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Abstract

The objective of this paper is to analyze relative employment effects in Sweden due to offshoring. In contrast to most previous studies in this field, our analysis is based on firm level data. More specifically the dataset contains Swedish manufacturing firms, 1997-2002. In addition we have access to actual firm level import data on intermediate goods and services, respectively. The results show that the relative demand for high skilled labor is positively affected by service offshoring and offshoring of goods to Asia, but negatively affected by offshoring to high income countries. The relative demand for medium skilled labor is negatively affected by offshoring of goods to Eastern Europe, but positively affected by offshoring to high income countries. In contrast to expectations, the results show that the relative demand for low skilled labor is positively affected by offshoring of goods to Eastern Europe. However, these results are related to very small elasticities, which in turn translates into a small number of jobs affected.

JEL Classification: F14, F23, L23

Keywords: Offshoring, firm level data, relative employment, translog cost function

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1 Introduction

The objective of this paper is to analyse the relationship between offshoring and relative labor demand at the firm level in the Swedish economy. A key feature of the Swedish economy is the increased internationalization of the production of goods and services through international outsourcing, hereafter called offshoring. The decision on where to move production depends upon differences in comparative advantages and wages. In the US and in several other OECD countries national concerns have been raised against "the exports of low skilled jobs" to other countries. The US congress has to some extent listened to this fear and introduced some degree of protection against foreign multinational firms exploiting cheap labor and outsourcing of domestic production to other countries; see Kurz (2006). Swedish firms have mostly used Central and Eastern Europe, and in recent years also China and India, as their base for offshoring. There is an increasing trend of offshoring both world wide and in Swedish firms. According to EEAG (2005), international outsourcing as a share of inputs in Sweden has increased from 23 to 28 percent between 1995 and 2000.

Offshoring involves fragmentation of the production process across countries when there are differences in the relative endowments of skilled and unskilled labor or technology and natural resources between countries (Venables et al., 2005; Dunning, 1993). This means that parts of the ongoing production of goods or services are moved abroad and long-term agreements are signed between firms in two or more countries. In contrast to so called international outsourcing which only refers to contracts between detached sub-contractors offshoring includes contracts with both detached and majority owned affiliates abroad. Offshoring is expected to lead to both efficiency gains and changes in the firm structure and labor force composition.

Despite the media attention offshoring has created, there are still only a few studies that have analyzed the effects of offshoring on firms' efficiency and structure. International offshoring, outsourcing abroad, is usually the focus of attention, where imports are used as a proxy for offshoring. Further, most of the empirical studies are based on industry level data instead of firm level data. The advantage of using firm level data is that one can control for heterogeneity across firms. It is reasonable to expect the relationship between offshoring and labor demand to be different for different firms, even within the same industry.

The classic reference for studies of the relationship between offshoring and labor market effects is Feenstra och Hanson (1996; 1999), who estimated effects on relative wage differentials for high and low skilled labor in the US. More recent studies use a similar approach to estimate the relationship between offshoring and labor demand using industry level data for various countries; see, e.g. Falk and Koebel (2002), Strauss-Kahn (2004), Amiti and Wei (2006), Hijzen et al. (2005), and Ekholm and Hakkala (2006). However, these studies show no unanimous results.

Estimating a conditional labor demand function on US data, Amiti and Wei (2005) find that service outsourcing has no significant effect on labor demand, while there is a positive effect of material outsourcing. They argue that this is in line with previous results by Hanson et al. (2003) who find that there is complementarity between labor demand in foreign US affiliates and their parent firm. Using industry level data on the UK, Hijzen et al. (2005) report a negative and significant effect on the relative demand for unskilled labor. In a similar study using Swedish data, and dinguishing between offshoring to different regions, Ekholm and Hakkala (2006) find that offshoring to low income countries shifts labor demand away from workers with an intermediate level of education. They do however not find any significant effect on labor demand from offshoring to high income countries. Using data on Swedish multinational firms, Hansson (2005) finds clear effects on relative labor demand regarding foreign direct investments to non-OECD countries. It is therefore reasonable to believe that relative labor demand effects are different using firm level data rather than industry level data. This paper contributes to the literature by showing results on the relationship between offshoring and relative labor demand using firm level data where we are able to distinguish country of origin for imports of goods and services (waiting for this data regarding services). Further, the dataset contains information on the owner structure which makes it possible to distinguish between so called inhouse offshoring and offshore outsourcing. Employment is divided according to level of education, where we distinguish between skilled, medium skilled and unskilled labor.

The rest of the paper is organized as follows. In the next section we discuss the theoretical motives for the link between outsourcing/offshoring and effects on relative wages and labor demand in the home firm, and some descriptive statistics. In Section 3 we present the empirical specification, the dataset and the results. The paper concludes with Section 4.

