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Abstract

This paper studies the link between production transfer in Swedish-headquartered multinational enterprises (MNEs) and skill upgrading in Swedish manufacturing in the 1990s. The analysis distinguishes between horizontal and vertical foreign direct investment (FDI). The increased employment share in affiliates in non-OECD countries (vertical FDI) has a non-trivial, significantly positive effect on the share of skilled labour in the Swedish parents. On the other hand, the skill upgrading in the parents is 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.

Keywords: Multinational enterprises, skill upgrading, horizontal foreign direct investment, vertical foreign direct investment

JEL classification: F21, F23, J31

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1. Introduction

Increased international integration affects the labour market in various ways. One channel is through international trade. Basically, the idea is that increased trade with less-developed countries making intensive use of low-skilled labour in their exports displaces less-skilled labour-intensive production in the developed countries and thereby reduces the demand for low-skilled labour in these countries. There are now a significant number 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 labour, is foreign direct investment (FDI).

Swedish-headquartered multinational enterprises dominate Swedish manufacturing and so it is reasonable to expect that their localisation behaviour has an impact on the demand for skills in Swedish 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 endeavour to exploit factor price differences across countries. Accordingly, we would expect Swedish MNEs to invest horizontally in other developed countries, but vertical FDI to take place in low-income countries.

The purpose of this paper is to analyse the link between production transfer within Swedish-headquartered MNEs and skill upgrading in Swedish manufacturing. My approach has close similarities to Slaughter (2000), which in turn is based on a method commonly employed by Berman, Bound & Grilliches (1994). However, Slaughter (2000), which studies production transfer in US-headquartered MNEs, draws no distinction between horizontal and vertical FDI

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

[2] Examples of models with vertically integrated MNEs are Helpman (1984), Helpman & Krugman (1985) and Feenstra & Hanson (1996), whereas Markusen, (1984), Horstmann & Markusen (1992) and Markusen & Venables (1998) represent models with horizontally integrated MNEs.

and his analysis is solely carried out at industry level. 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 able to assess the differential impact that horizontal and vertical FDI is expected to have on skill upgrading. Moreover, the data I use give me an opportunity to perform the analysis also at 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, in contrast to the pre-1990 period, we can observe a significant increase in 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 for this development is that Swedish MNEs have tried to utilise the large supply of cheap labour in the immediate neighbourhood which the process of transition in the CEECs has given rise to. Thus, it seems that, as opposed 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 manufacturing in general, and in Swedish MNEs in particular.

A highly topical question is whether, in recent years, Swedish MNEs have transferred their more highly skilled operations abroad, while keeping their less-skilled operations in Sweden.[3] If this is the case it may have strong policy implications since it would indicate severe shortcomings in the conditions for highly advanced production in Sweden. I review the facts put forward in favour 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 in 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 in Swedish MNEs located in other OECD countries.

The plan of the paper is as follows. Section 2 serves as background to the empirical analysis. Section 2.1 gives a brief overview of the new theories on MNEs and tries to identify some empirical implications. Section 2.2 surveys a few, closely related, empirical studies on the

[3] See e.g. Blomström (2000) and Jacobsson (1999).

effects of FDI on home country employment in Swedish manufacturing. Section 3 presents some facts on Swedish MNEs in the 1990s. Section 4 contains an econometric analysis of the impact of production transfer in Swedish MNEs on skill upgrading. Section 5 concludes.

2. Theoretical background and related empirical work

2.1 A brief theoretical overview[4]

The theoretical foundation of the empirical analysis has its origin in a number of articles that try to integrate MNEs into general equilibrium trade models. A characteristic feature of MNEs is that their parents are often firms that make intensive 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-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 involves 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 localisation 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 there are plant-level scale economies in combination with some sort of trade cost. Otherwise production would be concentrated to one single plant serving other locations with exports. Also, following from an assumption of plant-level scale economies, 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 exports 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 in the parent firms.

In vertical MNEs the stages of production have different factor intensities. By locating skilled labour-intensive activities in skilled-labour abundant countries and less-skilled intensive activities to less skilled-labour 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-labour abundant country and then shipping the final product back to the MNEs home country or to another country. This means that, unlike horizontal MNEs, vertical MNEs are encouraged by lower trade costs, but also, as opposed to horizontal MNEs, production transfer within vertical MNEs generates skill upgrading in the parent firms in skilled-labour abundant home countries.

2.2 Empirical studies of FDI on parent employment in Swedish MNEs

Home country employment effects of FDI on 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 surveyed Swedish manufacturing MNEs at six points in time over the period 1970-94. The first is Blomström, Fors & Lipsey (1997) (hereafter BFL), which has attracted much attention. They run some descriptive regression equations showing the relationship in Swedish MNEs between foreign production and employment in the parent firm given the level of parent production. BFL find that Swedish parents employ more labour 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 that increase their activities abroad to have more supervisory and auxiliary employment in the parent at home to co-ordinate and support the activities in foreign affiliates. Moreover, BFL assert that their result is inconsistent with a significant allocation of labour-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 increases in production in developing countries are associated with higher parent white-collar employment. However, there is no relationship (or a negative association) between foreign production in developed countries and parent white-collar employment, whereas blue-collar parent employment is positively related to foreign production in developed countries.[5] BFL are of the opinion that "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" (pp.1794). Yet this suggestion appears

[4] For more comprehensive surveys see Markusen (1995) and (1998).

inconsistent with their interpretation that supervisory and auxiliary employment (expected to be skilled) has increased when Swedish MNEs expanded production abroad. Also somewhat puzzling, is that the positive association with parent blue-collar employment seems to be strong even with production in affiliates in developing countries. Finally, one could argue 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 expansion in affiliates abroad influences parent employment at home.

