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IS HUMAN CAPITAL LOSING FROM OUTSOURCING? EVIDENCE FOR AUSTRIA AND POLAND

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Abstract

Feenstra and Hanson (1997) have argued in the context of the North American Free Trade Agreement that US outsourcing to Mexico leads to an increase in the skill premium in both the US and Mexico. In this paper we show on the example of Austria and Poland that with the new international division of labour emerging in Europe Austria, the high income country, is specializing in the low skill intensive part of the value chain and Poland, the low income country, is specializing in the high skill part. As a result, skilled workers in Austria are losing from outsourcing, while gaining in Poland. In Austria, relative wages for human capital declined by 2 percent during 1995-2002 and increased by 41 percent during 1994-2002 in Poland. In both countries outsourcing contributes roughly 35 percent to these changes in the relative wages for skilled workers. Furthermore, we show that Austria's R&D policy has contributed to an increase in the skill premium there.

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1 Introduction

The debate about globalization has shifted recently to a new frontier. Firms in rich countries are seen to outsource white color workers to India, China, and to Eastern Europe raising fears that this will adversely affect the long run growth potential of industrialized economies and will result in an increase in unemployment of high skilled workers in Europe and in a decline in the skill premium in the US.[1] In a previous paper, Marin (2004) has shown that German and Austrian firms offshore the skill intensive stages of production to Eastern Europe relocating high skilled jobs to this region. She finds that German affiliates in Eastern Europe are on average almost 3 times as skill intensive compared to their parent companies in Germany. The skill intensity of the off-shoring activity of Austrian firms is slightly above that of the activity of parent firms in Austria.

In this paper we examine empirically whether outsourcing to New Europe has hurt skilled workers in Old Europe and has benefited workers in New Europe.[2] Figure 1 gives the ratio of skilled to unskilled wages in the last decade in Germany and Austria on the one hand and in Poland, Hungary and the Czech Republic on the other. We use as a proxy for the skill wage ratio relative wages of non-production to production workers. The data show a strong increase in the relative wage for skills in Poland, Hungary and the Czech Republic, while this ratio appears to have remained almost constant in Germany and Austria.[3]

These wage data do not show a pattern of factor prices that trade economists usually expect from trade and investment integration. Typically, when a skill rich country like Germany (relative to Poland) integrates with a skill poor country like Poland, we expect relative wages for skills to go up in Germany and to decline in Poland. The reason is that trade integration leads a country to specialize in those sectors which use the country's abundant factor intensively. Thus, skill rich Germany specializes in the skill intensive sectors and labor rich Poland specializes in labor intensive sectors. As a result the relative demand for skills goes up in Germany and declines in Poland leading to an increase in the relative wage for skills in Germany and to a decline of those in Poland.

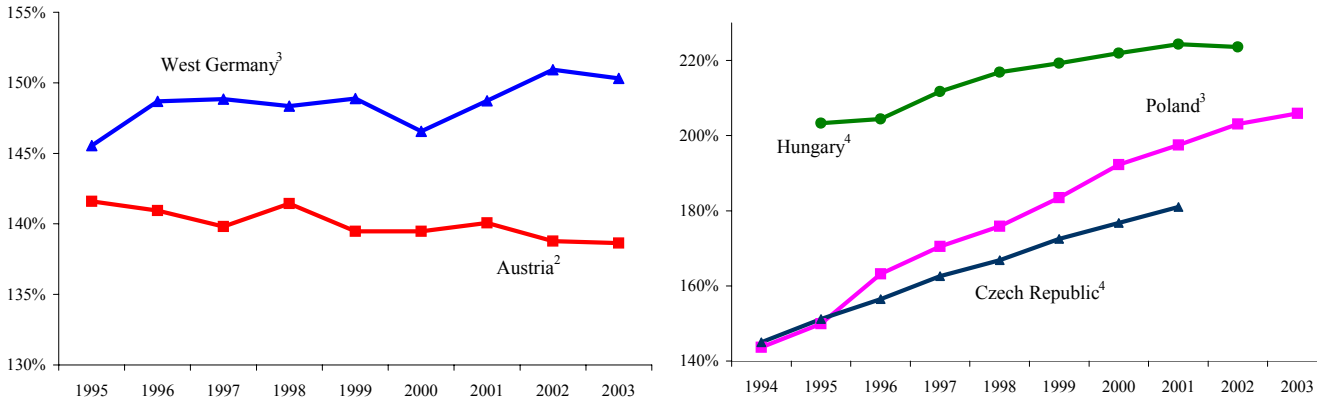
Why have relative wages for skilled workers increased in New Europe and remained somewhat constant in Old Europe? Why do we observe a perverse Stolper-Samuelson effect in these countries? We explore these questions on the example of two countries from Old and New Europe: Austria and Poland. Austria

[1] The last Brookings Trade Forum in 2005 is devoted to the theme of Outsourcing of White Collar Workers.

[2] For the New International Division of Labor in Europe, see Marin (2006).

[3] For an explanation of the evolution of the skill premium in Germany, see Marin and Raubold (2005).

Figure 1: Relative Wages[1] in Selected Countries



[1]non-production workers'wage to production workers' wage
[2]manufacturing and mining
[3]manufacturing
[4]industry
Source: Own calculations based on data gathered from Statistic Austria, Central Statistical Office of Poland and PAIiIZ.

and Poland are no natural pair to consider. Although Austria's foreign direct investment to Poland accounts for 10.4 percent of total outgoing Austrian FDI to Eastern Europe in 2002-2004 and has shown a tremendous increase in the last ten years (see Table 1), Austria's share in total incoming FDI in Poland is negligible (see Table 1). Still, we choose these two countries, because Poland is the largest country in New Europe and Austria is the country in Old Europe most integrated with New Europe. The Central and Eastern European Countries (CEE) account for 58 percent of total outgoing FDI in Austria in 2002-2004 (see Table 1).[4]

Table 2 takes a closer look at outsourcing in selected countries and the development in their labor markets. With an annual growth rate of the skill wage ratio of 4.4 percent, Poland shows the strongest increase in the skill premium since the announcement of Eastern Enlargement. Compared to Poland, Mexico's increase in the relative wage for skills appears to be small in face of the North American Free Trade Agreement (NAFTA). The annual increase in the skill premium in Germany and the US are of the same order of magnitude, while Austria's skill premium declined modestly. At the same time, Austria and Poland experienced a sharp increase in outsourcing between 1995 and 2002. In both countries outsourcing has grown annually by 6 and 7 percent, respectively. This can also bee seen from Figure 2 which shows that the measure for outsourcing in Austria (the share of imported inputs in percent of output) increased from 20 percent in 1990 to 30 percent in 2000, while remaining constant over the previous decade. In Poland

[4] In 2003 CEE accounted for 88% of total outgoing FDI in Austria, while only for 4% in Germany (see Marin, Lorentowicz and Raubold (2003)).

