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INWARD FDI AND DEMAND FOR SKILLS IN SWEDEN*

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Abstract

We observe a substantial increase of foreign ownership in Sweden in the 1990s. Did that have any effect on relative demand for skilled labor? Has technology transfers – often associated with inward FDI – led to increased demand for skills due to skilled-biased technical change? Are there any grounds for the worries in the public Swedish debate that more skilled activities have been moved abroad to countries where the headquarters are located? We obtain support for that the share of skilled labor tends to rise in non-multinationals – but not in multinationals – that become foreign owned. Yet it does not seem to be any relationship between increased foreign ownership and the relative demand for skilled labor in Swedish manufacturing between 1986 and 2000. Interestingly, increased competition from low-wage countries, rather than inward FDI, has had significant impact on skill upgrading, and appears to have played a larger role in the 1990s than before.

JEL classification: F23, J23, J31
Keywords: foreign ownership, skill upgrading, wage differentials

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1. Introduction

The employment share of skilled labor, i.e. employees with post-secondary education, has grown continuously in Sweden over the last decades. The increasing skill share in the 1990s might be explained by larger supply of skilled labor owing to a heavy expansion of higher education in Sweden. Yet it seems that factors on the demand side have dominated because at the same time we observe rising relative wages of skilled labor.[1] In particular, two factors on the demand side have been emphasized in the literature, namely skilled-biased technological change and increased import competition from low-wage countries, and numerous studies on different countries have tried to quantify the importance of these factors.[2]

Another conceivable channel through which the increased internationalization may affect relative demand for skills is foreign direct investment (FDI). Swedish headquartered multinational enterprises (MNEs) have for a long time been significant employers in Swedish manufacturing. Hansson (2004) examines the impact of their localization behavior (outward FDI) on relative labor demand in their Swedish parents.[3] He finds that increased employment in affiliates in low-wage countries is positively related to skill upgrading in the Swedish parents. This indicates that within Swedish MNEs less-skilled activities are transferred to low-wage countries. Changes in employment in affiliates in other high-wage countries are, on the other hand, unrelated to parent skill upgrading. However, a characteristic feature of the 1990s is increased inward FDI to Sweden, resulting in rapidly growing foreign ownership.[4] Does more inward FDI explain the increased relative demand for skilled labor in Sweden in the 1990s?

The theory of MNEs assumes that MNEs possess firm-specific assets, like technological assets, that give them an advantage relative to indigenous firms. This is necessary to compensate for the disadvantages they face in foreign countries and thus to be able to establish abroad (Dunning 1977). It is often believed that MNEs are important conveyers of technology internationally since one motive to FDI is to profit from utilizing firm specific technology intensive assets in many countries. By transferring technology abroad MNEs will

[1] Section 2.2 discusses this more in depth.
[2] Machin and Van Reenen (1998), Anderton and Brenton (1998), Hansson (2000), etc.
[3] Similar studies on US and Japanese multinationals are Slaughter (2000) and Head and Ries (2002).
[4] See Figure 1 in section 2 below

affect technological change in their host countries. Consequently, if inward FDI has an impact on technological change, and if it is skill-biased, increased foreign ownership might influence host country relative demand for skilled labor positively. Parallel trends in Sweden in the 1990s between rising shares of skilled labor, a growing wage differential between skilled and less-skilled labor, and increased inward FDI suggest that the larger presence of foreign affiliates possibly is an explanation to skill upgrading and rising inequality.

Another motive to FDI is technology sourcing. Technological capabilities of indigenous firms give rise to country specific advantages, which attract foreign firms. If technology sourcing causes FDI, a reasonable assumption is that the acquired domestic firms keep the same skill mix after takeover, which means that relative demand for skills is unaffected by inward FDI.

In the public Swedish debate the increased foreign ownership has aroused some anxiety. Jonung (2002) asserts that the acquisition of Swedish MNEs by foreign firms, in which the headquarters move abroad, entail less employment of skilled labor in Sweden. He argues that when the headquarters leave other functions using qualified employees will disappear too. Gradually activities, such as research and development (R&D) but also advanced production, will be removed from Sweden. Increased inward FDI is then negatively related to skill upgrading.

Lower relative demand for skilled labor in the presence of more foreign-owned firms is also consistent with the recent MNE models in which foreign affiliates are less skill-intensive than their parents. The reason is that skill-intensive activities, such headquarter service and R&D, are assumed to be located in the parent country. However, in these models the implications of greater MNE activities on skill upgrading and wage inequality are ambiguous (Markusen and Venables 1997).

Evidently, one may argue that inward FDI has various, and sometimes opposite, effects on relative demand for skilled labor, which highlight the need for empirical work. The purpose of the paper is to examine the impact of growing inward FDI and rising foreign-affiliate presence on skill upgrading and increased wage inequality in Swedish manufacturing from 1986 to 2000.

The paper is related to Feenstra and Hanson (1997), Blonigen and Slaughter (2001) and Taylor and Driffield (2005) and we contrast our findings with theirs.[5] Likewise as in all these studies, we follow the approach by Berman, Bound and Grilliches (1994) and estimate a relative labor demand function, and we control for technological change and increased international competition from low-wage countries. Unlike these studies, we have access to firm-level data, which is advantageous, since the channels, we discuss above, through which inward FDI may affect relative demand for skills should appear mainly on the firm level. Feenstra and Hanson (1997) and Blonigen and Slaughter (2001) are studies on industry level that captures such direct effects on firm level, as well as indirect effects through technology and wage spillovers from foreign-owned firms to indigenous firms within the same industry. Also, Taylor and Driffield (2005) is an industry level analysis, but they focus entirely on the indirect effects from the presence of foreign-owned firms on domestic firms.

An improvement compared to the previous literature estimating changes in relative demand for skilled labor is that we are able to more appropriately take changes in relative wages between skilled and less-skilled labor into account. Access to a new, large data set on individual wages makes it possible to generate relative wages on industry level over the studied period.

Besides sharply growing inward FDI, another distinguishing feature of the globalization process in Sweden (and in other high-wage countries) in the 1990s is increased competition from low-wage countries. This owes to the transition from plan to market economy in the neighborhood countries in Central and Eastern Europe and that large countries, such as China and India, have been more market oriented. Lower barriers to trade and reduced costs for transport and communication have further intensified that development. Accordingly, we may expect larger impact from low-wage competition on skill upgrading and wage inequality in the 1990s than in the 1970s and 1980s.

To preview our result, there seems to be no grounds for the worries that foreign-owned firms move out skill-intensive activities from Sweden. If anything, the employment share of skilled

[5] Feenstra and Hanson (1997) use regional data on industry level in Mexican manufacturing 1975 to 1988. Blonigen and Slaughter (2001) and Taylor and Driffield (2005) are studies on developed countries, the former on US manufacturing industries 1977 to 1994 and the latter on UK manufacturing 1983 to 1992. A slightly different study on the same topic is Figini and Görg (1999). They argue, based on a model by Aghion and Howitt (1998), that there should be an inverted-U shape relationship between wage inequaliy and the presence of foreign owned firms; something they also get empirical support for using Irish data.

labor appears to increase in non-multinationals that become foreign-owned and we find no relationship between increased foreign ownership and the relative demand for skilled labor. Another interesting result is that it looks like competition from low-wage countries has a larger negative impact on less-skill intensive activities in Swedish manufacturing in the 1990s than before.