Braconier & Ekholm (2000) (hereafter BE) is the second study that looks at how parent employment is affected by FDI in Swedish manufacturing MNEs. They estimate a labour 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 substitution between parent firm employment in Sweden and affiliate employment in other high-income locations. No relationship, substitute or 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 they do not disaggregate employment into skilled and less-skilled labour.

On the basis of, among other things, the result in BFL, suggesting that skill intensity may have risen faster in the high-income foreign locations than in Sweden,[7] some strong policy

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

[6] Brainard & 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.

[7] Other evidence put forward, e.g. in Blomström (2000) and Jacobsson (1999), is that real wages have increased more in high-wage foreign locations than in the Swedish parents over the period 1970-94. However, an alternative explanation to this development may be a slower growth rate in Sweden than in other developed countries over this period. Hansson & Lundberg (1991) find that productivity growth in Sweden 1970-85 is significantly lower than for an average of 13 other OECD countries (Table 6.1) and Henrekson (1996) shows that Sweden's poor growth performance has continued at least until the beginning of the 1990s. Such an explanation also squares with the fact that the relative wage in overall Swedish manufacturing to overall manufacturing in high-income locations follows the same pattern as the relative wage changes in Swedish MNEs, i.e. the wages in the parents relative to the wages in the affiliates. Moreover, Blomström (2000) asserts that the fact that wages in foreign subsidiaries have increased relative to average wages in other OECD countries between 1970 and 1990 suggests that Swedish MNEs have transferred more and more advanced operations to their foreign affiliates. We could, however, just as well explain this observation by Swedish MNEs changing their production towards more skill intensive production, for instance by shifting from natural resource based production to more high-tech production.

conclusions have been drawn.[8] As I argue above some objections can be made against the conclusions drawn in BFL and in section 4 I carry out another test of whether Swedish MNEs have substituted skilled labour in their parents with skilled labour in their affiliates in other high-income countries. Before I present the result of my regression analysis let me discuss the data I use, and show some stylised facts on the employment in Swedish-headquartered manufacturing MNEs in the 1990s.

3. Some facts on Swedish manufacturing MNEs in the 1990s

My data is mainly from two sources.[9] The employment data on the Swedish parents and the affiliates abroad are from Statistics on International Business (SIB) that is compiled by Statistics Sweden and consists of the 80 largest Swedish-headquartered manufacturing MNEs.[10] The data on parent employment divided into skilled and less-skill labour comes from Statistics Sweden, Regional Labour Statistics.[11] My definition of skilled labour is based on educational attainment and I define skilled labour as employees with post-secondary education, i.e. with more than 12 years of education.[12]

Table 1 reveals that Swedish MNEs have a dominating role as employers in Swedish manufacturing. Even though their share of total manufacturing employment declined between 1990 and 1997, it was still 36 per cent in 1997.[13] 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 becoming more involved in foreign production and their activities abroad are increasing. The employment share in their foreign affiliates has

[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 pp.200).

[9] The Appendix gives a more complete description of the data and its sources.

[10] The employment coverage of the SIB data is larger than in the IUI database. One reason being that the IUI database only includes firms with producing affiliates abroad, whereas the SIB data contains firms with at least one affiliate abroad. In the IUI database, the number of employees in the Swedish MNE parents in 1990 is 306,000 and 471,000 abroad (Hatzius 1998 Table 1). In *Table 1*, we see that in the SIB data the corresponding figures for 1990 are 381,000 in Sweden and 515,000 abroad. SCB (1998) maintains that 98 % of the employees in Swedish manufacturing MNEs abroad in 1996 are to be found in the 80 largest enterprises.

[11] Notice that the methods of collecting data differ. This explains the slight difference in total employment of the MNE parents in Table 1 and Table 3.

[12] Most likely, such a division into skilled and less skilled is more appropriate than the often used, e.g. in Slaughter (2000), non-production/production worker classification. Obviously, educational attainment has its imperfections too: it does not capture experience, it partially understates participation in further education and training, and there are variations in the quality of schooling over time and between regions/countries. However, educational attainment seems to be correlated with occupation and earnings, and initial attainment is a good predictor of whether a person will participate in further education and training.

[13] One explanation of the drastic fall in the MNEs' employment share in Swedish manufacturing between 1993 and 1997 may be that, due to mergers, some large, formerly, Swedish-owned enterprises shifted to foreign ownership, e.g. Pharmacia.

increased from slightly less than 58 per cent in 1990 to almost 64 per cent in 1997. This provides evidence of transfer of production in Swedish MNEs.

