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ABSTRACT

Swedish Multinationals and Competition from High- and Low-Wage Locations*

This study uses data on Swedish multinationals to estimate cross elasticities of labour demand in different locations. With a vertical decomposition of the firm's activities, whether there is substitution or complementarity between employment in different parts of the firm will depend on whether wage changes lead to a relocation of activities or simply to changes in marginal costs and/or demand for inputs in other parts of the firms. We find that there is some evidence of a substitutionary relationship between employment in the Swedish parts of the firms and employment in other high-income locations, but we do not find any evidence of substitution stemming from employment in low-income locations. We find mainly a relationship of complementarity between employment in different affiliates.

JEL Classification: F23, J23
Keywords: labour demand, multinational firms, vertically integrated

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NON-TECHNICAL SUMMARY

A central theme of policy debate in the 1990s has been the effect of increasing globalization. Economic activity in different countries is seen to have been becoming progressively more integrated. Although this process is likely to yield long-term efficiency gains, it is likely that some groups may lose out in the short-run.

One potential vehicle for closer economic integration of different parts of the world is Multinational Enterprises (MNEs). Through the MNEs' ability to shift production between locations, they may expose labour in their home countries to very direct wage-competition from labour in other countries. A relocation of activities from the home country to a foreign location will temporarily reduce home country employment, thereby affecting wages in a negative direction. Although such relocations are likely to enhance long-run efficiency, and therefore welfare, the associated adjustment costs may clearly affect welfare negatively. Especially, the release of low-skilled workers, as a consequence of a relocation of the MNEs' activities to low-wage countries, may generate adjustment costs for the home country.

However, although potential wage-competition from low-wage countries stemming from the MNEs' relocation of activities is a legitimate concern, employment in different locations do not have to be substitutes for each other. According to the theoretical literature on MNEs, which has been centred around the distinction between horizontal and vertical foreign direct investment (FDI), there may be a complementarity relationship between employment in different parts of the firm as well. With horizontal FDI, meaning foreign investments in the same type of activities as are conducted at home, we would expect mainly a substitutionary relationship between the firm's foreign and domestic activities as long as the produced good is tradable. Either the firm produces the good at home and then exports it, or it produces it in its foreign affiliate, in which case employment in the domestic part of the firm has to be lower than in the exporting case. With vertical FDI, however, meaning foreign investment in activities that are either upstream or downstream in relation to the activities undertaken at home, there is an element of complementarity between the firm's domestic and foreign operations. Both upstream and downstream activities are undertaken to produce the good that is demanded by the firm's customers. When one of these activities expands, it tends to bring with it an expansion of the other activity as well.

To illustrate how different parts of MNEs interact, we set up a simple model of a both horizontally and vertically integrated MNE, which operates in different locations. Wage changes in one location in which the firm operates may affect

employment decisions in another location through either of two channels. To begin with, increased wage differences between locations may induce the firm to relocate activities, in which case there is a substitutionary relationship between employment in the different locations. However, if the change in labour costs is not sufficiently large as to induce a relation of activities, there will be a complementarity relationship instead. Then, a wage change in one location will affect employment in locations conducting downstream activities through its effect on the cost of upstream activities. It will affect employment in locations conducting upstream activities through the demand for such activities. A wage increase in one location will thus either increase production costs in other locations as well, which tends to reduce output in these other locations, or reduce demand for other locations' output. In either case, the demand for labour in other locations tends to decrease. A relationship of substitution is more likely between locations that have similar wages and low bilateral trade costs, whereas the opposite is true for a complementary relationship.

In the empirical analysis we estimate cross-price (wage) elasticities within Swedish MNEs between three types of locations: the home country (i.e. Sweden), high-income locations and low-income locations. We use firm-level data collected by the Research Institute of Industrial Economics (IUI) that cover the period 1970 – 94.

For employment in the Swedish parts of the firms we find some evidence of a substitutionary relationship with affiliate-employment in other high-income countries, but no significant relationship with low-income countries. Consequently, there is some evidence of wage-competition, but it seems to stem from other high-wage countries rather than low-wage countries.

When we examine employment in affiliates located in other high-income countries, we find evidence of complementarity with employment in other high-income countries, while neither wages in Sweden nor in low-income locations seem to affect employment. Finally, we look at employment in low-wage locations. Also in this case, we find complementarity with similar (i.e. low-wage) locations. However, this effect seems to be restricted to affiliates located in low-wage countries in Europe (including Turkey).

All in all, we conclude that the relationship between employment in different parts of Swedish MNEs seems to be mainly complementary. In this respect, our results differ from results previously found for the US, where substitutability has been found between employment in affiliates in similar locations. However, the results are consistent with recent theorizing on MNEs in the sense that recent models predict that MNEs from small, skill-abundant countries should be mainly of the vertically integrated kind.

1 Introduction

One major concern regarding the operations of large multinational firms is that by locating activities abroad they may reduce employment and wages in their home countries. In particular, this is an issue that has been raised in connection with the expansion of these firms' operations in developing countries. By the multinational firms' ability to relocate activities to countries with lower wages, the home countries may become more exposed to factor price adjustment in terms of falling relative wages. Although a relocation of activities from the home country to affiliates abroad may enhance efficiency in production in the long-run, there may be substantial adjustment costs associated with this. Such relocations across locations may thus have significant impact on the overall welfare and income distribution of the countries in which the multinational firms operate.

However, the relationship between the multinationals' foreign employment and their domestic employment in the home country is not unambiguously a substitutionary one. According to the theoretical literature on multinationals, which has been centered around the distinction between horizontal and vertical foreign direct investment (FDI), there may be a complementarity relationship between employment in the domestic and foreign parts of the firm as well.[1]

With horizontal FDI, meaning foreign investments in the same type of activities as are conducted at home, we would expect mainly a substitutionary relationship between the firm's foreign and domestic activities as long as the produced good is a tradable. Either the firm produces the good at home and then exports it, or it produces it in its foreign affiliate, in which case employment in the domestic part of the firm has to be lower than in the exporting case.[2] With vertical FDI, however, meaning foreign investment in activities that are either upstream or downstream in relation to the activities undertaken at home, there is an element of complementarity between the firm's domestic and foreign operations. Both upstream and downstream activities are undertaken to produce the good that is demanded by the firm's customers. When one of these activities expands, it tends to bring with it an expansion of the other activity as well.[3]

[1] See, for instance, the survey by Markusen (1995).