The outline of the paper is the following. In section 2.1, we present our data and how foreign ownership and skill intensities in MNEs (Swedish and foreign-owned) and non-MNEs have developed over the studied period. Among Swedish social scientists there has been discussions whether the growing employment of skilled labor is due to factors on the supply or on the demand side. In section 2.2, we contribute to that debate by showing some new estimates on the trend in relative wages between skilled and less-skilled labor in Swedish manufacturing from 1986 to 2000, which we then plot against the employment share of skilled labor. From this analysis we conclude that factors on the demand side dominate, and in section 3, we examine the effects of increased foreign ownership on the relative demand for skills in Swedish manufacturing. Section 4 summarizes and concludes.

2. Data and description

2.1 Foreign ownership and skill intensities in MNEs and non-MNEs

The data come from Statistics Sweden (SCB) and Swedish Institute for Growth Policy Studies (ITPS) and is put together into a unique microeconomic database at Trade Union Institute for Economic Research (FIEF). The database enables us to link information on the financial accounts of enterprises, register-based labor statistics (i.a. education levels and incomes) and individual wage statistics. Moreover, the firms can be divided into foreign-owned firms, Swedish multinational enterprises (MNEs) and other Swedish firms (non-MNEs). Here, we use a panel of firms including all manufacturing firms with 20 employees or more. The panel's share in total manufacturing employment is around 95 percent, which is a rough indicator on its coverage.

Ever since the mid-1980s foreign ownership in Swedish manufacturing (and in the business sector as a whole) has increased steadily. Foreign-owned firms are firms where foreigners

possess more than 50 percent of the voting rights. *Figure 1* shows that in 1986 12 percent of the manufacturing employment is in foreign-owned firms, while in 2000 this share has risen to almost 34 percent. Above all, after 1994, in connection with the Swedish membership in the European Union (EU), foreign ownership in Swedish manufacturing seems to really have taken off. Between 1994 and 2000 the share of employment in foreign owned firms increased by 15 percentage points.

Figure 1 Share of employment in foreign-owned firms in Swedish manufacturing, 1986-2000. Percent.

To a large extent the limited foreign ownership until the mid-1980s can be explained by legal impediments for foreigners to own Swedish firms and propriety. Behind these obstacles were in many cases purely protectionist reasons.[6] In the end of the 1980s and in the beginning of the 1990s much of the hindrance for foreigners to acquire Swedish firms were abolished. This, together with a general trend of more international mergers and acquisitions in most industrial countries, are the main explanations to the increased foreign ownership in Swedish business sector. Other explanations put forward are that: (i) the Swedish tax system has favored foreign ownership at the expense of private Swedish ownership, (ii) the depreciation of the Swedish krona in the beginning of the 1990s entailed that Swedish firms were particularly cheap to acquire, (iii) the Swedish "business climate" improved in the 1990s compared with the 1980s, and (iv) due to the Swedish membership in the EU it has been more inviting to acquire Swedish firms.[7]

Foreign-owned firms differ in many respects from domestically owned firms. Yet the crucial differences appear to exist between MNEs (foreign-owned firms and Swedish MNEs), on the one hand, and non-MNEs, on the other. Bandick (2004) shows that MNEs in Swedish manufacturing pay higher wages, are larger, more capital and skill intensive, and have higher productivity than non-MNEs. It is by now well documented that the gaps between MNEs and non-MNEs (even after controlling for firm and industry characteristics) are more pronounced than between foreign-owned and domestically owned firms.[8] The multinationality of firms is

[6] A quotation from an official report (SOU 1986:23 p.143) gives an indication of the sentiments at that time: "kontrollen över svenska företag bevaras åt svenska intressen" (maintain the control of Swedish firms to Swedish interests). See also Henrekson and Jakobsson (2002) p.41.
[7] Jonung (2002) emphasizes the importance of the tax system, whereas the other explanations are discussed, e.g. in Malmberg and Sölvell (1998).
[8] See, e.g. Doms and Jensen (1998).

thus more important than foreign ownership per se. Access to superior technology and being a part in an international network are factors that may give rise to performance gaps.

Since our main interest is associated with skill upgrading when firms become foreign-owned we begin by taking a closer look at the development of skill intensities (shares of the employees with post-secondary education) in our three types of firms: foreign-owned firms, Swedish MNEs and non-MNEs. Swedish MNEs are Swedish owned firms that has at least one affiliate abroad or is part of an enterprise group that has affiliates abroad. Non-MNEs are firms that neither are Swedish MNEs nor are foreign-owned firms.

Figure 2 Share of skilled labor in foreign-owned firms, 1986-2000, in Swedish MNEs and in non-MNEs, 1993-2000, median (percent).

From *Figure 2* it is clear that ever since 1986 the share of skilled labor has been growing continuously in foreign-owned firms. From 1993 onwards we are able to separate the domestically owned firms into Swedish MNEs and non-MNEs. The skill intensity levels are higher in MNEs than in non-MNEs; in 2000 the median in foreign-owned firms and Swedish MNEs are around 15 percent, while in non-MNEs it is just below 10 percent. This suggests that the relative labor demand pattern differs between MNEs and non-MNEs. Yet we observe similar trends in skill shares in all types of firms, which means that there has been an overall increase in the share of skilled labor in Swedish manufacturing. Is this development due to the expansion of higher education in the 1990s or is it a result of high relative demand for skilled labor?

2.2 Growing skill shares – larger supply of skilled labor or increased demand for skills?

A simple model, where factors on the demand and the supply side interact, has often been used to explain trends in relative employment and relative wages of skilled labor. While much of the international literature emphasizes factors on the demand side – skilled-biased technical change and increased competition from low-wage countries – some Swedish social scientists stress explanations on the supply side. Edin and Holmlund (1995) examine relative wages of skilled labor (university wage premiums) from the late 1960s until the beginning of the 1990s and their finding is that the development is consistent with changes in relative supply of skilled labor (individuals with a university education). Le Grand et al. (2001), a group of

sociologists that have studied the Swedish labor market in the 1990s in an official report, conclude that the supply of skilled labor has grown faster than the employers' demand.

In *Figure 3* we plot the share of skilled labor together with relative wages between skilled and less-skilled labor over the period 1986 to 2000. This gives a hint whether changes on the demand or on the supply side are most influential in explaining the development of the skill share in manufacturing. Factors on the demand side appear to be more important if the growing skill share in manufacturing is accompanied by increased relative wages. As a measure of relative wages we use the university wage premium for individuals in manufacturing. We get the university wage premium from estimating standard Mincerian wage equation on a new, large data set on individual wages (see Appendix). We compare individuals with at least 3-years of university education to those with 3-years of gymnasium.[9] The skill share is the share of the employed in manufacturing with some post-secondary education.

Figure 3 Relative wages and skill share in Swedish manufacturing, 1986-2000

Figure 3 shows some interesting patterns. First, we observe a significant increase in relative wages of skilled labor (the university wage premium) in manufacturing over the studied period 1986 to 2000. In 1986, skilled labor wages in manufacturing are 35 percent higher than less-skilled labor wages, whereas in 2000 skilled labor wages are 48 percent higher, i.e. between 1986 and 2000 relative wages of skilled labor has increased with 13 percentage points. Our results deviate quite a lot from le Grand et al. (2001) that found only small changes in relative wages of skilled labor, yet it is in line with Gustavsson (2004).[10] Second, we can see that in the figure relative employment and relative wages of skilled labor move in the same direction. This indicates that although the supply of skilled labor has increased

[9] Table A1 in Appendix shows the results from the estimated wage equations for manufacturing and the private sector in selected years.

