The Effect of Offshoring on Labor Demand: Evidence from Sweden*

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Abstract

We analyze the effects of offshoring of intermediate input production on the relative demand for workers with different levels of educational attainment in Sweden. In the analysis we distinguish between offshoring to high-income and low-income countries. The econometric results using data for the 1995-2003 period indicate that offshoring to low-income countries tends to shift labor demand away from workers with an intermediate level of education and towards workers with a high level of education. Offshoring to high-income countries is estimated to have the opposite effect. The results are robust to a number of different specifications.

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1 Introduction

The phenomenon of so-called offshoring to low-wage countries has recently generated a great deal of attention. The shift of production to countries with significantly lower wages has created worries over a possible reduction in the relative demand for unskilled labor and increased wage inequality. However, the activities concerned do not appear to be limited to labor-intensive manufacturing but also extend to skill-intensive services such as computer programming. This development has generated new worries about the consequences of globalization, i.e. worries about losing high-wage jobs rather than low-wage jobs.

In this paper, we study the relationship between offshoring and the demand for different types of labor. By offshoring we mean a shift from domestic to foreign suppliers of intermediate inputs and services. Using this definition, we include both international outsourcing proper; that is, situations where the firm decides to purchase inputs from independent foreign suppliers instead of producing them itself; and a relocation of the firm's own activities, so-called in-house offshoring or vertical foreign direct investment (FDI).

The first systematic analyses of the effect of offshoring on the demand for skilled and unskilled labor were carried out by Feenstra and Hanson (1996, 1999). They developed a methodology for estimating the effect of imported intermediate purchases on the relative wages of production versus non-production workers. Basically, the idea behind the methodology is to assess to what extent domestic workers have been substituted for workers abroad through increasing imports of intermediate goods. They found that offshoring could account for about 15 percent of the observed increase in the relative wage of non-production workers in the US during the 1979-1990 period (Feenstra and Hanson, 1999). A number of subsequent studies have used similar methodologies to study the effect of offshoring on labor demand (Falk and Koebel 2002, Strauss-Kahn 2004, Amiti and Wei 2005a, 2005b and Hijzen, Görg and Hine 2005). Because of a lack of direct information about imported inputs, the studies by Feenstra and Hanson (1999), Strauss-Kahn (2004) and Amiti and Wei (2005a, 2005b) use information on import penetration in conjunction with information about input-output coefficients to construct proxies.[1] Falk and Koebel

[1] Amiti and Wei (2005a, 2005b) study the effect on the overall labor demand rather than the relative

(2002) and Hijzen *et al.* (2005) have direct information on imported inputs and are also able to measure skills more precisely. Falk and Koebel (2002), dealing with Germany 1978-1990, find a significantly negative impact of imported materials on the demand for labor with the lowest educational attainment, but the effect is not robust when they allow for heterogeneity across durable and non-durable goods industries. Hijzen *et al.* (2005), on the other hand, dealing with the UK 1982-1996, find that offshoring had a strong negative impact on the demand for workers in occupations considered to be low-skilled.

With the exception of the study by Strauss-Kahn (2004) for France, neither of these studies distinguish between offshoring to low-income and high-income countries; a distinction that is likely to be important for the effect on the relative demand for skills.[2] To a large extent, trade in intermediate inputs – like trade in final goods– takes place between countries with similar relative factor endowments and wage levels. This trade is likely to be explained by factors such as scale economies and product differentiation rather than labor cost differentials. When intermediate input production is offshored from one high-income country to another, the factor intensities of the offshored activities may not differ much from the factor intensities of the activities that remain onshore. The possible difference in main driving forces behind offshoring to high-income and low-income countries makes it important to empirically distinguish these two phenomena when analyzing the impact of offshoring on the relative demand for skills.[3]

In this paper, we use data for Sweden 1995-2003 to estimate the relationship between offshoring and the demand for workers with different level of educational attainment. Sweden is a relatively skill-abundant country where wages are determined through collective

demand for skilled and unskilled labor. Strauss-Kahn (2004) finds evidence of a negative impact of offshoring on the demand for non-production workers in France.

[2]That the source of imports is important for the effect of import penetration on the relative demand for production and non-production workers has been shown by e.g. Anderton and Brenton (1999) and Hansson (2000). Anderton and Brenton (1999) found that import penetration from low-income countries explained up to 40 percent of the observed increase in the cost share of skilled workers in textile industries in the United Kingdom, while import penetration from high-wage countries had no statistically significant impact. Hansson (2000) found that import penetration from non-OECD countries contributed to a decrease in the relative demand for highly educated workers in Sweden.

[3]Theoretical analyses of offshoring by e.g. Jones and Kierzkowski (2001) and Grossman and Rossi-Hansberg (2006) show that even if the offshored activities are less skill intensive than the ones that remain at home, the effect on relative wages can go either way depending on the sector-bias of offshoring and on whether relative goods prices are affected.

bargaining and a strong emphasis on income equality prevails. The wage distribution has traditionally been relatively flat compared with other countries. Sweden is also a country where the manufacturing sector has been dominated by large multinational enterprises (MNEs) with a large share of their operations located abroad.[4] Although the main reason behind the predominance of large MNEs is debated, the wage distribution with relatively costly workers at the low end is likely to be a contributing factor. Decreased costs for trading intermediate inputs and the opening up of low-wage regions in Asia and Eastern Europe for investment may have created especially strong incentives for Swedish firms to offshore activities intensive in low-skilled labor, since this type of labor is relatively costly in Sweden.

As in Falk and Koebel (2002) and Hijzen *et al.* (2005) we use direct information on imported inputs from input-output tables. We combine this information with trade data to construct proxies of offshoring to different groups of countries. We distinguish between high-income and low-income countries as well as between countries belonging to different regions. As in Falk and Koebel (2002) we use information about educational attainment to allocate employees into different skill groups.

The remaining part of the paper is organized as follows: In the next section we explain how we measure offshoring and present descriptive evidence on the development of Swedish offshoring 1995-2003. We then proceed to presenting the econometric analysis in section 3 and the results in section 4. Finally, section 5 concludes.

2 Swedish Offshoring 1995-2003

Our measure of offshoring is based on information about imported inputs from the input-output tables. Feenstra and Hanson (1999) distinguish between *narrow* and *broad* offshoring. Narrow offshoring only includes imported intermediate inputs from the importing industry, i.e. an industry's purchases of imported intermediate inputs produced in the same industry. Broad offshoring also includes imported non-energy intermediate inputs

[4] In 2003, MNEs accounted for 72 percent of value added, 87 percent of exports and 64 percent of total employment in manufacturing (ITPS, 2006).

from all other industries. They prefer the narrow to the broad measure, since it is closer to the phenomenon of fragmentation and vertical specialization that takes place within industries. For instance, in the car industry, imports of steel would not normally be considered to stem from offshoring, but the purchase of automobile parts would, particularly if the parts were formerly manufactured by the importing company. Moreover, a shift from a domestic to a foreign steel supplier would not affect the workers in the automobile industry but those in the steel industry. The rationale for using the broad measure is that the industry classification may be too narrow in the sense of classifying production processes formerly made within a firm into another industry when outsourced to a sub-contractor.

Here, the *narrow* and the *broad* measures of offshoring are defined as imported intermediate inputs in relation to industry output:[5]

$$z_i^N = \frac{m_{ii}}{Y_i} \tag{1}$$

$$z_i^B = \frac{\sum_{j=1}^{N} m_{ij}}{Y_i}, \tag{2}$$

where m_{ij} is industry i's use of imported intermediate inputs from industry j and Y_i is production. In the econometric analysis we will focus on the narrow measure and only report how results using the broad measure differ.

Direct information about industry use of imported intermediates through input-output tables is only available for 1995, 2000 and 2003; the years for which detailed input-output tables have been constructed. However, by interpolating information from these input-output tables, we can construct a more complete time series for offshoring. Focusing on a time series for the narrow measure, we start from the observation that (1) can be rewritten as the product between the share of imported inputs in total imports and the ratio between imports and output:

$$z_i^N = \frac{m_{ii}}{M_i}\frac{M_i}{Y_i}, \tag{3}$$

[5] Some studies have put imports of intermediate inputs in relation to total inputs instead.

where M_i is total imports in industry i. We observe the share of intermediate inputs in total imports in industry i, m_{ii}/M_i, in 1995, 2000, and 2003, while we observe imports in relation to domestic output every year during the period studied. To obtain imputed values of z_i^N for 1996-1999, and 2001-2002 we use a linear interpolation of m_{ii}/M_i based on the 1995, 2000 and 2003 values.[6] This procedure is based on the assumption that the relationship between an industry's use of imported inputs from its own industry and total imports in this industry changes slowly and trendwise.

Measure		**1995**	**2000**	**2003**	**Change**	
					(perc. points)	**(percent)**
Share in output						
All industries	Narrow	3.9	4.3	4.5	0.6	15.4
	Broad	13.7	15.3	14.9	1.2	8.8
Manufacturing	Narrow	8.6	9.0	10.2	1.6	18.6
	Broad	21.3	22.6	26.4	5.1	23.9
Services	Narrow	1.0	1.3	1.2	0.2	20.0
	Broad	8.6	10.4	7.3	-1.3	-15.1
Services within manuf.		10.0	13.1		3.1*	31.0*
Share in intermediate consumption						
All industries	Narrow	7.2	7.7	8.2	1.0	13.9
	Broad	25.2	27.1	27.1	1.9	7.5
Manufacturing	Narrow	13.0	13.0	14.8	1.8	13.8
	Broad	31.5	32.6	38.2	6.7	21.3
Services	Narrow	2.1	2.8	2.7	0.6	28.6
	Broad	18.5	21.9	15.8	-2.7	-14.6

Note: The narrow measure consists of imported inputs within the industry whereas the broad measure consists of imported inputs from all industries. Source: Input-output tables collected by Statistics Sweden.

