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Trade, Earnings, and Mobility - Swedish Evidence[1]

by

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Abstract

Using a large longitudinal data set, we study the effects of increased trade on earnings and mobility in the Swedish labor market in the late 1980s and early 1990s. Earnings respond significantly to changes in industry sales, whether generated by domestic market forces or international trade: Swedish exports (imports) raise (lower) annual earnings, but changes in trade affect earnings just as any other shift in market conditions. In general, the wage effects are small; the prime response to changes in the product market appears to be variations in employment. We also examine whether trade has differential effects across skill groups. However, we do not find systematic differences in the effects of trade across the earnings distribution.

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1. Introduction

Sweden has for a long time been one of the countries with the smallest earnings inequality in the world. During the 1960s and 1970s wage dispersion decreased dramatically due to union wage policy and increasing supply of skilled labor. In the mid 1980s the tide turned. The centralized bargaining system started to crumble in 1983 and the increase in the relative supply of skilled labor slowed down. Also, there is some evidence that there has been an underlying trend increase in the relative demand for skilled labor throughout the period (Edin and Holmlund, 1995).

Even if the Swedish wage structure still is compressed by international standards, there has been a trend increase in wage dispersion since the mid 1980s. Between 1983 and 1996 the ratio of annual earnings for full time workers in the top decile relative to the bottom decile increased from 1.88 to 2.28, i.e. by 21 percent. This increase in wage dispersion is substantially smaller than in some of the well documented countries like the US and the UK.[1] Still the trend towards greater inequality is notable in light of the Swedish historical record of small and declining wage inequality.

The other dimension of the increasing inequality is the massive increase in unemployment in the 1990s. Unemployment rates rose rapidly from less than 2 percent in 1989 to over 9 percent in late 1993. Concomitantly, the unemployment rates for the less skilled increased to much higher levels than for the high skilled, but the relative magnitudes of unemployment rates by skill level have remained constant throughout the period (Edin *et al*., 1995). Thus, the structure of the unemployment increase in Sweden is very similar to the development in continental Europe during the 1980s. In our opinion, it is still an open question whether the shock was non-neutral across skill groups.[2]

The main candidates for explaining the deteriorating situation for the low-skilled have been skill biased technical change and increasing trade with low-wage countries. This has spurred a lively academic debate in recent years about the labor market consequences of international trade, see Johnson and Stafford (1999) for a recent comprehensive survey.

[1] For example, the rate of increase is twice as high in the UK. Between 1983 and 1992 real annual earnings for Swedish men rose 15 percentage points faster in the top decile of the earnings distribution compared to the bottom decile. The corresponding number for, e.g., the UK is 35 percentage points for males and 24 percentage points for females; see OECD (1993).

[2] The constancy of relative unemployment rates is sometimes taken as evidence in favor of neutrality (Nickell and Bell, 1995).

Previous Swedish studies of the effects of trade on wages do not provide any strong evidence of major effects on the relative position of the unskilled. Oscarsson (1996) analyzes changes in relative wages across educational groups in manufacturing using a Heckscher-Ohlin framework. She uses data for the period 1968-1991 and finds that changes in commodity prices (and TFP growth) cannot explain the observed trends in relative wages. Hansson (1997) decomposes the changes in employment by skills (education) in manufacturing for the period 1970-1993. He finds that most of the increase in high skill employment occurs within industries (or even plants). This pattern is interpreted as evidence of skill-biased technical change. There is, however, some evidence that increased import penetration increased the relative demand for skilled workers within industries during the period 1970-1985, but this effect is not present in later years.

In a more recent paper, Hansson (1999) has disaggregated Swedish trade data to allow for import penetration from the "South", i.e. non-OECD. He finds effects of intensified competition from the South on the relative demand for skilled labor. The effects are small, however, and concentrated to the 1970s and the beginning of the 1980s. Furthermore, Machin and van Reeenen (1998) report that various measures of imports, including non-OECD imports, do not affect the share of non-production workers in a study of seven OECD countries, including Sweden.

In this paper we take another look at the impact of trade on the labor market. There are at least two reasons for why we think the issue deserves further investigation. First, and most importantly, we think that the use of aggregate data may mask differential effects across the skill distribution. We differ from previous studies in using longitudinal micro data to investigate the effects of changes in international trade. The use of micro data allows us to control for worker characteristics in much more detail than in previous studies. Further, we can directly estimate differential trade effects across the income distribution. Adverse labor market effects, if any, are likely to be most severe among the less skilled. The second reason to study trade effects in the labor market is the potential for such influences in the near future. These effects have become more pertinent in the light of the large potential for increasing trade with the Central and Eastern European Countries (CEEC). The liberalization of the formerly centrally planned economies is expected to increase Swedish trade with low wage countries radically. It has been projected that Swedish trade with the CEEC will, in the long run, increase by a factor of 5 to 10 as compared to 1989 (SOU 1997:156). So, rather than focusing only on OECD and non-OECD,

we divide the second group into LDC (Less Developed Countries) and CEEC trade.

In the empirical analysis we focus on the earnings growth of individuals initially employed in the manufacturing sector. We estimate standard earnings growth equations amended with various measures of industry sales and trade. We also present some evidence on separations as well as entry to employment in the tradable sector.[3] The data used in the analysis covers the period 1985-1995. Due to data limitations for the post 1990 data, we focus on the period 1985-1990. However, we also present some results for the years 1990-1995 - a time period that is very interesting due to increasing trade with non-OECD countries and rising unemployment. We pay particular attention to the developing trade relations with the Central and Eastern European Countries (CEEC) and the Less Developed Countries (LDC). In spite of the high degree of openness of the Swedish economy, trade with these groups has been fairly limited. Since non-OECD trade is of a small magnitude, it may be important to treat trade with the OECD countries separately from other countries to be able to identify potentially heterogeneous trade effects. In the same spirit, imports from countries that are unskilled labor intensive can be expected to have adverse effects on the less skilled in particular. Therefore, we will also examine the impact for different skill groups.

The remainder of the paper is organized as follows. In section 2 we give a brief overview of Swedish trade relations in recent years. Section 3 provides the simple demand-supply framework underlying the estimated equations. Section 4 gives a description of the data. In section 5 we turn to the empirical analysis. We start by examining the impact of trade expansion on annual earnings growth for workers initially employed in manufacturing. This measure will be influenced by both induced wage changes due to trade and pure trade displacement. This section also contains an analysis of earnings growth of (industry-) movers and stayers. In an attempt to take a closer look at the employment effects of trade, we analyze displacement and entry into the tradable sector in section 6. Finally, in section 7, we conclude with a summary of our main findings.

[3] We study displacement rather than unemployment entry and unemployment duration, as in Aiginger et al. (1996), partly because of data limitations, but, more importantly, because we believe that the duration of unemployment demands a more complicated framework than simply relating variations in the duration of spells to changes in trade.