Another striking feature is that it is in the non-OECD affiliates that employment has increased, both in absolute terms and in terms of the world-wide MNE activity, while the share in the OECD affiliates is unchanged. In this respect developments in the 1990s differ from the trends in the 1970s and 1980s. Before 1990 employment in foreign affiliates also grew, both in absolute terms and in relative terms to the Swedish parents.[14] However, the increase was then, particularly in the 1980s, limited to the affiliates in OECD.[15] 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 that employment has been growing, in both absolute and in relative terms, while it has fallen in Latin America. Relatively, 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 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		
	Thousands	%	Thousands	%	Thousands	%	Thousands	Thousands	MNE share
1990	381	42.5	427	47.7	88	9.8	896	913	0.42
1993	296	39.9	366	49.4	79	10.7	741	683	0.43
1997	272	36.5	361	48.5	112	15.0	745	749	0.36
90-97	–109	–6.0*	–66	0.8*	24	5.2*	–151		

Notes: OECD consists of 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.

[14] Hatzius (1998), Table 2.

[15] Braunerhjelm & Ekholm (1998), Table A.9.

Table 2. Employment of affiliates in non-OECD country group,s 1990-97

Country group	1990		1997		1990-97	
	Thousands	%	Thousands	%	Thousands	Percentage points
CEEC	0.3	0.3	31.1	27.8	30.8	27.5
Latin America	51.9	59.0	36.1	32.2	–15.8	–26.8
Asia	32.1	36.5	38.2	34.1	6.1	–2.4
Total	88	100	112	100	24	

In Table 3, I compare the employment of skilled and less skilled labour in the MNE parents with Swedish manufacturing in general. Unfortunately, I have no information about the kind of jobs that have been created in the affiliates. However, Table 3 points out that between 1990 and 1997 the MNE parents shifted their employment mix sharply towards skilled labour; 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 manufacturing as a whole; the absolute increase in skill share is 8.3 percentage points in the MNE parents compared to 5.0 percentage points in overall manufacturing.

Another interesting observation is that the skill share is significantly higher in the MNE parents than in manufacturing as a whole, when industry differences in skill shares are held constant. The skill share in the MNE parents is around 5 percentage points higher than in overall manufacturing. This circumstance is consistent with the usual assumption in the new, theoretical MNE models that, in general, MNE parents are more human capital intensive than other firms. Further evidence, in Table 3, for the conjecture that MNEs are knowledge-based is higher research and development (R&D) intensity, R&D expenditures as a share of value added is about 9 percentage points higher in the MNE parents than in manufacturing as a whole.[16]

[16] One should, however, be aware of the fact that R&D expenditure in small firms tends to be understated.

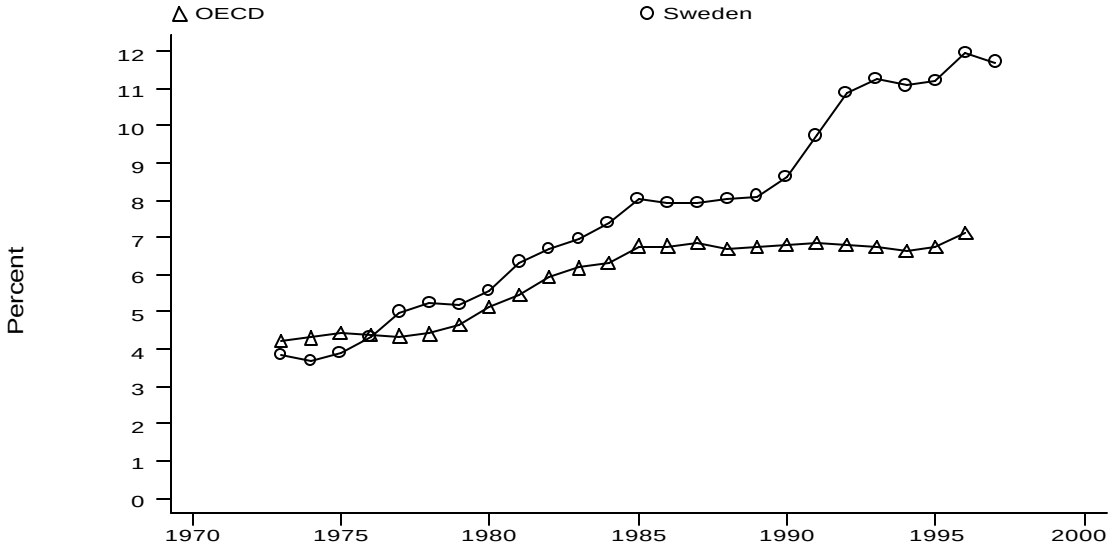
Table 3. Skilled and less-skilled employment in MNE parents and in overall manufacturing, 1990-97

Year	Skilled workers (Thousands)		Less-skilled workers (Thousands)		Skill share (Per cent)			R&D intensity (Per cent)	
	MNE Parents	Manu-facturing	MNE Parents	Manu-facturing	MNE Parents	Manu-facturing	Diffe-rence†	MNE Parents	Manu-facturing
1990	66	114	321	799	17.1	12.5	4.8	18.2	9.6
1993	61	105	236	578	20.5	15.4	3.2	20.1	11.0
1997	69	131	203	618	25.4	17.5	6.1	18.7	11.6
90-97	3	17	−118	−181	8.3*	5.0*		0.5	2.0

Notes: † To hold industry differences in skill shares constant I calculate the difference between the MNEs' and the total manufacturing skill share by estimating the following regression equation: $P^E_{jit} = \beta_{0t} + \beta_1 P^E_{it} + \varepsilon_{jit}$. P^E_{jit} is the share of skilled labour in MNE j producing in industry i at time t and P^E_{it} is the skill share in industry i at time t. The difference presented in the table is equal to the intercepts β_{0t}, which are significant for each year t.