2 Offshoring and labor demand

Firms are profit maximizers and strive to achieve efficiency in production. Firm level productivity can increase if increased competition on the product market induces firms to replace expensive and inefficient own production with intermediate goods and services or other purchases from national sub-contractors with cheaper imports. These efficiency gains arise when sub-contractors are specialized in the production of a certain good or service. The firm can thus focus on the main activity. According to the theory of comparative advantage such specialization will lead to mutual gains between countries when they engage in trade. Offshoring can thereby imply that the firm is offered a wider variety in the choice of goods and services when production is moved abroad. Finally, offshoring can also be a necessary step for a firm who wishes to expand but lacks access to proper competence in the home country.

A Swedish firm can, e.g. offshore by hiring agents in low-income countries to produce un-

skilled intense intermediate goods and services. In this way the firm can focus the domestic activity on production where it has a comparative advantage. Structural changes induced by offshoring can therefore lead to changes in productivty which in turn can affect labor demand, partly because the same amount of output now can be produced with less labor input, partly because domestic employment is substituted for less expensive intermediate imports. Thus, it is possible that offshoring will affect the relative demand for labor of different skill groups. However, the size of the net effect is an empirical question to answer.

Grossman and Helpman (2005) develop a theoretical model where they analyze factors that are important for the firm's decision about where to outsource activities. Since finding an appropriate partner for outsourcing involves a search cost, they argue that country size is important in the sense that a larger (or thicker) market makes it easier for the firm to find an appropriate partner. In the same manner, highly developed infrastructure and communication technology will affect the search cost negatively and therefore facilitate outsourcing. It is also important that the suppliers are able to customize the product according to the outsourcing firm's needs, and that the partners are able to establish a dependable relationship.

It is also reasonable to believe that the factor content of offshoring differs between countries or regions. We expect that offshoring to countries with comparative advantage in labor intensive production will have a negative effect on relative demand for low skilled labor. However, offshoring to more developed countries is likely to have a similar factor content as domestic production which means that there may not be any particular impact on the relative demand for labor of various skills due to comparative advantage. Thus, in order to distinguish between these effects of offshoring we divide imports of intermediate goods into four regions according to the country of origin. As mentioned in the Introduction, Eastern Europe has traditionally been important for Swedish firms in terms of offshoring. This region is interesting in the sense that wages are relatively low even when controlling for productivity and level of education.[1] This is in contrast to Asia where the level of education is lower and thus, unskilled labor more abundant. According to Barro and Lee (2000) the average level of education has increased in general across countries during the period 1975-2000. However, it appears as if, e.g. Japan and South Korea have caught up with Sweden while China and India are still lagging behind. In addition, public expenditures on education as a share of GDP is approximately 2.6 percent in China and India, as opposed to an average of 6.1 percent in Hungary and Poland and 7.5 percent in Sweden. This difference is also reflected in the share of university students. However, there is no apparent difference in R&D expenditures relative to GDP between countries in Asia (China and India) and Eastern Europe (Hungary and Poland); see Hansson et al. (2007).

In this paper we use the narrow definition of offshoring which was first introduced by Feenstra and Hanson (1999) and later used by, e.g. Hijzen et al. (2005) and Ekholm and Hakkala (2006).

[1] Hansson et al. (2007).

This means that we limit offshoring to only include imports of intermediate goods for firms in a given industry within the same two-digit industry. Feenstra and Hanson (1999) argue that the narrow definition is preferred to a broader definition, imported inputs from all industries, since the former is closer to what is thought of as fragmentation within industries.[2] In addition, and in line with Hijzen et al. (2005), we prefer the narrow definition since we are interested in analyzing offshoring as a channel for changing the relative demand for labor in a similar sense as factor biased technological change, which in empirical work traditionally has been proxied by innovation activity. Since most of the variation in relative demand for labor takes place within industries (see e.g., Hansson, 2000) the narrow definition is more in accordance with within industry changes.

Figure 1 shows total offshoring of intermediate goods and services in Swedish manufacturing firms. It is apparent that there is more offshoring of goods than service, but that the latter has increased dramatically over the period 1997-2002. Let us next take a closer look at offshoring of goods. With the results of Grossman and Helpman (2005) in mind, it is reasonable to expect that Swedish firms outsource activities to other developed and high income countries to a larger extent than to developing and low income countries. This is also in accordance with Figure 2 which shows offshoring of intermediate goods divided according to four offshoring regions. As Hansson (2005) point out, offshoring to e.g. Eastern Europe only took off in 1993. Though offshoring to this region is still very low compared to offshoring to high income countries, it has doubled during the period of study. Also Asia appears to be a growing base for offshoring.