2. Swedish Trade Relations

Like most other countries, Sweden has been exposed to an increasing rate of globalization during the last twenty years. Swedish international trade has increased at a steady rate; from 1975 to 1993, imports (M) and exports (X) as shares of sales in agriculture, mining and manufacturing (ISIC 1-3) increased from 33 to 41 percent and 32 to 47 percent respectively. These increases in trade have, however, in no way been uniformly distributed across Sweden's trading partners.

Table 1 shows Swedish trade as a share of sales in agriculture, mining and manufacturing (ISIC 1-3) and net trade ratios, $(X - M)/(X + M)$, for the years 1975, 1980, 1985, 1990 and 1993.[4] Swedish trade with the OECD (incl. the EU) has increased substantially, while trade with the CEEC and

Table 1: Swedish imports, exports and net trade by trading partner, 1975-1993

Year	1975	1980	1985	1990	1993
OECD					
IMPORTS/sales	0.271	0.284	0.329	0.324	0.354
EXPORTS/sales	0.248	0.265	0.343	0.337	0.398
NET trade ratio	0.044	0.035	0.021	0.019	0.058
CEEC					
IMPORTS/sales	0.018	0.015	0.016	0.011	0.013
EXPORTS/sales	0.019	0.014	0.011	0.009	0.015
NET trade ratio	0.033	0.043	0.167	0.108	0.070
LDC					
IMPORTS/sales	0.042	0.066	0.037	0.033	0.042
EXPORTS/sales	0.045	0.050	0.052	0.040	0.063
NET trade ratio	0.031	0.137	0.170	0.103	0.195
TOTAL					
IMPORTS/sales	0.331	0.365	0.382	0.368	0.410
EXPORTS/sales	0.312	0.329	0.407	0.387	0.476
NET trade ratio	0.030	0.052	0.031	0.024	0.075

Notes*:* The CEEC includes Bulgaria, Hungary, Poland, Romania, the former Czechoslovakia, the former USSR, and the former Yugoslavia. OECD refers to the member countries as of 1993. Sales refer to the sales in agriculture, mining and manufacturing (ISIC 1-3). *Source*: Statistics Sweden.

[4] Due to a change in the industry classification, we are unable to use post-1993 trade data in our empirical analysis. Therefore, we limit our description of trade to the period up to 1993.

Table 2: Changes in trade by manufacturing sector, percent.

(Percentage point changes between indicated years; 1985 levels relative to sales in parentheses)

	All countries				CEEC				LDC			
	Exports		Imports		Exports		Imports		Exports		Imports	
	85-90 (1985)	90-93	85-90 (1985)	90-93	85-90 (1985)	90-93	85-90 (1985)	90-93	85-90 (1985)	90-93	85-90 (1985)	90-93
Resource	4.6 (25.6)	7.8	4.0 (26.3)	4.4	0.0 (0.4)	0.7	1.2 (2.6)	0.5	0.5 (1.9)	0.9	1.3 (3.1)	0.1
Labor	10.1 (46.7)	13.0	2.4 (70.7)	17.5	0.1 (1.1)	1.9	0.0 (1.6)	1.8	1.1 (3.5)	1.3	2.7 (10.7)	8.6
Scale	1.1 (48.7)	7.0	0.4 (28.5)	2.7	0.1 (1.4)	0.2	0.2 (0.8)	0.3	1.5 (5.4)	0.9	0.4 (1.2)	0.4
Technology	4.6 (71.6)	11.1	1.0 (48.7)	0.3	0.1 (1.9)	1.1	0.0 (0.4)	0.1	2.9 (12.7)	5.1	0.5 (1.5)	0.6
R&D	8.1 (84.4)	0.3	7.6 (102.8)	10.4	0.3 (2.1)	0.4	0.0 (0.2)	0.2	0.9 (6.2)	1.9	3.9 (1.8)	3.7
All sectors	3.2 (48.5)	9.4	0.5 (39.6)	3.6	0.2 (1.2)	0.7	0.4 (1.3)	0.4	1.3 (6.1)	2.3	0.3 (2.7)	0.6

Notes: Exports and imports are normalized by sales. The industry classification is based on Pavitt (1984). The CEEC includes Bulgaria, Hungary, Poland, Romania, the former Czechoslovakia, the former USSR, and the former Yugoslavia. LDC-trade equals total trade minus OECD- and CEEC-trade. *Source*: Statistics Sweden.

the LDC has been remarkably stable and continues to represent only a minor share of Swedish overall trade. Although trade with the LDC and the CEEC increased a great deal from 1990 to 1993, these increases started from very low levels. Hence, the bulk of the rise in total Swedish trade over the period is due to more intensive trade with other developed countries

It comes as no surprise that there is a break in the downward trend of CEEC trading shares with Sweden after 1990. During the 1990s, both CEEC imports and, in particular, exports increase. This break coincides with the time of the transition of the CEEC from centrally planned to market economies. These countries can be expected to contribute to increasing Swedish trade shares even more in the future. Table 1 also reveals an increase in LDC trade since 1990, which is more pronounced than the increase in CEEC trade.

A more detailed description of Swedish trade is given in Table 2, where we report changes in trade with different groups of countries by manufacturing sector for the years 1985-90 and 1990-93. One of the main

impressions from the table is the increase in overall trade - exports in particular - in the 1990s relative to the 1985-90 period. The explanation for this is readily found in the macroeconomic development. During the late 1980s the manufacturing exports were held back by an emerging cost crisis. Increasing Swedish exports during the 1990s are to a large extent related to the abandoning of the fixed exchange rate in November 1992. Imports increased at a more modest rate during the 1990s in line with a slow development of overall domestic demand and rapidly increasing unemployment.

Trade with the CEEC and LDC shows a similar pattern as overall trade. Both imports and exports tend to increase in the 1990s after a period of stagnation in the late 1980s. Turning to the sectoral composition of trade, we find that trade with CEEC and LDC differs from trade with the OECD countries.[5] In scale-, technology- and R&D-intensive goods, Sweden is a net exporting country to the CEEC and the LDC.[6] The bulk of imports from CEEC and LDC refer to resource intensive goods and labor intensive goods. LDC imports are particularly concentrated to labor intensive goods. It is also in labor intensive goods one can find the largest increases in imports from the LDC: between 1985 and 1993 imports doubled from about 11 percent to 22 percent relative to Swedish sales.

3. Labor Market Effects of Trade Induced Shifts in Product Demand

To set the stage for the ensuing empirical work, we present a simple model to illustrate how trade induced shifts in product demand affect the labor market. The model draws heavily on Freeman and Katz (1991).

To focus on the main ideas, we ignore the complexities stemming from non-competitive wage setting. While recognizing that the institutions for wage determinations are likely to matter for the *quantitative* effects of trade

[5] This is also reflected in the share of intra industry trade, which, for instance, amounts to 23 percent of total trade for the CEEC to be compared with 60 to 70 percent for the OECD countries (SOU 1997:156).