[10] Le Grand et al. (2001) find that the return to one additional year of schooling in the private sector increased from 5.4 to 6.1 percent between 1991 and 2000 (5.2 percent in 1981). Assuming a difference of four years of education between skilled (at least 3-years of university education) and less-skilled (3-years of gymnasium) indicates that relative wages of skilled labor has increased with barely 3 percentage points. According to Gustavsson (2004) Table B5, in 1992, skilled labor's wages are almost 27 percent higher than of less-skilled in the private sector, whereas the gap has increased to 38 percent in 2000, which means that relative wages of skilled labor has grown with 11 percentage points. Le Grand et al. (2001) base their estimate on LNU (Swedish Level-of-Living Survey), where the number of individuals is relatively low, less than 1800 each year. Gustavsson (2004) uses LINDA (Longtudinal Individual Data for Sweden), where the number of individuals is much larger (16,117 in 1992 and 61,035 in 2000). The wage variable in Gustavsson (2004) is the same as ours, i.e. full time equivalent monthly wages in logs, and is from Statistics Sweden's wage statistics, whereas wage in le Grand et al. (1991) is log hourly wage.

factors on the demand side appears to dominate in explaining the growing skill share in manufacturing. Given the relative importance of factors on the demand side, it seems reasonable to base the analysis of how foreign ownership affects advanced production in Sweden on a framework that aims to explain relative demand for skilled labor, and in which the effects of foreign ownership then is taken into account.

3. Foreign ownership and effects on the localization of R&D and advanced production

We use two approaches to examine whether technology transfer leads to increased demand for skills or advanced production and research and development (R&D) tend to move from Sweden when firms become foreign-owned. To begin with, in section 3.1, we exploit our panel of firm data by estimating simple firm-fixed effect models. This means that we can compare the development of shares of skilled labor and R&D intensities (expenditure on R&D as a share of sales) before and after Swedish-owned firms are taken over by foreign firms. After that, in section 3.2, we carry out a more elaborate analysis where we start out from a model where changes in relative demand for skilled labor on firm (and industry) level is estimated.

3.1 The firm-fixed effect model

Figure 2 indicates that MNEs (foreign-owned firms and Swedish MNEs) are more skill intensive (the share of the employees with a post-secondary education is larger) than in non-MNEs. However, an explanation to this pattern might be that MNEs are active in skill intensive industries, while non-MNEs tend to be clustered in less skill intensive industries. Therefore, we show, in *Table 1*, some OLS estimates based on our panel of manufacturing firms controlling for industry and time before we, in *Table 2*, present the firm-fixed effect estimates. To be able to separate Swedish MNEs from Swedish non-MNEs we have to restrict ourselves to the period 1993 to 2000.

Table 1 Skill shares and R&D intensities in foreign-owned firms, Swedish MNEs and non-MNEs in Swedish manufacturing, 1993-2000. OLS estimates. Dependent variables: share of the employees with post-secondary education and expenditure on research and development as share of sales (percent).

The estimates in column (i) show that the share of skilled labor, on average, is 7.2 percent higher in foreign-owned firms and 5.9 percent higher in Swedish MNEs than in non-MNEs, which, in turn, is 9.5 percent. Controlling for industry effects and that skill intensity might be related to firm size shrink the difference between MNEs and non-MNEs, in column (ii), to 4.6 percent for foreign owned firms and to 4.3 percent for Swedish MNE, and we cannot reject the hypothesis that skill shares are the same in foreign owned firms and Swedish MNEs. In other words, the result confirms that there are distinct differences in skill shares between MNEs and non-MNEs, whereas foreign owned firms and Swedish MNEs are very similar. Moreover, Swedish MNEs and foreign owned firms seem to be concentrated to skill intensive industries.

Much of the concern about the growing foreign ownership in Sweden has been about what happens with firms' R&D when they become foreign-owned. Before we deal with that question we begin and examine whether R&D intensities (R&D expenditures as a share of sales)[11] differ between our groups of firms. We present, in columns (iii) and (iv), OLS estimates for R&D intensities similar to those we report for skill shares in columns (i) and (ii). Here, we are limited to firms with 50 employees or more since this is Statistics Sweden's cut-off for collecting data on R&D expenditure. The R&D intensity is significantly higher in MNEs than in non-MNEs; the R&D intensity is around 2 percent in foreign-owned firms and Swedish MNEs but only 0.7 percent in other Swedish firms. However, when we, in specification (iv), take industry effects and firm size into account some interesting patterns appear. The R&D intensity is still higher in Swedish MNEs than in non-MNEs, yet the difference is less than in specification (iii). Unlike specification (iii), the R&D intensity in foreign-owned firms is about the same as in other Swedish firms, and significantly lower than in Swedish MNEs. Hence, it seems that among MNEs foreign-owned firms spend less on R&D. Furthermore, in contrast to skill shares R&D intensities are positively correlated with firm size, i.e. larger firms invest relatively more in R&D than smaller firms.

[11] We use data on R&D expenditure from Statistics Sweden, Financial statistics. An alternative source to similar data is Statistics Sweden, R&D statistics. Although, the latter data may be of better quality, it is only available every second year, which is a drawback in a short panel. There are quite a lot of zero observations on R&D expenditure in the dataset and tobit estimations rather than OLS might be more appropriate. Rerunning the specifications in Table 1, excluding zero observations on R&D intensity, gives qualitatively the same results. On the other hand, not excluding R&D intensity outliers, i.e. observations where R&D expenditures as a share of sales is larger than 75 percent, have a large effect on the outcome and the interpretations.

The analysis in *Table 1* is cross-sectional in character, which means that it cannot tell us anything about the impact of foreign ownership on skill shares and R&D intensities. One reason to lower R&D intensities in foreign-owned firms compared to Swedish MNEs may, for instance, be that MNEs in general tend to have the lion's share of their R&D in their home countries.[12] To investigate how changes into foreign ownership affect skill shares and R&D intensities we utilize our panel of firm data to estimate some firm-fixed effect models. This means that we compare skill shares and R&D intensities before and after the acquisition in firms that are acquired by foreigners. Permanent characteristics of individual firms are absorbed by the fixed effects and do not appear as the consequence of foreign ownership. In other words, we examine if foreigners change the skill mix (or the R&D intensity) in the Swedish firms they takeover or if they buy firms that already have the desired skill (R&D) intensity? We estimate the following model

$$Y_{jt} = \alpha + \beta_1 FO_{jt} + \beta_2 SMNE_{jt} + \lambda Firm_{jt} + \gamma Year_t + F_j + \varepsilon_{jt} \qquad (1)$$

The dependent variable Y_{jt} is skill share or R&D intensity in firm *j* at time *t*. FO_{jt} is a dummy variable that equals one if firm *j* is foreign-owned at time *t*. The β_1 coefficient tells us whether the skill share (R&D intensity) has changed in firms acquired by foreigners. $SMNE_{jt}$ is a dummy variable that equals one if firm *j* is a Swedish MNE at time *t*. If β_2 is positive the skill share (R&D intensity) has increased in firms that become Swedish MNEs. Firm characteristics $Firm_{jt}$, such as size (log employment), and year dummies $Year_t$ are added. F_j is a time-invariant firm-specific fix effect and ε_{jt} is an error term. *Table 2* reports the results from estimating firm-fixed effect models.

Table 2 Effects of foreign ownership on skill share and R&D intensity. Firm-fixed effect estimates. Dependent variables: share of the employees with post-secondary education and expenditure on research and development as share of sales (percent).

The positive coefficient on FO_{jt} in column (i) – the whole period 1986-2000 – and in column (ii) – the period 1993-2000 – indicates that the share of skilled labor increases when firms

[12] This is the case in Swedish MNEs, which have higher R&D intensity in Sweden than abroad. The number of R&D workers in relation to all employees in the 20 largest Swedish manufacturing MNEs 2001 is 15 percent in Sweden and 5 percent abroad (ITPS 2003).

become foreign-owned.[13] Furthermore, the estimate on $SMNE_{jt}$, in column (ii), implies that the skill share rises in local Swedish firms that establish abroad, i.e. turn into Swedish MNEs.