Table 1: Foreign Direct Investment Pattern in Austria and Poland

	Austria's outgoing FDI		Poland's incoming FDI		
	1992-1994	2002-2004	1994-1996	2001-2003	
CEE	33.83	58.00	7.86	19.07	France
Hungary	18.03	10.93	21.07	10.74	USA
Czech Rep.	9.87	7.19	14.27	13.94	Germany
Poland	0.59	10.40	7.81	18.08	Netherlands
Croatia	1.00	6.36	4.79	9.22	UK
Slovak Rep.	1.53	3.10	10.37	2.15	Italy
Slovenia	2.00	3.86	3.16	5.21	Sweden
Romania	0.18	10.35	0.51	7.96	Belgium
Russia	0.15	1.15	2.33	4.11	Denmark
Bulgaria	0.23	1.35	0.00	0.00	Russia
EU-15	35.24	28.30	1.07	0.45	Ireland
Germany	9.66	10.30	3.33	1.83	Switzerland
UK	6.67	3.52	1.31	-1.01	Austria
other	30.93	13.69	21.48	10.32	other
total	100.00	100.00	100.00	100.00	total

Notes: The numbers show the percentage distribution of foreign direct investment flows. Countries are ranked according their average (1992-2004 for Austria and 1994-2003 for Poland) importance as source and as host country, respectively.
Source: Own calculations based on data of the Austrian National Bank, OeNB, and the Polish Information and Foreign Investment Agency, PAIiIZ.

the measure of outsourcing (foreign assets in percent of domestic assets) increased from 4 to 80 percent between 1994 and 2002. Thus, outsourcing is a candidate for explaining the evolution of the skill premia in both countries.[5]

This paper explores the role of outsourcing for the decline in the skill premium in Austria and for the increase of the skill premium in Poland. In Section 2 and Section 3 we develop the theoretical framework and its empirical implementation along the lines of Feenstra and Hanson (1996b, 1997) who have argued that the increase in the skill premium in the US as well as in Mexico in face of NAFTA can be explained by capital movements in the form of foreign direct investment from the US to Mexico. US multinationals started to outsource the labor intensive

[5]For the determinants of outsourcing see Marin (2006).

Table 2: Outsourcing and Labor Market Outcomes in Selected Countries

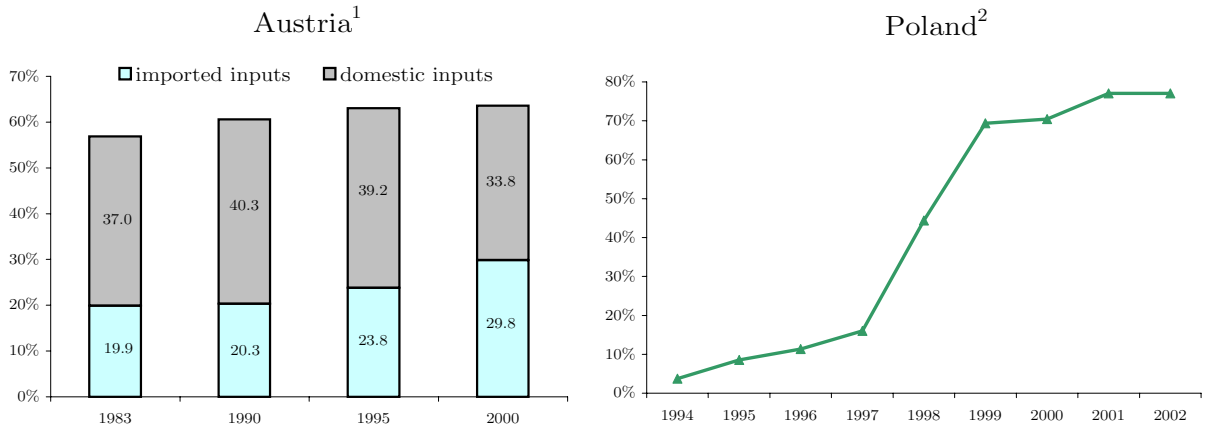
	Poland 1994-2002	Austria 1995-2002	Germany 1990-2000	USA 1979-1990	Mexico 1975-1988
outsourcing	6.91[c]	6.01[d]	-	4.67[e]	17.60[f]
relative wages[a]	4.42	-0.29	0.71	0.72[g]	1.39[h]
relative employment[a]	1.22	1.97	2.01	-	-
high-skilled workers' wage share[b]	3.74	1.14	1.56	1.27	1.50[h]

[a] non-production to production workers in manufacturing for Poland, Germany, USA and Mexico, in mining and manufacturing for Austria
[b] (non-production to production workers' wage*number of non-production to production workers)/((non-production to production workers' wage*number of non-production to production workers)+(production to production workers' wage*number of production to production workers)) in manufacturing for Poland, Germany, USA and Mexico, in mining and manufacturing for Austria
[c] 1+(foreign fixed assets/domestic fixed assets), manufacturing
[d] narrow definition of outsourcing: (imported inputs from own sector/value added of sector)*100, mining and manufacturing
[e] (imported inputs from the same sector/total non-energy material purchases)*100, manufacturing
[f] incoming FDI / total fixed investment
[g] weighted by the industry share of total manufacturing shipments
[h] for US-Border region only, manufacturing
Source: Poland, Austria and Germany: own calculations; USA: data from Feenstra and Hanson (1996b); Mexico: data from Feenstra and Hanson (1997).