Table 1 shows different measures of offshoring for 1995, 2000 and 2003. In addition to the measures of narrow and broad offshoring in (1) and (2), we also show corresponding

[6] To construct a time series for the broad measure, we proceed along similar lines. We start from the observation that (2) can be rewritten as $z_i^B = \sum_{j=1}^{N} (m_{ij}/M_j)(M_j/Y_i)$ and interpolate m_{ij}/M_j based on the 1995, 2000 and 2003 values.

measures where imports of intermediate inputs are put in relation to the industry's total use of intermediate inputs. It may be argued that the former measure is the better one, since it is unaffected by changes in domestic outsourcing. All measures except the one for broad offshoring in services indicate that offshoring increased between 1995 and 2003. In manufacturing, the share of imported inputs increased by 1.5-5 percentage points when put in relation to total output and by 2-7 percentage points when put in relation to total inputs. In percentage terms there was a large increase in narrow offshoring in services (20 percent based the output-based measure and 29 percent based on the input-based measure). However, the increase occurred from very low levels. Offshoring of manufacturing inputs was considerably more important than of services throughout the period.

We construct proxies of offshoring to different country groups by assuming that the country distribution of imports of products used as intermediates is captured by the country distribution of overall imports, which consist of both intermediate and final goods. While the assumption that the two country distributions are the same is unlikely to hold in a strict sense, there is no obvious reason why they should differ in a systematic way. A recent study by Bergstrand and Egger (2008) presents evidence suggesting that the pattern of bilateral trade in intermediates is very similar to the pattern of bilateral trade in final goods. On average, intermediate inputs make up about 40 percent of overall imports in Sweden, implying that the weight of the country distribution of intermediates in the distribution for overall imports is about 0.4.[7]

Figure 1 shows narrow offshoring to different regions in 1995, 2000 and 2003. It is clear from this figure that the main part of what we measure as narrow offshoring takes place in Western Europe. There has been increases in offshoring to Asia and Central and Eastern Europe (CEE) over time, but between 1995 and 2003 narrow offshoring increased to Western Europe as well.[8] The only region for which there is a clear upward trend

[7]Imports of intermediate inputs excluding crude oil and petroleum products make up 37 percent of total imports in 2000. Information about the share of intermediate inputs in trade is available on the web site of the National Institute of Economic Research in Stockholm (see www.konj.se).

[8]The measures presented in Figure 1 are not adjusted for any influence generated by exchange rate changes. A source of possible bias of the measures is price differences between regions. When a firm switches from a Western European supplier to an Asian one, the same amount of inputs may be purchased at a lower cost. If such cost reductions are reflected in the price of the final output, however, this will not necessarily bias the measure of offshoring to low-cost countries downwards.

1995-2003 is Central and Eastern Europe.

{Figure 1: Narrow offshoring by regions 1995, 2000 and 2003}

Most of what we measure as offshoring of intermediate input production is thus not related to sourcing of inputs from low-income countries. Not even when we focus on changes over time do low-income regions stand out as particularly important. So while it is important to study offshoring to low-income countries in order to address issues of current concern, it is also important to study offshoring to high-income countries, since it constitutes the main part of current fragmentation of production.

3 Econometric Analysis

3.1 Econometric specification

In the econometric analysis, we model the impact of offshoring on labor demand in a similar way as has previously been done for factor-biased technological change (FBTC). The underlying assumption is that technological change as well as offshoring affect productivity, but not necessarily in a uniform way across all factor inputs. For instance, the introduction of new computer-based technologies will increase the productivity of labor with computer skills, but may leave the productivity of other types of labor unaffected. Such technological development may change the relative demand for skilled versus unskilled labor. In a similar manner, cost-reducing offshoring will increase productivity in the sense of increasing net revenue per unit of factor input. However, when labor-intensive assembly activities are being offshored, the productivity of workers involved in headquarters activities and intermediate input production is likely to increase, whereas the productivity of domestic assembly workers is unaffected. As with the introduction of new technologies, this might lead to changes in the relative demand for skills.

We carry out the analysis based on a translog cost function, first introduced in the context of trade and demand for skills by Berman *et al.* (1994) and used in a number of studies of offshoring and the relative demand for skilled and unskilled labor (e.g. Feenstra and Hanson 1996, Geishecker 2006, Strauss-Kahn, 2004, and Hijzen *et al.* 2005). Our approach deviates from the standard approach in the same way as the study by Hijzen *et al.* (2005). Rather than estimating a single cost share equation, we estimate a system of cost share equations simultaneously for three types of labor: unskilled, semi-skilled and skilled. Previous studies have either estimated the cost share equations in first differences or with fixed-effects in order to take industry-specific time-invariant effects into account. We apply a fixed-effects within estimator since first-differencing may exacerbate potential problems of measurement error in the data (Griliches and Hausman, 1986).

To control for FBTC induced by domestic innovation, we also include the industry's R&D intensity. This variable is intended to capture changes in working practices due to the adoption of more advanced technologies.[9]

We assume that industry i, $i = 1, ...I$, produces an output using different types of labor, capital and intermediate inputs. Intermediate inputs are either sourced domestically or from abroad. By differentiating a translog cost function and applying Shephard's lemma, we can express the cost share of factors as a function of factor prices, output levels and factors inducing factor-biased technical change (see Appendix C). Under a common short-run cost function, where capital is considered to be a quasi-fixed factor, industry i's cost share of labor belonging to skill group j is given by

$$\theta_{ij} = \alpha_{ij} + \sum_{s=1}^{S} \gamma_{js} \ln w_s + \phi_j \ln Q_i + \delta_j \ln K_i + \sum_{r=1}^{R} \lambda_{jr} z_{ir} \qquad (4)$$
$$(j = 1, ...S, s = 1, ...S, r = 1, ...R),$$

where $\theta_{ij} \equiv w_j L_{ij} / \sum_{s=1}^{S} w_s L_{is}$, K_i is the capital stock, Q_i is value added, and z_{ir} denotes variables capturing factor-biased technical change.

The value of the parameters γ_{js} will depend on whether different types of labor tend to be substitutes for or complements to one another, while the value of δ_j will depend on whether capital tends to substitute or complement labor belonging to skill group j. The

[9] The variable is used as a proxy picking up technological change in previous studies by e.g. Machin and Van Reenen (1998) and Hijzen *et al.* (2005).

values of parameters λ_{jr} depend on whether technical change is biased towards or away from the usage of labor belonging to skill group j.

We distinguish between three different skill groups based on educational attainment: workers with at most *lower* secondary education, workers with at most *upper* secondary education, and workers with tertiary education.[10] This results in a system of three equations such as (4); one for each skill group. Homogeneity in prices implies $\sum_{s=1}^{S} \gamma_{js} = 0$ and symmetry of the underlying translog cost function that $\gamma_{js} = \gamma_{sj}$; restrictions imposed in the analysis.[11] Only two of the three cost share equations are independent.[12] To take a possible correlation between the residuals of the two equations into account, we estimate the system using iterated seemingly unrelated regression (ISUR).

Concavity of the cost function in wages requires the own-wage elasticities, which are functions of γ_{jj}, to be negative. However, we do not impose any further restrictions on the γ's than the ones implied by homogeneity and symmetry. Koebel *et al.* (2003) test the concavity assumption using different functional forms (Box-Cox, normalized quadratic and translog) and conclude that concavity is observed only in a small number of cases. However, when assessing the performance of different models they show that predicted values are relatively close to observed ones irrespective of whether concavity restrictions are imposed or not.[13]

As noted above, we consider mainly two measures of FBTC: offshoring (denoted z_{i1}) and R&D intensity (denoted z_{i2}). The latter variable is defined as:

$$z_{i2} = \frac{R_i}{Y_i}, \tag{5}$$

where R_i is total expenditures on R&D and Y_i is total output in industry i.

While our offshoring measure captures in-house offshoring – or FDI – to the extent that

[10] Lower secondary education corresponds to 9 years of schooling while upper secondary education corresponds to 11-13 years of schooling.

[11] For our main specification cannot reject the hypothesis that restrictions apply.

[12] Note that $\sum_{j=1}^{S} \theta_{ij} = 1$ implies that parameters γ_{js}, ϕ_j, δ_j, and λ_{jr} sum to zero across the S equations.

[13] A Box-Cox transformation seems to generate the most reliable model and is favored over the translog function in Falk and Koebel (2002). We use the translog function but have also carried out regressions using a Box-Cox transformation to check robustness. Re-estimating our model using a Box Cox transformation did not change the results.

it concerns production of intermediate inputs that are imported back to Sweden for further processing, they do not capture situations in which firms offshore final goods production or production of intermediate inputs used in production abroad. These situations may also affect the relative demand for different types of workers at home. For a country such as Sweden, offshoring of the final stages of production may be particularly important since multinationals constitute an important part of total production and the Swedish market for final goods is rather small.[14] In order to control for such changes in the location of production we include the following measure of the extent to which multinationals carry out their operations abroad:

$$z_{i3} = \frac{L_{iF}^{M}}{L_{iS}^{M}}, \tag{6}$$

where L_{iF}^{M} is the number of employees in foreign affiliates of multinationals in industry i and L_{iS}^{M} the number of employees at the Swedish parents belonging to industry i.[15] Employment is here used as a proxy for sales since sales figures are unavailable at a disaggregated industry level. Note that changes in the offshoring measures (1) and (2) are likely to partly capture changes in this measure of FDI.