[6] The fact that the CEEC tend to be net exporters in sectors using low skilled workers and physical capital in relatively large quantities, and net importers of human capital intensive goods is true for the entire EU; Neven (1995), Graziani (1995) and (SOU 1997:156).

on the labor market, we do not think that they are important for the *qualitative* effects. Thus, to illustrate the mechanisms at work we focus on a full employment model.

Assuming competitive wage setting, we have that industry labor demand (N^d) and supply (N^s) are given in first differences by

$$\mathrm{d}\ln N^d = -\varepsilon^d \,\mathrm{d}\ln W + \mathrm{d}\ln \Omega^d, \tag{1}$$

and

$$\mathrm{d}\ln N^s = \varepsilon^s \,\mathrm{d}\ln W, \tag{2}$$

where ε^d and ε^s denote the elasticities of labor demand and labor supply with respect to the wage (W); Ω^d is an indicator of shifts in the derived demand for labor due to exogenous changes in product demand. For convenience, we ignore factors that might shift labor supply. In competitive equilibrium, we get

$$\mathrm{d}\ln W = \frac{\mathrm{d}\ln \Omega^d}{\varepsilon^d + \varepsilon^s}, \tag{3}$$

and

$$\mathrm{d}\ln N = \frac{\varepsilon^s \,\mathrm{d}\ln \Omega^d}{\varepsilon^d + \varepsilon^s}. \tag{4}$$

Given a measure of Ω^d, the coefficient on this variable in a wage equation is thus the inverse of the sum labor demand and labor supply elasticities. This coefficient is likely to vary both with respect to the time span between subsequent observations and with the level of industry aggregation. In the long run when factor mobility is infinite we expect no wage response to exogenous changes in product demand. Moreover, the wage response will depend on the level of industry aggregation, primarily because the labor supply elasticity is likely to be lower at higher levels of aggregation.

In practice, we do not observe the shifts in derived labor demand induced by, e.g., an increase in world market competition in our data. What we do observe are industry prices (P) and output (q), which are endogenous with respect to wages. Therefore we want to address the question of how large the simultaneity bias is likely to be. In order to do so, we formulate a simple model of the product market in each industry.

We take the demand for industry products to be given by

$$\mathrm{d}\ln q = -\eta \,\mathrm{d}\ln P + \mathrm{d}\ln \Omega^d, \tag{5}$$

where η denotes the elasticity of product demand with respect to prices. Technology is taken to be constant returns to scale, so prices depend solely on costs of production

$$\mathrm{d}\ln P = \alpha\,\mathrm{d}\ln W\,, \tag{6}$$

where α is labor's share in total cost. Industry wages are determined according to (3).

Substituting (6) into (5) we get a relationship between output and wages. For our purposes, however, it is more convenient to formulate this relationship in terms of sales ($Q = Pq$) and wages

$$\mathrm{d}\ln Q = (1-\eta)\alpha\,\mathrm{d}\ln W + \mathrm{d}\ln \Omega^{d}\,. \tag{7}$$

Finally, using (3) and (7) to eliminate the unobservable (from our point of view) shift factor, Ω^{d}, and solving for the wage, we get

$$\mathrm{d}\ln W = \frac{\mathrm{d}\ln Q}{\varepsilon^{d} + \varepsilon^{s} + (1-\eta)\alpha} = \beta\,\mathrm{d}\ln Q\,. \tag{8}$$

A simple way to think of our regression analysis below, is that we are estimating an equation such as (8) with an error term appended to it. What we want to get at is $(\varepsilon^{d} + \varepsilon^{s})^{-1}$; what we are getting, however, is β. What is the likely magnitude of this bias? It is clear from (8) that in the lucky case that the elasticity of product demand is unity, the bias disappears. If $\eta < 1$, we have a downward bias, while the converse is true if $\eta > 1$. In the manufacturing industry, the share of labor costs in sales (α) was less than 0.2 in 1985. Moreover, in practically all our regressions we estimate β to be less than 0.1, suggesting that the bias is modest for realistic values of η.[7]

The bias arising from regressing wages on sales may, however, be severe with a more complex stochastic structure of the model. If, instead of appending an error term to (8), we allow for error terms in the underlying

[7] If we instead assume that an industry in a given country faces infinitely elastic product demand at the going world market price and that industry supply depends positively on prices, we would arrive at the conclusion that the coefficient on sales is always biased downwards. Gottfries (1998) estimates the long-run price elasticity of Swedish exports to be between 1 and 2, implying that exporting Swedish firms have some degree of market power.

equations, sales will be correlated with the stochastic part of the regression. This line of reasoning suggests that the issue of endogeneity should be taken seriously and, consequently, we will address the issue further in what follows (see Appendix A4).

Introducing Trade

As indicated, we think of the market equilibrium as delivering a relationship between labor earnings and sales (Q). To illustrate how we introduce trade into this framework, let X denote exports, M imports, and D the size of the domestic market (i.e., $D = Q - X + M$). Define the import share of the domestic market as $m = M/D$ and the share of exports in domestic production as $x = X/Q$. Then we can write sales as $Q = D(1 - m) + Qx$. Take the total differential of this decomposition and solve for $\mathrm{d}\,Q$

$$\mathrm{d}\,Q/Q \approx \mathrm{d}\,D/D + Q/(Q - X) \cdot \mathrm{d}\,x - D/(D - M) \cdot \mathrm{d}\,m. \qquad (9)$$

Approximating percentage changes with log changes and letting $w_x = Q/(Q - X)$ and $w_m = D/(D - M)$, we get

$$\mathrm{d}\ln Q \approx \mathrm{d}\ln D + w_x \cdot \mathrm{d}\,x - w_m \cdot \mathrm{d}\,m. \qquad (10)$$

In the long run, we see no compelling argument for the separate components of sales to have different effects on wages (and employment). Nevertheless, we enter this expression freely into our regressions and check whether the different components have separate effects. The weights, w_x and w_m, are constructed by averaging over the sample period.

4. Data

The empirical analysis is based on a representative panel of the Swedish population (LINDA). The original data set covers around 3 percent of the population each year and the data are cross-sectionally representative; see Edin and Fredriksson (2000). The data are based on a combination of income tax registers, population censuses and other sources.

In the empirical analysis, we mainly use data for the Census years 1985 and 1990. We use these years, partly because we are less interested in short run variations, but also because we have access to higher-quality data during Census years; among other things we know the employment status of each individual (in October each year). A study of the 1990s is made difficult by the fact that the industry coding was changed in 1993; as a consequence we are unable to match individual and industry data for the entire 1990-1995 period. However, we will present some evidence for this period, using 1993 trade data as a proxy for 1995 trade.