According to Table 1 (and Figure 2) Swedish MNEs have higher skill shares than non-MNEs, but about the same as in foreign-owned firms. Therefore, we might expect a different impact on the share of skilled labor after foreign takeovers of non-MNEs than of Swedish MNEs. In column (iii), we exclude Swedish MNEs and the results show that the skill share after takeover is significantly higher in non-MNEs acquired by foreign firms. In column (iv), where we instead drop non-MNEs, we find that the share of skilled labor is unaffected in Swedish MNEs that become foreign owned.

Finally, we observe that the coefficient on size is negative in all specifications where firm's skill share is the dependent variable, i.e. column (i) - (iv). This indicates that contracting firms tend to shed less-skilled labor.

Looking at R&D intensities, in specification (v), we find that R&D intensities rise when firms become foreign owned.[14] The positive coefficient on size suggests that R&D intensities increase in growing firms.

3.2 Relative labor demand and foreign ownership

Analytical framework

To study how foreign ownership affects relative demand for skilled labor we follow a commonly applied approach of Berman et al. (1994).[15] The derivation of the econometric specification starts out from a translog cost function, where skilled and less-skilled labor are variable factors and physical capital is treated as a fixed factor. By assuming cost minimizing firms a firm's (industry's) wage bill share of skilled labor P^W is a function of relative wages

[13] Almeida (2003) estimates a similar model on Portuguese firms and she finds no significant changes in the workforce educational composition in firms taken over by foreigners.
[14] The result is not robust; the coefficient on foreign-owned firm in column (v) is insignificant if zero observations are excluded. Also, the R-square in column (v) is quite low.
[15] The same method has been used by, e.g. Autor et al. (1998) and Machin and Van Reneen (1998). Anderton et al. (2002) and Hansson (2000) and (2004) are application on Swedish data.

of skilled labor (w_s / w_u), capital stock *K*, real output *Y*, and technological level *T*.[16] Changes in relative labor demand can be estimated on firm (or industry) level by using the following regression equation:

$$\Delta P_{it}^{W} = \alpha + \beta_1 \Delta \ln(w_s / w_u)_{it} + \beta_2 \Delta \ln K_{it} + \beta_3 \Delta \ln Y_{it} + \beta_4 \Delta T_{it} + \varepsilon_{it} \qquad (2)$$

Let *i* index firms (industries) and *t* index time. Δ denotes changes, α is an intercept and ε is an error term.

An increase in the dependent variable ΔP_{it}^{W} – the level change in the skill-labor share of the total wage bill – indicates skill upgrading. As we mentioned above our definition of skilled labor is based on educational attainment; skilled labor is employees with a post-secondary education, i.e. with more than 12 years of schooling.[17]

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. The coefficient β_1 is positive (negative) depending on whether the average elasticity of substitution is below (above) 1. Due to lack of good measures of relative wage variations between skilled and less-skilled labor on industry level many researchers have omitted the variable $\Delta \ln(w_s / w_u)_{it}$. If there are perfect labor mobility changes in relative wages is the same in all industries during a time period and time fixed effects would capture such changes (Blonigen and Slaughter 2001). Other researchers have constructed skilled (less-skilled) labor wages w_s (w_u) by dividing wage bills for skilled (less-skilled) labor with total employment of skilled (less-skilled) labor. One problem is that such wage measures consist of the same terms as the dependent variable P^W, which might introduce bias into the estimates. Another problem is that the constructed wages do not take cross-industry variations in skill mixes in to account. Since we have access to a new, large dataset on individual wages we obtain relative wages in 18 manufacturing industries over the

[16] See e.g. Berndt (1991) section 9.4 for a derivation.

[17] Most likely, such a division into skilled and less-skilled labor is more appropriate than the often used production/non-production classification (e.g. in Blonigen and Slaughter 2001) or a distinction between operatives and non-operatives (e.g. in Taylor and Driffield 2005). However, educational attainment has its imperfections too, for instance, it does not capture experience, it partially understates participation in further education and training, and there are variations in quality of schooling over time and between regions/countries.

studied period by estimating Mincerian wage equations for each industry.[18] Based on these estimates we then generate annual average changes in relative wages in these 18 manufacturing industries for different time periods. In our estimated model we use this variable as a measure of exogenous changes in relative wages that the firms in various industries face.

A positive coefficient on ΔK_{it} ($\beta_2 > 0$) indicates that skilled labor is complementary to physical capital in the production process. Whether changes in real value added ΔY_{it} are related to the skilled labor share of the total wage bill is shown by the estimate of β_3. ΔT_{it} is changes in technology and as a measure of technological change we employ the R&D intensity *RD/Q*, i.e. R&D expenditure as a share of sales. New technologies are continuously introduced at a high rate in R&D intensive firms (industries) and if technological change shifts labor demand in favor of better-educated workers, β_4 is positive.[19]

To analyze the effect of foreign ownership on relative demand for skills we append to the wage bill share equation in (2) regressors that aim to capture such an impact. We have argued that there will be a direct effect on firm level of foreign ownership and in our firm level analysis we add two dummy variables: $FO1_{it}$ equals 1 if a firm is foreign-owned during the period *t* and $FO2_{it}$ equals 1 if a firm become foreign-owned in period *t*.

Taylor and Driffield (2005) put forward two additional arguments why increased inward FDI may widen the wage gap between skilled and less skilled labor and give rise to the use of more skilled labor on industry level. First, the entrance of foreign firms in an industry boosts the demand for skilled labor in that industry and increase wage inequality because foreign firms have higher demand for skilled labor. Second, technology spillovers from entering foreign firms to domestic firms within the same industry increase relative demand for skilled

[18] Table A2 in Appendix shows the estimated relative wages between skilled and less-skilled labor in year 2000 and annual average changes in relative wages 1986 to 2000 in the 18 manufacturing industries.
[19] Taylor and Driffield (2005) construct R&D stocks and weigh them with value added to obtain an intensity measure on industry level of technological change, whereas Blonigen and Slaughter (2001) employ the the share of computer investmet in total investment.

labor on industry level. In the industry level analysis we include ΔFDI_{it}: changes in the share of employment in foreign-owned firms in industry *i* over the period *t*.[20]

$$\Delta P_{it}^{W} = \delta_t (TD)_t + \beta_1 \Delta (w_s / w_u)_{it} + \beta_2 \Delta \ln K_{it} + \beta_3 \Delta \ln Y_{it} + \beta_4 (RD/Q)_{it} +$$

$$+ \beta_5 \Delta (M/C)_{it}^{Low-wage} + \begin{bmatrix} \gamma_1 FO1_{it} + \gamma_2 FO2_{it} \\ \gamma \Delta FDI_{it} \end{bmatrix} + \varepsilon_{it} \qquad (3)$$

The dummy variables $FO1_{it}$ and $FO2_{it}$ and ΔFDI_{it} are our key variables in equation (3), which is the model we eventually estimate. The sign on the γ coefficients indicates if inward FDI has an impact on relative demand for skills. The interpretation of significantly positive (negative) estimates of γ is that foreign ownership has contributed to shifts in demand towards skilled (less-skilled) workers.