FIGURE 1 ABOUT HERE

FIGURE 2 ABOUT HERE

3 Empirical analysis

3.1 Empirical specification

We will apply the - by now - standard empirical specification suggested by Berman et al. (1994), which originates from a translog cost function specified in Appendix. Here, labor of various skills is a variable input while capital is assumed to be a fixed input. Suppressing the time index the specifiation is given by

$$S_{ij} = \alpha_j + \sum_{s=1}^{J} \alpha_{js} \ln w_{ij} + \beta_j \ln K_i + \delta_j \ln Y_i + \sum_{p=1}^{P} \lambda_{jp} z_{ip}, \text{ for } j = 1, ..., s, ., J \qquad (1)$$

where $S_{ij} = \partial \ln C_i / \partial \ln w_{ij} = (w_{ij}/C_i)/(\partial C_i/\partial w_{ij}) = w_{ij}x_{ij}/C_i$, $\sum_{j=1}^{J} S_{ij} = 1$, w_{ij} is wages for skill group j in firm i, K_i is input of capital in firm i, Y_i is output in firm i, and z_{ip} is

[2] However, Feenstra and Hanson (1999) note that the distinction between the narrow and broad definitions of outsourcing is not without problems.

technological change for proxy p in industry i. Wages can either be thought of as set economy wide or alternatively as industry or firm specific. If wages are set economy wide we would end up with one wage for each skill group and for each year. Thus, by including time specific effects we would pick up this effect and wages would be redundant (or more correctly, wages and time specific effects would be linearly dependent). We follow Ekholm and Hakkala (2006) and include time specific effects (and exclude $\ln w_{ij}$) in the estimations since these are potentially important to catch general trends in the level of education of labor and therefore also cost shares.[3]

Estimates of β_j indicate that labor and capital are compliments ($\beta_j > 0$) or substitutes ($\beta_j < 0$) in the production process, while δ_j show whether or not an increase in output has any effect on wages for different groups of labor. Estimates of λ_{jp} indicate whether technological change is potentially biased towards ($\lambda_{jp} > 0$) or against ($\lambda_{jp} < 0$) skill group j. In the empirical analysis we will use two measures of factor biased technological change, namely R&D intensity and offshoring.

In line with Feenstra and Hanson (1999), Hijzen et al. (2006), and Ekholm and Hakkala (2006) we estimate (1) as a system of equations for labor of three different levels of education. Since the three cost shares sum to one, only two of the three cost share equations are independent. Thus, we will only be able to estimate two of the equations simultaneously. We also consider possible correlation between the residuals by using Zellner's seemingly unrelated regression method (SUR). Since SUR is not necessarily unsensitive to which one of the three equations that is excluded, we use iterated SUR (ISUR).[4]

3.2 Data

Our final dataset includes firms in the manufacturing industry with an average number of employees of at least 50 for the period 1997-2002. This leaves us with 2710 firms. The reason for excluding smaller firms is that firm-level R&D data, which are used as a proxy for skill biased technological change, are only available for larger firms. Since skill biased technological change may have a similar effect on labor demand as offshoring, it is important to also control for the former in order to be able to separate between the two effects.[5] We use R&D intensity as a proxy for technological change. This is specified as

$$z_{i,R\&D} = \frac{R\&D_i}{VA_i}$$

[3] Hansson (2005) note that cross-sectional relative wage variation might be related to compositional changes in labor rather than exogenous wage differences which w_{ij} is assumed to measure. He argues that it therefore would be more appropriate to control for the age structure of employees.

[4] ISUR means that the seemingly unrelated regressions should iterate over the estimated disturbance covariance matrix and parameter estimates until the parameter estimates converge.

[5] As an alternative proxy for technological change we have used the firm level share of technicians, which would allow us to also include small firms in the dataset. However, this proxy is highly correlated with skilled labor, which makes it difficult to obtain reliable results.

where $R\&D_i$ is R&D expenditures in firm i and VA_i is value added in firm i.

Data on imports of intermediate goods divided according to country of origin are available 1997-2002 and provided by Statistics Sweden. Data on imports of intermediate services are provided by the Swedish Central Bank (Riksbanken) for the period 1992-2002. Unfortunately we have not yet access to service imports according to country of origin (it has been ordered but not yet delivered), but only on an aggregate total basis. We divide offshoring of goods into four different regions: region 1 includes Asian countries (except Japan which is included in region 3),[6] region 2 consists of Eastern Europe,[7] region 3 includes high income countries, and region 4 contains the rest of the world. More specifically, narrow offshoring, $z^r_{i,on}$, is measured as

$$z^r_{i,on} = \frac{M^r_{i\in f}}{F_i}$$

where $M^r_{i\in f}$ is imports of intermediate goods or services originating from region r for firm i in industry f where imports are classified according to the same two-digit industry f, and F_i is total inputs used in the production in firm i.

We divide labor into high skilled, medium skilled and low skilled based on the level of education. The definition of the variables contained in our dataset is given in Table 1. Descriptive statistics for the variables used in the estimations are reported in Table 2. The wage bill for medium skilled labor constitutes approximately half of the total wage bill for firms in Swedish manufacturing, while the cost shares for high skilled and low skilled labor are 20 and 26 percent, respectively. As already indicated in Figure 2 imported intermediate goods from high income countries as a share of total inputs is much higher than from other regions.