In all applications, we restrict attention to individuals aged 16-59 working in manufacturing (ISIC 3). Thus, we concentrate on workers in the sectors mostly exposed to foreign competition.[8] For each individual we have information on a set of background characteristics - including age, sex, education, region of residence etc. – their labor earnings, and the industry they worked in (four-digit ISIC). Unfortunately, we only have access to annual earnings; wage rates would of course have been preferable but given that we look only at manufacturing we will to large extent sample full-time working men.

The above restrictions combined with dropping observations with missing information result in a usable sample of 24,685 individuals. Descriptive statistics on this sample are reported in Table 3. We also provide information on the sub-samples of individuals who had positive labor earnings in 1990 and those who were employed in October 1990 according to the Census.

Table 3 shows, for instance, that approximately three quarters of those employed in manufacturing are men and that real earnings grew at an *annual* rate of 2.3 percent for those who had non-zero income in 1990 and 3.7 percent for those who were employed in 1990. Comparing the characteristics of individuals with positive earnings, or those who were employed in 1990, with the entire sample, we see that those who moved to non-employment tended to be older, less educated and have lower earnings in 1985. Whether these differences across groups are related to changes in trade is an issue that we will examine later on.

[8] The manufacturing share of total exports amounted to 96 %, 1985-90, and the manufacturing share of total imports averaged 86 % between 1985-90.

Table 3: Descriptive statistics, 1985-90 sample

Sample	All		Income 1990>0		Employed 1990	
	Mean	SD	Mean	SD	Mean	SD
Age (1985)	37.4	11.8	36.8	11.5	36.7	11.4
Female	.274		.269		.264	
Cohabiting (1985)	.178		.182		.183	
Married (1985)	.484		.477		.481	
Education (1985):						
< 9 years	.272		.258		.257	
9-10 years	.166		.170		.170	
Short high school	.322		.327		.328	
High school	.126		.129		.129	
Short university	.067		.068		.068	
University degree	.043		.045		.045	
Postgraduate	.003		.003		.003	
Δ Education (1985-1990)	.040		.041		.038	
Ln Annual earnings (1985)	1.80	.572	1.81	.570	1.82	.557
Ln Annual earnings (1990)			1.92	.685	2.00	.478
Δ ln Annual earnings			.117	.702	.187	.530
Industry mobility (1985-1990)	.474					
thereof: within manufacturing	.156					
other industries	.228					
not employed	.090					
Industry variables:						
Δ ln Sales (Δln$Q$)			.364	.233		
Δ ln Domestic demand (Δln$D$)			.454	.248		
Δ Export share (Δx)			.021	.141		
Δ Import share (Δm)			.012	.122		
Industry variables:						
# observations	24,685		23,657		22,466	

Notes: Employed 1990 refers to those who were employed in October 1990 according to the Census. Industry variables are weighted by the industry's share of employment in 1985. They are defined in connection to equation (9).

There are 76 distinct industries of employment in our sample. On the basis of the industry classification of each individual we match data on industry characteristics. As mentioned earlier, we have no information on world market prices across industries. The information in our data permits a separation of total trade according to aggregates of countries: the OECD-countries, the CEEC, and the LDC, where these aggregates are defined as in section 2.

The lower part of Table 3 gives a summary description of the major industry variables weighted by each industry's employment share in 1985. For an average employee in 1985, sales (*Q*) grew slower than domestic demand for industry products (*D*) between 1985 and 1990. The mirror image of this development is that the average employee experienced a reduction in the export share (*x*) of 2.1 percentage points and an increase in the import share (*m*) of 1.2 percentage points. The standard deviations suggest that there is a lot of industry variation behind these averages, although we feel that some of the variation across industries may reflect the fact that trade, in particular, is poorly measured.[9]

5. Earnings Growth

In our analysis of trade effects in the labor market, we will concentrate on annual earnings of individuals initially employed in manufacturing. Changes in trade may influence many aspects of individuals' experiences in the labor market. First, trade changes may affect the hours and wages of employees staying on in their jobs. Second, they may have an effect on the probability of leaving the job and hence the probability of being out of employment. Finally, trade changes may influence where movers (and new entrants) end up, conditional on getting a new job. The use of annual earnings means that our dependent variable will pick up trade effects on wages as well as hours. Our outcome measure will also be affected by mobility between sectors.

We think of our basic analysis as exploring the overall effect on earnings for individuals initially employed in trade exposed industries. This overall effect may then be decomposed into various effects: e.g., different effects for movers and stayers as well as employment and wages.

[9] The corresponding tables with sample means and industry variables for the 1990-95 sample are found in the Appendix.

Basic Earnings Regressions

We start from a simple "Mincerian" earnings equation including trade related variables and estimate the model using first differences to purge the estimates of individual-specific fixed effects. Let $\Delta \ln y_{ij,t+1}$ denote the change in log earnings between time periods *t* and *t*+1 for individual *i* employed in industry *j* at time *t*. For these individuals we estimate the regression

$$\Delta \ln y_{ij,t+1} = \beta' \Delta \mathbf{Z}_{ij,t+1} + \Delta v_{ij,t+1}, \qquad (11)$$

where **Z** is a vector consisting of personal characteristics as well as industry specific variables, including trade. Note that the industry variables are measured as the change in characteristics for the industry where the individual was employed in 1985. Hence, we will not condition on variables - such as industry mobility between 1985 and 1990 - that are the potential outcomes of individual decisions.

In Table 4 we report estimates of the benchmark equation. In the first column, we see the simple specification with earnings related to overall sales. As expected, industry sales are positively related to earnings. A 10 percent expansion of industry sales is associated with a 1.1 percent increase in earnings for individuals employed in that industry in 1985. In the second column, we check whether the distinction between quantity and prices matters. It turns out that it does not, since we cannot reject the hypothesis that the coefficients on production and price are equal.

In the third column of Table 4, we allow the different components of sales to have separate effects on earnings. The coefficients come in with the expected signs; earnings increase with domestic demand and exports, but decrease with imports. It is noteworthy, that the estimated earnings effects are similar to those reported in Freeman and Katz (1991) for US manufacturing. Earnings rise by 0.64 percent in response to an export-induced increase of sales by 10 percent; earnings fall by 0.69 percent in response to an import-induced sales expansion of equal size. The earnings responses to trade are marginally smaller (in absolute value) than the 0.85 percent increase in earnings due to a 10 percent increase in domestic demand. However, we are not able to reject the hypothesis that the

Table 4: Earnings Regression

Dependent variable: change in log earnings between indicated years. (Huber-White standard errors allowing for correlation within industry in parentheses)