stages of production to Mexico. The so called *maquiladoras* emerged in Mexico. *Maquiladoras* are affiliates of US multinationals in Mexico which specialize in the low skill intensive part of the value chain. US multinationals' outsourcing activities to Mexico leads relative wages for skills to increase in the US as well as Mexico. The increase in the skill premium in Poland and its decline in Austria suggests that an inverse *maquiladoras* effect is emerging in Austria and Poland. Austrian firms are outsourcing the more skill intensive stages of production to Eastern Europe and specializing in the more labor intensive stages of production in Austria leading to a decline in the skill premium in Austria.[6] Poland on the other hand is receiving outsourcing of multinational activities from more skill rich countries like the US, the Netherlands, and France resulting in an increase in the skill premium in Poland. Section 4 examines whether such an inverse *maquiladoras* effect can be identified for Austria and whether the decline in the skill premium in Austria can be attributed to outsourcing. Section 5 then examines whether multinational outsourcing has been contributing to the increase in the skill premium in Poland. Section 6 concludes.

[6]Marin (2004) shows that Austria is poor in skills relative to Eastern Europe.

Figure 2: Outsourcing in Austria and Poland



[1]Domestic and imported inputs in percent of output, manufacturing and mining.
[2]Foreign fixed assets relative to domestic fixed assets, manufacturing.
Source: Own calculations based on data gathered from Statistic Austria, Central Statistical Office of Poland and PAIiIZ.

2 The Framework

In the Feenstra and Hanson's (1996a) model, the world economy consists of two countries: North and South. Each country is endowed with three factors of production: capital, high-skilled labor and low-skilled labor. These endowments are assumed to be sufficiently different so that factor prices are not equalized. Returns to capital and the relative wage of high-skilled labor are assumed to be higher in the South, reflecting a relative scarcity of capital and high-skilled labor in the South. Initially, there is no international factor mobility, but labor mobility between skill categories within each country. In other words, the supply of skilled and unskilled workers can react to changes in the relative wages. On the production side there is a single final good assembled from a continuous range of intermediate inputs at no additional cost. These inputs are produced using all factors and differ only with regard to the relative amounts of high-skilled and low-skilled labor engaged in their production since capital enters the production function with the same cost share for all inputs. They are indexed by $z \in [0, 1]$ and ranked in a way that high-skilled labor intensity is increasing with z. Assuming that for constant wages the minimum cost of producing one unit of input is a continuous function of z and that all inputs are produced in both countries, Figure 3 depicts the minimum cost locus for intermediate goods produced in the North ($C^N C^N$) and in the South ($C^S C^S$).

z^* is defined as the "cutoff intermediate input" where the minimum production cost in the South and the North is equal. $C^S C^S$ lies below $C^N C^N$ to the left of

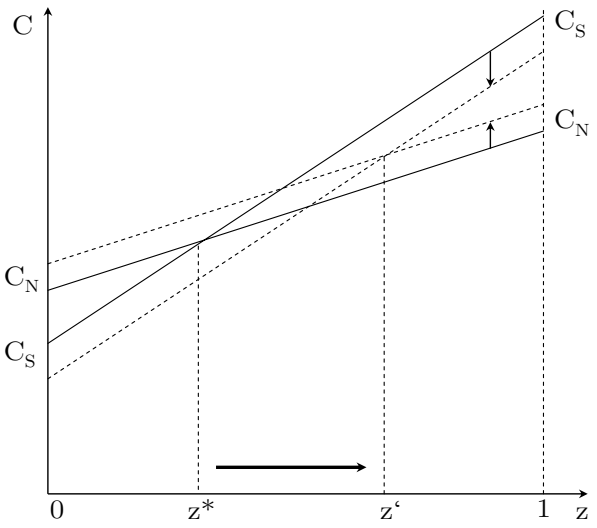


Figure 3: Outsourcing from the North to the South.

z^* since the relative wage of low-skilled labor, which is relatively intensive used in the production of these inputs, is lower in the South. The opposite holds for intermediates lying to the right of z^*. Thus, the South has a cost advantage in producing inputs, which are relatively low-skilled labor intensive and the North has a cost advantage producing inputs which are relatively high-skill intensive. The following trade pattern emerges: the South exports intermediate goods in the range $z \in [0, z^*)$ while the North exports those in the range $z \in (z^*, 1]$.

What will happen in the model if Northern firms are allowed to invest in the South? They will have an incentive to do so in order to earn the higher returns to capital in the South. The flow of capital from the North to the South will cause a reduction in the Southern return to capital and an increase in return to capital in the North. Consequently, at constant wages, this change will alter the minimum cost loci shown in Figure 3. $C^S C^S$ will move down and $C^N C^N$ up increasing the critical value of z^* to z'. That is, the production of inputs in range $[z^*, z')$ now will take place in the South rather than in the North. In other words, in the South, the range of intermediate production will spread toward inputs that engage a higher ratio of high-skilled to low-skilled labor. The inputs, which still will be produced in the North, will use a higher ratio of high-skilled to low-skilled labor relative to those that will leave. Therefore, both countries will experience an increase in the average skill intensity of production and an increase in the relative demand for high-skilled labor. As a result, the relative wage of skilled labor will rise in both countries. Summing up, z^* is increasing with the Southern to Northern capital ratio. Thus, the relative wage of skilled workers will be positively affected by accumulation of capital in the South relative to the North. Feenstra and Hanson

(1996a) show that this result also holds for exogenous relative capital accumulation in the South not necessarily caused by Northern firms' investment.

Following Feenstra and Hanson's (1996a) interpretation of the model, the activities which are outsourced by industrialized countries to developing countries are relatively low-skilled from the perspective of the home country and relatively high-skilled for the host country. Thus, outsourcing increases the relative demand for high-skilled workers in both countries resulting in a higher relative wage for high-skilled labor.