TABLE 1 ABOUT HERE
TABLE 2 ABOUT HERE

3.3 Results

Are there any characteristic differences between firms that offshore as opposed to firms that do not offshore? According to Table 3, which reports mean differences between these two types of firms, offshoring firms have a significantly larger capital stock and higher value added than the average non-offshoring firm. Interestingly, offshoring firms have a significantly larger share of low skilled labor, on average. This is compensated by a lower share of medium skilled labor. Taking a closer look at which industries that are most prone to offshore we find that goods offshoring is highest in the apparel industry while service offshoring is highest in the telecommunication sector.

[6] According to the World Bank, Hong Kong, Singapore, and South Korea are classified as high income countries. The qualitative results for skilled and medium skilled labor are not affected whether we include these countries in region 1 or region 3.

[7] Albania, Belarus, Bosnia-Hercegovina, Bulgaria, Czech Republic, Croatia, Estonia, Hungary, Latvia, Lithuania, Macedonia, Moldavia, Poland, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, and Ukraine.

TABLE 3 ABOUT HERE

Equation (1) is estimated with time specific effects. We use two estimation methods, seemingly unrelated regression which allows for correlation between the error terms and within estimates using ordinary panel data methods. We believe that it is important to control for firm specific effects. However, since our dataset consists of very few time periods in relation to the number of firms our estimations of the fixed effects may possibly not be efficient, which will translate into the covariance matrix. Though, the number of observations is high enough to give consistent estimates. It is however important to realize that the uncertainty in error terms may be carried over and accentuated in the SUR model when we include firm specific effects. We therefore report both the SUR estimates as well as ordinary within estimates.

The results in Table 4 suggest that capital is a substitute for high skilled labor and complement to medium skilled labor. We also find a positive and significant coefficient for R&D intensity, which indicates skill biased technological change. These results are in line with previous studies; see e.g. Berman et al. (1994), Feenstra and Hanson (1999), Hansson (2005), Hijzen et al. (2005), and Ekholm and Hakkala (2006).

According to Table 4 there is a positive relation between the relative demand for skilled labor and offshoring to Asia, while there is a negative effect on the relative demand for skilled labor when firms offshore to high income countries. The pattern is somewhat different when looking at the effect on medium skilled labor. Here offshoring to high income countries has a positive effect on firms' relative demand for medium skilled labor, while offshoring to Eastern Europe has a negative effect on this skill group. Interestingly we find no negative effects on unskilled labor from offshoring, while the results show a positive effects from offshoring to Eastern Europe. However, when adding the two lowest skill groups the results show a negative effect on the composite of these two groups from offshoring to Asia while the effect from Eastern Europe disappears. Unfortunately it is not possible to distinguish whether it is the medium or unskilled group that is most affected.

TABLE 4 ABOUT HERE

Let us next quantify the effects in terms of elasticities. According to Table 5 the elasticities of offshoring are in general very low, which indicates that the economic impact of offshoring is limited for labor demand in Sweden. This is in stark contrast to the results by Ekholm and Hakkala (2006) who report much higher elasticities of offshoring using industry level data. However, despite the high elasticities they conclude that it translates into a rather small number of lost jobs. According to Table 5, a one-percent increase in offshoring to Asia leads to a 0.1 percent increase in the relative demand for skilled labor, while a corresponding increase in offshoring to high income countries leads to a 0.3 percent decrease in the relative demand for

skilled labor. The elasticies for the relative demand for medium and low skilled labor are even smaller.

TABLE 5 ABOUT HERE

We also estimate equation (1) using total offshoring of goods and services, respectively. The results are reported in Table 6 and show that there is a positive and significant relationship between service offshoring and the relative demand for high skilled labor, while the effect is negatively significant for the relative demand for medium skilled labor. According to the iterated SUR estimations relative demand for low skilled labor is negatively affected by service offshoring. However, this effect disappears in the within estimations, which are our preferred estimations. Judging from these results the fear of a brain drain of high skilled labor due to offshoring seems unmotivated. In addition, Table 7 shows that the elasticities of service offshoring are very low, which again means that the economic effect of offshoring appears to be relatively low.

TABLE 6 ABOUT HERE
TABLE 7 ABOUT HERE

As a test for robustness it is common in the literature to re-run the regressions using employment shares instead of wage shares; see e.g Hijzen et al. (2005) and Ekholm and Hakkala (2006) and in single relative demand equations, e.g. Machin and van Renen (1998), Anderton and Brenton (1999), and Strauss-Kahn (2004). We only report the elasticities, which can be found in Tables 5 and 7 under the columns denoted Number. The results are in general in accordance with those obtained from estimations of the cost share equations.