In estimating (4) we also use different specifications of the main offshoring variable. We use total offshoring, which is what we can construct from the input-output tables, and we use separate measures for offshoring to low-income and high-income countries constructed in the way explained in the previous section. We expect offshoring to low-income countries to be negatively related to the relative demand for low-skilled workers because the offshored activities mainly substitute for activities intensive in low-skilled labor. Offshoring to high-income countries, on the other hand, is not expected to exhibit

[14] According to the data for Swedish multinational firms collected by the Research Institute of Industrial Economics (Institutet för Näringslivsforskning), the largest part of affiliate sales of Swedish multinational firms in 1998 was sales in the local market (64 percent of total sales), while the smallest category was sales back to Sweden (11 percent of total sales). The remaining quarter of affiliate sales was exports to third countries.

[15] Although somewhat differently specified, this is similar to a measure used by Hansson (2004, 2005) when examining the effect of a transfer of production within multinational firms on the relative demand for skills. We use the ratio between affiliate and parent employees rather than, as Hansson (2004, 2005), the share of affiliate employees in total employment. The reason for our using the ratio between foreign and home employment is that, for a particular region, this measure is independent of the firms' employment in other regions.

such a negative relationship.

An obvious problem in identifying the parameter λ_{j1} is that labor cost shares and import shares of intermediate inputs are likely to be jointly determined. To tackle this potential endogeneity problem we use an instrumental variable (IV) approach. We instrument offshoring using a similar measure based on data for Finland. Finnish offshoring is likely to be affected by the same kind of changes in offshoring costs as Swedish offshoring. It is unlikely, however, that Finnish offshoring affects labor cost shares of different skill groups in Sweden. Thus, we expect Finnish offshoring to fulfill the criteria of being a valid instrumental variable.[16]

When estimating (4), we also include time dummies or a time trend to control for economy-wide trends in labor cost shares of workers with different levels of education. Time dummies should absorb any economy-wide effects of changes in the relative supply of workers with different levels of education. Differential effects at the industry level could potentially bias our results, but we find no reason to believe that such differential effects should be correlated with the offshoring variable. Our identifying assumption is that the time dummies capture any relative supply effects and that the other variables therefore capture shifts in, and movements along, the relative demand curve.

We carry out three sets of estimations: (*i*) one where we exclude wages altogether, assuming them to be set economy-wide and being captured by time dummies, (*ii*) one where we include economy-wide wages and use a time trend to account for secular trends in the labor cost shares of workers with different skill levels, and (*iii*) one where we allow wages to differ across industries and include time dummies to account for economy-wide changes in the labor cost shares.[17] The specification with industry-specific wages may suffer from an endogeneity problem since industry wages may be affected by, or jointly determined with, the relative use of workers belonging to different skill groups. Moreover, a differential evolvement of wages across industries may be related to a differential evolvement of the composition of workers (within the education-based categories used here) rather

[16] We cannot find similarly good instruments for in-house offshoring, however, because sector and country distributed information about Finnish FDI is unavailable.

[17] Time dummies cannot be used in Specification 2 since they would be linearly dependent with wages.

than of the price of homogenous workers. Finding valid instruments for wages is however notoriously difficult and will not be attempted here. The specification without any wage variables, on the other hand, may suffer from omitted variable bias.

Specifications (i) and (ii) are based on the assumption that wages are equalized across industries. This is a strong assumption, but it is not entirely unjustified when dealing with a country such as Sweden, where trade unions traditionally have promoted a so-called *solidarity wage policy*, meaning the same pay for the same job. When wages change in one industry as a result of offshoring, it is effectively assumed that wages in other industries are affected in the same way and that the time dummies or wage variables fully capture the effect of this wage change on the labor cost shares. If the latter assumption does not hold, our estimate of λ_{j1} is likely to be biased downwards since the labor cost shares will evolve in a similar way in industries with and without offshoring.

An additional concern is the use of measures of offshoring which are partly based on interpolation. The interpolation of the ratios between imported intermediates and total imports may affect the standard errors of the offshoring variables. Partly to deal with this problem, we base our statistical inference on bootstrapped standard errors.[18] In order to check robustness of the results we also estimate the model using only the three years for which we have directly observed data. We estimate weighted regressions using industry employment shares as weights.

3.2 Data

Our information about employees and wages stems from a register-based database for labor market statistics called RAMS (Regional Arbetsmarknadsstatistik). This database includes information about wages, number of employees and the level of educational attainment of employees. Wages are measured as gross wage including taxable wage benefits. Input-output tables containing information about imports are produced by Statistics Sweden, but comparable tables are only available for 1995, 2000 and 2003. This information is combined with trade data from Statistics Sweden to create time series of imports of inter-

[18] Our standard errors are based on 1,000 bootstrap replications, using the same sample size as the regressions.

mediate inputs at the country-industry level. Industry-distributed data on output, value added, capital stocks and R&D expenditures has been provided by Statistics Sweden as well, while industry-distributed information about employment at Swedish multinationals have been provided by the Swedish Institute for Growth Policy Studies (ITPS). Summary statistics and other more detailed information about the data used can be found in Appendix A.

4 Results

4.1 Main analysis

Tables 2A-2B present the estimated elasticities for all variables calculated from the estimated parameters of (4) and sample means of the labor cost shares (see Appendix C for a derivation of the elasticities).[19] The estimates for the offshoring and R&D variables are semi-elasticities showing the estimated percentage change in the demand for workers belonging to a particular skill group associated with a one *percentage point* increase in the offshoring or R&D variable. Table 2A shows the results from regressions with a measure of overall offshoring and Table 2B shows the results from regressions with separate measures of offshoring to high-income and low-income countries.

[Table 2A-2B about here]

The tables show four specifications: (1) does not include any wage variables, (2) and (3) include economy-wide wages and a time trend, while (4) includes industry-specific wages. The difference between (2) and (3) is that in-house offshoring (FDI) is included as a control variable in the latter but not the former. Looking at the results for the estimated wage elasticities, we see that some of them are positive and significant in specification (4), where wages are assumed to be industry-specific. This clearly violates the property of concavity of the cost function and may be due to mixing up changes in the composition of workers with changes in the price of workers. In specification (2), the estimated own

[19] The regression results from estimating (4) may be obtained from the authors upon request.

wage elasticities for workers with upper and lower secondary education are all negative. For workers with tertiary education they are positive, but not significantly different from zero. Because the specification with economy-wide wages gives more plausible estimates of γ_{jj} we find it preferable to the one with industry-specific wages.

According to the results in Table 2A, overall offshoring is not associated with any clear shift in labor demand across skill groups. However, in Table 2B, where the offshoring measure has been split into a high-income and a low-income part, the estimated elasticities produce a clear pattern. Offshoring to low-income countries is associated with a shift in demand away from workers with upper secondary education and towards workers with tertiary education. Offshoring to high-income countries, on the other hand, is associated with a shift in the other direction; away from workers with tertiary education and towards workers with upper secondary education. This result goes through in all specifications. The estimated semi-elasticity of offshoring to low-income countries with respect to demand for workers with upper secondary education ranges between -4.3 and -6.1, depending on specification. This implies that, for a given level of output and capital, a one percentage point increase in the measure of offshoring to low-income countries is estimated to be associated with a reduction in the demand for workers with upper secondary education by about 4-6 percent. The estimated semi-elasticity of offshoring to high-income countries with respect to demand for workers with tertiary education ranges between -1.3 and -1.7, implying that a one percentage point increase in the measure of offshoring to high-income countries is associated with a reduction in the demand for workers with tertiary education by about 1.5 percent. The opposite relationships between offshoring to high-income and low-income countries and the demand for workers with different levels of education most likely explain why the estimated elasticities of overall offshoring are not significantly different from zero. Including measures of FDI to high-income and low-income countries does not affect these results. The estimated coefficients become somewhat smaller in magnitude, but they remain significant at the five percent level.

It is useful to compare these elasticities with those obtained for R&D. For a given level of output and capital, increases in R&D are associated with a shift in labor demand away from workers with lower and/or upper secondary education, depending on specification, and towards workers with tertiary education. This is consistent with results from Machin and Van Reenen (1998), Haskel and Heden (1999), Hansson (2005) and Hijzen *et al.* (2005). The estimated elasticities imply that a one percentage point increase in R&D expenditures as a share of sales is associated with an increased demand for workers with tertiary education by about 1.5 to 2.3 percent.

The results based on the broad measure are very similar.[20] Overall offshoring does not appear to be associated with any shift in labor demand, while offshoring to low-income countries seems to be associated with a shift away from workers with upper secondary education and towards workers with tertiary education. The only substantial difference from the results for narrow offshoring is that the estimated elasticities for offshoring to high-income countries are generally insignificant.

Results based on an IV approach are presented in Tables 3A-3B. The tables report F-tests based on the first stage regressions, which indicate that the instruments are strongly correlated with the offshoring measures.[21] We again present estimated elasticities based on the three different specifications regarding wages. However, we do not include a specification with FDI as an additional control since we have no appropriate instrument for this variable.[22]

[Table 3A-3B about here]

The results are relatively similar to the ones presented in Tables 2A-2B. In one of the specifications with overall offshoring (specification 3), two of the estimated elasticities are now significant, indicating that the net effect of overall offshoring is a shift in demand away from workers with upper secondary education and towards labor with tertiary education. The estimated elasticities in the two other specifications are still insignificant. When we split offshoring into a high-income and a low-income part, the pattern is the same as before; offshoring to low-income countries shifts labor demand away from workers with upper secondary education and towards workers with tertiary education while offshoring

[20] The results can be obtained upon request.

[21] We use Finnish offshoring to high-income countries as instrumens for Swedish offshoring to high-income countries and similarly for offshoring to low-income countries.