[2] However, even in the case where a firm locates a production plant abroad simply to supply a foreign market from a foreign subsidiary, some complementary activities such as headquarter activities will be undertaken at home.

[3] Of course, there may be an element of substitution associated with vertical FDI as well. If an upstream or downstream activity previously conducted in the home country becomes relocated to a foreign affiliate, there will be substitution of foreign employment

To examine the effect of the multinationals' foreign activities on the domestic economy is a difficult task. There are two strands in the literature dealing with such issues. First, there is a literature dating from the 1970's, where the relationship between affiliate production and exports from the home country is analysed (e.g. Swedenborg 1979, Lipsey and Weiss 1981, 1982, Svensson 1996). The earlier studies showed that there seemed to be a positive effect of outward FDI on exports and this was taken to indicate that FDI tends to generate intra-firm trade because of the vertical nature of the firms' activities.[4] However, it is not possible to infer from these studies whether an expansion of foreign activities tends to reduce or expand domestic employment. For instance, if a downstream activity were relocated from the home country to abroad, there could very well be a positive effect on home country exports even though home country employment was reduced. Similarly, if exports were to decrease as a consequence of increased overseas activities at the firm level, home country employment could still increase if there were a more than offsetting expansion of production for the domestic market.[5]

There is also a more recent literature on the role played by outsourcing by multinational firms in reducing demand for unskilled labour in the home country (e.g. Slaughter 1995, Feenstra and Hanson 1996a, 1996b).[6] These studies are based on a Heckscher-Ohlin type of framework, where outsourcing is taken to lead to increased imports of unskilled labour intensive goods. The upshot of this literature is that outsourcing seems to play a limited role in affecting the relative demand for skilled and unskilled labor. However, these studies are conducted on industry-distributed data, which means that important information at firm-level is lost in these studies.

In two recent working papers, Brainard and Riker (1997a, 1997b) have used firm-level data for the U.S. to analyse the effect of affiliate employment on the demand for labour in other parts of the firm. They estimate labour demand equations within multinational firms, yielding estimates of cross-elasticities between labour demand in different parts of the firm. They find that for the U.S. multinationals, a substitutionary relationship seems to exist mainly between labour employed in affiliates located in the same type of locations with regards to their relative factor endowments (or rather

for employment at home.

[4]Svensson (1996), on the other hand, found a negative correlation between outward FDI and exports from Sweden.

[5]An early attempt to focus directly on the effect of outward FDI on home country employment is Kravis and Lipsey (1988) (see also Lipsey, 1994, and Blomström, Fors and Lipsey, 1997).

[6]See also Lawrence, 1994.

their relative endowments of skilled and unskilled labour). Between labour employed in affiliates located in different types of locations, i.e. one located in a high-wage country and the other located in a low-wage country, there seems to be mainly a relationship of complementarity.

This study employs a similar method as the one in Brainard and Riker (1997a, 1997b) and applies it to firm-level data on Swedish multinational firms. We thus estimate cross-elasticities, which enable us to assess the effect of wage changes in one type of locations on the demand for labour in another location and thus whether there is a relationship of complementarity or substitution between the employment in different parts of the firm.

In the analysis, we distinguish between affiliates located in high-income and low-income countries on the assumption that cross-elasticities may vary depending on the type of location. In particular, we are interested in examining whether employment in the Swedish parts of the firms is affected differently by wage changes in low-wage countries compared with wage changes in other high-wage countries. Furthermore, we also want to study whether there are differences in the effect on affiliate employment of wage changes in locations that are either of the same or different type with regards to whether it is a high-wage or low-wage location.

The analysis is based on the methodology used in the papers by Brainard and Riker (1997a, 1997b), but our study differs from theirs in several respects. To begin with, the type of multinational activity conducted by firms from a small country such as Sweden is likely to differ markedly from the activities of firms from a large country such as the US (cf. Markusen *et al.,* 1996). Therefore, the pattern of interaction between different parts of the firm may differ between Swedish and US MNEs. Furthermore, our empirical implementation differs somewhat from the one chosen by Brainard and Riker (1997a, 1997b). In particular, we explicitly address, and try to control for, potential problems of endogeneity with respect to wages and productivity differences across locations.

What we find is some evidence of a substitutionary relationship between employment in the Swedish parts of the firms and employment in other high-wage locations. However, between employment in the different foreign affiliates, there seems to be mainly a relationship of complementarity.

The paper is organised as follows: In section 2, the theoretical framework is presented. We use a simple model of a horizontally and vertically integrated firm that has production plants in several locations. The data used in the analysis is presented in section 3 and the specification of the econometric model explained in section 4. Section 5 presents and discusses the results and, finally, section 6 gives some concluding remarks.

2 Theoretical Framework

A firm with production units in several locations that only seeks to minimise production costs will choose to produce wherever it is least costly to do so. However, if the whole production process can be divided in separate stages and there are costs associated with trade between locations, an increase in production costs in one location does not necessarily lead to a relocation of production from that unit to another unit. It may be that the only effect is to increase production costs in other locations as well.

Moreover, if there is a relocation of production, this is likely to affect production costs in units not directly affected by this relocation. For instance, let us assume that a unit located abroad experiences a cost increase and this unit is located in a country that differs substantially from the home country in terms of relative factor endowments. In such a case it is more likely that the cost increase will lead to a relocation of production to plants located in similar locations with regards to relative factor endowments than to the home country. If these plants are related to the parent firm through trade flows, however, the increase in costs is likely to have a negative effect on production and employment at home. For instance, if the foreign plants serve the parent firm with components that are assembled at home, costs will increase in the parent firm as well, which in turn has a negative effect on product demand. If the parent firm instead exports components to the foreign plants, demand for components will decrease, with a similarly negative effect on labour demand in the home firm.