3 The Empirical Model

The model of Feenstra and Hanson (1996a) provides a formalization of the idea that outsourcing induces a shift in the factor intensities in domestic and foreign production. As described in the previous section, the countries are - by assumption - endowed with three factors of production: low-skilled labor, high-skilled labor and capital. In the production process these three factors are combined, which leads to the following unit variable cost function for each sector i and for each point in time t:

$$cv_{it} = cv(w_{it}^{LS}, w_{it}^{HS}, r_{it}, OUTSOURC_{it}, TECH_{it}) \tag{1}$$

We include in addition to the factor prices w^{LS}, w^{HS} and r_{it} two variables: outsourcing ($OUTSOURC$) and technical change ($TECH$). Following the existing literature, the inclusion of outsourcing as well as technical progress in the unit cost function is justified by arguing that merely including the factors of production will not capture other factors which might influence the production costs. In this context outsourcing can be thought as a form of technical change since it acts as an "endogenous technical change".[7]

Berman *et al* (1994) suggested that a translog cost function can be derived from the unit cost function. Assuming capital as a fixed factor of production, the differentiation of the translog cost function with respect to the prices of the variable factors, w^{LS} and w^{HS}, gives the factor demand equation in the form of the factor's share in total variable cost. In our analysis the factor's share in total variable cost is defined as the high-skilled workers' wage bill in the total wage bill. This wage bill share of the high-skilled workers (WBS^{HS}) measures the relative demand for high-skilled labor. From this we receive the following estimating equation:

$$\begin{aligned} WBS_{it}^{HS} &= \beta_0 + \beta_1 lnY_{it} + \beta_2 lnK_{it} + \beta_3 OUTSOURC_{it} \\ &\quad + \beta_4 TECH_{it} + u_{it} \end{aligned} \tag{2}$$

[7] See Feenstra and Hanson (1996a).

The dependent variable in this equation is a composite measure. It incorporates relative wages of non-production workers as well as their relative employment.

4 Outsourcing in Austria

In this section we analyze the consequences of increased competition due to imported intermediate goods for the Austrian labor market. Particularly, we want to address the question of how international outsourcing affects the demand for high-skilled labor in Austria. What is an appropriate measure of this competition in imported inputs? In the existing literature, there are two definitions known that use the data of input-output tables: wide and narrow definitions of outsourcing. The wide definition refers to the intermediate goods that a particular sector imports from all sectors all over the world. In contrast, the narrow definition of outsourcing is related just to the imported inputs from the firm's own sector. The reasoning for favoring the latter definition is that the workers of a particular sector might be solely affected by decisions of firms at the sectoral level over "make or buy" inputs.[8] Firms of a particular sector are not able to produce inputs that they buy from other sectors. Therefore, the factor intensities and the demand for high-skilled labor should not be affected by the decision if inputs from other sectors are sourced domestically or from abroad. In this paper we will use therefore the narrow definition of international outsourcing.

4.1 Data and Variables

The sample includes annual data of 15 industrial sectors that are pooled over the years 1995-2002. The sectors are classified according to the European NACE system at the 2-letter level.[9] The sample period starts in the year 1995, because consistent data with respect to sector classification are only available for the years after Austria's accession to the EU.

The labor demand data are taken form the Association of Austrian Social Insurance. The skill levels are proxied by the commonly used broad definition of production ("Arbeiter") and non-production workers ("Angestellte") for low-skilled and high-skilled workers. The statistics show the wages and the employment separately for production and non-production workers.

We define the variable international outsourcing $OUTS$ as the share of imported inputs in value added. The narrow definition of outsourcing takes the imported inputs of the own NACE 2-letter sector into account. Some other studies are using the imported intermediate inputs a a share of the sum of domestic

[8] See Geishecker (2002).
[9] The considered sectors belong to NACE C and D.

and imported inputs.[10] The advantage of our measure $OUTS$ is that it controls for changes in the degree of value added, and consequently, for overall changes in the use of intermediate goods. Since we want to analyze the importance of outsourcing for the labor market, it might not be appropriate to look just at the relative importance of imported inputs compared to total inputs.

As control variables, we use data on output Y, value added VA, and gross fixed capital formation K from the OCED STAN database. Since no industry-level measure of capital stocks is available,[11] we use gross fixed capital formation data to construct a measure for the capital stocks. For this calculation, we employ the perpetual inventory method.

Technical change is proxied by the variable $R\&D\ L$ measuring the R&D personnel as a proportion of the sector's employment.

See the Data Appendix for further description of the data and their sources.

4.2 Empirical Results

We estimate our equation with fixed effects, since any variation between units not accounted for by the independent variables creates unobserved heterogeneity in the model. Given that industries differ from each other in the characteristics not included in our empirical model, estimating with OLS would relegate the omitted heterogeneity to the error term and the coefficients would be biased.[12] Furthermore, we also incorporate time fixed effects. This is important, since we have neglected the fact, that the international outsourcing might be determined by some foreign factors. Due to obvious reasons we cannot include these variables in the regression. By inclusion of time dummies, we assume that the foreign variables' impact is the same across industries and varies only over time. Moreover, there might exist some aggregate exogenous factors that are correlated with the industry-level relative labor demand.

Not surprisingly, statistical tests show that there is a heteroscedasticity problem plaguing our data. In order to assure the efficiency of diagnostic tests all standard errors reported in the results are robust to heteroscedasticity.

We first estimate our basic equation (2) with the wage bill share as the dependent variable in Table 3.

In column (1) of Table 3, the wage bill share of the high-skilled workers WBS is regressed on $OUTS$ and the control variables, Y and the capital output ratio

[10] See for example Feenstra and Hanson (1996b) and Geishecker (2002).

[11] Data of capital stocks are available at the aggregated level of ISIC 1-letter sectors for the years 1988 to 2000.

[12] The big advantage of the fixed effects versus random effects is that any potential correlation of the explanatory variables with the individual effects is rendered harmless since the fixed effects and therefore their correlation with the explanatory variables are annihilated.