					1985-90						**1990-95**	
	(1)	(2)	(3)	(4)	(5) Empl. '90	(6) Inc. restr.	(7) Stayed	(8) Moved within	(9) Moved outside	(10)	(11)	(12) Inc. restr.
mean(dep. variable)							.150	.253	.225			
SD(dep. variable)							.381	.538	.762			
Δln(sales)	.1071											
	(.0282)											
Δln(production)		.1090										
		(.0295)										
Δln(price)		.1025										
		(.0356)										
Δln(domestic demand)			.0851	.0948	.0519	.0216	.1057	.0284	.1464	.1340	.1371	.0487
			(.0298)	(.0289)	(.0220)	(.0111)	(.0174)	(.0323)	(.0509)	(.0437)	(.0453)	(.0187)
w_x Δ(export share)			.0639	.1051	.0601	.0346	.0866	.0926	.0809	.0920	0.0836	.0350
($w_x \Delta x$)			(.0272)	(.0401)	(.0189)	(.0139)	(.0140)	(.0315)	(.0421)	(.0393)	(.0496)	(.0178)
w_m Δ(import share)			.0687	.1053	.0636	.0327	.1030	.1006	.0838	.0918	.0843	.0349
($w_m \Delta m$)			(.0277)	(.0368)	(.0154)	(.0134)	(.0165)	(.0343)	(.0446)	(.0394)	(.0451)	(.0178)
$w_x \Delta x^c$				.1539							.0913	
				(.2356)							(.0198)	
$w_x \Delta x^l$				.0240							.0018	
				(.0612)							(.0129)	
$w_m \Delta m^c$				.3231							.1317	
				(.3949)							(.0466)	
$w_m \Delta m^l$				.0313							.0022	
				(.0193)							(.0065)	
λ							.2851	.0465	.3823			
							(.0221)	(.0574)	(.0551)			
R^2	0.080	0.080	0.080	0.080	0.116	0.080	0.141	0.177	0.105	0.033	0.033	0.066
#observations	23657	23657	23657	23657	22466	15744	12981	3853	5632	22333	22333	15111
Test (*p*-value)	--	--	0.528	0.954	0.449	0.648	--	--	--	0.000	0.174	0.002

Notes: Column (5) excludes those who did not work according to the 1990 Census; column (6) excludes those who earned less than SEK 80,000 in 1985 or less than SEK 118,000 in 1990. The estimates in columns (7)-(9) are corrected for selection using the Multinomial Logit in Table 6 column (1). The standard errors are not corrected for prior estimation of λ. Column (12) excludes those who earned less than SEK 118,000 in 1990 or less than SEK 140,000 in 1995.The regressions include a constant and the changes in marital status, educational status, age squared, and region of residence. The test is for equality in the absolute values on the coefficients on Δln(domestic demand), $w_x \Delta x$, and $w_m \Delta m$. Superscripts *c* and *l* denote CEEC and LDC, respectively.

absolute magnitudes of the trade effects are equal to the effect of domestic demand.[10]

In column four, we allow trade with different groups of countries (OECD, LDC, CEEC) to have separate effects. This produces somewhat higher estimates for OECD trade (the main effect) compared to column three, but all the four additional coefficients are poorly determined. We are not able to reject that the effects of trade with the CEEC or LDC are equal to the effects of OECD trade.

In the next two columns of Table 5 we report small variations of the basic sample used in the previous columns.[11] In column 5, we restrict the sample to individuals employed in 1990 according to the census, and in column 6 we exclude individuals earning less than SEK 80,000 in 1985 or less than SEK 118,000 in 1990. These income cutoffs are chosen as to correspond to a full time annual earnings for individuals at the lower end of the income distribution.[12] In both these cases earnings are less sensitive to variations in sales, suggesting that hours variation among part-time workers may be a substantial part of the overall effects.

Mover and Stayer Earnings

An interesting question is whether the earnings prospects of individuals who stayed on or moved to other industries would have been differentially affected by market conditions. This is an issue, since it is highly plausible that individuals' mobility decisions are taken on the basis of the expected pay-off of moving and staying, respectively.

An analysis of this question, however, demands that appropriate account is taken to the fact that individuals potentially self-select (or get selected) into different states of employment or non-employment. Under some assumptions, a multinomial logit for these different states can serve as a basis for purging the estimates of such selection bias; see Lee (1983) for details. Essentially, the procedure amounts to a generalization of Heckman's (1979) two-stage methodology.

Columns (7)-(9) in Table 4 presents separate earnings growth equations for individuals who either stayed on in the same industry, moved to another industry

[10] The estimated effects of the components of sales are all smaller than the estimate on total sales. This may be due to two factors. First, measurement errors in trade are probably more severe than in total sales. (Table A2 in the Appendix provides some evidence of the sensitivity of estimates for excluding small industries with "extreme" changes in trade.) Second, the decomposition if total sales into its components is not exact.

[11] We have also tried specifications where we include 2-digit industry dummies or change in industry log productivity to account for industry characteristics in addition to sales. The results are robust to these changes.

[12] The income cut-offs correspond to full time earnings for the lowest quartile of publicly employed cleaning personnel.

within the manufacturing sector, or moved outside manufacturing. Each equation includes a selection correction term (λ) calculated on the basis of the multinomial logit.[13]

The first thing to note is the large difference in the mean growth rates between stayers and movers. On average, earnings grew by 15 percent for those who stayed in the industry; movers within manufacturing saw earnings grow by 25 percent and movers outside experienced earnings growth of 22 percent. Although mean growth rates were higher for mobile workers, there is considerably more diversity in these groups, suggesting that both pull and push factors were important driving forces for mobility. The dissimilarities in the mean and spread of earnings growth suggest that the processes driving mover and stayer earnings might be different.

In comparison to our previous results, the responsiveness of earnings to market conditions has risen slightly. This is a consequence of the fact that we are now taking into account that those with unfavorable shifts in product demand left the labor market.[14] Moreover, the estimated coefficients on the selection correction terms make economic sense. They suggest that those with higher unobserved earnings growth were more likely to stay on, while those with lower unobserved growth were more likely to move. The estimates for stayers is also the set of estimates that have a clear interpretation, the earnings gains of movers are to a larger extent influenced by factors not related to changes in sales in their original industry.

Basic Earnings Regressions for the 1990's

It is clear from sections 1 and 2 that the early 1990's were much more eventful in terms of changes in trade and employment in the Swedish economy than the late 1980's. Therefore, we report some estimates from the 1990-1995 period in the last three columns of Table 4, in spite of the fact that the quality of the data is somewhat weaker. In particular, one should note that the trade variables refer to the period 1990-1993.

Overall, the qualitative results are very similar to the earlier period. Given the large differences in the overall macroeconomic performance across the samples, we find the similarity of estimates for the two time periods striking. The most notable difference is that most of the estimated coefficients are larger in absolute values. The effects of domestic demand and trade come in with the expected

[13] The estimates of λ are calculated on the basis of the corresponding specification of the displacement equation. The identifying variables are housing status, household composition, log industry employment in 1985 and log 1983 earnings (see Table 6). The results are similar if we omit 1983 earnings as an identifying variable.