In order to analyse the different types of relationships that can prevail between the different parts of a multinational firm, we construct a simple model of a both horizontally and vertically integrated firm that has production plants in several locations.[7] More specifically, we assume that two distinct intermediate inputs have to be combined in order to supply the product in a market and that high trade costs make one of these inputs non-traded. We assume that the firm has some monopoly power, while it is a price taker in the labour market. Markets are assumed to be segmented so that the firm sets price independently in the different locations. The two different intermediate inputs are labeled X and Y, while the final product is labeled Q.

We assume the following production function for the firm:

$$Q = \min(X, Y) \qquad X = \gamma L \qquad Y = \lambda L \tag{1}$$

[7] The model is inspired by the theoretical framework used in Brainard and Riker (1997b).

where L denotes labour. If either X or Y are shipped across borders, an iceberg trade cost has to be incurred. We assume that when one unit of a good is shipped across a border, only $\tau < 1$ arrives at the destination. These trade costs differ between goods and pairs of locations.

The firm maximizes total profits Π, which can be defined as net revenue over all its locations i:

$$\Pi = \sum_i \left(P_i^D \left(Q_i \right) Q_i - w_i (\frac{1}{\gamma} X_i + \frac{1}{\lambda} Y_i) \right) \tag{2}$$

where $P_i^D \left(Q_i \right)$ is the inverse demand function, $X_i = \sum_j X_{ij}$, $Y_i = \sum_j Y_{ij}$, the first subscript being the index for the location in which the intermediate input is produced and the second one being the index for the location in which the intermediate input is used to produce the final good; and w is the wage rate.

Because there are trade costs associated with trade between locations, cross-hauling of the inputs X and Y will never occur. For each location i, the following relationship must hold:

$$Q_i = X_i + T_{Xi} = Y_i + T_{Yi} \tag{3}$$

where

$$T_{Gi} = -\sum_{j \neq i} G_{ij} \quad \text{if the affiliate exports good } G,\ G = X, Y \tag{4}$$

$$T_{Gi} = \sum_{j \neq i} \tau_{Gji} G_{ji} \quad \text{if the affiliate imports good } G,\ G = X, Y \tag{5}$$

If trade costs are high, production will be organised in a strictly horizontal fashion. This means that $T_{Gi} = 0$, i.e. there will be no intra-firm trade. In such a case, the different production units will operate completely independent of each other and wage changes in one location will not affect the demand for labour in another location.

To bring out the relevant results as clearly as possible, let us assume that trade costs associated with cross-border trade in X are prohibitively high. The motivation for this assumption is that for some activities, especially the supply of services such as marketing and sales services, there are very strong advantages with being in proximity to the consumers. We assume the following:

$$\tau_{Xij} w_i < w_j \qquad \forall i, j \tag{6}$$

which implies that $T_{Xi} = 0, \forall i$. X is thus now effectively non-traded and output of X will depend directly on the size of local demand:

$$Q_i = X_i \tag{7}$$

The total demand for labour in location i then becomes:

$$L_i = \frac{1}{\gamma} Q_i(P_i^D, \mathbf{w}) + \frac{1}{\lambda} Y_i \tag{8}$$

where $\mathbf{w}$ is the vector of wage rates in the different locations.

Expression (8) reveals that anything that affects the amount of final goods supplied in the domestic market will also affect the domestic labour demand. Q_i will depend on the domestic consumers' demand for the final product and cost factors affecting marginal costs of producing Q, which may not only include the domestic wage rates, but the wage rates in foreign locations as well. Labour demand will increase with an increase in domestic demand and decrease with increases in domestic wages. Labour demand will also depend of the amount of Y that is produced. Apart from the case where trade costs associated with Y are so high that Y becomes non-traded as well, there are two possible cases: the case where Y is produced and exported to other locations and the case where Y is not produced but instead imported from other locations. Let us analyse each of these two cases in turn.

2.1 *Case I: Y is exported*

If the production plant in location i exports Y to other parts of the firm, the amount exported will stand in direct proportion to the amount of the final good produced in each location and to the trade costs, i.e. $Y_{ij} = \frac{Q_j}{\tau_{Yij}}$, where τ_{Yij} is the trade cost associated with exporting from i to j.[8] Labour demand is then given by:

$$L_i = \left(\frac{1}{\gamma} + \frac{1}{\lambda}\right) Q_i(P_i^D, w_i) + \frac{1}{\lambda} \sum_{j \in E} \frac{Q_j}{\tau_{Yij}} (P_j^D, w_j, \frac{w_i}{\tau_{Yij}}) \tag{9}$$

where E is the set of locations that import Y from i (which will be the locations j for which the inequalities $w_i < \tau_{Yij} w_j$ and $\tau_{Yij} w_i < \tau_{Ykj} w_k$, $\forall k, k \neq i$ holds). Since Q_j will depend on local demand and wage rates in location j, it follows that an increase in product demand in location j will increase the demand for labour in location i, while an increase in wage rates in location j will decrease the demand for labour in location i. That is,

[8] The analysis is based on the assumption that i is the unique location with the minimum costs (i.e. marginal costs plus trade costs) of supplying Y to j.

$$\frac{dL_i}{dw_j} < 0,\ j \in E \tag{10}$$

This is the case where the relationship between labour demand in different parts of the firm is one of complementarity. However, in the case where the wage change is sufficiently large to produce changes in the trade pattern within the firm, there may be a different outcome. Suppose that there is a decrease in the wage rate in location j that is sufficiently large for the following inequality to hold:

$$w_j < \tau_{Yij} w_i \tag{11}$$

Production of Y may then shift from location i to location j, since it will be cheaper to produce Y in j than to import it from location i. An outcome with relocation of production will therefore lead to a substitutionary relationship of labor demand between different parts of the firm.

