification, in column (v), I add the base-year industry skill mix. However, the coefficient on the base-year industry skill mix is insignificant, which suggests that no industry characteristics are needed.²⁹ Finally, in column (vi), I run the regression unweighted to examine whether the effects apply uniformly to all MNE parents, or whether the largest MNE parents drive the results. Here, the coefficients on all MNE transfer variables are positive and significant; yet the largest coefficient is on vertical MNE transfer in the period 1993-97.

Consistent with the industry level analysis, in Table 4, is that the estimate on the MNE parent R&D intensity is positive and clearly significant in all specifications. Skill upgrading is larger the more R&D intensive the MNE parent. Likewise, the coefficient on changes in physical capital $\Delta \ln K$ is insignificant, while the estimate on changes in value added $\Delta \ln Y$ is negative, and in some specifications significant.

One might argue that investments in physical capital and R&D expenditure are simultaneously determined with changes in the skilled-labor wage bill share. As a sensitivity test I present the result from a standard IV (2SLS) regression where $\Delta \ln K$ and RD/Y are assumed to be endogenous.³⁰ When we compare the outcome in column (vii) with the OLS estimate of the same model specification in column (ii) we cannot observe any important differences.

²⁸ Inclusion of industry dummies entails that all coefficients, even on MNE parent R&D intensity, turn to be insignificant.

²⁹ This was proposed by one of the referees. I have also experimented with other industry base-year characteristics, such as base-year output and base-year capital intensity, getting similar outcomes.

³⁰ I employ lagged $\Delta \ln K$ and lagged RD/Y as instruments.

In sum, the regression analyses – on industry- as well as on firm-level – supports the idea that in the 1990s vertical FDI has contributed to skill upgrading in Swedish manufacturing MNE parents. In particular, this seems to be valid for the period after 1993 when Swedish FDI in the CEEC gained momentum. Another noticeable result is that there are no signs of Swedish MNEs shifting their more-skilled operations to other OECD countries, while keeping their less-skilled activities in Sweden. Rather the upshot of the regression analyses is consistent with models of horizontal MNE transfers, in which the affiliates service foreign markets without affecting the relative labor demand of the parents in Sweden.

V. Conclusions

One of the main findings the analysis has generated is that increased employment shares in non-OECD affiliates are significantly related to skill upgrading in Swedish manufacturing MNE parents during the 1990s. This outcome is consistent with the predictions of vertical MNE models and is not necessarily incompatible with what other empirical studies have found. One explanation to that Slaughter (2000) does not obtain any effect of MNE transfer on US skill upgrading might be that he does not distinguish FDI by country of destination.³¹ On the other hand, the results in Head and Ries (2002) accord with my findings. In their firm-level analysis Japanese FDI in low-income countries tend to raise skill intensity in the MNE parents in Japan, but this effect diminishes as investment shifts towards high-income countries.

Previous studies of Swedish MNEs are in many cases complementary. For instance, the finding in BFL that both white- and blue-collar parent employments increase with larger production in developing countries by no means contradicts that the parents at the same time

³¹ If I constrain the coefficient on $\Delta(MNE)^j$ to be the same irrespective of country of FDI destination, it is positive but insignificant.

have skill upgrading. One reason that BE cannot detect any impact on the parent employment of their affiliates' activities in low-wage countries is probably because they are not able to divide parent employment into skilled and less-skilled labor. Another explanation could be that the affiliates' employment shares in these countries, until the beginning of the 1990s, have been of almost negligible importance. The descriptive part of the paper shows that the transition in the CEECs appears to have led to a change, i.e. to a substantial increase in the employment shares of Swedish MNEs in the CEECs. This, in turn, may explain the significant effect I get in the regression analysis from increased non-OECD employment shares on skill upgrading in the MNE parents

Neither the descriptive part, nor the regression analysis, give any support for that Swedish MNEs have transferred their more skilled-based production to other OECD countries, while retaining their less-skilled activities in Sweden. First, more pronounced skill upgrading has occurred in the Swedish MNE parents compared to non-Swedish MNE affiliates and other non-MNE manufacturing firms in Sweden. Second, in the regression analysis employment changes in OECD affiliates are unrelated to parent skill upgrading.

Finally, as in many other similar studies, the results of the regression analysis strongly support that technical change is an important driving force behind the increased demand for skills; skill upgrading has been larger in MNE parents with high R&D intensities.

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Table 2. Employment of affiliates in non-OECD country groups 1990-97.