Furthermore, we include a variable measuring changes in competition from (and offshoring[21] to) low-wage countries in an industry *i* during the period *t*, $\Delta (M/C)_{it}^{Low-wage}$. The average annual change in import from low-wage countries[22] as a share of consumption might capture the effect of multinationals moving low-skill intensive parts of the production (for instance assembly of components) overseas, but continue to carry out the high skill intensive activities in the home country, given that the goods are imported back, either to be used as intermediate inputs or sold as finished goods. Also, the variable $\Delta (M/C)_{it}^{Low-wage}$ takes into account the effect of domestic consumers and producers switching from buying low-skill intensive final and intermediate goods from domestic producers to foreign suppliers in low-wage countries. *Figure 4* shows the trend in the share of imports from low-wage countries in consumption in Swedish manufacturing between 1986 and 2000.

[20] This variable is very similar to those that Blonigen and Slaughter (2001) and Taylor and Driffield (2005) use, which means that our industry level estimate is comparable with theirs.

[21] The terms outsourcing and offshoring are sometimes used interchangeably. However, there is a distinction between the two concepts. We define outsourcing as acquiring goods and services from an outside company (domestic or foreign). Offshoring means that goods and services are supplied either by a foreign affiliate or by an unaffiliated foreign company.

[22] We define as low-wage countries all countries except the "old" OECD countries: 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.

Figure 4 Import from low-wage countries as a share of consumption in Swedish manufacturing, 1986-2000.

Disregarding the sudden drop in the import share between 1994 and 1995, which most likely is a statistical artifact[23], we observe a steady increase in competition (and offshoring to) low-wage countries over the studied period. If the variable $\Delta(M/C)_{it}^{Low-wage}$ has the expected effect on relative labor demand, the coefficient β_5 is positive.[24] Finally, we add time dummies to our estimated model to control for period-specific skill upgrading that is common to all industries (firms).

Empirical results

Our econometric analysis is carried out on firm-level as well as on industry level. We include into the analysis all firms in manufacturing with 50 employees or more during the period 1986 to 2000.[25] In the industry level analysis we have aggregated data on firm level to SNI69 4-digit level industries over the period 1986-90 and between 1990 and 2000 to SNI92 3-digit level industries. We use data for 1986, 1990, 1993, 1996 and 2000 and calculate annual average changes in the four time periods. *Table 3* presents the results on firm-level, in column (i), and the estimates from the industry-level analysis, in column (ii).

Table 3 Effects of inward FDI on skill upgrading in Swedish manufacturing, 1986-2000. Dependent variable: annual average changes in skilled labor wage-bill shares ΔP^W or annual average changes in skilled labor employment shares ΔP^E.

From the results in *Table 3* we infer there is no relation between foreign-affiliate activity and demand for skills in Swedish manufacturing in the 1990s. The coefficients on the dummy variables $FO1_{it}$ and $FO2_{it}$ are insignificant in the firm-level analysis, in column (i), and the same applies, in column (ii), to the estimate on ΔFDI_{it} in the industry level analysis. Our

[23] The two percentage points drop in the time series between 1994 and 1995 might be explained by changes in the country of origin classification of imports after Sweden's accession to the European Union (EU) in 1995. From 1995 onwards imports originating from outside the EU, but cleared through the customs in another EU country, is falsely registered as import from the transit EU country. Apparently, this involves that the amount of imports from low-wage countries is underestimated.

[24] The possible impact from international trade is not at all taken into account in Blonigen and Slaughter (2001). Taylor and Driffield (2005) append total import and total export intensities on industry level to their models. However, it is questionable whether import from other high-wage countries includes higher proportion of less-skilled activities than the domestic production in an importing high-wage country, like the UK and Sweden. Moreover, it is unclear how the export intensity affects relative demand for skilled labor.

[25] Data on expenditure on R&D is only available in firms with 50 employees or more.

results in column (ii) correspond with Blonigen and Slaughter (2001), but diverge from Taylor and Driffield (2005). The latter find that inward FDI has a significant impact on wage inequality and skill upgrading in the UK. A difference between the studies is that we and Blonigen and Slaughter (2001) employ a first-difference approach, whereas Taylor and Driffield (2005) estimate industry fixed-effects models. Another difference is that Taylor and Driffield (2005) use data aggregated on industry level from domestic firms only, whereas we and Blonigen and Slaughter (2001) utilize data aggregated from both domestic and foreign-owned firms.

At first sight the result in Table 3 of no impact of inward FDI on the demand for skills contradicts our finding in Table 2 that the share of skilled labor goes up after takeover in non-MNEs acquired by foreign firms. However, an explanation might be that the acquired non-MNEs in general are small and firms less than 50 employees are not included in our analysis of relative labor demand.[26] Furthermore, we remark that the estimates in Table 3 are size-weighted.

Interestingly, increased importance of import from low-wage countries has, in column (ii), the expected effect on relative labor demand on industry level. Since there is a drop in $\Delta(M/C)_{it}^{Low-wage}$ in 1995 owing to changes in the classification of the origins of imports we exclude, as a robustness check in column (iii), the period 1993-96 from the analysis. We find then that the estimate on $\Delta(M/C)_{it}^{Low-wage}$ does not change very much and it is still clearly significant.

To evaluate the economic impact of increased competition from low-wage countries we multiply the mean of the independent variable $\Delta(M/C)_{it}^{Low-wage}$ with its regression coefficient in column (ii) and then we divide that with the mean of the dependent variable ΔP^W. The calculation shows that the increased share of import from low-wage countries in consumption "explains" 19 percent of the changes in wage-bill shares of skilled labor on industry level between 1986 and 2000. Previous analyses have seldom found a clear impact from this

[26] Notice that if we rerun specification (i) in Table 2 and restrict our sample to firms with 50 employees or more (the same firms as in Table 3) the coefficient on *FO* is insignificant. Hence, the skill mix appears to be unaffected in large Swedish firms taken over by foreigners. Moreover, we know that Swedish MNEs are significantly larger than non-MNEs; among the Swedish manufacturing firms with 20 employees or more in year 2000 the average size of Swedish MNEs is 298 employees, whereas the average number of employees in non-MNEs is 58.

variable.[27] Indeed, in Hansson (2000) intensified competition from low-wage countries correlates positively with skill upgrading in Swedish manufacturing during the period 1970 to 1993. However, that result is, to a large extent driven, by some industries within the textile sector. The calculation of the impact of low-wage competition for the period 1970 to 1993 indicates that only 5 percent of the skill upgrading is "explained". To be able to compare that figure with the effect on skill upgrading for the period 1986 to 2000 we estimate, in column (iv), the same specification as in Hansson (2000) Table 8[28] and here we find that 14 percent of the skill upgrading in Swedish manufacturing in the late 1980s and in the 1990s is "explained" by increased competition from low-wage countries. From this we conclude that increased competition from (and offshoring to) low-wage countries seem to have larger impact on relative demand for skills in the 1990s than before.

In the firm-level analysis, in column (i), the coefficient on $\Delta(M/C)_{it}^{Low-wage}$ is significant only on 10 percent level. One reason to that may be that changes in import on industry level affects firms differently within an industry, depending on heterogenity among firms within an industry. Another reason is that exiting and entering firms are included in the industry level analysis, while the analysis on firm level exclusively deals with continuing firms. As a consequence, firms shuting down due to increased import competition from low-wage countries are not included in the firm-level analysis.

Not surprisingly, we observe, as in most other similar studies, a positive relationship, both on firm- and on industry-level, between R&D intensity and changes in skilled-labor wage bill shares. The interpretation is that technological change is an important driving force behind the growing demand for skills.

Changes in output is negatively correlated with skill upgrading on firm-level. This indicates that firms that reduce their production lower their demand for less-skilled labor, which is consistent with our results in the firm-fixed effect analysis in Table 2. On industry level, in column (ii), there is no relation between output growth and changes in skilled labor wage bill

[27] See, e.g. Machin and Van Reneen (1998).