[14] This particular result does not hold when we exclude 1983 earnings from the list of identifying variables.

signs in column (10), with the previous effect somewhat larger. There is some evidence that trade with the CEEC has larger effects than overall trade in column (11). These estimates are more precise, but substantially smaller in comparison to the 1985-1990 estimates.[15] When we impose an income restriction analogous to the one used for the earlier period in column (12), there is, again, an indication that most of the effects are due to variation in hours worked.

The Effects of Trade across the Income Distribution

The international debate on the effects of trade in the labor market has to a large extent been tied to the phenomenon of increasing inequality in earnings. Thus, even if the overall effects of increasing trade on earnings is minor, trade may well have substantial effects on certain groups, e.g., the less skilled. To address this issue we report estimates for different quartiles of the observed skill distribution in Table 5. We choose to report the estimates for the baseline specification only, since the estimates of trade effects, especially for different groups of countries, are sensitive to variations of the main sample such as those in columns 3, 5 and 6 in Table 4.

In the first four columns we report estimates by quartiles of the (predicted) 1985 earnings distribution.[16] One striking feature of these (point-) estimates is that the sensitivity of earnings to changes in domestic demand is much higher for less skilled workers. There is no such pattern for the trade effects. On the contrary, it is actually in the two top quartiles we find the largest trade effects, though not very precisely estimated. Still, we are not able to reject coefficient equality on the sales variables in any quartile. These estimates suggest that the employment opportunities for the less skilled are the ones that are most responsive to (any) shifts in the product market.[17]

[15] The significance of the CEEC import coefficient is driven by one single industry (see Table A2).

[16] We prefer to use predicted instead of actual earnings because it partly alleviates the problem of part time workers. We have used the 1984 survey of Household Market and Nonmarket Activities (see Klevmarken and Olovsson, 1984) to look at hours worked for manufacturing workers. In the bottom quartile of the actual earnings distribution, 44 % worked less than 30 hours per week. This should be compared to 4 % in the remaining part of the earnings distribution.

[17] We have also experimented with dividing up the sample according to type of industry (see Table 2). It turns out that the only group of industries that deviate from the rest is labor intensive production. In our 1985-1990 data these industries have substantially higher estimates for trade than other industries, while in 1990-1995 the opposite is true.

Table 5: The Distributional Effects of Trade

Dependent variable: change in log earnings between indicated years
(Huber-White standard errors allowing for correlation within industry in parentheses)

	1985-90				1990-95			
	(1) Q1	(2) Q2	(3) Q3	(4) Q4	(5) Q1	(6) Q2	(7) Q3	(8) Q4
Δln(domestic demand)	.1475 (.0744)	.1012 (.0604)	.0523 (.0305)	.0405 (.0275)	.0556 (.0464)	.1605 (.0574)	.1372 (.0493)	.1548 (.0493)
w_x Δ(export share) (w_x dx)	.0443 (.0583)	.0258 (.0534)	.0898 (.0407)	.0756 (.0453)	.0955 (.0495)	.0671 (.0524)	.1125 (.0499)	.0469 (.0503)
w_m Δ(import share) (w_m dm)	-.0512 (.0642)	-.0246 (.0595)	-.1019 (.0441)	-.0767 (.0468)	.0955 (.0495)	.0667 (.0524)	.1124 (.0499)	.0467 (.0503)
R^2	0.090	0.051	0.060	0.062	0.070	0.038	0.030	0.054
Test (p-value)	0.189	0.460	0.182	0.690	0.598	0.000	0.072	0.000
# observations	5915	5914	5913	5915	5585	5582	5582	5584

Notes: All regressions include a constant and the changes in marital status, educational status, age squared, and region of residence. The test is for equality in the absolute values on the coefficients on Δln(domestic demand), $w_x \Delta x$, and $w_m \Delta m$. Q1-Q4 denotes different quartiles of the predicted earnings distribution in 1985 (1990). The predicted earnings distribution was calculated from a regression relating the log of 1985 (1990) earnings to a constant, sex, age, age squared, education, immigrant status, marital status, occupation, and county of residence.

In the last four columns we report estimates by quartiles of the observed skill distribution in 1990. These estimates do not conform entirely to those for 1985-1990. The effects of changes in domestic demand are now actually smaller for the first quartile. Also, the point estimates of the trade effects vary substantially between quartiles in a way that is not intuitively obvious. These estimates may serve as a good illustration of the fact that the estimates for sub-samples may be very sensitive; in spite of the reasonably large number of observations, we have only a limited number of industries.

6. Separations and Entry

We now turn to an examination of the relationship between mobility patterns and trade. We begin by investigating the association between separations and changes in the "origin" industry. By "separated" workers we mean all workers who did not remain in their 1985 industry of employment. We then proceed to an analysis of the relationship between entry and changes in the "destination" industries.

Separations

We distinguish between four groups of workers: stayers; movers within manufacturing; movers to employment outside manufacturing; and movers to non-employment. Let P_{ik} denote the probability that an individual *i* is in state $k = 0,\ldots,3$, where $k = 0$ denotes staying on in the same industry. As in the analysis above, we think of this probability as being determined by a vector of individual and (origin) industry characteristics, $\tilde{\mathbf{z}}_{ij}$. Individual heterogeneity is handled by introducing the log of earnings in 1983 among the regressors.[18] Under a particular assumption about the random disturbances we have the multinomial logit model where

$$P_{ik} = \frac{\exp(\mathbf{b}_k' \tilde{\mathbf{Z}}_{ij})}{1 + \sum_k \exp(\mathbf{b}_k' \tilde{\mathbf{Z}}_{ij})}, \qquad (12)$$

and $\mathbf{b}_0 = 0$ is an identifying normalization.[19]

The first three columns of Table 6 present the results of estimating equation (12). To interpret these estimates note that $\partial \ln(P_{ik}/P_{i0}) \big/ \partial \tilde{Z}_{ij} = b_k$ and $\partial \ln(P_{ik}/P_{i\ell}) \big/ \partial \tilde{Z}_{ij} = b_k - b_\ell$.

By and large, the results of the baseline specification are in line with our priors. An increase in the demand for industry products is associated with a reduction of the probability of being displaced, irrespective of category. There is a distinct difference between those who have left manufacturing and movers within manufacturing. Apparently, the reasons for leaving manufacturing are not connected to changes in sales to the same extent as internal mobility within manufacturing. Moreover, the individual components of the change in sales come in with expected sign; a rise in import penetration, for instance, always

[18] To retain the size of our sample we assigned a unit value to those with zero earnings in 1983 and included a dummy for these individuals.