[22] Including the same measures as the ones in Table 2A-2B does not affect the results.

to high-income countries shifts labor demand in the opposite direction. The magnitude of some of the estimated elasticities is however considerably larger and they vary more across specifications. The estimated elasticity of offshoring to low-income countries with respect to demand for workers with upper secondary education now ranges between -1.3 and -14.0, while the estimated elasticity of offshoring to high-income countries with respect to demand for workers with tertiary education ranges between -6.7 and -16.9. The magnitudes may seem large from an economic point of view, but it should be noted that a one percentage point increase in the offshoring measures would, in fact, imply a large increase considering that overall offshoring increased by about 1.5 percentage point during the entire 1995-2003 period.

Offshoring to low-income countries includes offshoring to China and India as well as offshoring to countries in Central and Eastern Europe (CEE). Since labor endowments in these countries differ, offshoring does not necessarily have the same impact on the demand for different types of workers. To examine whether there is indeed a difference, we split the offshoring measure in a somewhat different way. In Table 4A, we show IV results splitting overall offshoring into offshoring to CEE and offshoring to the rest of the world. In Table 4B we show the corresponding results when splitting overall offshoring into offshoring to Asian countries and offshoring to the rest of the world.[23] According to the results in Table 4A, offshoring to CEE countries have the effect found for offshoring to low-income countries; a shift in labor demand away from workers with upper secondary education and towards workers with tertiary education. However, as is evident from Table 4B, the estimated effect of offshoring to Asia is more similar to the one estimated for offshoring to high-income countries; a shift in labor demand away from workers with tertiary education and towards workers with upper secondary education. The magnitude of the estimated elasticities for offshoring to Asia is very large, but a one percentage point increase in the measure would imply more than a doubling from its 2003 level.

[Table 4A-4B about here]

[23] We pool the rest of countries into one group since splitting the offshoring measure into additional country groups create problems with multicollinearity.

Offshoring is thus estimated to affect the structure of labor demand, but in a way that depends on the destination of offshoring activities. Offshoring to low-income countries is estimated to primarily shift labor demand away from workers with an intermediate level of education, while offshoring to high-income countries is estimated to primarily shift labor demand away from workers with higher education. These results may be compared to the findings by Hijzen *et al.* (2005), who found a negative elasticity of overall offshoring with respect to the least skilled workers in the UK, but never distinguished between offshoring to high-income and low-income countries.[24] The difference in results may be partly explained by different definitions of skills; Hijzen *et al.* use occupations to define skill groups while we use educational attainment. Falk and Koebel (2002), who also use educational attainment as a measure of skill, find no robust evidence that the lowest skill group can be substituted for imported materials in Germany. However, their estimates of price elasticities indicate complementarity between workers with an intermediate level of education and imported materials, suggesting that overall offshoring is associated with a shift in labor demand towards – and not away from – this skill group.

4.2 Robustness checks

We run a number of additional regressions to check robustness of the results. First, we run regressions based on only proper data points, i.e. on data for 1995, 2000 and 2003.[25] The results, presented in Table 5, are consistent with our main findings; that is, offshoring to low-income countries is associated with a shift in labor demand away from workers with an intermediate level of education and towards workers with a high level of education while offshoring to high-income countries is associated with a shift in opposite direction.

[Table 5 about here]

As mentioned in the previous section, if wages are affected by offshoring in one industry, wages in other industries will be affected as well, and if this effect is not properly accounted

[24] The estimated elasticity was around -0.4 for the 1982-1996 period.

[25] We estimate only two our specifications; the one without any wage variables and the other including industry-specific wages.

for, the estimate of the offshoring elasticity may be biased. In order to investigate whether this potential problem affects our results, we run regressions using employment shares instead of labor cost shares as dependent variables. This means estimating the effect of a labor demand shock on labor demand excluding any effect on wages – a procedure that may be justified for countries where the wage component can be expected to be small due to regulated labor markets and collective bargaining over wages (cf. Machin and Van Reenen 1998, Anderton and Brenton, 1999, Strauss-Kahn, 2003, and Hijzen *et al.*, 2005). Tables A2A-A2B in Appendix B report results based on IV. We do not find any substantial differences compared to the results based on labor cost shares. The signs of the estimated elasticities of overall offshoring differ across specifications, but the signs of the ones for offshoring to high-income and low-income countries are similar to what we found before.

The result that offshoring to low-income countries primarily shifts labor demand away from workers with an intermediate level of education – and not workers with a low level of education – is somewhat surprising, considering that we would expect offshoring to low-wage countries to mainly substitute for unskilled labor. Possibly, the finding is due to the characteristics of the Swedish labor market. A large share of the Swedish labor force has upper secondary education, but older cohorts of workers are more likely to have only lower secondary education. These older cohorts may be in a better position to keep their jobs, thanks to longer experience and the fact that Swedish labor market legislation provides job security based on tenure.

To explore whether an age effect is underlying the results presented in Tables 2-5, we carry out a similar econometric analysis defining different worker groups on the basis of age instead of education. We define three age groups; workers aged 25-39, 40-54 and 55-65.[26] According to the results, which are reported in Table A3 in Appendix B, the elasticity of offshoring to low-income countries is not significantly different from zero for any age group. Thus, we do not find any evidence that offshoring to low-income countries is associated with a shift in labor demand towards older and more experienced workers. The estimated elasticity of offshoring to high-income countries is positive and significant at the 5-10 percent level for the oldest age group in two of the specifications, so there is some

[26] Age-distributed data is available only for 1995-2000.

indication that offshoring to other high-wage economies is associated with a shift towards older workers. Arguably, categorizing workers only according to age generates groups that are too heterogenous with respect to education to properly disentangle a possible age effect. Unfortunately, our data do not allow us to differentiate with respect to both age and education, so we cannot investigate this possible interpretation of the results any further.

Finally, offshoring to low-income countries has increased much more in the electronic industry than in the rest of the manufacturing sector. Therefore, we check whether the results are entirely driven by this sector by re-estimating the model without the electronic industry. The positive relationship between offshoring to high-income countries and the labor cost share of workers with upper-secondary education still remains significant in all specifications. The estimated relationship between this labor cost share and offshoring to low-income countries remains negative in all specifications, but it is only statistically significant in the one with instrumented offshoring and economy-wide wages and a time trend (which is our main specification). Thus, while the results do not appear to be entirely driven by changes in the electronics industry, it is clear that these changes are important for the results regarding offshoring to low-income countries. However, it should be noted that the electronic industry is one of the most important industries in terms of employment and value added in Swedish manufacturing. Therefore, even if the negative relationship between offshoring to low-income countries and the relative demand for workers with an intermediate level of education were entirely driven by this industry, it would probably still be an important relationship for the overall Swedish economy.[27]

4.3 Quantifying the results

The estimated elasticities presented above are relatively large, in particular regarding offshoring to low-income countries. However, as already noted, a one percentage point increase in offshoring in fact constitutes a very large increase from its present level. To assess the economic importance of the results, we use the estimated semi-elasticities to

[27] All of these results can be obtained from the authors upon request.

calculate the estimated percentage change in demand associated with the actual average economy-wide change in offshoring between 1995 and 2003.[28] We focus on the estimates for workers with upper secondary and tertiary education, since these are the skill groups for which we get consistent and significant estimates across different specifications. As noted above, the estimated elasticities obtained when instrumenting for offshoring are in some cases considerably larger than in the ones obtained without instrumenting. In theory, the assessment of economic importance should be based on the instrumented elasticities since they are the only ones that lend themselves to a causal interpretation. However, as is well known, estimates based on instrumental variable methods may suffer from large inconsistency if there is some correlation between the instrument and the error term. In Table 6, we present estimated averages based on both methods.

Table 6. Implied changes in demand for workers of actual increase in offshoring 1995-2003

Level of education	**Type of offshoring**	**Estimation method**	**Estimated elasticity**	**Perc change. in demand**
Upper-sec.	Low-income	non-inst.	-6.06	-4.10
		inst	-14.0	-9.47
	High-income	non-inst.	0.78	0.45
		inst	3.70	2.13
Tertiary	Low-income	non-inst.	10.6	7.15
		inst	30.1	20.3
	High-income	non-inst.	-1.65	-0.95
		inst	-8.30	-4.78

Note: The calculations are based on the actual change in the weighted average of offshoring between 1993 and 2003, which was .0068 for offshoring to low-income countries and .0058 for offshoring to high-income countries. Source: authors' own calculations.

According to our assessment, the actual increase in narrow offshoring to low-income countries in 1995-2003 was associated with a reduction in the demand for workers with upper secondary education by about 4 percent based on non-instrumented results and by about 9.5 percent based on instrumented results. It was associated with an increase in the demand for workers with tertiary education by about 0.5 percent based on non-instrumented results and by about 2 percent based on instrumented results. The increase

[28] For a similar exercise in the context of FDI, see Becker *et al.* (2005).

in offshoring to high-income countries is estimated to have been associated with an increase in the demand for workers with upper secondary education by about 7 percent based on non-instrumented results and by about 20 percent based on instrumented results. It was associated with a decrease in the demand for workers with tertiary education by about 1 percent based on non-instrumented results and by about 5 percent based on instrumented results.

Whether these estimated effects are large or small is difficult to judge and depends on ones priors. It should be noted that our analysis does not take into account that offshoring may have affected growth of output and capital accumulation; factors that in quantitative terms might be more important for employment growth than any substitution between domestic workers and imported inputs. The estimated change in employment presented in Table 5 is the one directly related to offshoring. Indirect effects stemming from changes in investment and output growth are not accounted for.

5 Concluding Remarks

In this paper, we have used a cost function approach to estimate the relationship between offshoring of intermediate input production and the composition of labor demand. We argue that most of what we measure as offshoring is in fact related to imports of intermediate inputs from other high-wage countries and try to distinguish between offshoring to high-income and low-income countries in the econometric analysis. We find that offshoring to low-income countries is associated with a shift in labor demand away for workers with an intermediate level of education – upper secondary education – and towards workers with a high level of education. Offshoring to high-income countries is estimated to be associated with a shift in labor demand in the opposite direction. In neither case does offshoring seem to be associated with any particular shift in the demand for workers with the lowest level of education.