Table 3: Outsourcing and Demand for High-Skilled Labor in Austria

dependent variable: *wage bill share*				
	(1)	(2)	(3)	(4)
OUTS	- 0.018*	- 0.030**	- 0.034***	- 0.036***
	(0.011)	(0.012)	(0.010)	(0.010)
ln Y	3.999*	4.256**	3.721*	2.704
	(2.100)	(1.962)	(1.964)	(2.031)
ln K/Y	3.440*	4.740**	4.098*	2.826
	(2.059)	(2.064)	(2.067)	(2.098)
R&D L		0.414**	0.362*	0.365**
		(0.198)	(0.183)	(0.179)
R&D SUB			0.829***	0.974***
			(0.303)	(0.311)
FDI L				- 0.039**
				(0.019)
constant	- 3.647	- 11.677	- 4.552	10.394
	(25.443)	(24.341)	(24.353)	(25.474)
Adj. R^2	0.997	0.997	0.997	0.997
N	120	120	120	120

Notes: Parameters are estimated by OLS regressions; *** (**) [*] indicates significance at the 1 (5) [10] percent level; robust standard errors are reported in parentheses; industry and time dummies are included but for expositional ease are not shown. Variables are defined as follows: *wage bill share* = (wage bill of non-production workers/industry wage bill)*100; *OUTS* = (imported inputs from own sector/value added)*100; *ln Y* = log real output; *ln K/Y* = log [(capital/output)*100]; *R&D L* = (R&D employment/employment)*100; *R&D SUB* = (R&D subsidies/value added)*100; *FDI L* = (employment in foreign affiliates in Austria/employment)*100.

K/Y. The results suggest that outsourcing has a significant negative effect on the demand for high-skilled labor. Thus, rather than saving on low skilled labor as is commonly assumed, outsourcing saves on high skilled labor relative to low skilled labor. Furthermore, the sector's output and capital output ratio have a positive impact on the non-production workers' share of the wage bill.[13] This suggest that the output elasticity is higher for high-skilled labor than for low-skilled labor.

Additionally, specification (2) includes the *R&D L* as a proxy for technical change,[14] which is positively signed and statistically significant at the five percent

[13] We have also run all the regressions with investments (gross fixed capital formation) instead of capital stocks, but the results are very similar.

[14] The regressions are also carried out with data on R&D expenditures relative to value added. The results for the estimated coefficients (not reported here) are very similar to those for R&D employment.

level. This indicates that labor saving technical change shifts the demand toward non-production workers. It is interesting to note that the inclusion of $R\&D\ L$ in column (2) magnifies the negative impact of OUTS on high skilled labor and raises the significance to the 5 percent level.

We include two additional variables $R\&D\ SUB$ and $FDI\ L$ in the regression to control for further factors which may have put pressure on the relative demand for skilled labor in Austria. $R\&D\ SUB$ measures public subsidies to the private sector in percent of value added. The reason why we include this variable in the regression is that the government in Austria pursued an active technology policy driving up relative wages of skilled labor in Austria. $R\&D\ SUB$ is supposed to control for this policy induced effect on relative wages of skilled workers.[15] Compared to other OECD countries, governmental R&D policy plays an important role in Austria. In 2001, 38.2 percent of R&D expenditures are financed by the government, whereas only 29.1 percent of R&D expenditures are state-financed on OECD average. Since these state-financed R&D expenditures are used as a policy instrument, they might be unequally distributed among sectors. As a proxy for R&D subsidies we use in our analysis the R&D subsidies of the state-owned research foundation for enterprises ("Österreichische Forschungsförderungsgesellschaft"). The subsidies vary from 2.3 percent of the sector's R&D expenditures in the coke and oil sector to 21.6 percent in the wood sector.

Table 4: Who Contributes to R&D

	Financing R&D in 2001 (in percent)				
	Austria	USA	France	Japan	Finland
State Aid	38.2	27.8	36.9	18.5	25.5
Domestic Firms	41.8	67.3	54.2	73	70.8
Foreign Firms	19.7	-	7.2	0.4	2.5

Source: Statistische Nachrichten 6/2004, Statistics Austria.

The positive and highly significant coefficient on $R\&D\ SUB$ indicates that an increase of state-aided R&D expenditures in percent of value added by 1 percentage point is pushing up the relative wage bill of high-skilled workers by 0.83 percentage points. The technology policy effect on the relative wage bill of skilled workers is of much larger magnitude than the effect of technical change and outsourcing.

[15] For the R&D policy induced effect on relative wages for skilled workers in Austria see Marin (1995). She shows that the same policy has contributed to the slowing of the speed by which the pattern of trade moved up the technological ladder in Austria.

Furthermore, the inclusion of $R\&DSUB$ increases the statistical significance of OUTS to the 1 percent level.

In the last specification of Table 3, we include $FDI\ L$ measuring the percent of employment of foreign affiliates in Austria by sector. The reason why we include this variable is that foreign firms play an important role in the R&D and trade activity taking place in Austria. In 2001, 20 percent of R&D expenditures is financed by foreign firms (see Table 4). This share is the largest one among OECD countries.[16] In addition, foreign affiliates in Austria generate a large share of Austrian imports. Table 5 shows, that around one third of all imports are done by foreign multinationals in Austria. The presence of foreign firms in Austria varies strongly according to the sector. The share of employment of foreign affiliates in percent of sector's employment ranges from 3.8 percent in the furniture sector to 70 percent in the coke and oil sector.[17]

Table 5: Role of Foreign Firms for Foreign Trade and the Austrian Labor Market

	1995	1998	2002
share of FDI employment in total employment	16.26	17.00	16.65
share of FDI-Imports in total imports	-	21.75	32.08

Source: Own calculations based on data of the Austrian National Bank, OeNB, the OECD STAN database, and Eurostat Comext data base.

Foreign multinationals tend to increase the relative demand for unskilled labor in Austria suggesting that they invest in unskilled labor intensive sectors. This is consistent with the fact that Austria is a relatively human capital poor country.[18] The estimated coefficient on $FDI\ L$ is negative and significant at the 5 percent level. A 1 percentage point increase in the share of imported inputs ($OUTS$) and in the share of employment in foreign multinationals in Austria lowers the relative demand for high skilled labor by about 0.04 percentage points.

The economic impact of international outsourcing implied by these estimates is substantial over the considered period. The observed increase in the non-production wage bill share in the period 1995 to 2002 is 3.36. Multiplying the coefficient on outsourcing from column 4 by the change in outsourcing (12.67 percentage points) and dividing this by the change in the wage bill share [(-0.036*12.67)/3.36]

[16] In the EU-15 countries 7.7 percent of the R&D activity is undertaken by foreign multinationals. See Statistische Nachrichten 6/2004, Statistics Austria.