[19] The assumption that the disturbances of the underlying model are IID with the type I extreme-value distribution yields the multinomial logit model.

increases the probability of being displaced. There are some differences with respect to the responsiveness to these components across categories; for movers within manufacturing and the non-employed, domestic market forces seem to be more important than international trade.[20]

Table 6: Separations and Entry

	Separations			Entry		
	Moved within (1)	Moved outside (2)	Non-employed (3)	From within (4)	From outside (5)	From non-employment (6)
Δln(domestic demand)	.7281	.1793	.3222	1.107	1.273	.8652
	(.0844)	(.0793)	(.1141)	(.088)	(.092)	(.0833)
w_x Δ(export share)	.3693	.1417	.2139	1.035	1.204	.2526
($w_x \Delta x$)	(.1042)	(.0928)	(.1424)	(.143)	(.150)	(.1108)
w_m Δ(import share)	.4613	.1696	.2889	.953	1.065	.2585
($w_m \Delta m$)	(.1097)	(.0980)	(.1467)	(.127)	(.134)	(.1077)
pseudo-R^2		0.098		0.155	0.160	0.164
$(1 - \ln L(\hat{\mathbf{b}})/\ln L(\mathbf{0}))$						
# observations		24685		292828	331132	365408
Test (*p*-value)	0.000	0.309	0.043	0.002	0.000	0.000

Notes: The "moved-outside" category consists of all employed individuals who did not move within manufacturing. The separation equations all include a constant, the log of earnings in 1983, a dummy for those with zero earnings in 1983, and the following individual characteristics as of 1985: sex, immigrant status, age, age squared, educational status, marital status, region of residence, housing status (home ownership or rental), and the number of persons aged 20-59 in the household. In addition they include the log of industry employment in 1985 and the changes in (individual) marital and educational status. All entry equations include eight industry dummies and the log of industry employment in 1985. The test is for equality in the absolute values on the coefficients on Δln(domestic demand), $w_x \Delta x$, and $w_m \Delta m$. Superscripts c and l denote CEEC and LDC respectively.

We also examined whether individuals in the bottom quartile of the 1985 earnings distribution were more likely to be displaced because of shifts in sales. This turned out not to be the case, although the probability of being displaced is higher (to non-employment in particular) for these individuals for reasons unrelated to changes in product market conditions.

[20] These coefficients can be transformed to elasticities. The elasticities are weighted averages of the fraction of individuals in each state. Stayers have elasticities that are of the opposite sign compared to those who are displaced; moreover, they turn out to be least responsive to market conditions. To get a rough idea of the size of the elasticities for movers within, movers outside and the non-employed, respectively, multiply the coefficients by 1.0, 1.4, and 1.3.

Entry

Our last piece of evidence concerns the relationship between entry and trade. To capture the extent to which trade in a sector affects the probability of an inflow of labor to that sector, we match individual and industry data on the basis of individuals' industry affiliation in 1990, instead of on the basis on their industry of employment in 1985. We consider three groups of entrants separately: movers within manufacturing; entrants from outside manufacturing; and entrants from non-employment.

To be slightly more formal, let P_{ij} denote the probability that an individual *i* enters industry $j = 1,\ldots,J$. With an analogous distributional assumption as in the case of displacement, this probability equals

$$P_{ij} = \frac{\exp(\mathbf{c}'\mathbf{V}_j)}{\sum_j \exp(\mathbf{c}'\mathbf{V}_j)}, \qquad (13)$$

where $\mathbf{V_j}$ is a vector of industry attributes. Notice that individual characteristics cancel out of (13). This is a consequence of our identifying assumption, namely that the parameter vector **c** is equal across industries.[21] However, the consequences of individual attributes can be investigated by either dividing the sample into different sub-samples or interacting a particular individual characteristic with a set of industry dummy variables.

The last three columns of Table 6 give the results of estimating the model in (13). We include the log of industry employment in 1985 to control for industry size and two-digit industry dummies in addition to the variables used previously. The results conform to our priors in the sense that any change implying an expansion of industry sales increases the probability of entry into that sector. For purposes of interpreting the effects on the probabilities, note that $\partial P_{ij} / \partial V_j = P_{ij}(1 - P_{ij})c$. Given that we have entered the industry variables in logs, we obtain an elasticity interpretation by multiplying the coefficients with $(1 - P_{ij})$. If we are interested in the effects in an average industry, this correction is almost immaterial. The estimates in column (4), for instance, roughly suggest that there is a one-to-one relationship between increases in sales and entry probabilities. Entry from non-employment appears to be least responsive to changes in sales.[22]

[21] Equation (13) is simply a conditional logit.

[22] The low estimates on the trade variables for entrants from non-employment is at least partly a consequence of the fact that there is no relationship between trade changes and entry of females in this group.

7. Concluding Remarks

Using a large longitudinal data set, we examine the effects of increased trade on the earnings of workers in manufacturing. We also study the effects of trade on worker mobility, including mobility between sectors, transitions to non-employment and the industry destination of new entrants into the labor market.

Our main result is that earnings respond significantly to changes in industry sales, whether generated by domestic market or trade forces. Although we have found robust evidence that an increase in Swedish exports raises annual earnings and an increase in imports lowers earnings, we are in most cases not able to reject the hypothesis that changes in the domestic market and changes in trade are alike. Thus, on average, changes in international trade tend to affect earnings just as any other shift in market conditions. Furthermore, given the small changes in trade with non-OECD countries, trade does not appear to be a major factor in the changes in earnings for Swedish workers during our period of analysis.

An important question is whether the effects of increased trade vary across the earnings distribution. In terms of earnings, we have some evidence that variations in sales in general affect the lower part of the distribution more than the upper part. Beyond that, we have little evidence that trade has a particularly large effect for individuals at the lower end of the skill distribution.

A related result concerns the impact of imports from different regions of origin. We have allowed trade with the CEEC and trade with the LDC to have separate effects from overall (i.e. OECD) trade. It is often argued that increasing trade with non-OECD countries is potentially more harmful for less skilled workers. We do not find evidence supporting such claims. In most cases, we found no significant differences across these aggregates in terms of the effects on earnings.

A qualitatively similar pattern as for earnings arises for the effects on displacement. An increase in Swedish exports tends to reduce mobility out of the exporting industry, while an increase in imports tends to stimulate mobility. Contrary to the earnings estimates, however, we find that domestic market forces drive some aspects of mobility to a greater extent than international trade.

In general, we find that employment (separations and entry) is more sensitive to product market conditions than earnings. During a five-year period, individuals appear to have been able to move out of industries hit by negative trade shocks in order to avoid significant earnings losses.

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Appendix

A1. Included Industries

As a general rule, we use industry information at the four-digit ISIC level of aggregation. In five instances, however, we were forced to merge two industries into one since information was missing on some key variables. We merged ISIC 3131 and ISIC 3132; ISIC 3231 and 3232; ISIC 3511 and 3512; ISIC 3821 and 3829; and, finally, ISIC 3851 and 3853.