Country group	1990		1997		1990-97	
	Thousands	Percent	Thousands	Percent	Thousands	Percentage points
CEEC	0.2	0.3	31.0	27.8	30.8	27.5
Latin America	51.5	58.5	35.4	31.6	-16.1	-26.9
Asia	31.3	35.6	38.1	34.1	6.9	-1.5
Other	5.0	5.7	7.3	6.6	2.3	0.8
Total	88	100	111.9	100	23.9	

Table 1. Employment in Swedish manufacturing MNE parents, in their affiliates in OECD and non-OECD countries, and in overall Swedish manufacturing 1990-97.

Year	Swedish-headquartered manufacturing multinational enterprises (MNE)						Swedish manufacturing		
	Sweden		OECD		Non-OECD		Total	Employment	MNE share
	Thousands	Percent	Thousands	Percent	Thousands	Percent	Thousands	Thousands	Percent
1990	381	42.6	426	47.6	88	9.8	894	897	42.5
1993	296	39.9	366	49.4	79	10.6	741	686	43.1
1997	272	36.5	361	48.5	112	15.0	746	749	36.3
90-97	-108	-6.0*	-64	0.9*	24	5.2*	-148	-148	-6.2*

Notes: OECD is Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Switzerland, the United Kingdom and the United States. * Percentage points

Table 3. Skilled and less-skilled employment in MNE parents, non-Swedish MNE affiliates and other non-MNE firms in Swedish manufacturing 1990-97.

Year	Swedish MNE parents				Non-Swedish MNE affiliates				Other non-MNE firms				Difference in employment (wage-bill) skill share relative to other non-MNE firms	
	Share*	Skilled	Less-skilled	Skill share	Share*	Skilled	Less-skilled	Skill share	Share*	Skilled	Less-skilled	Skill share	Swedish MNE parents β_1	Non-Swedish MNE affiliates β_2
	Percent	Thousands		Percent	Percent	Thousands		Percent	Percent	Thousands		Percent	Percentage points	
1990	42.5	51	252	16.8	16.5	19	99	16.1	41.0	29	263	9.9	4.0 (5.9)	3.8 (5.3)
1993	43.5	50	201	19.9	17.5	18	83	17.8	39.0	27	198	12.0	5.3 (7.5)	5.0 (6.8)
1997	36.5	56	178	23.9	23.4	31	119	20.7	40.1	32	225	12.5	7.5 (9.3)	4.3 (6.0)
90-97	-6.0	5	-74	7.1	6.9	12	20	4.6	0.9	3	-38	2.6	3.5 (3.4)	0.5 (0.7)

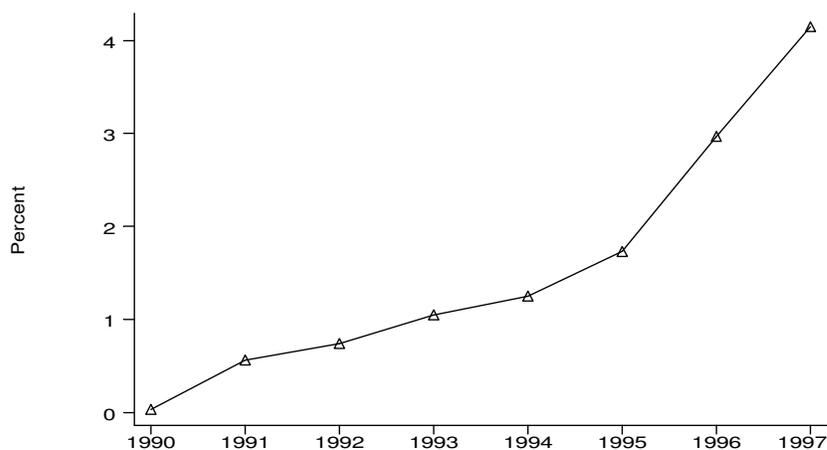
Notes: Table 3 is based on data from a database containing all manufacturing firms larger than 20 employees, which means that the figures on Swedish MNE parents are not comparable with the figures in Table 1. However, the firms in the database include around 80 percent of manufacturing employment. The advantage of using this data is that I am able to divide the firms into MNE parents, foreign-owned firms and other non-MNE firms. Moreover, I can control for firm size (employment) and which industry a firm belongs to when I examine the difference in skill usage between various types of firms. The last two columns of the table present results from the following regression model: $s_{ji} = \beta_0 + \beta_1 D^S + \beta_2 D^{NS} + \beta_3 \ln(\text{employment})_j + \text{Industry}_i + \varepsilon_{ji}$ s_{ji} is the employment (wage-bill) skill share in firm j in industry i. D^S and D^{NS} are dummy variables, where $D^S = 1$ if firm j is a Swedish MNE and $D^{NS} = 1$ if it is a non-Swedish MNE affiliate. * Share of total employment in all firms.