[28] We use another dependent variable ΔP^E – annual average changes in the employment share of skilled labor – and we exclude the relative wage regressor $\Delta \ln(w_s / w_u)$ and changes in the employment share in foreign-owned firms ΔFDI. Furthermore, we employ another indicator on technological change *TECH*, the share employees with post-secondary technical education in the beginning of each period. However, number of industries is less in Hansson (2000).

shares. Changes in capital is unrelated to skill upgrading (except in column (iv)), which means that the evidence of capital-skill complementarity is meagre.

Finally, the coefficient on changes in relative wages is insignificant in column (i), as well as in column (ii). This implies that we cannot reject the hypothesis that the average elasticity of substitution between skilled and less-skilled labor is equal to one.

4. Concluding remarks

Sharply increased foreign ownership at a time of widening wage inequality and growing employment share of skilled labor on aggregate level hint that there might be significant technology transfers from abroad leading to skilled-biased technical change and increased relative demand for skilled labor. Yet our econometric analysis gives only minor support for that.

In our firm-fixed effect analysis we find that the share of skilled labor tend to rise in non-MNEs, but not in Swedish MNEs, that become foreign-owned. One interpretation is that technology transfers occur from foreign-owned firms to acquired non-MNEs, whereas technology sourcing is an important motive behind the acquisitions of Swedish MNEs. In the more elaborate analysis of relative demand for skilled labor there appears to be no relationship between increased foreign ownership and the demand for skills in Swedish manufacturing in the 1990s. Consequently, we conclude that the growing foreign ownership seems not to have been an important driver behind aggregate skill upgrading in Swedish manufacturing in the 1990s.

We find no ground for the worries that foreign-owned firms acquiring Swedish MNEs have removed the advanced activities from Sweden. If anything, R&D intensities appear to increase in Sweden after foreign acquisitions.

Like in the 1970s and 80s skilled-biased technical change and more intense competition from low-wage countries appear to have led to increased demand for skills in Swedish manufacturing also in the 1990s. Interestingly, the latter seems to have larger impact on skill upgrading in the 1990s than before. Finally, another remarkable result is that skill upgrading

is higher in firms that reduce their output, which suggest that contracting firms shed less-skilled labor.

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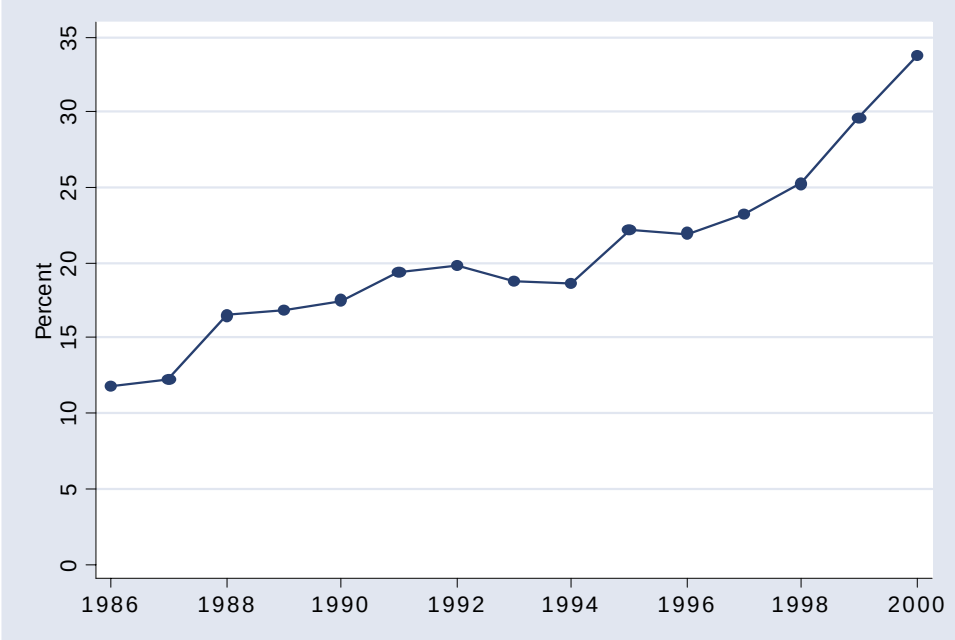
Figure 1 Share of employment in foreign-owned firms in Swedish manufacturing, 1986-2000 (percent)



Notes: Manufacturing firms with 20 employees or more. Firms are foreign-owned if foreigners have more than 50 percent of the voting rights.

Figure 2 Share of skilled labor in foreign-owned firms, 1986-2000, in Swedish MNEs and in non-MNEs, 1993-2000, median (percent).

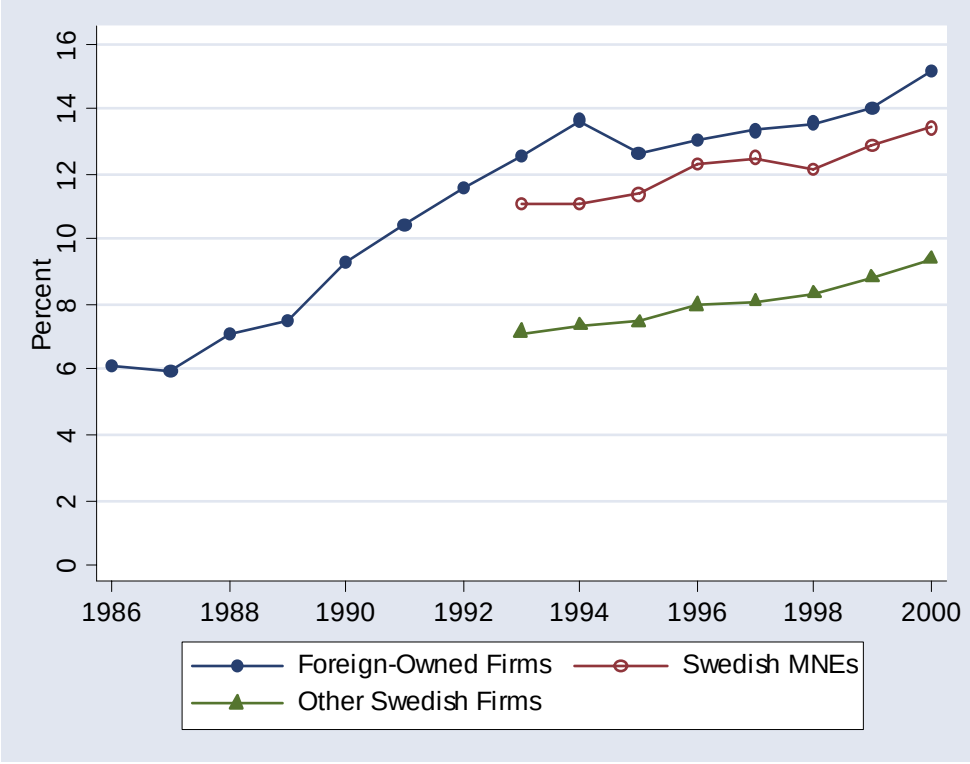
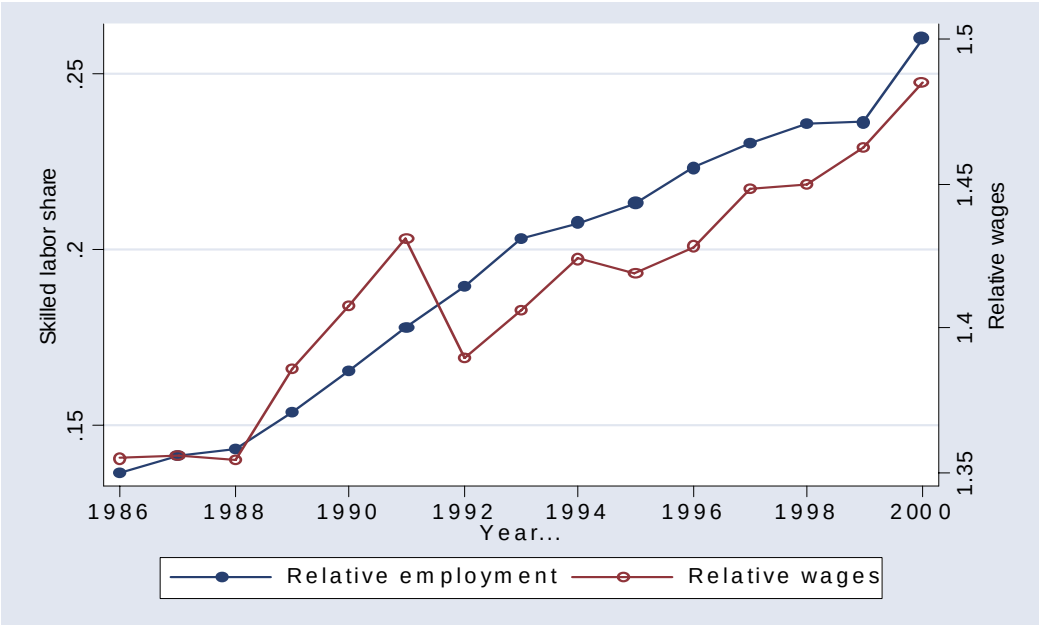