4 Concluding remarks

The objective of this paper is to analyze relative employment effects in Sweden due to offshoring. Since employment is one of the key concerns in the debate on the effects of globalization in general and of the enlargement of the European Union specifically, this paper offers an important contribution. The analysis is based on an administrative dataset containing Swedish manufacturing firms, 1997-2002. For this time period we have access to data on country of origin of goods that are subject to offshoring, which makes it possible to specifically analyze employment effects of offshoring to countries in the enlarged EU as opposed to countries in other parts of the world. Employment is divided according to three levels of education, which makes it possible to at a more detailed level analyze relative effects of various employment categories depending on where the firms offshore to. The results show that when looking at offshoring on an aggregate level without respect to which regions the firm offshore to, offshoring of intermediate services appears to affect the relative labor demand in Swedish firms. More specifically we find that

the relative demand for high skilled labor is positively affected while medium skilled labor is negatively affected. There is no effect on the relative demand for low skilled labor. Looking at offshoring of goods, we find that only the relative demand for low skilled labor is affected, but in contrast to expectations positively affected. However, the picture is somewhat different when we break down offshoring of goods into different regions. The relative demand for high skilled labor is positively affected by goods offshoring to Asia and negatively affected by offshoring to high income countries. Further, the relative demand for medium skilled labor is negatively affected by offshoring to Eastern Europe, while positively related to offshoring to high income countries. On the other hand, the results show that the relative demand for low skilled labor is only affected by offshoring to Eastern Europe, and that the effect is unexpectedly positive. When adding the two lowest skill groups the results show a negative effect on the relative demand for the composite of these two skill groups from offshoring to Asia while the effect from Eastern Europe disappears. However, it is important to note that the elasticities are very low which translates into a very limited impact on the number of jobs affected by offshoring.

Appendix

We will base the analysis on a cost function such as $C_i = C(w_{ij}, x_{ik}, z_{ir})$ which we will assume has a translog cost functional function[8]

$$\begin{aligned}\ln C_i(w,x,z) &= \alpha_0 + \sum_{j=1}^{J}\alpha_j \ln w_{ij} + \sum_{k=1}^{K}\beta_{ik}\ln x_{ik} + \sum_{p=1}^{P}\gamma_r z_{ip} \\ &+\frac{1}{2}\sum_{j=1}^{J}\sum_{s=1}^{J}\alpha_{ij}\ln w_{ij}\ln w_{is} + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K}\beta_{kl}\ln x_{ik}\ln x_{il} \\ &+\frac{1}{2}\sum_{p=1}^{P}\sum_{t=1}^{P}\gamma_{rt}z_{ip}z_{it} + \frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{K}\delta_{jk}\ln w_{ij}\ln x_{ik} \\ &+\frac{1}{2}\sum_{j=1}^{J}\sum_{p=1}^{P}\delta_{jp}\ln w_{ij}z_{ip} + \frac{1}{2}\sum_{k=1}^{K}\sum_{p=1}^{P}\delta_{kp}\ln x_{ik}z_{ip}\end{aligned} \tag{A1}$$

where w_{ij} is wages for skill group j in firm i, x_{ik} is fixed inputs and outputs for inputs and outputs k in firm i, and z_{ip} is technological change for proxy p in industry i. Using Shepard's lemma to cost minimize gives equation (1). For the cost function to work well it must be assumed to be homogeneous of degree one in prices which implies

$$\sum_{j=1}^{J}\alpha_j = 1 \text{ and } \sum_{j=1}^{J}\alpha_{js} = \sum_{j=1}^{J}\alpha_{sj} = \sum_{j=1}^{J}\delta_{jk} = \sum_{j=1}^{J}\delta_{jp} = 0$$

[8] See Berndt (1991) for more details on the translog cost function.

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Figure 1: Total imports of intermediate goods and services, billion SEK, 1997-2002