These results are robust to a number of different specifications. They contrast with the estimated relationship between R&D investments and the relative demand for different skill groups. Increased R&D intensity seems to be associated with a shift in labor demand away from workers with the lowest level of education (and towards workers with the highest level of education).

A decomposition of offshoring to different geographical regions yields results suggesting that the negative relationship between offshoring to low-income countries and the demand for workers with upper secondary education is mainly driven by offshoring to Central and Eastern Europe. The results for offshoring to Asia are more similar to the ones for offshoring to high-income countries. Our estimated elasticities are fairly large, but they translate into what we ourselves consider to be moderate changes in the demand for different types of workers from actual offshoring 1995–2003.

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A Appendix: Data

The trade data along with input-output tables, price deflators and other industry-specific variables have been provided by Statistics Sweden. Capital stocks are based on investments in machinery, equipment and buildings and have been computed using the perpetual inventory method. Value added has been computed as sales minus costs for intermediate inputs. Capital stocks and value added have been deflated using industry-distributed producer price indices. Comparable input-output tables containing information about imports are available for 1995, 2000 and 2003. The 2003 table used was classified according to product times industry, rather than product times product, but according to Statistics Sweden the differences between the two classifications are minor.

Data on number of employees, wages and educational attainment have been collected from the RAMS database (Regional Arbetsmarknadsstatistik). Wages are calculated as gross wages including taxable wage benefits. Lower secondary education is defined as "grundskola" (nine years of schooling), while upper secondary education is defined as "gymnasium" (usually twelve years of schooling). Information about employment of Swedish multinationals at the industry level has been provided by the Institute for Growth Policy Studies (ITPS). Wages have been deflated using the consumer price index.

The basic industry classification used is based on three-digit SNI92 (which corresponds to three-digit NACE). There are some instances where three-digit industries have been lumped together because of suppression of data at a more detailed level. For most variables collected from the trade or industry statistics, we have information at a level of aggregation where the manufacturing sector consists of 89 industries. Information on capital stocks, however, is only available at a higher level of aggregation – roughly at the two-digit level. Moreover, the input-output tables use an industry classification corresponding to two-digit NACE. Therefore, the analysis is carried out using a an industry classification where the manufacturing sector consists of 20 industries.

To construct measures of offshoring for Finland, we use symmetric input-output tables with information on demand for imports for each year 1995-2003 provided by Statistics Finland. The division of overall offshoring into offshoring to high-income and low-income countries has been carried out in a similar way as for Sweden. Information about imports has also been provided by Statistics Finland.

Table A1. Summary statistics

Variable	Mean	Std. Dev.	Min	Max
Cost share				
lower sec.education	0.260	0.107	0.051	0.492
upper sec. education	0.493	0.059	0.290	0.625
tertiary education	0.247	0.136	0.071	0.660
Economy-wide wages (mill. SEK)				
lower sec.education	0.194	0.011	0.171	0.207
upper sec. education	0.214	0.013	0.187	0.229
tertiary education	0.310	0.025	0.263	0.341
Industry wages (mill. SEK)				
lower sec.education	0.189	0.029	0.111	0.245
upper sec. education	0.205	0.035	0.099	0.264
tertiary education	0.288	0.057	0.117	0.403
Capital stock (mill. SEK)	24891	21690	983	88637
Value added (mill. SEK)	18483	14978	1	58937
R&D expenditure per gross output	0.037	0.044	0	0.275
Narrow offshoring	0.076	0.057	0.005	0.258
High-income countries	0.067	0.053	0.005	0.234
Low-income countries	0.009	0.010	0.000	0.052
Broad offshoring	0.220	0.164	0.043	0.749
High-income countries	0.192	0.148	0.037	0.669
Low-income countries	0.028	0.021	0.004	0.105
Instrument for narrow offshoring	0.100	0.102	0.000	0.603
High-income countries	0.086	0.095	0.000	0.577
Low-income countries	0.014	0.015	0.000	0.064
Instrument for broad offshoring	0.216	0.205	0.001	1.308
High-income countries	0.185	0.189	0.001	1.253
Low-income countries	0.032	0.034	0.000	0.154
FDI	1.519	1.337	0.061	6.843
High-income countries	1.061	1.126	0.035	6.164
Low-income countries	0.474	0.629	0.000	3.958

Note: 180 observations. All variables are in non-logarithmic form.

B Appendix: Additional tables with results

[Table A2A-A3 about here]

C Appendix: Deriving elasticities

Our estimating equations are derived from the following translog cost function for industry i:

$$C_i = \beta_i + \sum_{j=1}^{S} \alpha_j \ln w_j + \sum_{j=1}^{S} \sum_{s=1}^{S} \gamma_{js} \ln w_j \ln w_s + \phi \ln Q_i \tag{7}$$

$$+ \sum_{j=1}^{S} \phi_j \ln Q_i \ln w_j + \delta \ln K_i + \sum_{j=1}^{S} \delta_j \ln K_i \ln w_j \tag{8}$$

$$+ \eta \ln Q_i \ln K_i + \sum_{r=1}^{R} \kappa_r z_{ir} + \sum_{j=1}^{S} \sum_{r=1}^{R} \lambda_{jr} z_{ir} \ln w_j \tag{9}$$

$$(j= 1, ...S, s = 1, ...S, r = 1, ...R),$$

where the variables are as defined in the main text. By differentiating (7) with respect to w_j we get:

$$\theta_{ij} = \alpha_j + \sum_{s=1}^{S} \gamma_{js} \ln w_s + \phi_j \ln Q_i + \delta_j \ln K_i + \sum_{r=1}^{R} \lambda_{jr} z_{ir}, \tag{10}$$

where

$$\theta_{ij} \equiv \frac{\partial C_i}{\partial w_j} \frac{w_j}{C_j}.$$

and $\frac{\partial C_i}{\partial w_j} = L_{ij}$ according to Shephard's lemma. Industry i's demand for factor j can then be written as:

$$L_{ij} = \frac{C_j}{w_j} \left[\alpha_j + \sum_{s=1}^{S} \gamma_{js} \ln w_s + \phi_j \ln Q_i + \delta_j \ln K_i + \sum_{r=1}^{R} \lambda_{jr} z_{ir} \right]. \tag{11}$$

Differentiation of expression (11) yields:

$$\widehat{L}_{ij} = \widehat{C}_j - \widehat{w}_j + \frac{1}{\theta_{ij}} \left[\sum_{s=1}^{S} \gamma_{js} \widehat{w}_s + \phi_j \widehat{Q}_i + \delta_j \widehat{K}_i + \sum_{r=1}^{R} \lambda_{jr} dz_{ir} \right] \tag{12}$$

utilizing the equality in (10) and letting a hat above a variable indicates relative change (i.e. $\widehat{x} \equiv dx/x$).

Substituting $\widehat{C}_j$ in (12) for $\sum_{s=1}^{S} \theta_{is} \widehat{w}_s$ and collecting terms result in:

$$\widehat{L}_{ij} = \left(\frac{\gamma_{jj} + \theta_{ij}^2}{\theta_{ij}} - 1 \right) \widehat{w}_j + \sum_{k=1}^{S-1} \left(\frac{\gamma_{jk} + \theta_{ik}\theta_{ij}}{\theta_{ij}} \right) \widehat{w}_k + \frac{1}{\theta_{ij}} \left[\phi_j \widehat{Q}_i + \delta_j \widehat{K}_i + \sum_{r=1}^{R} \lambda_{jr} dz_{ir} \right], \tag{13}$$

where $k \neq j$. Hicksian wage elasticities are given by:

$$\frac{\widehat{L}_{ij}}{\widehat{w}_j} = \frac{\gamma_{jj} + \theta_{ij}^2}{\theta_{ij}} - 1$$

$$\frac{\widehat{L}_{ij}}{\widehat{w}_k} = \frac{\gamma_{jk} + \theta_{ik}\theta_{ij}}{\theta_{ij}}.$$

The technology variables, z_{ir}, are expressed as shares. Therefore, we report the results for them as semi-elasticities:

$$\frac{\widehat{L}_{ij}}{dz_{ir}} = \frac{\lambda_{jr}}{\theta_{ij}}.$$

In our calculations, we evaluate these elasticities using parameter estimates and sample means of θ_j.

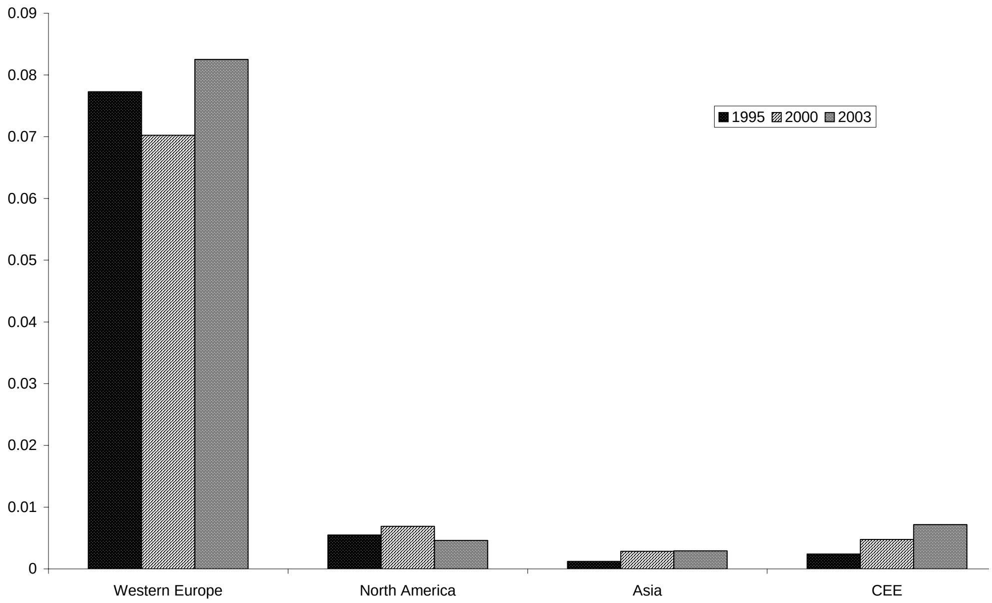

Figure 1: Offshoring (narrow measure) in 1995, 2000 and 2003 by regions.