* Percentage points.

Figure 1. Manufacturing R&D expenditure as a share of value added in Sweden and in OECD, 1973-97



Notes: OECD consists of Australia, Canada, Denmark, Finland, France, Germany (before 1991 West Germany), Italy, Japan, the Netherlands, Norway, the United Kingdom and the United States. Data on R&D expenditure for Sweden 1997 are from SCB (1999**).**

Source: OECD (1999) and OECD (1998).

R&D is one of the most skill-intensive parts of a firm's activities. If it is the true that Swedish MNEs have begun to locate their most skill-intensive production stages in other high-income countries we would expect to see a falling R&D intensity in Swedish manufacturing in comparison to other OECD countries. However, Figure 1 shows that this is not the case, if anything the pattern is the opposite. Until the mid-1980s R&D intensity in Sweden and in other OECD countries is about the same and growing. After that the gap between the R&D intensities in Sweden and in OECD has widened and in 1996 it is almost 5 percentage points higher in Sweden than in OECD.

This section indicates that Swedish MNEs have changed their localisation pattern and increased their employment share in the CEECs. It also throws some doubts on the assertion that Swedish MNEs have 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 in Swedish MNEs on home country employment, regression analysis is required.

4. Econometric analysis of MNE transfer on skill upgrading

4.1 Analytical framework

To analyse the link between MNE transfer and within-industry (firm) shifts in Swedish manufacturing labour demand in a regression model, I apply a method frequently used by a number of researchers.[17] This means that I derive my econometric specification from a non-homothetic translog cost function. Skilled labour and less-skilled labour are variable factors and physical capital is treated as a fixed factor. Cost minimisation leads in each industry (firm) to the following equation which explains the level of change over a certain time period in the industry's (firm's) skilled labour share of the total wage bill.

$$\Delta P_{it}^{W} = d + a\Delta \ln\left(w_s / w_u\right)_{it} + b_1 \Delta \ln K_{it} + b_2 \Delta \ln Y_{it} + b_3 \Delta T_{it} + e_{it} \qquad (1)$$

Let *i* indexed industries (firms) and *t* index time. ΔP_{it}^{W} is the level change in the skilled-labour share of the total wage bill and captures skill upgrading. K_{it} is physical capital, Y_{it} is real value added output, and T_{it} is an index of the state of technology. d is the intercept and e_{it} is an error term.

The relative wage regressor $\Delta \ln\left(w_s / w_u\right)_{it}$ accounts for changes in P^W due to substitution away from a more expensive factor. The sign of the coefficient a depends on whether the average elasticity of substitution between skilled and less-skilled labour s is greater or less than one; a is negative when s is larger than one. However, in my estimations I will follow the practice of many other researchers[18] and omit the relative wage regressor since cross-sectional relative wage variation might be a result of compositional change rather than exogenous wage differences. If we assume perfect inter-industry labour mobility, no cross-sectional wage variation arises and $\Delta \ln\left(w_s / w_u\right)_{it}$ is a constant and could then be picked up by time dummies $\left(TD\right)_t$.[19]

[17] Among others, Berman et. al. (1994), Feenstra & Hanson (1996), Autor et al. (1998), Machin & Van Reneen (1998), Hansson (2000) and Slaughter (2000).

[18] See references in the preceding footnote.

[19] Nevertheless, in all the various econometric specifications I present in the following section, I have also included relative wage changes at industry level $\Delta \ln\left(w_s / w_u\right)_{it}$. The coefficient on $\Delta \ln\left(w_s / w_u\right)_{it}$ appears to be insignificant in almost all specifications and its inclusion never has any substantial impact on the other estimates. This is not very surprising since the relative wage between skilled and less-skilled labor in Sweden, defined as in the paper, has been almost constant over the studied period (Arai & Kjellström 2001). Moreover,

A positive coefficient on $\Delta \ln K_{it}$ ($\beta_1 > 0$) indicates that skilled labour is complementary to physical capital in the production process. The estimate of β_2 shows whether growth in output is related to the skilled labour 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 technological innovations change demand in favour of better-educated workers, β_3 is positive. As a measure of ΔT_{it} I employ the R&D intensity RD / Y; 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 employees in an industry using a computer at work in 1989.

To analyse the effect of MNE transfer on skill upgrading I follow the approach used by Slaughter (2000) and append regressors measuring MNE transfer to equation (1).[20] Thus, my basic regression model is given by equation (2)

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

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*. I assume that increased foreign 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. $\gamma_{OECD} = 0$.[21]

since I have access to relative wages on industry level back until 1987, I have an opportunity to address problems with endogeneity by using lagged changes in relative wages, either directly in the regressions, or as instruments of $\Delta \ln (w_s / w_u)_{it}$. In neither case does this alter my main results to any appreciable extent.

[20] Notably, in Slaughter's model specification there is no technology indicator.

[21] Admittedly, this is a rough classification of FDI and certainly some FDI in large non-OECD countries is horizontal, while there is vertical FDI in OECD countries too.