[17] The numbers show averages for 1995 to 2002.

[18] For a comparison of Austria's skill endowment with other OECD and Eastern European countries see Marin (2004).

results in a negative contribution of 0.136. This implies that the wage bill share of human capital would have increased by 13.6 percent more in the absence of outsourcing in the last decade.

Table 6: Outsourcing and Decomposed Demand for High-Skilled Labor in Austria

dependent variables: *(1)-(3): relative wages, (4)-(6): relative employment*						
	(1)	(2)	(3)	(4)	(5)	(6)
OUTS	- 0.155***	- 0.148***	- 0.179***	- 0.109*	- 0.149**	- 0.142***
	(0.056)	(0.055)	(0.061)	(0.063)	(0.067)	(0.051)
ln VA	- 20.131**	- 27.179***	- 22.592***	67.617***	52.529***	66.058***
	(8.557)	(9.386)	(8.270)	(14.162)	(9.758)	(15.608)
ln K/VA	- 17.521*	- 22.064**	- 19.831**	57.372***	51.123***	54.806***
	(9.145)	(9.115)	(8.724)	(10.280)	(7.831)	(11.164)
R&D L		2.637*			3.074***	
		(1.516)			(1.073)	
R&D SUB			2.349			4.923**
			(1.664)			(2.025)
constant	449.505***	520.155***	480.238***	- 721.512***	- 582.880***	- 697.668***
	(104.218)	(109.201)	(100.009)	(152.852)	(106.720)	(168.349)
Adj. R^2	0.975	0.976	0.975	0.994	0.995	0.994
N	96	96	96	120	120	120

Notes: Parameters are estimated by OLS regressions; *** (**) [*] indicates significance at the 1 (5) [10] percent level; robust standard errors are reported in parentheses; industry and time dummies are included but for expositional ease are not shown.
Variables are defined as follows: *relative wages* = (70-percentile wage of non-production workers/30-percentile of production workers)*100; *relative employment* = (number of non-production workers/number of production workers)*100; *OUTS* = (imported inputs from own sector/value added)*100; *ln VA* = log real value added; *ln K/Y* = log [(capital/value added)*100]; *R&D L* = (R&D employment/employment)*100; *R&D SUB* = (R&D subsidies/value added)*100; *FDI L* = (employment in foreign affiliates in Austria/employment)*100.

How robust are these results? A decomposition of the wage bill share into relative wages and relative employment may deliver interesting insights. In Table 6, we replace the dependent variable *wage bill share* with the new dependent variables, relative wages and relative employment of high-skilled labor, respectively. We then run similar regressions as in Table 3. The coefficient on $OUTS$ is negative and statistically significant at the 1 percent level in all three relative wage regressions and somewhat less significant in the relative employment regressions.

The R&D measures have a strong and significant impact on the relative employment. The $R\&D\ L$ ratio and the $R\&D\ SUB$ influence the relative employment

of high-skilled workers positively, whereas the $FDI\ L$ ratio has a strong negative impact, which is not reported in the table. These variables, however, have only a minor effect on relative wages.

International outsourcing can explain 38 percent of the decrease in the wage gap between the 70-percentile of the non-production workers and the 30-percentile wage of the production workers. Relative employment would have grown by 24 percent more in the absence of outsourcing activities that occurred in the considered period of 8 years. As shown in Table 6 outsourcing has a negative impact on relative wages, as well as on relative employment. However, while the wage gap is decreasing, outsourcing contributes significantly to this development, and it acts against the rise in relative employment.

5 Multinational Outsourcing to Poland

In this section we investigate how outsourcing by foreign firms has affected the evolution of the skill-premium in Poland. We capture outsourcing of foreign firms to Poland by the share of foreign-owned fixed assets in domestic fixed assets $(1 + \frac{K_{it}^{FDI}}{K_{it}^{D}})$. This measure arises from disaggregating of the capital stock (K) into domestic capital (K^D) and foreign capital (K^{FDI}).[19]

5.1 Variables and Data

We study the relative labor demand for skilled workers in Poland on the manufacturing industry. Our data set consists of an unbalanced panel [20] of 23 ISIC industries over a 9 years' period (1994-2002).[21] We measure the employment of high-skilled (low-skilled) workers as an annual average employment of non-production (production) workers, and the wage of skilled (unskilled) workers as an annual average gross wage of non-production (production) workers. Unfortunately, especially at the level of disaggregation we use in our empirical work, no better proxies for high-skilled and low-skilled labor are available. Hence, the high-skilled labor wage share is measured as the non-production workers' wage share in the total wage bill.

Our data allow us to separate foreign and domestic owned fixed assets. [22] To control for the restructuring processes in Polish manufacturing we add the share

[19] $ln(K^D + K^{FDI}) = ln(K^D) + ln(1 + \frac{K_{it}^{FDI}}{K_{it}^{D}})$

[20] Some numbers are not made public for confidentiality reasons.

[21] Bruno, Crino and Falzoni (2004) examine a similar question for the three countries Poland, the Czech Republic and Hungary. However, they have data on 6 ISIC industries, only over the period 1994 to 2001.

[22] Feenstra and Hanson (1997) for lack of data could not directly measure the capital stock in foreign ownership and thus used the number of foreign firms as a proxy. Bruno, Crino and Falzoni (2004) measure foreign capital with foreign direct investment stock.

of private firms in total number of manufacturing firms ($PRIV$). We assume that private enterprises have stronger incentives to rationalize and modernize their production than their public counterparts so that their activities might have affected the relative high-skilled labor demand. Furthermore, we include the variables $R\&D$ expenditures share in sales ($R\&D$) and the import and export shares in sales (M and X). R&D is supposed to account for technological improvements and M and X capture the potential influence of international integration and of the exposure to international competition. Finally, as the total labor cost function condition on total output, it is common practice to include output in this type of the regression. However, due to high correlation between output (measured by sales) and domestic fixed assets, which enters the regression in levels, we excluded the former variable from regression. Nevertheless, accounting for industry and time fixed effects helps to resolve potential problems arising from omitting output in the regression. Thus our modified estimating equation is:

$$\begin{aligned} WBS_{it}^{HS} &= \alpha_1 + \alpha_2 ln(1 + \frac{K_{it}^{FDI}}{K_{it}^{D}}) + \alpha_3 lnK_{it}^{D} + \alpha_4 lnPRIV_{it} \\ &\quad + \alpha_5 lnR\&D_{it} + \alpha_6 lnM_{it} + \alpha_7 lnX_{it} + \epsilon_{it} \end{aligned} \tag{3}$$