Table 2A. Elasticities calculated from estimated parameters of translog cost functions. Total offshoring (narrow measure).

		(1)			(2)			(3)			(4)	
	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3
K	-0.002	0.094	-0.186	-0.005	0.099	-0.192	0.013	0.089	-0.191	0.003	0.045	-0.093
	(0.066)	(0.063)	(0.048)	(0.065)	(0.060)*	(0.044)***	(0.056)	(0.057)	(0.048)***	(0.064)	(0.057)	(0.041)**
Q	-0.004	0.012	-0.019	-0.003	0.010	-0.018	-0.003	0.010	-0.018	-0.004	0.007	-0.010
	(0.015)	(0.032)	(0.025)	(0.013)	(0.026)	(0.021)	(0.012)	(0.027)	(0.020)	(0.015)	(0.028)	(0.022)
R/Y	-0.778	-0.581	1.978	-0.780	-0.627	2.072	-0.904	-0.559	2.067	-0.834	-0.910	2.693
	(0.259)***	(0.477)	(0.439)***	(0.268)***	(0.458)	(0.422)***	(0.294)***	(0.462)	(0.452)***	(0.295)***	(0.398)**	(0.389)***
Offshoring	0.268	-0.098	-0.087	0.274	-0.151	0.014	0.323	-0.179	0.018	0.276	-0.064	-0.162
	(0.235)	(0.332)	(0.306)	(0.220)	(0.328)	(0.293)	(0.234)	(0.342)	(0.300)	(0.238)	(0.270)	(0.288)
FDI							-0.007	0.004	0.000			
							(0.006)	(0.007)	(0.006)			
w_1				-2.073	1.906	-1.626	-2.082	1.857	-1.520	-0.938	0.341	0.306
				(0.908)**	(0.553)***	(0.540)***	(0.935)**	(0.584)***	(0.524)***	(0.295)***	(0.172)**	(0.164)*
w_2				3.619	-2.544	1.273	3.527	-2.431	1.146	0.647	0.427	-1.532
				(1.051)***	(0.951)***	(0.866)	(1.110)***	(0.987)**	(0.885)	(0.327)**	(0.197)**	(0.199)***
w_3				-1.547	0.521	0.353	-1.445	0.457	0.374	0.291	-0.884	1.226
				(0.580)***	(0.740)	(0.881)	(0.565)**	(0.753)	(0.847)	(0.152)*	(0.112)***	(0.184)***
No of obs.		180			180			180			180	
R^2 of regression		*L1*:0.99 *L2*:0.92			*L1*:0.99 *L2*:0.91			*L1*:0.99 *L2*:0.91			*L1*:0.99 *L2*:0.95	
Ind. dummies		yes			yes			yes			yes	
Year dummies		yes			no			no			yes	
Time trend		no			yes			yes			no	

Note: L_s denotes demand for skill group *s*, where 1=lower secondary education, 2=upper secondary education and 3=tertiary education. Specification (2) and (3) include economy-wide wages while specification (4) includes industry-specific wages. Standard errors in parenthesis are based on bootstrapping. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively.

Table 2B. Elasticities calculated from estimated parameters of translog cost functions. Offshoring to low- and high-income countries (narrow measure).

		(1)			(2)			(3)			(4)	
	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3
K	-0.002	0.095	-0.187	-0.006	0.100	-0.193	0.008	0.101	-0.211	0.001	0.051	-0.104
	(0.067)	(0.059)	(0.048)***	(0.064)	(0.056)*	(0.046)***	(0.060)	(0.053)*	(0.047)***	(0.065)	(0.054)	(0.041)**
Q	-0.003	0.007	-0.011	-0.002	0.006	-0.010	-0.002	0.006	-0.010	-0.003	0.004	-0.005
	(0.013)	(0.022)	(0.018)	(0.013)	(0.020)	(0.015)	(0.012)	(0.018)	(0.014)	(0.014)	(0.024)	(0.019)
R/Y	-0.837	-0.294	1.467	-0.831	-0.368	1.608	-0.885	-0.530	1.989	-0.862	-0.678	2.260
	(0.266)***	(0.339)	(0.330)***	(0.271)***	(0.332)	(0.333)***	(0.300)***	(0.308)*	(0.378)***	(0.301)	(0.303)**	(0.310)***
Offsh. LI	1.485	-6.004	10.427	1.446	-6.063	10.585	1.243	-5.530	9.735	1.354	-4.270	7.102
	(0.997)	(1.600)***	(1.506)***	(1.048)	(1.586)***	(1.455)***	(2.861)	(1.507)***	(4.367)**	(1.130)	(1.705)**	(1.727)***
Offsh. HI	0.071	0.859	-1.789	0.088	0.782	-1.654	0.170	0.674	-1.524	0.098	0.614	-1.328
	(0.285)	(0.306)***	(0.392)***	(0.266)	(0.323)**	(0.342)***	(0.266)	(0.140)***	(0.407)***	(0.289)	(0.255)**	(0.359)***
FDI LI							-0.017	0.088	-0.071			
							(0.016)	(0.016)***	(0.018)***			
FDI HI							-0.001	-0.034	0.035			
							(0.009)	(0.009)***	(0.009)***			
w_1				-2.152	1.952	-1.635	-2.230	1.994	-1.636	-0.865	0.306	0.299
				(0.904)**	(0.543)***	(0.539)***	(0.903)**	(0.552)***	(0.547)***	(0.286)***	(0.163)*	(0.167)*
w_2				3.707	-2.431	0.956	3.786	-2.661	1.334	0.580	0.347	-1.304
				(1.031)***	(0.901)***	(0.797)***	(1.049)***	(0.875)***	(0.785)*	(0.309)*	(0.187)*	(0.201)***
w_3				-1.555	0.362	0.679	-1.556	0.551	0.302	0.285	-0.770	1.004
				(0.566)***	(0.674)	(0.804)	(0.596)**	(0.642)	(0.836)	(0.158)*	(0.119)***	(0.209)***
No of obs.		180			180			180			180	
R^2 of regression		*L1*:0.99 *L2*:0.93			*L1*:0.99 *L2*:0.93			*L1*:0.99 *L2*:0.94			*L1*:0.99 *L2*:0.95	
Ind. dummies		yes			yes			yes			yes	
Year dummies		yes			no			no			yes	
Time trend		no			yes			yes			no	

Note: L_s denotes demand for skill group *s*, where 1=lower secondary education, 2=upper secondary education and 3=tertiary education. Specification (2) and (3) include economy-wide wages while specification (4) includes industry-specific wages. Standard errors in parenthesis are based on bootstrapping. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively.

Table 3A. Elasticities calculated from estimated parameters of translog cost functions using IV. Total offshoring.

	(1)			(2)			(3)		
	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3
K	0.518	0.381	-1.306	-0.012	0.081	-0.150	0.006	-0.040	0.074
	(0.592)	(0.739)	(0.932)	(0.072)	(0.074)	(0.049)***	(0.071)	(0.065)	(0.047)
Q	0.015	0.022	-0.060	-0.003	0.010	-0.016	-0.003	0.003	-0.002
	(0.025)	(0.042)	(0.040)	(0.012)	(0.025)	(0.018)	(0.016)	(0.023)	(0.019)
R/Y	-2.415	-1.534	5.603	-0.695	-0.563	1.855	-0.950	-0.436	1.870
	(1.943)	(2.514)	(3.056)*	(0.313)**	(0.501)	(0.407)***	(0.376)**	(0.387)	(0.393)***
Offshoring	12.476	6.702	-26.501	0.043	-0.507	0.966	0.474	-3.023	5.538
	(13.993)	(17.503)	(21.578)	(0.680)	(0.803)	(0.778)	(1.451)	(0.947)***	(1.382)***
w_1				-2.108	1.893	-1.564	-1.219	0.553	0.177
				(1.000)**	(0.579)***	(0.618)**	(0.350)***	(0.223)**	(0.162)
w_2				3.595	-2.647	1.505	1.050	0.141	-1.386
				(1.100)***	(0.990)***	(0.916)	(0.424)**	(0.241)	(0.238)***
w_3				-1.487	0.637	0.059	0.169	-0.811	1.208
				(0.632)**	(0.777)	(0.935)	(0.157)	(0.112)***	(0.194)***
No of obs.	180			180			180		
R^2 of regression	*L1*:0.99 *L2*:0.92			*L1*:0.99 *L2*:0.92			*L1*:0.99 *L2*:0.95		
Ind. dummies	yes			yes			yes		
Year dummies	yes			no			yes		
Time trend	no			yes			no		
F-test first stage	31.31			31.31			31.31		

Note: L_s denotes demand for skill group *s*, where 1=lower secondary education, 2=upper secondary education and 3=tertiary education. Specification (2) include economy-wide wages while specification (3) includes industry-specific wages. Standard errors in parenthesis are based on bootstrapping. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively. The last row reports F-test of excluding instrument in first stage regression.