Notice that $\Delta(MNE)_{it}^{Non-OECD}$ captures somewhat other influences on skill upgrading than a changed import share from non-OECD countries in consumption, $\Delta(M/C)_{it}^{Non-OECD}$: a variable commonly used to analyse the impact of outsourcing on skill upgrading.[22] $\Delta(M/C)_{it}^{Non-OECD}$ may include vertical MNE transfer as well as arm's length transactions between Swedish and foreign firms in the same industry. Moreover, $\Delta(M/C)_{it}^{Non-OECD}$ also takes into account the effect of domestic consumers switching from buying low-skill intensive final goods from domestic producers to foreign suppliers in low-wage countries. On the other hand, $\Delta(MNE)_{it}^{Non-OECD}$ is only affected by within-firm activities and does not require the affiliates' output to be sent back to Sweden.[23]

4.2 Empirical results[24]

The econometric analysis is carried out both at industry and at firm level and the data are combined from many different sources. The Appendix gives a complete description of the data. The industry analysis is similar to Slaughter's (2000) study of US multinationals, which enables me to make comparisons with his results. At the industry level, I am also able to evaluate the importance on manufacturing skill upgrading in Sweden of vertical production transfers within the MNEs compared to the effect of increased import competition from non-OECD countries. One drawback of doing the analysis at industry level is that there are few observations. In the industry analysis I pool observations from three years, 1990, 1993 and 1997 for 15 industries covering the whole manufacturing sector.[25] By doing the analysis at firm level I increase the degrees of freedom substantially. Furthermore, I can avoid some of the problems of MNEs disappearing from the sample due to changes in 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.

[22] See, e.g. Machin & Van Reenen (1998), Anderton & Brenton (1999) and Hansson (2000).

[23] Suppose the production of a low-skilled good in Sweden that is exported to other countries in the EU is transferred within a Swedish MNE to one of the Baltic States. This is captured by $\Delta(MNE)_{it}^{Non-OECD}$ but not by $\Delta(M/C)_{it}^{Non-OECD}$.

[24] From now on I suppress industry *i* and time *t* indexes.

[25] Table A1 in Appendix contains a list of the industries included in the analysis.

Industry level analysis

Table 4 gives the results of the analysis carried out at industry level. Specifications (i) to (iv) analyse the effects on skill upgrading in all firms at industry level, while in column (v) the focus is narrowed down to MNEs only. As a comparison with previous studies looking at the impact of outsourcing on skill upgrading, I start in specifications (i) and (ii) by replacing $\Delta(MNE)^{j}$ with $\Delta(M/C)^{Non-OECD}$. In columns (ii) and (iv), with all firms included in the analysis and computer use *CU* employed as technology indicator, both the coefficients on changes in non-OECD imports $\Delta(M/C)^{Non-OECD}$ and on vertical MNE transfer $\Delta(MNE)^{Non-OECD}$ are positive and significant at a 10 per cent level.[26] They are still positive, though insignificant, in columns (i) and (iii) when R&D intensity *RD/Y* instead of computer use is utilised as the technology indicator. Hence, there appears to be some support for the belief that, over the period studied, 1990-97, intensified import competition from non-OECD countries and vertical MNE transfer have increased the relative demand for skilled labour in Swedish manufacturing.

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

Variables	(i) All firms	(ii) All firms	(iii) All firms	(iv) All firms	(v) MNEs only
$\Delta \ln K$	0.086	0.064	0.087	0.073	0.051
	[2.34]	[1.85]	[2.24]	[2.10]	[1.25]
$\Delta \ln Y$	0.019	0.021	0.016	0.020	–0.033
	[1.21]	[1.81]	[0.84]	[1.43]	[–2.56]
(RD/Y)	0.006		0.008		0.029
	[1.09]		[1.06]		[3.61]
CU		0.015		0.015	
		[3.16]		[3.08]	
$\Delta(M/C)^{Non-OECD}$	0.097	0.157			
	[1.15]	[1.96]			
$\Delta(MNE)^{OECD}$			–0.019	–0.014	–0.008
			[–1.13]	[–0.84]	[–0.16]

[26] The correlation between $\Delta(M/C)^{Non-OECD}$ and $\Delta(MNE)^{Non-OECD}$ is 0.41.

$\Delta(MNE)^{Non-OECD}$			0.027	0.045	0.207
			[1.04]	[1.73]	[2.04]
Intercept	0.005	4.29×10^{-4}	0.005	6.66×10^{-4}	–0.004
1990-93	[2.22]	[0.20]	[2.37]	[0.32]	[–1.30]
Dummy	–0.004	–0.004	–0.005	–0.006	0.006
1993-97	[–1.74]	[–1.88]	[–1.80]	[–2.24]	[1.98]
$\overline{R}^2$	0.371	0.488	0.376	0.492	0.366
Observations	30	30	30	30	30

Notes: All regressions are computed over 15 manufacturing industries for the periods 1990-93 and 1993-97 and are weighted by the average industry share of the manufacturing wage bill. In the regressions square brackets [ ] give White's heteroskedasticity-consistent *t* statistics.