A2. Descriptive statistics 1990-95 sample

Table A1: Descriptive statistics

Sample	All		Income 1995>0	
	Mean	SD	Mean	SD
Age (1990)	37.4	11.8	36.9	11.5
Female	.284		.280	
Cohabiting (1990)	.048		.050	
Married (1990)	.483		.481	
Education (1990):				
< 9 years	.201		.186	
9-10 years	.185		.187	
Short high school	.367		.371	
High school	.125		.127	
Short university	.074		.078	
University degree	.045		.047	
Postgraduate	.003		.003	
Δ Education (1990-1995)	.128		.129	
ln Annual earnings (1990)	7.28	.525	7.29	.520
ln Annual earnings (1995)			7.11	.979
Δ ln Annual earnings			.180	.917
Industry variables:				
Δ ln Sales ($\Delta \ln Q$)			.082	.231
Δ ln Domestic demand ($\Delta \ln D$)			.176	.296
Δ Export share (Δx)			.099	.100
Δ Import share (Δm)			.087	.212
# observations	24,112		22,333	

Notes: Industry variables are weighted by the industry share of employment in 1990. They are defined in connection to equation (9).

A3. Outlier Sensitivity

Table A2: Outlier sensitivity

Dependent variable: change in log earnings between indicated years
(Huber-White standard errors allowing for correlation within industry in parentheses)

	1985-90 excluding industry no. 3214			1990-95 excluding industry no. 3831		
	(1)	(2)	(3) income restr.	(4)	(5)	(6) income restr.
Δln(domestic demand)	.1055 (.0333)	.1082 (.0320)	.0326 (.0100)	.1610 (.0478)	.1542 (.0484)	.0576 (.0208)
w_x Δ(export share) (w_x dx)	.1294 (.0486)	.1402 (.0492)	.0720 (.0211)	.1320 (.0556)	.1032 (.0570)	.0479 (.0245)
w_m Δ(import share) (w_m dm)	.1201 (.0417)	.1354 (.0427)	.0628 (.0186)	.1238 (.0521)	.1056 (.0522)	.0452 (.0231)
$w_x \Delta x^c$		.0994 (.2463)			.0651 (.0251)	
$w_x \Delta x^l$		.0511 (.0645)			.0315 (.0126)	
$w_m \Delta m^c$		-.2657 (.3945)			-.0935 (.0608)	
$w_m \Delta m^l$		-.0003 (.0270)			-.0021 (.0069)	
R^2	0.080	0.080	0.081	0.033	0.034	0.066
Test (p-value)	0.660	0.716	0.019	0.017	0.252	0.153
# observations	23646	23646	15738	22004	22004	14569

Notes: The 1985-90 results should be compared with columns (3), (4) and (6) in Table 4 and the 1990-95 results with columns (10)-(12) in Table 4. Column (3) excludes those who earned less than SEK 80,000 in 1985 and less than SEK 118,000 in 1990. Column (6) excludes those who earned less than SEK 118,000 in 1990 and those who earned less than SEK 140,000 in 1995. All regressions include a constant and the changes in marital status, educational status, age squared, and region of residence. The test is for equality in the absolute values on the coefficients on Δln(domestic demand), $w_x \Delta x$, and $w_m \Delta m$.

A.4 Simultaneity Bias

This appendix is devoted to examining the possibility of simultaneity bias. *A priori* you would certainly expect product demand to be endogenous with respect to wages. In the highly stylized framework of section 3 we argued that the magnitude of the bias is likely to be small for reasonable values of the

underlying parameters. However, we also noted that in a more complex setting this might be a more serious issue.

In the absence of data on world market prices, finding valid instruments is not an easy task. We experimented with different sets of instruments. First, we used information on trade and sales across industries in Germany and Finland. Second, we used lagged changes and 1985 levels of sales, trade, and employment in Swedish industries. Finally, we tried a combination of the former two sets of instruments. The second set of instruments did not perform particularly well, which is to be expected since the 1985-levels are endogenous if we believe in the specification of the earnings equation (in levels). The problems associated with the second set of instruments also plagued the third, so we settled on using the foreign data. We think that these are plausibly exogenous to the developments in the Swedish labor market.

The German and Finnish data come from the OECD database STAN and cover 36 industries. Hence, there is loss of information at the industry level in comparison to our Swedish data that cover 76 industries.

Table A3: Estimates treating industry variables as endogenous.

Dependent variable: change in log earnings 1985-90
(Huber-White standard errors allowing for correlation within industry in parentheses)

	(1) OLS	(2) 2SLS	(3) OLS empl. '90	(4) 2SLS empl. '90	(5) OLS inc. restr.	(6) 2SLS inc. restr.
Δln(domestic demand)	.1400	.1246	.0740	.0503	.0197	-.0017
	(.0449)	(.0590)	(.0399)	(.0485)	(.0140)	(.0228)
w_x Δ(export share)	.1699	.1663	.1227	.1371	.0673	.0924
	(.0595)	(.1019)	(.0515)	(.0826)	(.0270)	(.0459)
w_m Δ(import share)	.1473	.1337	.1111	.1078	.0573	.0605
	(.0519)	(.0865)	(.0442)	(.0736)	(.0232)	(.0449)
R^2	0.080	0.080	0.116	0.115	0.080	0.076
Test (*p*-value)	0.094	0.332	0.412	0.376	0.121	0.030
# observations	23657	23657	22466	22466	15744	15744

Notes: There are 36 different industries. Columns (3)-(4) excludes those who did not work at the time the 1990 Census was conducted; columns (5)-(6) excludes those who earned less than SEK 80,000 in 1985 and less than SEK 118,000 in 1990. All regressions include a constant and the changes in marital status, educational status, age squared, and region of residence. The additional instruments used to identify the model were the changes in log domestic demand, the weighted changes in the export shares, the weighted changes in the import shares, and the 1985 level of log sales in Germany and Finland respectively. The test is for equality of the absolute values of the coefficients on ln(domestic demand), $w_x \Delta x$ and $w_m \Delta m$.

Table A3 presents the results. For purposes of comparison, columns (1), (3) and (5) give OLS-estimates based on an aggregation of the Swedish data to the 36 industries covered by STAN. Remember that the level of aggregation is likely to matter as the coefficients on the industry variables are functions of the inverse of labor supply and demand elasticities; see equation (3). In particular, the elasticity of labor supply is likely to decrease at higher levels of aggregation, implying that the absolute values of the coefficients increase.

With respect to the issue of endogeneity, no clear pattern emerges from these estimates. The equation for the whole sample suggests, if anything, a mild upward bias in the coefficients on both exports and imports. Variations in the choice of samples, however, produce conflicting evidence. The final columns, where an income restriction is imposed, suggest a downward bias, while the equation for those employed in November 1990 yields mixed results. Since there is no clear evidence of strong endogeneity of industry variables, we decided to treat the trade variables as exogenous.

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