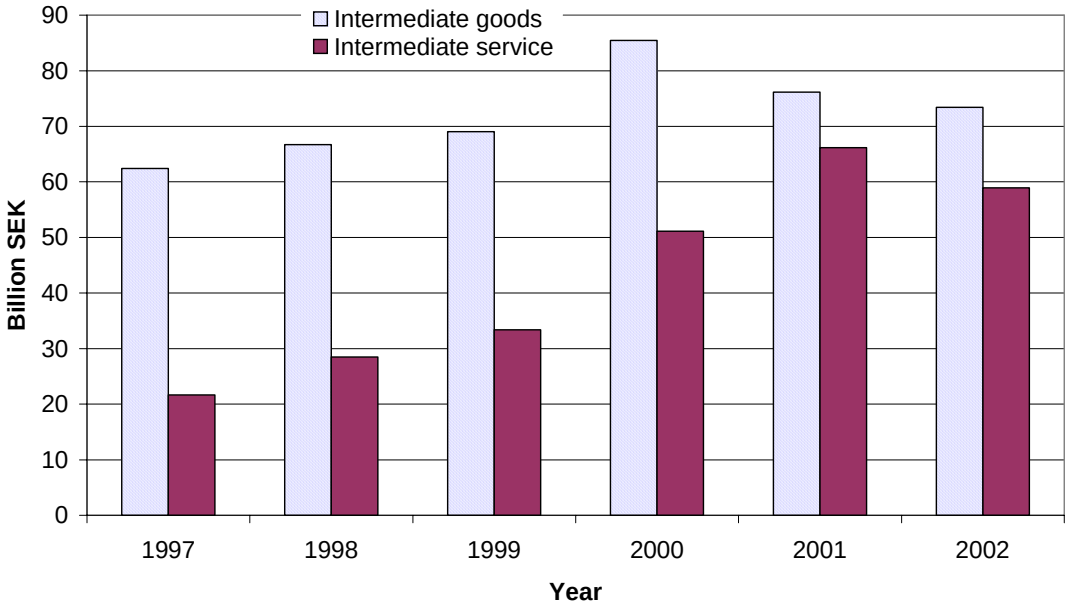

Figure 2: Imports of intermediate goods according to offshoring region, billion SEK, 1997-2002

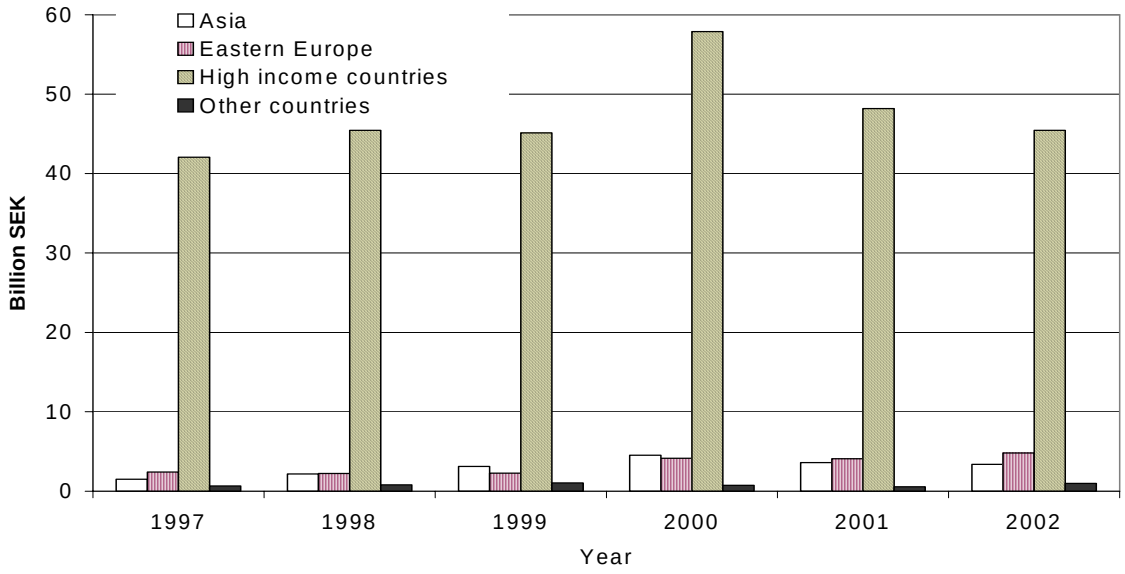

Table 1: Variables and sources

	Description:	Source:
Wage incomes W:	Total wage incomes for all employees	SCB, Regional Labor Statistics
Wage high skilled labor W^S:	Wage incomes for employees with post-secondary education	SCB, Regional Labor Statistics
Wage medium skilled labor W^M:	Wage incomes for employees with secondary education	SCB, Regional Labor Statistics
Wage low skilled labor W^L:	Wage incomes for employees with less than secondary education	SCB, Regional Labor Statistics
Employment E:	Number of employees	SCB, Regional Labor Statistics
High skilled employment E^S:	Number of employees with post-secondary education	SCB, Regional Labor Statistics
Medium skilled employment E^M:	Number of employees with secondary education	SCB, Regional Labor Statistics
Technicians T:	Number of employees with technical post-secondary education	SCB, Regional Labor Statistics
Physical capital K:	Stocks of fixed assets at book value	SCB, Structural Business Statistics
Real output Y:	Value-added, 1991 prices	SCB, Structural Business Statistics
R&D intensity $z_{R\&D}$:	R&D expenditures divided by value added	SCB, Structural Business Statistics
Imports, total $M^{tot,services}$:	Import of services	Riksbanken
Imports, total $M_{i\in f}^{tot,goods}$:	Import of intermediate goods (narrow definition)	SCB, International Trade Statistics
Imports, region 1 $M_{i\in f}^{1,goods}$:	Import of intermediate goods from Asia	SCB, International Trade Statistics
Imports, region 2 $M_{i\in f}^{2,goods}$:	Import of intermediate goods from Eastern Europe	SCB, International Trade Statistics
Imports, region 3 $M_{i\in f}^{3,goods}$:	Import of intermediate goods from high income countries	SCB, International Trade Statistics
Imports, region 4 $M_{i\in f}^{4,goods}$:	Import of intermediate goods from other countries	SCB, International Trade Statistics