Dependent variable:

ΔP^W 100 × the average annual change in skilled labour's share of the wage bill

Independent variables:

$\Delta \ln Y$ 100 × the average annual change in the log of real output

$\Delta \ln K$ 100 × the average annual change in the log of capital

(RD/Y) 100 × R&D expenditure as a share of value added

CU 100 × the share of employees using a computer at work in 1989

$\Delta(M/C)^{Non-OECD}$ 100 × the average annual change in imports from non-OECD countries/(sales value + imports – exports)

$\Delta(MNE)^{OECD}$ 100 × the average annual change in the employment share of OECD affiliates in total employment of Swedish-headquartered MNEs

$\Delta(MNE)^{Non-OECD}$ 100 × the average annual change in the employment share of non-OECD affiliates

Surprisingly, compared with former studies,[27] in columns (i) and (iii) the estimates of *RD/Y* are insignificant. On the other hand, the coefficient on *CU* is positive, and clearly significant, which means that skill upgrading has been larger in industries where computer use is more prevalent. This result conforms to what Autor et al. (1998) have obtained for the US and

[27] See Machin & Van Reneen (1998) and Hansson (2000).

Haskel & Heden (1999) for the UK. The coefficient on changes in physical capital $\Delta \ln K$ is positive and significant, at least at a 10 per cent level, which also corresponds to the findings of other researchers. Finally, as we expect from the new, theoretical MNE models, horizontal MNE transfer has no effect on skill upgrading; the coefficient on $\Delta(MNE)^{OECD}$ is insignificant.

When, in column (v), I narrow the analysis down to the MNEs only, I obtain a statistically more significant effect of vertical MNE transfer on skill upgrading. This is a reasonable outcome bearing in mind that the importance of MNE activities varies among industries and that may blur influences when the analysis is carried out for all firms. A back-of-the-envelope calculation shows that, between 1990-97, vertical MNE transfer "explains" almost 15 per cent of the overall skill upgrading in Swedish manufacturing MNEs.[28] Horizontal MNE transfer is also unrelated to changes in the relative demand for skilled labour. Unlike the result for all firms, in columns (i) and (iii), variations in the R&D intensity of the MNEs affect their skill upgrading positively and the estimates are strongly significant. The coefficient on physical capital investments is positive, but insignificant.

Firm level analysis

I continue then and estimate the model in equation (2) at the firm level. I run the regression model first, on a balanced and then on an unbalanced sample of firms. My balanced sample consists of 27 Swedish manufacturing MNEs, for which there are data in 1990, 1993 and 1997. The unbalanced sample includes, in addition to the MNEs in the balanced sample, another 35 firms where observations are only available from 1990 and 1993 and 11 firms for which I only have observations from 1993 and 1997.[29] Table 5 reports the results of the estimations at firm level.

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

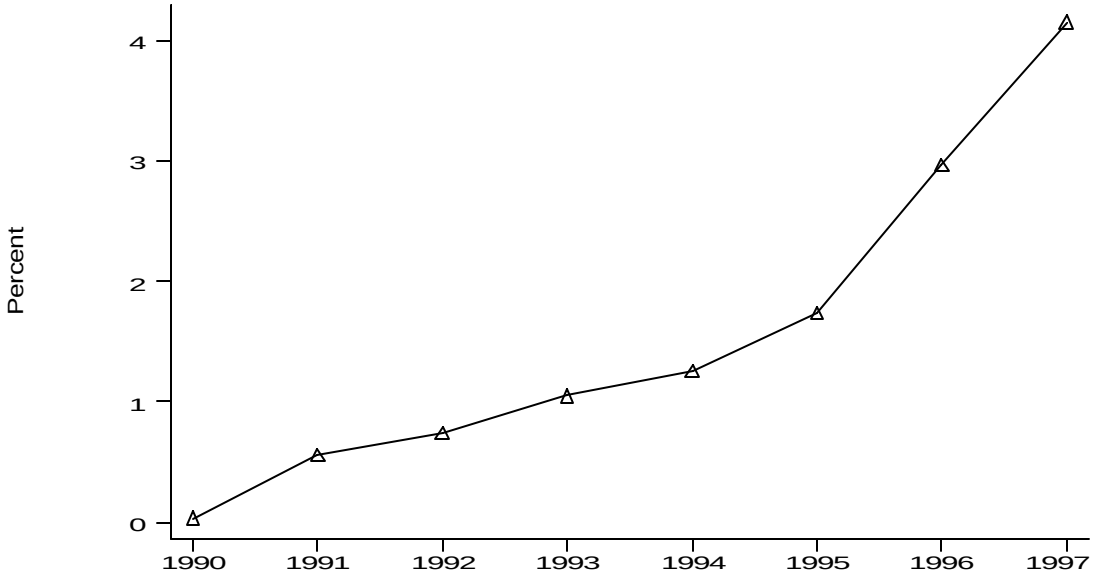
[29] For a few firms I have no observations in 1993 and 1997, only for 1992 and 1996. In these cases I impute to the longer time periods, 1990-93 and 1993-97, the annual average changes I obtain from using the 1992 and 1996 figures. Notwithstanding, many of the 80 MNEs originally included in the industry analysis have disappeared. Yet on average the balanced sample consists of 64 per cent and the unbalanced sample of 79 per cent of the employment in the industry analysis. This means that it is mostly small MNEs that have been lost in the firm level analysis.