2.2 *Case II. Y is imported*

Assume now that $w_j < \tau_{Yij} w_i$, $\exists j$, which implies that Y will be imported to location i.[9] Domestic labour demand in location i is now given by:

$$L_i = \frac{1}{\gamma} Q_i(P_i^D, w_i, \frac{w_m}{\tau_{Yim}}) \tag{12}$$

where w_m is the wage in the location from which Y is imported and τ_{Yim} is the trade cost associated with imports to i from m. Location m is the location for which the following inequalities hold: $w_m < \tau_{Yim} w_i$ and $\tau_{Yij} w_m < \tau_{Yim} w_j$, $\forall j$. Because wage increases in the locations from which Y is imported will increase the marginal cost of producing Q in location i, Q_i is a negative function of the wage rates in those locations. Thus, a marginal increase in the wage rate in location m, will have a negative effect on the domestic labour demand in location i.

$$\frac{dL_i}{dw_m} < 0 \tag{13}$$

However, in the case where the wage change is sufficiently large to produce changes in the trade pattern within the firm, there may be a different outcome. Suppose the increase in the wages in location m is sufficiently large for the following inequality to hold:

[9] We assume that there is a unique location that has the lowest cost of supplying Y to i.

$$w_m > \tau_{Yim} w_i \tag{14}$$

Production of Y may then shift from location m to location i, since it will be cheaper to produce Y than to import it from location m. However, this outcome would require that $w_j > \tau_{Yij} w_i$, $\forall j$, i.e. that it is cheaper to produce Y in location i than to import it from any other location in which the firm has production units. If this is not the case, the production of Y would instead shift to another foreign location, and the resulting increase in the cost of producing Y would feed into an increase in marginal costs in location i. Thus, even in this case, there would be a negative effect on the domestic labour demand in location i.

However, if the inequality $w_j > \tau_{Yij} w_i$, $\forall j$, holds after the wage increase in location m, production of Y will shift to location i and there will be a discrete increase in the domestic demand for labour. The size of this increase will depend on whether location i will only produce the amount of Y that is used domestically, or if it will also produce Y for exports to other locations. Thus, in the case where the change in foreign wages is sufficiently large to create a relocation of production activities, there may be a relationship of substitution between foreign and domestic labour. However, from the point of view of a particular location, this is not necessarily the case, because the relocation may shift production to a completely different part of the firm.

Under what circumstances is it likely that a change in foreign wages will result in a relocation of activities? Except for the trivial observation that this is likely to occur for very large wage changes, we may also note that a relocation is more likely between locations that have similar wages, i.e. similar relative factor endowments and technologies, and between locations for which trade costs are low.

To conclude, demand for labour in location i will depend on domestic and foreign product demand together with domestic and foreign wages. In reduced form, the equation for labour demand in location i can be written as:

$$L_i = f(w_i, \mathbf{w}_E, \mathbf{w}_M, \boldsymbol{\tau}_{YiE}, \boldsymbol{\tau}_{YiM}, P_i^D, \mathbf{P}_E^D) \tag{15}$$

where $\mathbf{w}_E$ is the vector of wages in the locations to which location i is exporting, $\mathbf{w}_M$ is the vector of wages in the locations from which location i is importing. $\boldsymbol{\tau}_{YiE}$ and $\boldsymbol{\tau}_{YiM}$ denote vectors of trade costs for exports to and imports from other locations, while $\mathbf{P}_E^D$ is a vector of inverse demand for the final product in the locations to which location i is exporting. Whether changes in foreign wages have a positive or negative effect on domestic labour

demand depends on whether they lead to a relocation of activities or simply to a change in marginal costs.

In the empirical analysis, we shall estimate a log-linear variant of (15) where we put restrictions on the way wages and measures of product demand in different locations enter into the equation. As we have no direct measures of trade costs, these will be captured by fixed-effect dummies.

3 Data

We use firm-level data on Swedish multinationals within the manufacturing sector. These data have been collected since the early 1970's about every fourth year. In our sample, we have data for six years: 1970, 1974, 1978, 1986, 1990 and 1994.[10]

Over the time period that we consider, the full sample of Swedish multinationals cover some 700 observation at the firm level and some 3000 observation at the affiliate level. Only producing affiliates are included in the database.

In our analysis, we have eliminated affiliates that are operating in substantially different industries from the Swedish parent firm. This is done in order to ensure that the activities in the affiliates are sufficiently integrated with each other and the ones undertaken in the home part of the firm for there to be potential interactive effects on employment. We do not want to eliminate affiliates that operate in industries that can be considered to be either upstream or downstrem in relation to the industry of the parent firm, only those that conduct activities that are clearly very different from the parent company's core activity, thereby eliminating pure conglomerates. We have not eliminated any affiliates belonging to the same two-digit ISIC group as the parent. For affiliates belonging to a different two-digit group than the parent, we have used a case by case procedure to decide whether the affiliate should be eliminated or not.[11]

Moreover, we have eliminated all firms that appear only once or twice in the time series.[12] Having done this, we are left with an unbalanced panel with about 200 observations at the firm level and 1300 observations at the affiliate level. There are 44 firms included in the panel and 594 affiliates.[13]

[10] A description of these data can be found in Braunerhjelm and Ekholm (1998)

[11] In this process, we have eliminated less than five percent of the affiliates.

[12] On account of missing information about some of the variables included in the econometric analysis, we still have several firms which appear only twice in the estimations.

[13] These 44 MNEs employ between 74 and 86 percent of the total employment in Sweden that can be attributed to Swedish MNEs.

We divide the host countries into a high-income group and a low-income group based on the level of per capita income. Ideally, we would want to group countries according to their relative factor endowments and perhaps their geographical location as a basis for judging the relative importance of trade costs. However, per capita income can serve as a crude measure of both these things. The group of high-income countries consists of the Western European countries (except Greece, Portugal and Spain), the US, Canada, Japan, Australia and New Zealand, while the group of low-income countries consists of all other countries.

Before we enter into the specification of the econometric analysis, we shall present some descriptive evidence based on these data. Figure 1 shows the distribution of firm employment among the three different types of locations: the home location (i.e., Sweden), high-income foreign locations and low-income foreign locations. As can be seen from this figure, the relative importance of employment in Sweden has decreased over time. In this sense there is evidence of a substitution of foreign employment for domestic employment. However, it is also evident that it is mainly the group of high-income countries that have gained employment in relative terms. The increase in the share of employment in low-income locations is very modest; only a few percentage points.