Table 2: Descriptive statistics 1997-2002

Variable	No. of obs.	Mean	Std. Dev.	Min.	Max.
S_h	11428	0.203	0.153	0.000	1.000
S_m	11428	0.534	0.116	0.000	1.000
S_l	11428	0.262	0.124	0.000	1.000
$z_{o,\,n}^{tot,\,goods}$	11428	0.071	0.143	-0.040	2.022
$z_{o,\,b}^{tot,\,services}$	11048	0.020	0.401	0.000	33.565
$z_{o,\,n}^{1,\,goods}$	11428	0.003	0.021	-0.004	0.476
$z_{o,\,n}^{2,\,goods}$	11428	0.003	0.024	0.000	0.604
$z_{o,\,n}^{3,\,goods}$	11428	0.024	0.087	-0.028	2.014
$z_{o,\,n}^{4,\,goods}$	11428	0.001	0.010	0.000	0.618
$\ln K$	11428	9.962	3.029	-20.723	16.407
$\ln Y$	11428	11.061	1.103	4.907	17.072
$z_{R\&D}$	11428	0.068	2.362	-22.428	237.612

Note: Unweighted averages of each variable.

Table 3: Characteristics of offshoring firms relative to non offshorers 1997-2002

	Offshorers vs non offshorers of materials narrow definition	Offshorers vs non offshorers of services broad definition
Variables	mean diff	mean diff
Capital	-37.84% (11.55)	-477.03% (16.92)
Y	-19.12% (15.90)	-340.30% (46.41)
R&D intensity	-70.24% (0.74)	-830.70% (2.86)
S_h	2.36% (1.65)	-59.16% (34.87)
S_m	6.21% (15.69)	9.68% (25.11)
S_l	-3.93% (16.77)	15.32% (18.46)
Observations	11428	11428

Notes: The unweighted average of each variable for offshoring firms is subtracted from the corresponding value for non-offshoring firms. t-statistics are reported within paranthesis.

Table 4: Regression results of wage bill share for manufacturing firms with more than 50 employees, region wise, 1997-2002

Dependent Variable	High skilled labor		Medium skilled labor		Low skilled labor	
	SUR	Within	SUR	Within	SUR	Within
$\ln K$	-7.5E-4***	-4.0E-4*	7.2E-4***	6.2E-4***	2.8E-5	-2.3E-4
	(2.0E-4)	(2.2E-4)	(2.0E-4)	(2.3E-4)	(1.7E-4)	(1.8E-4)
$\ln Y$	-0.013***	-0.009***	0.015***	0.011***	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(8.6E-4)	(9.2E-4)
$z_{R\&D}$	3.0E-4**	3.0E-4**	-1.7E-4	-1.8E-4	-1.3E-4	-1.2E-4
	(1.4E-4)	(1.4E-4)	(1.4E-4)	(1.5E-4)	(1.2E-4)	(1.2E-4)
$z_{o,n}^{1,goods}$	0.064*	0.080**	-0.017	-0.049	-0.046	-0.031
	(0.035)	(0.037)	(0.036)	(0.039)	(0.030)	(0.031)
$z_{o,n}^{2,goods}$	-8.9E-4	0.019	-0.043*	-0.059**	0.044**	0.040**
	(0.022)	(0.022)	(0.022)	(0.023)	(0.019)	(0.019)
$z_{o,n}^{3,goods}$	-0.026***	-0.023***	0.021***	0.017**	0.004	0.006
	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)
$z_{o,n}^{4,goods}$	-0.038	-0.016	-0.017	-0.059	0.056	0.074
	(0.043)	(0.061)	(0.044)	(0.064)	(0.037)	(0.051)
No. of obs.	11289	11289	11289	11289	11289	11289
R^2	0.101	0.119	0.118	0.140	0.354	0.439

Notes: All estimations include time and firm specific effects. SUR refers to iterated SUR. Standard errors in parenthesis, ***, **, * refer to 1%, 5% and 10% significance levels.