Table 5. Firm level wage bill share equations in Swedish manufacturing, 1990-97

Variables	(i) Unbalanced	(ii) Balanced	(iii) Unbalanced	(iv) Balanced
$\Delta \ln K$	–0.014	–0.027	–0.008	–0.003
	[–0.67]	[–0.76]	[–0.40]	[–0.07]
$\Delta \ln Y$	–0.003	–0.013	–0.007	–0.018
	[–0.34]	[–1.30]	[–0.71]	[–1.85]
(RD/Y)	0.014	0.020	0.011	0.017
	[2.48]	[4.63]	[2.29]	[3.90]
$\Delta(MNE)^{OECD}$	0.038	0.057	0.024	0.081
	[0.60]	[0.96]	[0.45]	[1.46]
$\Delta(MNE)^{Non-OECD}$	0.061	0.072		
	[0.72]	[0.67]		
$\Delta(MNE)^{Non-OECD}$			–0.086	–0.144
1990-93			[–0.93]	[–1.24]
$\Delta(MNE)^{Non-OECD}$			0.379	0.375
1993-97			[3.55]	[4.90]
Intercept	0.008	0.005	0.008	0.004
1990-93	[2.41]	[2.23]	[2.50]	[2.04]
Dummy	-8.77×10^{-5}	0.003	–0.001	0.002
1993-97	[–0.03]	[1.20]	[–0.54]	[0.99]
$\overline{R}^2$	0.051	0.280	0.128	0.405
Observations	100	54	100	54

Notes: All regressions are computed for Swedish manufacturing MNEs for the periods 1990-93 and 1993-97 and are weighted by the average firm share of the total MNE wage bill. In the regressions square brackets [ ] give White's heteroskedasticity-consistent *t* statistics. The variables are defined in Table 4 and the Appendix gives more details on the data.

Figure 2. The share of CEECs in employment of Swedish MNEs: 1990-97



Source: SCB Statistics on International Business.

In Table 5, the coefficient on R&D intensity *RD/Y* is positive and strongly significant in all specifications. This means that R&D intensive MNEs have been more likely to increase their skill shares. In contrast to the result at industry level the estimate of the change in physical capital $\Delta \ln K$ is never significant. Likewise, horizontal MNE transfer $\Delta(MNE)^{OECD}$, as well as vertical MNE transfer $\Delta(MNE)^{Non-OECD}$ in columns (i) and (ii), have no impact on skill upgrading. However, if we go back and take a closer look at Table 1 again, we discover that it is not until 1993 that Swedish FDI in non-OECD countries takes off and Figure 2 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 that we would observe a significant effect of vertical FDI on MNE parent skill upgrading in Swedish manufacturing. In columns (iii) and (iv), therefore, I let the coefficient of vertical MNE transfer $\Delta(MNE)^{Non-OECD}$ vary between the two periods.[30] It then turns out to be positive and strongly significant in the 1993-97 period, while it is insignificant in the 1990-93 period.

[30] Actually, $\Delta(MNE)^{Non-OECD}$ is the only variable for which the coefficients differ significantly between the two time periods in both the balanced and the unbalanced sample of firms.

To sum up, the regression analysis supports the idea that, in the 1990s, vertical FDI has contributed to skill upgrading in Swedish manufacturing MNEs. In particular, this seems to be valid for the period after 1993 when Swedish FDI in the CEEC gained momentum. Yet, one should be careful and not overemphasise this result. The division into horizontal and vertical FDI is crude and some FDI, for example in large CEECs such as Poland, is surely horizontal, i.e. of market seeking type. However, the fact that the coefficient on $\Delta(MNE)^{Non-OECD}$ is significant suggests that a considerable amount of vertical MNE transfer has occurred. Since Swedish-headquartered MNEs are such dominating employers in Swedish manufacturing, vertical FDI also appears to have had an effect, although to a much lesser extent, on general manufacturing skill upgrading. A rough calculation shows that, during the period 1990-97, vertical MNE transfer "explains" slightly more than 5 per cent of the increased skill share in Swedish manufacturing, which is, as shown above, less than if the analysis is narrowed down to the MNEs only.[31]

Another noticeable result is that there are no signs of Swedish MNEs shifting their more highly skilled operations to other OECD countries, while keeping their less-skilled activities in Sweden. Rather the upshot of the regression analysis is consistent with models of horizontal MNE transfers, in which the affiliates service foreign markets without affecting the relative labour demand of the parents in Sweden.

5. Conclusions

One of the main findings the analysis has generated is that increased employment in non-OECD affiliates has significantly boosted skill upgrading in Swedish manufacturing MNE parents during the 1990s. This outcome is consistent with the predictions of vertical MNE models but differs from that found by other empirical studies. One explanation why Slaughter (2000) does not obtain any effect of MNE transfer on US skill upgrading may be that he does not distinguish FDI by country of destination.[32] One reason why previous studies of Swedish MNEs have not detected any impact on parent employment of affiliates' activities in low-wage countries could be that their employment shares in these countries, until the beginning

[31] I arrive at this outcome by making the calculation described in footnote 30 using the estimate on $\Delta(MNE)^{Non-OECD}$ in Table 4 column (iv). The corresponding result for increased import competition from non-OECD countries, making the same computation using the coefficient of $\Delta(M/C)^{Non-OECD}$ in Table 4 column (ii), is almost 4 %.

of the 1990s, have been of almost negligible importance. The descriptive part of the paper shows that transition in the CEECs appears to have led to a substantial increase in the share of employment of Swedish MNEs in the CEECs. This, in turn, may explain the significant effect I obtain in the regression analysis from increased non-OECD employment shares on skill upgrading in the MNE parents. Vertical FDI seems even to have had an impact, though much smaller, on general manufacturing skill upgrading since the MNEs are such large employers in Swedish manufacturing.