In figure 2, we show the development of labour costs in high- and low-income locations, respectively, in relation to labour costs in Sweden.[14] The two solid curves show these relative labour costs based on our panel sample of multinationals. The Swedish wage is the average wage paid by our sample of Swedish multinationals. The wage in high-income (low-income) locations is the employment-weighted average of the wage paid by affiliates of all Swedish multinationals in our sample which are located in high-income (low-income) countries. Henceforth, we shall use the terms Swedish wage, wage in high-income locations and wage in low-income locations for these proxies of actual wages, but the reader should bear in mind that they are based on labour costs for our firm sample.

As can be seen from figure 2, the wage in both types of locations is lower than in Sweden in the beginning of the period. The real wage rate has increased in all three locations between 1970 and 1994, but, as is evident from Figure 2, real wages have increased more in both high- and low-income foreign locations than in Sweden. In the case of high-income locations, the wage has increased so much so that it surpasses the Swedish real wage towards the end of the period.

[14]The MNEs report all parent and affiliate data in Swedish kronor. Nominal wages have been deflated with industry-specific producer price indexes supplied by Statistics Sweden.

Two observations can be made in relation to this. First, the fact that the type of location that has substituted the most for Swedish employment is a location where wages have risen more than in Sweden is evidence against wage competition between the Swedish parts of the firms and the foreign parts of the firms. Second, the difference in the development of the Swedish wage rate and the wage rate in high-income locations could be evidence of a successive shift in the skill-composition of the labour force in different types of locations. In other words, the skill-intensity may have risen faster in the high-income foreign locations than in Sweden. The broken line in Figure 2 shows the relative wages in overall manufacturing in high-income locations *vis-a-vis* manufacturing in Sweden.[15] By comparing this curve with the curves based on the sample of Swedish MNEs, we see that relative wage changes within the Swedish MNEs follows the same pattern as overall manufacturing. Thus, there may very well be a shift of skilled activities towards high-income locations, but the shift then only seems to reflect a more general development found for the manufacturing sector as a whole. In any case, this evidence suggests that there may have been a substitution of skilled workers between the Swedish parents and affiliates located in other high-income countries (cf. Blomström, Fors and Lipsey, 1997).

4 Estimation

In our econometric analysis we estimate two different types of labour demand equations; one that focuses on the relationship between employment in the parent firms in Sweden and the employment in the foreign affiliates and one that focuses on the relationship between affiliate employment in different types of locations.

In the first type of equation, we estimate the effect of wage changes in high- and low-income foreign locations, respectively, on the employment in the Swedish parts of the firms. More specifically, we estimate the following equation:

$$\ln L_{it}^0 = \alpha + \delta_i + \gamma_t + \beta_0 \ln w_{it}^0 + \beta_1 \ln w_{it}^H + \beta_2 \ln w_{it}^L + \beta_3 \ln D_{it}^0 + \beta_4 \ln D_{it}^E + \varepsilon_{it} \tag{16}$$

where L_{it}^0 is employment in the home part of firm i, w_{it}^0 is the wage rate in the home country, w_{it}^H the wage rate in high-income countries and w_{it}^L the wage rate in low-wage countries. The wage variables w_{it}^H and w_{it}^L are averaged

[15] Here, the calculations are based on data from the STAN database compiled by the OECD.

over all high- and low-income host-countries, respectively, in which firm i operates. The variable D_i^0 is a measure of domestic final demand and D_i^E a measure of demand in countries to which the firms export. The subscript t denotes time. The parameter δ_i captures a fixed firm-specific effect and γ_t a fixed time-effect.

In order to reduce potential problems of endogeneity, our measures of w_{it}^0, D_i^0 and D_i^E are based on industry data for Sweden. The wage in Sweden, w_{it}^0, is measured by industry-distributed average labour costs in Swedish manufacturing.[16] The variable D_i^0 is proxied by industry-distributed domestic consumption and D_i^E by industry exports.[17] Ideally, we would like to have exogenous wage cost data for all the other countries too, but finding such data is difficult.[18] The variables w_{it}^H and w_{it}^L are therefore instead calculated in the following way: First we construct a wage rate for each location in the sample by taking the average over all affiliates of all the firms in the sample that are located in that particular host country. Then we construct employment-based averages for each parent firm distinguishing between high- and low-income locations.[19]

We expect β_0, the elasticity showing the effect of changes in the domestic wage on domestic employment, to be negative, while we expect β_3 and β_4 to be positive. The sign of β_1 and β_2, which can be interpreted as cross-elasticities showing the effect of changes in foreign wages on domestic employment, will depend on whether affiliate employment substitutes or complements employment in the home part of the firms.

In the second part of the analysis, we follow Brainard and Riker (1997b) in performing an analysis where we utilise the information on the affiliates in the data-set. More specifically, we estimate the following equation:

$$\begin{aligned} lnL_{jt} &= \alpha + \delta_j + \gamma_t + \beta_0 \ln w_{jt}^0 + \beta_1 \ln w_{jt}^H + \beta_2 \ln w_{jt}^L + \beta_3 \ln w_{jt}^S \\ &\quad + \beta_4 \ln D_{jt}^0 + \beta_5 \ln D_{jt}^S + \beta_6 \ln Y_{jt}^0 + \varepsilon_{jt} \end{aligned} \tag{17}$$

where L_{jt} is the employment in affiliate j, w_{jt}^0 is the wage rate in the host

[16] Wage data have been collected from *Industristatistiken* (Statistics Sweden) while information about payroll taxes have been supplied by the Swedish Employer's Confederation.

[17] Data on industry-distributed consumption are collected from the STAN database (OECD, 1998) and data on industry-distributed exports have been supplied by Statistics Sweden.

[18] However, in section 5 we also give results where exogenous unit labor cost data has been used instead of wages for the high-income countries.