Table 5: Marginal effects (elasticities) from within firm estimates in Table 4

Dependent Variable	High skilled labor		Medium skilled labor		Low skilled labor	
	wages	Number	wages	Number	wages	Number
$\ln K$	-0.002*	-0.004***	0.001***	0.002***	-8.6E-4	-0.001**
	(0.001)	(0.001)	(4.3E-4)	(4.1E-4)	(7.0E-4)	(6.7E-4)
$\ln Y$	-0.045***	-0.040***	0.020***	0.017***	-0.007**	-0.011***
	(0.005)	(0.006)	(0.002)	(0.002)	(0.003)	(0.003)
$z_{R\&D}$	1.2E-4**	1.3E-4**	-2.8E-5	-1.1E-5	-3.7E-5	5.4E-5
	(6.0E-5)	(6.0E-5)	(2.0E-5)	(2.0E-5)	(4.0E-5)	(4.0E-5)
$z_{o,n}^{1,goods}$	0.001*	0.001**	-2.8E-4	-2.9E-4	-3.6E-4	-1.8E-4
	(5.6E-4)	(5.9E-4)	(2.2E-4)	(2.1E-4)	(3.6E-4)	(3.4E-4)
$z_{o,n}^{2,goods}$	2.7E-4	3.3E-4	-3.2E-4**	-4.0E-4***	4.4E-4**	5.9E-4***
	(3.2E-4)	(3.3E-4)	(1.3E-4)	(1.2E-4)	(2.0E-4)	(2.0E-4)
$z_{o,n}^{3,goods}$	-0.003***	-0.003***	7.5E-4**	6.8E-4**	5.1E-4	3.1E-4
	(8.2E-4)	(8.6E-4)	(3.2E-4)	(3.1E-4)	(5.2E-4)	(5.0E-4)
$z_{o,n}^{4,goods}$	-6.0E-5	-1.4E-4	-8.4E-5	-6.2E-5	2.2E-4	2.0E-4
	(2.3E-4)	(2.4E-4)	(9.0E-5)	(9.0E-5)	(1.5E-4)	(1.4E-4)
No. of obs.	11289	11289	11289	11289	11289	11289

Notes: All estimations include time and firm specific effects. Wages refers to the wages for each group relative total wages. Number refers to the number of employees in each group relative total number of employees. Standard errors in parenthesis, ***, **, * refer to 1%, 5% and 10% significance levels.

Table 6: Regression results of wage bill share for manufacturing firms with more than 50 employees, total offshoring of goods and services, 1997-2002

Dependent Variable	High skilled labor		Medium skilled labor		Low skilled labor	
	SUR	Within	SUR	Within	SUR	Within
$\ln K$	-7.0E-4***	-3.9E-4*	6.7E-4***	5.8E-4**	3.4E-5	-1.9E-4
	(2.0E-4)	(2.2E-4)	(2.1E-4)	(2.4E-4)	(1.7E-4)	(1.9E-4)
$\ln Y$	-0.013***	-0.009***	0.015***	0.011***	-0.002***	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(8.6E-4)	(9.2E-4)
$z_{R\&D}$	3.1E-4**	3.1E-4**	-1.8E-4	-1.9E-4	-1.3E-4	-1.2E-4
	(1.4E-4)	(1.4E-4)	(1.4E-4)	(1.5E-4)	(1.2E-4)	(1.2E-4)
$z_{o,n}^{tot,goods}$	-0.015**	-0.007	0.003	-0.007	0.012**	0.014**
	(0.006)	(0.007)	(0.006)	(0.007)	(0.005)	(0.006)
$z_{o,n}^{tot,services}$	0.018***	0.010***	-0.011***	-0.007***	-0.006***	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
No. of obs.	11269	11269	11269	11269	11269	11269
R^2	0.106	0.120	0.120	0.140	0.355	0.441

Notes: All estimations include time and firm specific effects. SUR refers to iterated SUR. Standard errors in parenthesis, ***, **, * refer to 1%, 5% and 10% significance levels.

Table 7: Marginal effects (elasticities) from within firm estimates in Table 6

Dependent Variable	Skilled labor		Medium skilled		Unskilled labor	
	wages	Number	wages	Number	wages	Number
$\ln K$	-0.002*	-0.004***	0.001**	0.002***	-7.0E-4	-0.001**
	(0.001)	(0.001)	(4.4E-4)	(4.2E-4)	(7.1E-4)	(6.8E-4)
$\ln Y$	-0.046***	-0.040***	0.021***	0.017***	-0.007**	-0.011***
	(0.006)	(0.006)	(0.002)	(0.002)	(0.003)	(0.034)
$z_{R\&D}$	1.3E-4**	1.4E-4**	-2.9E-5	-1.2E-5	-3.6E-5	-5.3E-5
	(6.0E-5)	(6.0E-5)	(2.0E-5)	(2.0E-5)	(4.0E-5)	(3.0E-5)
$z_{o,n}^{tot,goods}$	-0.002	-0.004	-9.0E-4	-2.2E-4	0.004**	0.003*
	(0.002)	(0.002)	(9.3E-4)	(8.9E-4)	(0.002)	(0.015)
$z_{o,n}^{tot,services}$	6.3E-4***	7.1E-4***	-1.8E-4***	-1.3E-4***	-1.2E-4	-1.4E-4*
	(1.4E-4)	(1.4E-4)	(5.0E-5)	(1.0E-5)	(9.0E-5)	(8.0E-5)
No. of obs.	11269	11269	11269	11269	11269	11269

Notes: All estimations include time and firm specific effects. Wages refers to the wages for each group relative total wages. Number refers to the number of employees in each group relative total number of employees. Standard errors in parenthesis, ***, **, * refer to 1%, 5% and 10% significance levels.