Table 3B. Elasticities calculated from estimated parameters of translog cost functions using IV. Offshoring to low- and high-income countries.

	(1)			(2)			(3)		
	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3
K	0.110	0.260	-0.635	-0.018	0.009	0.001	0.013	0.017	-0.047
	(0.135)	(0.138)*	(0.175)***	(0.074)	(0.064)***	(0.056)	(0.071)	(0.060)	(0.043)
Q	0.002	0.012	-0.027	-0.005	-0.004	0.012	-0.004	-0.003	0.010
	(0.016)	(0.026)	(0.019)	(0.014)	(0.025)	(0.018)	(0.016)	(0.024)	(0.016)
R/Y	-1.115	-1.147	3.462	-0.682	-0.328	1.372	-0.912	-0.496	1.949
	(0.513)**	(0.649)*	(0.703)***	(0.337)**	(0.462)	(0.366)***	(0.355)**	(0.351)	(0.314)***
Offsh. LI	5.260	-1.317	-2.902	-2.003	-14.009	30.079	-0.556	-11.059	22.665
	(6.558)	(6.999)	(8.169)	(3.413)	(4.000)***	(4.457)***	(3.309)	(2.384)***	(3.397)***
Offsh. HI	2.094	7.361	-16.900	0.868	3.699	-8.299	1.269	2.703	-6.733
	(2.088)	(2.275)***	(3.039)***	(0.993)	(1.137)***	(1.294)***	(1.444)	(1.073)**	(1.573)***
w_1				-2.071	2.013	-1.841	-1.169	0.468	0.295
				(0.997)***	(0.572)***	(0.601)***	(0.341)***	(0.213)**	(0.174)*
w_2				3.822	-2.185	0.345	0.889	-0.116	-0.704
				(1.087)***	(0.902)**	(0.882)	(0.405)**	(0.257)	(0.218)***
w_3				-1.751	0.056	1.497	0.281	-0.469	0.409
				(0.593)***	(0.707)	(0.844)*	(0.175)	(0.124)***	(0.197)**
No of obs.	180			180			180		
R^2 of regression	*L1*:0.99 *L2*:0.93			*L1*:0.99 *L2*:0.93			*L1*:0.99 *L2*:0.96		
Ind. dummies	yes			yes			yes		
Year dummies	yes			no			yes		
Time trend	no			yes			no		
F-test first stage LI	66.08			66.08			66.08		
F-test first stage HI	20.93			20.93			20.93		

Note: L_s denotes demand for skill group *s*, where 1=lower secondary education, 2=upper secondary education and 3=tertiary education. Specification (2) and (3) include economy-wide wages while specification (4) includes industry-specific wages. Standard errors in parenthesis are based on bootstrapping. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively. The last rows report F-test of excluding instruments in first stage regression.

Table 4A. Elasticities calculated from estimated parameters of translog cost functions using IV. Offshoring to CEE.

	(1)			(2)			(3)		
	L_1	***L_2***	***L_3***	***L_1***	***L_2***	***L_3***	***L_1***	***L_2***	***L_3***
K	0.033	0.028	-0.090	-0.017	0.031	-0.044	0.002	-0.013	0.023
	(0.076)	(0.073)	(0.082)	(0.067)	(0.060)	(0.047)	(0.064)	(0.054)	(0.040)
Q	-0.001	0.005	-0.010	-0.003	0.005	-0.007	-0.003	0.001	0.001
	(0.015)	(0.029)	(0.021)	(0.014)	(0.028)	(0.021)	(0.016)	(0.028)	(0.019)
R/Y	-1.019	-0.077	1.225	-0.667	-0.138	0.977	-0.983	-0.162	1.357
	(0.461)**	(0.596)	(0.604)**	(0.327)**	(0.466)	(0.377)**	(0.449)**	(0.397)	(0.399)***
Offsh. CEE	8.570	-26.743	44.389	-2.224	-25.950	54.154	1.960	-26.551	50.955
	(11.929)	(12.931)**	(14.158)***	(6.119)	(7.645)***	(8.307)***	(9.470)	(6.408)***	(9.642)***
Offsh. Other	1.282	2.291	-5.923	0.388	2.117	-4.635	0.885	0.941	-2.810
	(1.513)	(1.867)	(2.279)**	(0.687)	(0.871)**	(1.026)***	(1.135)	(1.098)	(1.274)**
w_1				-2.224	2.050	-1.755	-1.210	0.524	0.227
				(0.977)**	(0.580)***	(0.568)***	(0.388)***	(0.260)**	(0.169)
w_2				3.893	-2.480	0.859	0.994	-0.057	-0.932
				(1.101)***	(0.911)***	(0.831)	(0.494)**	(0.309)	(0.239)***
w_3				-1.669	0.313	0.896	0.216	-0.584	0.705
				(0.573)***	(0.674)	(0.763)	(0.187)	(0.120)***	(0.196)***
No of obs.	180			180			180		
R^2 of regression	*L1*:0.99 *L2*:0.93			*L1*:0.99 *L2*:0.92			*L1*:0.99 *L2*:0.96		
Ind. dummies	yes			yes			yes		
Year dummies	yes			no			yes		
Time trend	no			yes			no		
F-test first stage CEE	58.81			58.81			58.81		
F-test first stage other	44.66			44.66			44.66		

Note: L_s denotes demand for skill group *s*, where 1=lower secondary education, 2=upper secondary education and 3=tertiary education. Specification (2) and (3) include economy-wide wages while specification (4) includes industry-specific wages. Standard errors in parenthesis are based on bootstrapping. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively. The last rows report F-test of excluding instruments in first stage regression.

Table 4B. Elasticities calculated from estimated parameters of translog cost functions using IV. Offshoring to Asia.

	(1)			(2)			(3)		
	L_1	***L_2***	***L_3***	***L_1***	***L_2***	***L_3***	***L_1***	***L_2***	***L_3***
K	0.015	-0.020	0.024	0.028	0.200	-0.428	-0.101	-0.019	0.145
	(0.080)	(0.078)	(0.085)	(0.073)	(0.077)**	(0.064)***	(0.090)	(0.068)	(0.075)*
Q	0.007	0.060	-0.127	0.010	0.046	-0.102	0.026	0.020	-0.068
	(0.018)	(0.022)***	(0.019)***	(0.017)	(0.024)*	(0.017)***	(0.022)	(0.029)	(0.024)***
R/Y	-0.573	1.626	-2.645	-0.625	-0.310	1.276	0.101	-0.199	0.290
	(0.609)	(0.637)**	(0.765)***	(0.334)*	(0.421)	(0.324)***	(0.813)	(0.474)	(0.802)
Offsh. Asia	17.588	86.481	-191.176	20.324	54.967	-131.128	59.224	28.277	-118.736
	(19.495)	(16.841)***	(23.179)***	(14.549)	(16.724)***	(20.295)***	(31.937)*	(20.431)	(36.952)***
Offsh. Other	-2.703	-30.360	63.465	-2.596	-8.120	18.944	-14.178	-9.388	33.655
	(7.432)	(6.920)***	(8.842)***	(2.101)	(2.339)***	(2.902)***	(9.115)	(5.136)*	(9.866)***
w_1				-2.207	1.676	-1.026	-0.412	0.735	-1.034
				(0.956)**	(0.601)***	(0.541)*	(0.753)	(0.303)**	(0.634)*
w_2				3.182	-3.376	3.396	1.395	0.568	-2.601
				(1.141)***	(1.049)***	(0.911)***	(0.575)**	(0.404)	(0.597)***
w_3				-0.975	1.584	-2.370	-0.983	-1.420	3.635
				(0.591)	(0.796)**	(0.787)***	(0.641)	(0.428)***	(0.786)***
No of obs.	180			180			180		
R^2 of regression	*L1*:0.99 *L2*:0.94			*L1*:0.99 *L2*:0.93			*L1*:0.99 *L2*:0.95		
Ind. dummies	yes			yes			yes		
Year dummies	yes			no			yes		
Time trend	no			yes			no		
F-test first stage Asia	68.71			68.71			68.71		
F-test first stage other	16.12			16.12			16.12		

Note: L_s denotes demand for skill group *s*, where 1=lower secondary education, 2=upper secondary education and 3=tertiary education. Specification (2) and (3) include economy-wide wages while specification (4) includes industry-specific wages. Standard errors in parenthesis are based on bootstrapping. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively. The last rows report F-test of excluding instruments in first stage regression.

Table 5. Elasticities calculated from IV estimates based on data for 1995, 2000 and 2003.