[19] That is, we define the variables as $w_{it}^H \equiv \sum_{k \in H} \frac{L_{ikt}}{L_{it}} w_{ikt}$ and $w_{it}^L \equiv \sum_{k \in L} \frac{L_{ikt}}{L_{it}} w_{ikt}$, where H and $L$are the sets of high- and low-income host countries, respectively, and w_{ikt} is measured as an average over all affiliates in the sample that are located in country k.

country of affiliate j, w_{jt}^H and w_{jt}^L are the wage rates in the high- and low-income locations, respectively, that other affiliates of affiliate j's parent firm are located in, and w_{jt}^S is the wage rate in Sweden in the industry in which the parent firm operates. The wage variable w_{jt}^0 is an average over all the affiliates in the sample that produce in affiliate j's host country, subtracting affiliate j. The wage variables w_{jt}^H and w_{jt}^L are the employment-based averages of the wage rates in other host countries in which the parent firm of affiliate j operates.

The variable D_{jt}^0 is a measure of local demand and here we follow Brainard and Riker (1997b) in proxying this with aggregate consumption of affiliate j's host country.[20] The variable D_{jt}^S is Swedish consumption in the industry in which affiliate j operates.[21] This variable is included as a proxy for intra-firm export demand on the grounds that it may capture the demand for exports to the home country. Finally, the variable Y_{jt}^0 is a proxy for overall labour productivity in host country j (measured as real GDP per capita).[22] This variable is included in order to avoid potential problem stemming from the fact that labour may be hetergenous rather than homogenous, as assumed in our model. If labour is heterogenous between locations (e.g. in terms of skill), labour productivity may differ across locations and wages may partially reflect productivity differences instead of pure cost differences. By including Y_{jt}^0, we attempt to control for differences in overall labour productivity between locations.

5 Results

Table 1 presents the results from the regressions using parent firm employment as regressand. The first two columns contain the results from regressions on the sub-set of firms that have affiliates in both high- and low-income locations (in the second column, the wage rate in low-income locations has been dropped), whereas the third column contains results from regressions on the sample of firms that have affiliates in high-income locations only. As expected the estimates of β_3 and β_4 are positive, but the regressions perform badly in some other respects. The precision of the estimates is fairly low, and the point estimates of β_0 are positive.

In the regressions performed on the sub-sample of firms with affiliates in both high- and low-income locations, the only significant estimates are the

[20] Data have been collected from World Development Indicator (World Bank, 1998).

[21] Data are the same as for industry-distributed consumption in (16), i.e., these data are collected from the STAN database (OECD, 1998).

[22] The data have been collected from Penn World Tables 5.6.

ones for the cross-elasticity with respect to wages in high-income locations and for the export demand variable. Dropping the wage rate for low-income locations from the regression has very little effect on the point estimates, which means that they are at least robust to the elimination of this variable. The estimate of the cross-elasticity with respect to wages in high-income locations has a positive sign, indicating a relationship of substitution between parent firm employment and affiliate employment in high-income locations. The estimate indicates that a one percent increase in wages in other high-income locations in which Swedish multinationals operate would increase employment in the Swedish parts of the firms with 0.8 percent. However, we do not find any evidence of a substitutionary relationship between employment in the Swedish parts of the firms and affiliate employment in low-income locations.

In the third column we report the results for the sample with affiliates in only high-income locations (reported as regression (3) in Table 1). This estimation also yields positive estimates for the coefficients of the demand variables, whereas the estimate of the own-wage elasticity now has the expected negative sign (although it is still insignificant). The estimate of the cross-elasticity β_1, however, switches sign and becomes insignificant. Thus, while we do find some evidence of a substitutionary relationship between employment in Sweden and employment in affiliates in high-income locations for firms that have affiliates in both high- and low- income locations, we do not find any evidence of such a relationship for the sample of firms with affiliates in only high income locations.[23]

It is interesting to note that we cannot reject the hypothesis that domestic consumption has no effect at all, whereas exports have a significantly positive effect on parent firm employment. An interpretation is that for multinational firms based in a small country such as Sweden, the domestic market constitute such a small part of the firms' total markets so that changes in domestic demand have very small effects on employment decisions.

It is also interesting to note that the econometric evidence of a substitutionary relationship between employment in Sweden and employment in affiliates in high-income locations gives a different picture than the overall trend, as displayed in Figures 1 and 2, where relative employment has increased in the high-income locations where wage costs have increased faster than in Sweden. This is indicative of the fact that whereas Figures 1 and 2 highlights the time dimension of employment and wages in Swedish MNEs,

[23]A closer look at the firms with affiliates in only high-income locations shows that these firms are located in natural-resource intensive and capital intensive low-tech sectors as Pulp & Paper, Steel & Iron and Rubber products. It is likely that changes in labor cost differences between locations have a weaker effect on labour demand in these industries.

they are of little use in determining how employment in different locations within a MNE interact.[24]

We now turn to the regressions based on equation (17). In Table 2, results from regressions with affiliate employment in high-income countries are reported. The table reports results from two different regressions; the difference lying in the level on which the fixed effects enter into the equation. We have only a few observations over time, while quite a few of the affiliates do not remain in the sample over the whole time period. Therefore, we specify the fixed effects not only on the affilate level, but on the firm level as well. By specifying fixed effects on the firm level, we are able to to increase the number of observations relevant for the within-variation. In regression (1) the fixed effects are based on the identity of the affiliate, exactly as specified in (17), whereas, in regression (2), they are instead based on the identity of the firm. The assumption underlying regression (2) is that there are differences in characteristics at the level of the firm rather than at the level of the affiliate that need to be controlled for. Affiliate-specific fixed effects control for both firm and location characteristics. Since we believe that location characteristics may be important, in regression (2) we control for locations by also including country dummies.

As can be seen from Table 2, the two different specifications yield similar results. As expected, the estimates of the elasticity for the local wage are negative and the estimates of the coefficient for local aggregate consumption are positive. The estimates of the cross elasticities with respect to high- och low-income locations, respectively, are both negative, indicating a relationship of complementarity with both types of locations. The point estimates are somewhat higher in regression (2) compared to regression (1). However, the precision of the estimates in (1) is higher. The estimated cross-elasticity with respect to the Swedish wage is insignificant.