5.2 Empirical Results

Table 7 reports the fixed effects estimation results for the wage share of high-skilled labor. Columns (1) presents the basic specification with the two independent variables: foreign ($1 + \frac{K^{FDI}}{K^{D}}$) and domestic capital ($K^{D}$). Columns (2) to (4) present the results when adding several control variables to the basic specification. The coefficient on the foreign capital variable is positive and statistically significant in all regressions. Its magnitude ranges from 0.029 to 0.044. But what is actually interesting is its economic significance. Multiplying the most conservative estimate of the coefficient of the foreign fixed assets (0.029) with the average growth of the share of foreign fixed assets between 1994 and 2002 (116.5 percent). The obtained number (0.034), is the contribution of foreign capital to changes in relative demand for skills. It implies that FDI can account for at least 34 percent of the observed increase in non-production workers' wage share (0.099) in the Polish manufacturing sector between 1994 and 2002.

The coefficient of domestic capital is also positive in all specifications but not statistically significant. The sign of domestic capital coefficient corroborates the theoretical result, that any accumulation of capital, be it domestic- or foreign-owned, leads to an increase in the relative demand for skilled labor. Its statistical insignificance, however, underlines the special role of foreign capital for the changes in relative high-skilled labor demand.

Table 7: Foreign Investors and Demand for High-Skilled Labor in Poland

dependent variable: *wage bill share*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ln\ (1+\frac{K^{FDI}}{K^D})$	0.044***	0.048**	0.046**	0.029**				
	(0.015)	(0.014)	(0.014)	(0.012)				
$ln\ (1+\frac{E^{FDI}}{E^D})$					0.114*	0.141***	0.124**	0.107***
					(0.062)	(0.049)	(0.048)	(0.039)
$ln\ K^D$	0.011	0.016	0.016	0.004	0.001	0.007	0.007	0.002
	(0.016)	(0.013)	(0.013)	(0.013)	(0.016)	(0.014)	(0.014)	(0.012)
$ln\ PRIV$		0.041**	0.036**	0.043**		0.045**	0.042*	0.050**
		(0.016)	(0.018)	(0.018)		(0.019)	(0.022)	(0.019)
$ln\ R\&D$			0.008**	0.007**			0.006***	0.006**
			(0.003)	(0.003)			(0.003)	(0.003)
$ln\ M$				-0.046***				-0.053***
				(0.011)				(0.012)
$ln\ X$				0.001				-0.003
				(0.017)				(0.016)
year dummies	yes***	yes***	yes***	yes***	yes***	yes***	yes***	yes***
constant	0.365	-0.004	0.041	0.237	0.251	0.223	0.163	0.321
	(0.332)	(0.276)	(0.273)	(0.259)	(0.335)	(0.293)	(0.298)	(0.238)
Adj. R^2	0.917	0.920	0.920	0.926	0.910	0.931	0.918	0.949
N	194	192	185	171	194	192	185	171

Notes: Parameters are estimated by OLS regressions; *** (**) [*] indicates significance at the 1 (5) [10] percent level; robust standard errors are reported in parentheses; industry and time dummies are included but for expositional ease are not shown.
Variables are defined as follows: *wage bill share* = wage bill of non-production workers/manufacturing wage bill; $ln\ (1+\frac{K^{FDI}}{K^D})$ = log [1 + (foreign fixed assets/domestic fixed assets)]; $ln\ (1+\frac{E^{FDI}}{E^D})$ = log [1 + (number of foreign firms/number of domestic)]; $ln\ K^D$ = log (domestic fixed assets); $ln\ PRIV$ = log (number of private firms/total number of firms); $ln\ R\&D$ = log (R&D expenditures/sales); $ln\ M$ = log (import/sales); $ln\ X$ = log (export/sales).

The inclusion of control variables does not change the results obtained for the basic regressors. $PRIV$ has a positive and significant impact on the high-skilled wage share. The result on the $R\&D$ variable suggests that the increase in the relative high-skilled labor demand was partly due to a technological upgrading. The negative coefficient on the import share can be seen from the Heckscher-Ohlin perspective. Given that Poland is low-skilled labor abundant compared to its trading partners, international trade would exert a downward pressure on earnings of high-skilled workers relative to the earnings of low-skilled workers. Nevertheless, the result on the export share is inconclusive. Finally, the inclusion of time dummies is crucial when analyzing the role of outsourcing for the skilled workers' relative

Table 8: Foreign Investors and Decomposed Demand for High-Skilled Labor in Poland

dependent variables: *(1)-(4): relative employment, (5)-(8): relative wages*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ln\ (1+\frac{K^{FDI}}{K^D})$	0.083**	0.094**	0.090**	0.045	0.183***	0.180***	0.174***	0.170***
	(0.041)	(0.039)	(0.035)	(0.033)	(0.042)	(0.045)	(0.045)	(0.051)
$ln\ K^D$	0.056	0.068	0.069	0.039	0.164***	0.161***	0.162***	0.166***
	(0.049)	(0.045)	(0.043)	(0.045)	(0.035)	(0.060)	(0.060)	(0.060)
$ln\ PRIV$		0.095**	0.083*	0.102**		-0.023	-0.034	-0.039
		(0.042)	(0.045)	(0.045)		(0.048)	(0.052)	(0.055)
$ln\ R\&D$			0.027**	0.025**			0.006	0.010
			(0.010)	(0.010)			(0.011)	(0.012)
$ln\ M$				-0.119***				-0.011
				(0.021)				(0.056)
$ln\ X$				0.026				0.005
				(0.047)				(0.069)
year dummies	yes	yes	yes	yes	yes***	yes***	yes***	yes***
constant	-0.835	-1.010	-0.861	-0.376	-1.042	-1.902	-1.746	-1.996
	(1.024)	(0.907)	(0.879)	(0.876)	(1.743)	(0.826)	(0.877)	(1.231)
Adj. R^2	0.836	0.838	0.837	0.847	0.773	0.769	0.771	0.775
N	194	192	185	171	194	192	185	171