Neither the descriptive part, nor the regression analysis, gives any support for the hypothesis 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 MNE parents compared to overall Swedish manufacturing. Second, there are no signs of a relocation of R&D, one of the most skill intensive parts of a firm, from Sweden to other high-income countries; rather the R&D intensity has grown faster in Sweden than in other OECD countries. Third, in the regression analysis, employment changes in OECD affiliates are unrelated to parent skill upgrading.

Finally, one can notice that, in accordance with the assumption of many of the new theoretical MNE models, the Swedish manufacturing MNE parents appear to be knowledge based; they have higher skill shares and higher R&D intensities than Swedish manufacturing firms in general. As in other similar studies, the results of the regression analysis strongly support the hypothesis that technical change is an important driving force behind the increased demand for skills. For instance, skill upgrading has been greater in industries where computer use is more prevalent.

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

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Appendix. Definitions and data sources

Variables

Wage incomes W: Total wage incomes for employees. Source: SCB Regional Labour Statistics.

Wage incomes skilled labour W^S: Wage incomes for employees with post-secondary education. Source: SCB Regional Labour Statistics.

Skilled labour's share of the wage bill P^W: $P^W = W^S / W$

Physical capital K: Capital stock, 1991 prices.

I derive capital stock estimates level by using a Perpetual Inventory Method (PIM). This implies that capital formations are added to and capital assets withdrawn are subtracted from an initial estimate (benchmark) of the capital stock. I assume linear depreciation, which means that the gross capital stock at time t is

$$K_t = K_{t-i}\left[1-(i/2a)\right] + \sum_{m=0}^{i-1} I_{t-m-1}\left[1-(m/2a)\right]$$

K_{t-i}: Capital stock in the beginning of year $t-i$, 1991 prices

I_{t-m-1}: Gross fixed capital formation year $t-m-1$, 1991 prices

a: Average service life in manufactures. Buildings 45 years and machinery 20 years (Meyer-zu-Schlochtern 1994)

Benchmark year 1990.

Source: Capital stock benchmarks. Industry: SCB (1996), MNE: Benchmarks are constructed by assuming the same capital-output ratios and shares of buildings and machinery as at industry level.

Investment, 1991 prices. Industry: Downloaded from www.scb.se, MNE: SCB Financial Statistics.

Real output Y: Value added, 1991 prices. Source: Industry: Downloaded from www.scb.se,

MNE: SCB Financial Statistics.

R&D intensity RD/Y:

RD: Expenditure on R&D, current prices.

Source: Industry: SCB (1999), MNE: SCB R&D Statistics.

Y: Value added, current prices.

Source: Industry: OECD (1998), MNE: SCB Financial Statistics.

Data on R&D expenditure are only available every second year. For the time period 1990-93 I use data from 1991 and for the period of 1993-97 I take the average of the R&D intensity in 1993 and 1995.

Computer use CU89:

The industry computer use frequencies originate from the June 1989 supplement to the Labour Force Survey (AKU). For my purpose the key question asked was "Do you at present use a computer at work?" By using the attached weight to each of the 14,638 observations in the sample I can calculate the share of computer users at industry level.

Import competition from non-OECD countries $(M/C)^{Non-OECD}$:

M and $M^{Non-OECD}$: Total import and import from non-OECD countries.

Source: SCB Foreign Trade Statistics.

X : Total export. Source: SCB Foreign Trade Statistics.

Q: Sales value. Source: OECD (1998)

C: Consumption, $C = Q + M - X$

Multinational enterprise employment $(MNE)^{OECD}$ *and* $(MNE)^{Non-OECD}$ *:*

Employment share in foreign affiliates in country group *j* of total MNE employment:

$(MNE)^{j} = E^{j} / E$

E^{OECD} and $E^{Non-OECD}$: Affiliate employment in Swedish-headquartered MNEs in OECD and non-OECD countries.

E: Total employment in Swedish- headquartered MNEs (parent and affiliates)

Source: SCB Statistics on International Business.

In the industry analysis the data are divided into 15 manufacturing industries covering the whole manufacturing. Table A1 shows the industries included.

Table A1. The 15 manufacturing industries

No	SNI92	Industry
1	15/16	Food, beverages and tobacco
2	17/19	Textiles, apparel and leather
3	20	Wood products
4	21	Paper and paper products
5	22	Printing and publishing
6	23/24	Chemicals
7	25	Rubber and plastics
8	26	Non-metallic mineral products
9	27	Basic metals
10	28	Metal products
11	29/30	Non-electrical machinery
12	31/32	Electrical machinery
13	33	Professional goods
14	34/35	Transport equipment
15	36	Other manufacturing

Data sources

OECD (1998), STAN Industrial Database

OECD (1999), ANBERD Database (DSTI/EAS Division)

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