The results suggest that there is a stronger complementarity between affiliates located in different high-income countries than between affiliates that are located in different types of locations. This result contrasts starkly to the findings of Brainard and Riker (1997) for U.S. firms, where there is a relationship of complementarity between affiliates in different types of locations and a substitutionary relationship between affiliates in the same type of locations. One interpretation of this result is that trade costs really matter for the kind of vertical decomposition of production stages that we believe gives rise to a complementarity relationship between employment in different affil-

[24]The estimated coefficients of the time dummies included in the regression bear out the strong trend-wise reduction of the MNEs' employment in Sweden which underlies Figure 1.

iates. While differences in production costs may be larger between affiliates located in high- and low-income countries, from the perspective of the affiliates in high-income countries, this difference may be offset by larger trade costs. Therefore, there may be more of a vertical decomposition between the different affiliates in high-income countries than between these affiliates and affiliates located in low-income countries.

In Table 3, we present the results for the same type of regressions for affiliate employment in low-income countries. Here, the problem with our panel being unbalanced becomes crucial. To begin with, because the foreign activities of Swedish multinationals are heavily biased towards industrialised countries, the number of affiliates located in low-income countries is much lower than the number of affiliates located in high-income countries. Moreover, fairly few of the affiliates remain in the sample for more than three points of observation. This means that our estimation based on (17) performs very badly indeed. However, in regressions with firm-specific fixed effects instead of affiliate-specific fixed effects, we are able to increase the precision in our estimates considerably. Table 3 presents results from the regressions with firm-specific fixed effects, whereas the results from the regressions with affiliate-specific fixed effects are presented in appendix.

Looking at the results presented in the first column of Table 3, we see that the estimated own-wage elasticity is again negative, while the estimated coefficient of local aggregate demand is positive. The cross elasticity showing the effect of wage changes in high-income countries is positive, but not significantly different from zero. However, the cross elasticity for wages in other low-income locations is significantly negative, indicating a relationship of complementarity between employment in different low-income locations. This is a slightly odd finding, as it would suggest that affiliates located in different low-income locations are more strongly linked to each other through intra-firm trade in inputs than affiliates located in different types of locations with respect to whether they are low- or high-income locations.

However, if we decompose the affiliates located in low-income locations along geographical lines, we find that the complementarity effect really stems from affiliates located in low-income countries in Europe. In the second and third columns of Table 3, we show the result from regressions run separately for affiliates in low-income countries in Europe (to which we have included Turkey) and for affiliates in the rest of the low-income countries (because there are no African countries represented in the sample, this corresponds to affiliates in Asian and Latin American countries). As it turns out, the cross-wage elasticity with respect to wages in low-income countries is strongly negative for the affiliates in the European low-income countries, while we cannot reject the hypothesis that the corresponding elasticity for the affiliates

in other low-income countries is zero. Hence, there seems to be vertical linkages between affiliates in low-income locations and affiliates in low-income locations in Europe, while we do not find any evidence of linkages at all between affiliates in low-income locations in Asia and Latin America and other affiliates.

We may also note that in these regressions, our control variable for differences in labour productivity is positive and significant, whereas it was insignificant in the regressions for affiliates in high-income locations. Again the estimated cross-elasticity with respect to the Swedish wage is insignificant.

In order to further explore whether the heterogeneity of labour may bias our results, we also use PPP adjusted unit labor cost (ULC) data to check the robustness of our previous results.[25] The ULC data also have the additional benefit of being exogenous to the MNEs. However, a drawback is that we only have ULC data for high-income locations, which means that we are only able to analyse cross-elasticities between high-income locations and Sweden. Furthermore, the data on ULC is country and time-specific and, hence, we have no variation in labour costs across firms and affiliates in the same location. This means that we are not able to include country-specific dummies in the regression with fixed-effects at the firm level using affiliate employment in high-income locations as dependent variable (which we did in column 2 of Table 2 and in Table 3).[26] Unit labour cost composites for individual firms are constructed in the same way as in the previous analysis and all the other data are the same. We present the results in Table 4.

The first column of Table 4 shows the results for employment in the parent firm in Sweden. The results are similar to those presented in column 2 of Table 1, with the exceptions that the estimated own wage elasticity is negative (but insignificant) while the substitutionary relationship with high-income locations is no longer significant (but the estimated coefficient is still positive). Exports is the only variable that turns out to be significant.

The second and third columns of Table 4 show the results from the regressions for employment in high-income affiliates. The signs of all the estimated coefficients are the same as in Table 2, although the precision of the estimates is generally somewhat lower. The estimated own-wage elasticity is negative, as is the estimated cross-elasticity with respect to wages in other high-income

[25] Specifically, we use data on current wage costs (w), employment (L) in the private business sector, volume GDP (GDP), and the PPP exchange rate with respect to USD (PPP) to construct a unit labor cost variable: $ULC = \frac{wL}{GDP \times PPP}$. All data are collected from *Economic Outlook (*OECD, 1998*)*.

[26] In this regression, not only the own labour cost variable but also the variable capturing local demand only vary across countries.

locations (indicating complementarity). The estimated cross-elasticity with respect to Sweden is positive (indicating substitution), although insiginificant. Local and Swedish demand both yield positive estimated coefficients; however, only the former is significant.

The regressions based on unit labour costs data are thus consistent with the findings from the other regressions; namely that there seems to be some evidence of substitution between parent firm employment in Sweden and employment in high-income foreign locations and that there is a relationship of complementarity between affiliates in different high-income locations.

6 Concluding Remarks

In this study we have analysed to what extent labour employed in different parts of a multinational firm are substitutes for or complement to one another. Based on data for Swedish multinationals, we find some evidence of a substitutionary relationship between parent firm employment in Sweden and affiliate employment in other high-income locations. However, we do not find any evidence of a relationship in either direction between parent firm employment and affiliate employment in low-income locations.

When we estimate cross-wage elasticities for affiliates located in high- and low-income locations, respectively, we find mainly a relationship of complementarity. We interpret this as indicating the importance of a vertical decomposition of production stages within firms, where affiliates serve each other through intra-firm trade in inputs. Our results are in this respect different from what has previously been found for the U.S., where complementarity only seems to prevail between affiliates in locations with different relative endowments. One possible explanation for this difference in results is that Swedish MNEs are vertically integrated to a larger extent than US ones. This is consistent with the results found in recent models of FDI (e.g. Markusen *et al.*, 1996), where vertically integrated MNEs tend to dominate in small and skilled-labour abundant countries.