Table 4. Industry level wage bill share equations in Swedish manufacturing 1990-97. Dependent variable: Change in skilled labors' share of the wage bill ΔP^W

Regressor	(i) MNE parents	(ii) Other firms	(iii) MNE parents
$\Delta \ln K$	0.061 [1.52]	0.009 [0.37]	0.099 [2.02]
$\Delta \ln Y$	-0.032 [-2.62]	0.063 [2.51]	-0.012 [-0.86]
(RD/Y)	0.027 [3.56]	-0.015 [-0.52]	
CU			0.018 [1.70]
$\Delta(MNE)^{OECD}$	-0.011 [-0.21]	-0.015 [-0.37]	0.023 [0.54]
$\Delta(MNE)^{Non-OECD}$	0.212 [2.11]	0.043 [0.63]	0.067 [0.42]
<i>Time dummies</i>	yes	yes	yes
\bar{R}^2	0.386	0.133	0.058
Observations	30	30	30

Notes: All regressions are estimated with OLS, computed over 15 manufacturing industries for the periods 1990-93 and 1993-97, and weighted by the average industry MNE (other firm) share of the total MNE (other firm) manufacturing wage bill. Square brackets [] give White's heteroskedasticity-consistent t statistics. ΔX and $\Delta \ln X$ are the average annual change in the variable X or the log of X .

Figure 1. The employment share of Swedish MNEs in the CEECs 1990-97



Source: SCB Statistics on International Business

Table 5. Firm level wage bill share equations in Swedish manufacturing MNE parents 1990-97. Dependent variable: Change in skilled labors' share of the wage bill ΔP^W

Regressor	(i) Balanced OLS weighted	(ii) Balanced OLS weighted	(iii) Unbalanced OLS weighted	(iv) Balanced OLS weighted	(v) Balanced OLS weighted	(vi) Balanced OLS unweighted	(vii) Balanced IV weighted
$\Delta \ln K$	-0.027 [-0.76]	-0.003 [-0.07]	-0.008 [-0.40]	-0.003 [-1.13]	-0.026 [-0.61]	-0.047 [-1.22]	-0.008 [-1.36]
$\Delta \ln Y$	-0.013 [-1.30]	-0.018 [-1.84]	-0.007 [-0.71]	-0.019 [-2.17]	-0.018 [-1.72]	-0.031 [-2.83]	-0.024 [-2.15]
(RD/Y)	0.020 [4.63]	0.017 [3.90]	0.012 [2.29]	0.016 [3.81]	0.014 [2.81]	0.027 [5.40]	0.030 [4.93]
$\Delta(MNE)^{OECD}$	0.057 [0.96]	0.081 [1.46]	0.024 [0.45]		0.087 [1.56]	0.088 [2.51]	0.090 [1.58]
$\Delta(MNE)^{OECD}$ 1990-93				0.116 [1.68]			
$\Delta(MNE)^{OECD}$ 1993-97				-0.090 [-1.08]			
$\Delta(MNE)^{Non-OECD}$	0.072 [0.67]						
$\Delta(MNE)^{Non-OECD}$ 1990-93		-0.144 [-1.24]	-0.086 [-0.93]	-0.162 [-1.31]	-0.135 [-1.15]	0.128 [2.57]	0.023 [0.16]
$\Delta(MNE)^{Non-OECD}$ 1993-97		0.376 [4.90]	0.379 [3.55]	0.326 [4.45]	0.302 [3.13]	0.266 [2.60]	0.379 [4.32]
<i>Base-year industry skill-mix</i>					0.028 [0.95]		
<i>Time dummies</i>	yes	yes	yes	yes	yes	yes	yes
\bar{R}^2	0.280	0.405	0.128	0.424	0.416	0.254	0.252
Observations	54	54	100	54	54	54	54

Notes: All regressions are estimated with OLS, except in column (vii) where I use 2SLS. They are computed over Swedish manufacturing MNE parents for the periods 1990-93 and 1993-97. In every specification, except (vi), I weigh the regressions by the average firm share of the total MNE wage bill. Square brackets [] give White's heteroskedasticity-consistent t statistics.