Figure 3 Relative wages and skill share in Swedish manufacturing, 1986-2000



Notes: Relative wages between skilled and less-skilled labor are calculated from estimated wage equations (see Table A1 in Appendix). Skilled labor is individuals with 3-years of university education and less-skilled labor has 3-years of gymnasium. Relative employment of skilled labor is the share with post-secondary education in total manufacturing employment.

Table 1 Skill shares and R&D intensities in foreign owned firms, Swedish MNEs and non-MNEs in Swedish manufacturing, 1993-2000. OLS estimates. Dependent variables: share of the employees with post-secondary education or expenditure on research and development as share of sales (percent)

	Skill share		R&D intensity	
Regressors	(i)	(ii)	(iii)	(iv)
Foreign-owned firm *FO*	7.23 [32.13]	4.74 [20.08]	1.21 [17.20]	0.10 [1.46]
Swedish MNE *SMNE*	5.89 [31.09]	4.47 [24.34]	1.34 [18.91]	0.44 [7.37]
Size *ln(employment)*		–0.13 [–1.37]		0.83 [17.82]
Constant	9.47 [46.34]	3.74 [8.29]	0.69 [7.17]	–4.09 [16.53]
Time dummies Industry dummies	yes	yes yes	yes	yes yes
R-square Number of observations	0.067 29,849	0.366 29,849	0.031 13,490	0.301 13,490

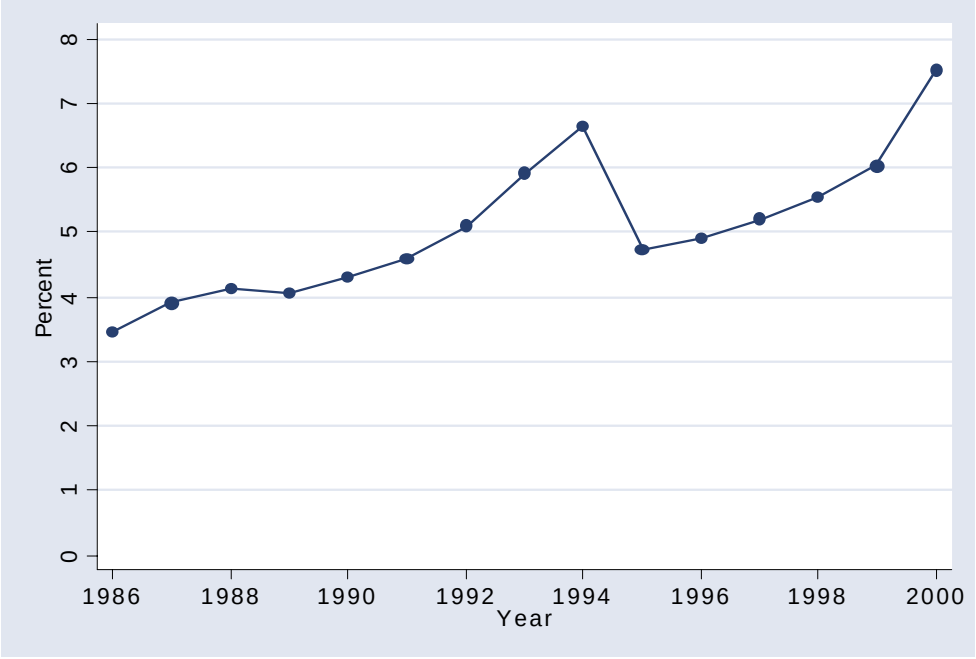
Notes: Within square brackets White's heteroskedasticity-consistent *t* statistics. Industries are defined as SNI92 3-digit. Reports on expenditure on R&D are only given for firms with 50 employees or more. We exclude some R&D intensity outliers (12 observations). Outliers are firms where R&D expenditures as a share of sales are larger than 75 percent (the average R&D intensity in the sample is 1.4 percent).

Table 2 Effects of foreign ownership on skill share and R&D intensity. Firm fixed-effect estimates. Dependent variables: share of the employees with post-secondary education or expenditure on research and development as share of sales (percent)

Regressors	Skill share				R&D intensity
	(i)	(ii)	(iii)	(iv)	(v)
	All firms 1986-2000	All firms 1993-2000	Non-MNE and FOF 1993-2000	Swedish MNE and FOF 1993-2000	All firms 1993-2000
Foreign-owned firm *FO*	0.63 (5.25)	0.60 (3.86)	0.55 (3.16)	0.06 (0.26)	0.239 (2.27)
Swedish MNE *SMNE*		0.46 (3.91)			0.068 (0.80)
Size *ln(employment)*	–2.31 (–43.75)	–2.39 (–29.07)	–1.71 (–17.09)	–3.36 (–27.34)	0.268 (3.88)
Constant	16.73 (70.93)	21.20 (62.69)	17.29 (44.01)	31.45 (53.10)	0.093 (0.27)
Time dummies	yes	yes	yes	yes	yes
Firm dummies	yes	yes	yes	yes	yes
Within R-square	0.198	0.081	0.056	0.135	0.004
Number of observations	50,878	28,078	21,520	10,516	12,331

Notes: *t* statistics within parentheses. We exclude firms that switch back and forth between being Swedish and foreign owned.

Figure 4 Import from low-wage countries as a share of consumption in Swedish manufacturing, 1986-2000.



Notes: Consumption = production + imports – exports. Footnote 22 defines the low-wage countries and footnote 23 gives an explanation to the drop in the import share between 1994 and 1995.

Table 3 Effects on relative demand for skills of foreign ownership (inward FDI) in Swedish manufacturing, 1986-2000. Dependent variables: average annual changes in skilled labor wage-bill shares ΔP^W or average annual changes in skilled labor employment shares ΔP^E.