For affiliates located in high-wage countries, there seems to be stronger complementarity with affiliates located in other high-income locations. A possible interpretation of this result is that higher trade costs associated with trade with low-income countries offset the potential gains from lower production costs so that the extent of vertical decomposition is larger between affiliates in different high-income locations than between affiliates in high- and low-income locations.

We also find complementarity between affiliates located in low-income countries in Europe and other affiliates located in low-income countries. Em-

ployment in affiliates located in Asia and Latin America, however, does not seem to be affected by wages in other locations.

All in all, we conclude that we do not find any evidence of competition from low-wage countries having a negative impact on employment in Sweden through the activities of multinational firms. If there is an element of wage-competition from other countries, it seems to stem from other high-wage countries rather than from low-wage countries. Overall, the employment in different parts of firms seem to be linked through a relationship of complementarity rather than substitution.

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Table 1. *Results from fixed-effects regression. Regressand: parent firm employment*

Regressors:	(1)	(2)	(3)
w^0	0.17	0.16	-0.25
	(0.28)	(0.28)	(0.46)
w^H	0.77*	0.77*	-0.08
	(0.35)	(0.35)	(0.20)
w^L	0.06	--	--
	(0.11)		
D^0	0.08	0.07	0.41
	(0.13)	(0.13)	(0.48)
D^E	0.35*	0.35*	0.24*
	(0.09)	(0.09)	(0.11)
Constant	-7.84	-7.10	-1.44
	(6.34)	(6.17)	(12.1)
Number of observations	120	120	78
Obs. per group (min/avg/max)	2/4.0/6	2/4.0/6	2/4.0/6
R^2 (within)	0.35	0.35	0.16
F-test:			
Prob(firm dummies=0)	0.00	0.00	0.00

Note: Regressions (1) and (2) are performed on a sub-sample consisting of firms with affiliates in both high- and low-income locations. Regression (3) is performed on the sub-sample of firms with affiliates in high-income locations only. Standard errors are reported in parentheses. The regressions also include time dummies, which are not reported. An asterisk (*) indicates significance at the 5 percent level.

Table 2. *Results from fixed-effects regressions. Regressand: affiliate employment in high-income location*

Regressors:	(1)	(2)
w^0	-0.41*	-0.56*
	(0.18)	(0.23)
w^H	-0.68*	-0.98
	(0.26)	(0.56)
w^L	-0.11	-0.21
	(0.08)	(0.13)
w^S	0.20	-0.07
	(0.17)	(0.41)
D^0	0.22	0.23*
	(0.14)	(0.03)
D^S	0.07	0.04
	(0.05)	(0.13)
Y^0	-0.16	-0.39
	(0.50)	(0.38)
Constant	9.51*	19.0*
	(4.58)	(8.84)
Number of observations	880	919
Obs. per group (min/avg/max)	2/3.0/6	4/30.6/157
R^2 (within)	0.06	0.07
F-tests:		
Prob($\beta_1=\beta_2$)	0.03	0.18
Prob(affiliate dummies=0)	0.00	
Prob(firm dummies=0)		0.00

Note: Standard errors are reported in parentheses. Both regressions include time dummies and regression (2) includes country dummies, which are not reported. The results reported in column (1) refer to a regression with affiliate-specific fixed effects, whereas the results reported in column (2) refer to a regression with firm-specific fixed effects. An asterisk (*) indicates significance at the 5 percent level.

Table 3. *Results from fixed-effects regressions. Regressand: affiliate employment in low-income locations*

Regressors:	*All affiliates*	*Europe*	*Asia/Latin America*
w^0	-0.36*	-1.27	-0.29*
	(0.14)	(0.89)	(0.16)
w^H	0.17	-0.22	0.02
	(0.68)	(1.43)	(0.74)
w^L	-0.81*	-1.65*	-0.29
	(0.19)	(0.63)	(0.21)
w^S	-0.75	-0.64	-0.80
	(0.39)	(0.85)	(0.42)
D^0	0.28*	1.91	-0.00
	(0.06)	(1.01)	(0.10)
D^S	-0.10	0.28	-0.09
	0.13)	(0.23)	(0.1)
Y^0	0.44*	1.42	0.52*
	(0.17)	(1.71)	(0.20)
Constant	16.6	-12.9	18.3
	(10.5)	(30.5)	(11.3)
Number of observations	380	71	309
Obs. per group (min/avg/max)	4/21.1/49	2/6.5/11	2/17.2/40
R^2 (within)	0.44	0.51	0.49
F-tests:			
Prob(β_1=β_2)	0.17	0.31	0.69
Prob(firm dummies=0)	0.00	0.00	0.00

Note: Standard errors are reported in parentheses. The regressions also include time and country dummies, which are not reported. An asterisk (*) indicates significance at the 5 percent level.

Table 4. *Results from fixed-effects regression with unit labor cost data.*

Regressors:	*Parent firm*	*High-income affiliates*	*High-income affiliates*
w^0	-1.35	-0.57	-0.69
	(1.53)	(0.42)	(0.43)
w^H	0.77	-2.05*	-1.72
	(1.27)	(0.75)	(1.38)
w^S	--	1.98	2.01
		(1.00)	(1.76)
D^0	-0.13	0.34*	0.20*
	(0.16)	(0.08)	(0.03)
D^E	0.21*	--	--
	(0.08)		
D^S	--	0.08	0.06
		(0.05)	(0.12)
Constant	15.44*	2.90*	4.13
	(2.57)	(1.22)	(2.44)
Number of observations	197	1048	1083
Obs. per group (min/avg/max)	2/4.5/6	2/3.0/6	3/24.6/157
R^2 (within)	0.13	0.06	0.05
F-test:			
Prob(affiliate dummies=0)		0.00	
Prob(firm dummies=0)	0.00		0.00

Note: Standard errors are reported in parentheses. The results reported in the second column refer to a regression with affiliate-specific fixed effects, whereas the results reported in the last column refer to a regression with firm-specific fixed effects. The regressions also include time dummies, which are not reported. An asterisk (*) indicates significance at the 5 percent level.