	(1)			(2)			(3)			(4)		
	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3
K	0.004	0.016	-0.035	0.020	-0.059	0.098	0.007	0.101	-0.209	0.028	-0.019	0.009
	(0.022)	(0.051)	(0.046)	(0.022)	(0.039)	(0.033)***	(0.022)	(0.046)**	(0.040)***	(0.023)	(0.040)	(0.034)**
Q	-0.057	0.053	-0.046	-0.045	0.014	0.019	-0.050	0.201	-0.348	-0.045	0.061	-0.076
	(0.028)*	(0.067)	(0.061)	(0.024)*	(0.043)	(0.035)	(0.026)*	(0.054)***	(0.048)***	(0.025)*	(0.044)	(0.034)**
R/Y	-1.197	-0.289	1.837	-1.406	-0.517	2.510	-1.184	-0.075	1.395	-1.330	-0.350	2.099
	(0.140)***	(0.329)	(0.300)***	(0.174)***	(0.296)*	(0.232)***	(0.143)***	(0.296)	(0.262)***	(0.179)***	(0.303)	(0.232)***
Offshoring	-1.074	-0.755	2.637	-0.579	-2.661	5.922						
	(0.651)	(1.535)	(1.396)*	(0.617)	(1.077)**	(0.796)***						
Offsh. LI							-1.261	-5.162	11.633	-1.527	-5.924	13.435
							(0.906)	(1.871)***	(1.655)***	(0.889)*	(1.624)***	(1.286)***
Offsh. HI							-0.685	9.260	-17.769	-0.009	1.945	-3.874
							(0.792)	(1.637)***	(1.448)***	(0.987)	(1.605)	(1.271)***
w_1				-1.264	0.495	0.340				-1.216	0.408	0.463
				(0.197)***	(0.270)*	(0.105)***				(0.208)***	(0.281)	(0.118)***
w_2				0.941	0.154	-1.296				0.776	-0.024	-0.768
				(0.270)***	(0.413)	(0.195)***				(0.281)***	(0.436)	(0.221)***
w_3				0.323	-0.766	0.956				0.440	-0.501	0.305
				(0.105)***	(0.195)***	(0.144)***				(0.118)***	(0.221)**	(0.168)*
No of obs.		60			60			60			60	
R^2 of regression		*L1*:0.99 *L2*:0.89			*L1*:0.99 *L2*:0.94			*L1*:0.99 *L2*:0.92			*L1*:0.99 *L2*:0.94	
Ind. dummies		yes			yes			yes			yes	
Year dummies		yes			yes			yes			yes	
F-test first stage		17.67			17.67							
F-test first stage LI								41.64			41.64	
F-test first stage HI								27.97			27.97	

Note: L_s denotes demand for skill group *s*, where 1=lower secondary education, 2=upper secondary education and 3=tertiary education. Specification (2) and (4) include industry-specific wages. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively. The last rows report F-tests of excluding instrument in first stage regression.

Table A2A. Elasticities calculated from estimated share equations using employment shares as dependent variables. Total offshoring (Instrumented narrow measure).

	(1)			(2)			(3)		
	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3
K	0.700	0.387	-2.126	-0.048	0.068	-0.114	-0.056	-0.014	0.124
	(0.532)	(0.699)	(0.865)**	(0.067)	(0.066)	(0.040)***	(0.063)	(0.061)	(0.043)***
Q	0.024	0.020	-0.092	-0.002	0.007	-0.017	-0.003	0.003	-0.003
	(0.023)	(0.039)	(0.037)**	(0.011)	(0.023)	(0.022)	(0.013)	(0.024)	(0.022)
R/Y	-3.004	-1.722	9.294	-0.592	-0.681	2.770	-0.735	-0.509	2.513
	(1.748)*	(2.379)	(2.841)***	(0.259)**	(0.457)	(0.413)***	(0.350)**	(0.365)	(0.413)***
Offshoring	17.453	7.369	-46.758	-0.188	-0.261	1.003	-1.014	-1.907	6.775
	(12.588)	(16.560)	(20.039)**	(0.647)	(0.643)	(0.629)	(1.335)	(0.817)**	(1.224)***
w_1				-2.588	2.181	-2.053	-1.533	0.717	0.364
				(0.939)***	(0.558)***	(0.583)***	(0.328)***	(0.204)***	(0.153)
w_2				3.938	-3.119	2.575	1.294	-0.323	-1.080
				(1.008)***	(0.854)***	(0.759)***	(0.369)***	(0.217)	(0.204)***
w_3				-1.351	0.853	-0.522	0.240	-0.478	0.716
				(0.598)**	(0.627)	(0.783)	(0.128)*	(0.103)***	(0.158)***
No of obs.		180			180			180	
R^2 of regression		*L1*:0.99 *L2*:0.91			*L1*:0.99 *L2*:0.91			*L1*:0.99 *L2*:0.94	
Ind. dummies		yes			yes			yes	
Year dummies		yes			no			yes	
Time trend		no			yes			no	
F-test first stage		31.31			31.31			31.31	

Note: L_s denotes demand for skill group *s*, where 1=lower secondary education, 2=upper secondary education and 3=tertiary education. Specification (2) and (3) include economy-wide wages while specification (4) includes industry-specific wages. Standard errors in parenthesis are based on bootstrapping. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively. The last row reports F-test of excluding instruments in first stage regression.

Table A2B. Elasticities calculated from estimated share equations using employment shares as dependent variables. Offshoring to low- and high-income countries (instrumented narrow measure).

	(1)			(2)			(3)		
	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3
K	0.136	0.214	-0.793	-0.059	0.018	0.041	-0.023	0.025	-0.035
	(0.126)	(0.112)*	(0.152)***	(0.072)	(0.059)	(0.051)	(0.057)	(0.053)	(0.036)
Q	0.006	0.011	-0.038	-0.006	-0.002	0.014	-0.005	-0.001	0.011
	(0.015)	(0.025)	(0.023)*	(0.013)	(0.021)	(0.022)	(0.013)	(0.023)	(0.021)
R/Y	-1.208	-1.169	5.043	-0.568	-0.519	2.287	-0.801	-0.546	2.715
	(0.474)**	(0.547)**	(0.627)***	(0.276)**	(0.386)	(0.339)***	(0.322)**	(0.331)	(0.330)***
Offsh. LI	7.055	0.248	-11.406	-3.640	-9.735	32.253	-4.367	-7.528	27.303
	(6.008)	(5.710)	(7.125)	(3.025)	(3.315)***	(3.544)***	(2.864)	(2.201)***	(2.727)***
Offsh. HI	3.385	5.541	-20.354	1.155	2.713	-9.204	1.844	2.117	-8.615
	(2.017)*	(1.826)***	(2.639)***	(0.931)	(0.930)***	(1.110)***	(1.279)	(0.977)**	(1.358)***
w_1				-2.459	2.293	-2.558	-1.638	0.666	0.663
				(0.943)**	(0.553)***	(0.584)***	(0.308)***	(0.201)***	(0.148)***
w_2				4.141	-2.826	1.463	1.202	-0.516	-0.410
				(0.998)***	(0.819)	(0.658)**	(0.363)***	(0.245)**	(0.184)**
w_3				-1.682	0.448	1.095	0.436	-0.234	-0.253
				(0.586)***	(0.541)	(0.663)	(0.149)***	(0.113)***	(0.163)
No obs.	180			180			180		
R^2 of regression	*L1*:0.99 *L2*:0.93			*L1*:0.99 *L2*:0.92			*L1*:0.99 *L2*:0.95		
Industry dummies	yes			yes			yes		
Year dummies	yes			no			yes		
Time trend	no			yes			no		
F-test first stage LI	66.08			66.08			66.08		
F-test first stage HI	20.93			20.93			20.93		

Note: L_s denotes demand for skill group *s*, where 1=lower secondary education, 2=upper secondary education and 3=tertiary education. Specification (2) and (3) include economy-wide wages while specification (4) includes industry-specific wages. Standard errors in parenthesis are based on bootstrapping. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively. The last rows report F-test of excluding instruments in first stage regression.

Table A3. Elasticities calculated from estimated parameters of translog cost functions assuming inputs of different age groups. Offshoring to low- and high-income countries (instrumented narrow measure).

	(1)			(2)			(3)		
	L 1	***L 2***	***L 3***	***L 1***	***L 2***	***L 3***	***L 1***	***L 2***	***L 3***
K	0.172	-0.064	-0.236	0.036	0.004	-0.093	0.000	0.008	-0.021
	(0.165)	(0.101)	(0.109)**	(0.094)	(0.060)	(0.073)	(0.051)	(0.041)	(0.041)
Q	-0.156	0.082	0.153	-0.015	0.010	0.009	0.107	-0.067	-0.078
	(0.144)	(0.090)	(0.101)	(0.053)	(0.042)	(0.032)	(0.095)	(0.064)	(0.053)
R/Y	-0.473	0.498	-0.159	-0.684	0.611	0.045	-0.788	0.617	0.271
	(0.350)	(0.212)**	(0.252)	(0.331)**	(0.207)***	(0.200)	(0.398)**	(0.241)**	(0.221)
Offsh. LI	2.783	-2.300	-0.652	4.489	-3.160	-2.430	4.652	-3.217	-2.664
	(6.712)	(3.458)	(4.741)	(6.183)	(3.186)	(4.466)	(2.894)	(1.961)	(2.097)
Offsh. HI	-4.672	2.182	5.309	-1.131	0.366	1.692	1.857	-1.404	-0.763
	(3.450)	(2.221)	(2.601)**	(1.312)	(1.072)	(0.916)*	(2.321)	(1.533)	(1.320)
w 1				0.109	-0.166	0.165	-0.062	-0.227	0.713
				(0.772)	(0.624)	(0.321)	(0.669)	(0.521)	(0.264)***
w 2				-0.181	-0.028	0.487	-0.247	0.165	0.156
				(0.678)	(0.656)	(1.253)*	(0.566)	(0.497)	(0.156)
w 3				0.071	0.180	-0.652	0.309	0.048	-0.868
				(0.312)	(0.244)	(0.238)***	(0.233)	(0.178)	(0.179)***
No of obs.	120			120			120		
R^2 of regression	*L1* :0.98 *L2* :0.97			*L1* :0.98 *L2* :0.96			L1:0.98 L2:0.97		
Ind. dummies	yes			yes			yes		
Year dummies	yes			no			yes		
Time trend	no			no			no		
F-test first stage LI	40.01			40.01			40.01		
F-test first stage HI	13.58			13.58			13.58		

Note: L_s denotes demand for age group *s* , where 1='25?age<39' , 2='40?age<54' and 3= 2='55?age<65'. Specification (2) and (3) include economy-wide wages while specification (4) includes industry-specific wages. Standard errors in parenthesis are based on bootstrapping. Significance at the 1, 5, and 10 percent level is indicated by ***, **, and *, respectively. The last rows report F-test of excluding instruments in first stage regression.