Regressors	(i) Firm-level ΔP^W	(ii) Industry-level ΔP^W	(iii) Industry-level ΔP^W	(iv) Industry-level ΔP^E
Changes in relative wage $\Delta \ln(w_s / w_u)$	0.018 [1.26]	0.016 [0.92]	0.018 [0.91]	
Changes in capital stock $\Delta \ln K$	-0.008 [-1.76]	0.013 [1.41]	0.005 [0.49]	0.016 [2.29]
Changes in output $\Delta \ln Y$	-0.012 [-2.67]	0.015 [1.62]	0.024 [2.40]	0.008 [0.91]
R&D intensity (RD / Q)	0.034 [3.03]	0.004 [2.74]	0.003 [2.54]	
Share of employees with post-secondary education *TECH*				0.021 [1.95]
Changes in import competition from low-wage countries $\Delta(M / C)^{Low-wage}$	0.151 [1.92]	0.223 [2.56]	0.244 [2.22]	0.144 [2.21]
Changes in the share of employees in foreign-owned firms ΔFDI		-0.001 [-0.13]	-0.005 [-0.33]	
Dummy variable: Foreign-owned = 1 *FOR*1	-0.001 [-1.45]			
Dummy variable: Become foreign-owned = 1 *FOR*2	-0.003 [-1.57]			
Period dummies *TD*	yes	yes	yes	yes
Adjusted R-square	0.116	0.183	0.193	0.200
Number of observations	4619	306	228	306

Notes: All regressions are estimated with OLS, computed over manufacturing firms with 50 employees or more (industries) for the periods 1986-90, 1990-93, 1993-96, and 1996-2000, and weighted by the average firm (industry) share of total manufacturing wage bill (employment). 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*. Skilled labor are employees with post-secondary education.

Appendix: Definitions and sources of data

Individual wage data

The wage variable is full time equivalent monthly wage and is from Statistics Sweden's annual study of wages in Sweden. This survey sample 50 percent of the individuals in the private sector and include all individuals in the public sector. The sampling frame for the private sector is made up of firms that are stratified according to industry and number of employees. Random draws are made within each stratum. Larger firms have higher probability of being sampled. Individuals working in firms with more than 500 employees are always in the sample, whereas the probability to be in the sample for individuals working in firms with less than 10 employees is only 3 percent. This means that we are able to compare the wage structure between different years. However, we advise against using this data in panel studies following the same individuals over a time period; the sample of individuals we observe many years in a row may not be representative for the whole population of employees between 18 and 65 years.

In addition to wages we also have information about sex, age and education. Furthermore, we know in which firm (and industry) an individual is working and thus he/she can be linked to our firm data. We have access to data for the period 1986 to 2000 and we use the information to estimate Mincer equations for each year over that period for individuals working in manufacturing (Figure 3). *Table A1* presents the results for selected years and for the private sector as a whole.

Table A1 Estimated wage equations 1986, 1992 and 2000 for manufacturing and 1992 and 2000 for the private sector. Dependent variable: log monthly wage.

	Manufacturing			Private sector	
Regressors	1986	1992	2000	1992	2000
Gymnasium ≤ 2 years (Upper secondary school)	0.093 (0.001)	0.104 (0.001)	0.057 (0.001)	0.095 (0.001)	0.051 (0.001)
Gymnasium = 3 years (Upper secondary school)	0.211 (0.001)	0.197 (0.002)	0.157 (0.001)	0.189 (0.001)	0.159 (0.001)
University < 3 years	0.240 (0.002)	0.242 (0.001)	0.270 (0.002)	0.247 (0.001)	0.270 (0.001)
University ≥ 3 years	0.515 (0.002)	0.526 (0.002)	0.552 (0.002)	0.469 (0.001)	0.475 (0.001)
Graduate studies	0.701 (0.007)	0.757 (0.007)	0.779 (0.005)	0.574 (0.003)	0.594 (0.003)
Experience	0.036 (0.0001)	0.020 (0.0001)	0.022 (0.0001)	0.020 (0.0001)	0.025 (0.0001)
$(\text{Experience})^2/100$	–0.054 (–0.0003)	–0.030 (–0.0003)	–0.035 (–0.0002)	–0.029 (–0.0002)	–0.040 (–0.0002)
Female	–0.214 (–0.001)	–0.138 (–0.001)	–0.117 (–0.001)	–0.151 (–0.001)	–0.151 (–0.0005)
Constant	8.752 (0.002)	9.261 (0.002)	9.333 (0.002)	9.259 (0.002)	9.527 (0.001)
R-square	0.521	0.394	0.401	0.384	0.345
Number of observations	198,675	262,100	377,050	666,024	1,172,417

Notes: White's heteroskedasticity-consistent standard errors within parentheses.

Since the number of individuals in our sample is quite large we can estimate separate Mincer equation for 18 manufacturing industries in 1986, 1990, 1993, 1996 and 2000, which we use in the analysis of changes in relative labor demand in section 3.2. From the estimates we calculate relative wages between skilled and less-skilled labor. *Table A2* shows the industries, relative wages for 2000, and annual average changes in relative wages between 1986 and 2000.

Table A2 Relative wages between skilled and less-skilled labor on industry level

SNI69 1986-90	SNI92 1990-2000	Industry	Relative wage 2000	Annual average change 1986-2000*
31	15+16	Food, beverages and tobacco	1.52	0.80
32	17+18+19	Textiles, apparel and leather	1.36	-0.72
33	20	Wood products	1.38	0.03
341	21	Paper and paper products	1.47	0.26
342	22	Printing and publishing	1.25	0.24
351/4–3522	23+24–244	Chemicals	1.46	0.38
3522	244	Drugs and medicines	1.38	0.13
355+356	25	Rubber and plastics	1.51	0.73
36	26	Stone, clay and glass	1.44	0.64
37	27	Basic metals	1.48	0.19
381	28	Metal products	1.45	0.56
382	29+30	Non-electrical machinery	1.51	0.65
383–3832	31	Electrical machinery	1.49	0.74
3832	32	Communication equipment	1.46	0.65
385	33	Professional goods	1.50	0.70
3843	34	Motor vehicles	1.43	0.63
384–3843	35	Other transport	1.57	0.42
39	36	Other manufacturing	1.33	0.23

Notes: * Percentage points. Skilled labor is individuals with 3-years of university and less-skilled labor has 3-years of gymnasium.

Data in the analysis of relative labor demand

Variables

Wage incomes W: Total wage incomes of employees.
Source: Statistics Sweden (SCB), Register-based labor statistics (RAMS).

Wage incomes skilled labor W^S: Wage incomes of employees with post-secondary education.
Source: SCB, RAMS.

Skilled-labor wage bill share P^W: $P^W = W^S / W$

Relative wage w_s / w_u *:* See above.

Capital stock K: Book value of buildings and machinery, 1991 prices.
Source: SCB, Financial accounts.

Real output Y: Value added, 1991 prices.
Source: SCB, Financial accounts.

R&D intensity RD/Q: *RD*: Expenditure on research and development, current prices. Source: SCB, R&D Statistics. *Q*: Production value, current prices. Source: SCB, Financial accounts. Years: 1987, 1991, 1993 and 1997.

Share of technicians TECH: Share of employees with post-secondary technical education in the beginning of each period, i.e. 1986, 1990, 1993 and 1996. Source: SCB, RAMS

Import competition from low-wage countries $\left(M / C\right)^{Low-wage}$: $M^{Low-wage}$: import from low-wage countries.

Footnote 22 defines the low-wage countries. C: consumption $C = Q + M - X$, where Q is production, M is total import and X is total export. Source: SCB, Foreign trade statistics and SCB, Financial Accounts.

Share of employment in foreign-owned firms FDI. Foreign-owned firms are firms where foreigners possess more than 50 percent of the voting rights. Source: SCB, Financial accounts.