Notes: Parameters are estimated by OLS regressions; *** (**) [*] indicates significance at the 1 (5) [10] percent level; robust standard errors are reported in parentheses; industry and time dummies are included but for expositional ease are not shown. Variables are defined as follows: *relative employment* = number of non-production workers/number of production workers; *relative wage* = wage of non-production workers/wage of production workers; $ln\ (1+\frac{K^{FDI}}{K^D})$ = log [1 + (foreign fixed assets/domestic fixed assets)]; $ln\ K^D$ = log (domestic fixed assets); $ln\ PRIV$ = log (number of private firms/total number of firms); $ln\ R\&D$ = log (R&D expenditures/sales); $ln\ M$ = log (import/sales); $ln\ X$ = log (export/sales).

demand in Poland. We should not forget that Poland is a transition economy with institutions and the economic system as a whole being still "work in progress". The positive coefficient on the year dummies suggests that the transition to market economy, has favored high-skilled workers.

In the remaining specifications of Table 7 we substitute $(1+\frac{K^{FDI}}{K^D})$ with the ratio of the number of foreign to domestic firms $(1+\frac{E^{FDI}}{E^D})$. An inspection of columns (5) to (8) shows that the results are robust to this alternative measure of outsourcing.

In Table 8 we replace the wage share of high-skilled workers as dependent variable by decomposing it into relative employment and wages of non-production workers. As can be seen, the result for the relative employment practically mirror

those for the wage share. Only the magnitude of the coefficients is twice as high (in case of $R\&D$ even triple) and the year dummies loose their significance. The regressions with high-skilled workers' relative wages in columns (5) to (8) give a different picture. The coefficients on domestic capital become significant at one-percent level, while the influence of privatization becomes negative and not significant. $R\&D$ retains its positive sign but it is no more significant, whereas year dummies are positive and highly significant.

The different results on the time dummies is not surprising. Under the socialist regime Poland had an extremely compressed wage distribution. Thus, one of the dimensions of the transition process was the liberalization of wage setting schemes. In the regression with relative wages significant and positive time dummies may reflect the labor market adjustments to a market economy. Meanwhile, the relative employment underwent changes which were rather industry specific and therefore, better captured by privatization advances. The main message of this Table, is the positive and significant impact of foreign capital $(1 + \frac{K^{FDI}}{K^D})$ on relative wages and the positive though less statistically significant impact on relative employment of non-production workers.

5.3 Robustness

Some studies additionally include relative wages of high-skilled workers as an independent variable arguing that they are of importance by factor supply and demand decisions. The relative wages of high-skilled workers are likely to be endogenous in wage share regression, and a failure to control for this may lead to simultaneity bias. So far we have just ignored potential influence of relative wages. Such approach, however, may cause an omitted variable bias. It is therefore necessary to verify the robustness of the OLS estimates with instrumental variables method.

We include the second and third lags of relative wages as instruments additionally to other right hand side variables. It is also likely that foreign capital is endogenous. Bruno, Crino and Falzoni (2004) and Pavcnik (2003) argue that foreign firms invest in some industries because of their high-skill intensity not the other way round. Tests for exogeneity, indeed, indicated that both relative wages and foreign capital variable are endogenous. Therefore, we also added first, second and third lags of foreign capital variable to the existing set of instruments. For the purpose of controlling for heteroscedasticity, we apply General Method of Moments (GMM) estimates.

Table B.2 in the Appendix shows IV-GMM results for the high-skilled workers' wage share. First of all, the coefficients on foreign capital remain positive, of the same value and statistically significant. The inclusion of relative wages, however, deprived privatization and year dummies of their explanatory power. Regarding

year dummies we have actually excluded them from the regression, since their presence led to rejection of the joint hypothesis of correct model specification and orthogonality conditions. This corroborates the above result that the transition process is partly responsible for the increase in non-production workers wage share, because it liberalized the wage setting mechanism.

Turning to Table B.3 in the Appendix reporting IV-GMM results for relative employment and wage, the inclusion of relative wages to the regression has similar consequences for relative employment as for relative demand with one major difference. Increasing relative wages have slightly (statistically insignificantly) retarded the increase of relative employment of non-production workers. Regarding relative wages, their development was driven mainly by foreign capital and aggregate shocks related to the transition process.

We also carried out the regression with all independent variables lagged one period, as Bruno, Crino and Falzoni (2004) did in order to compare their results with ours. The results for the two approaches differ in the value of coefficients of foreign capital variable. They are higher when using lags. We also reestimated our regressions with panel-corrected standard error estimation (PCSE), which allows correction for contemporaneous correlation across cross-sectional units and for autocorrelation. The results are similar to those presented in the paper.[23]

6 Conclusion

In this paper we have examined the importance of outsourcing for the labor market outcome in Austria and Poland prior to Eastern Enlargement. In contrast to other studies on the topic we find that outsourcing has lowered the skill premium in Austria, the high income country, while it has increased the wage gap in Poland, the low income country. We summarize our findings in Table 9. We also contrast our results with the empirical findings of Feenstra and Hanson (1997) for the US and Mexico. We report numbers for all four countries prior to Eastern Enlargement and to NAFTA. Austria and Poland liberalized their trade and investment regime in the 1990s after the fall of communism. Feenstra and Hanson (1997) report their numbers for Mexico in 1975-88 and for the US in 1979-1990. Several points are noteworthy from the Table 9.

First, Poland experienced the largest increase in outsourcing compared to Austria and the US. In the period 1994 to 2002 outsourcing in Poland (as measured by the ratio of foreign to domestic assets) has increased by 71 percent, in Austria (as measured by the share of imported inputs in percent of value added) it has increased by 50 percent in the period 1995 to 2002, and in the US outsourcing

[23] The results of PCSE and regressions with lagged independent variables are available form the authors upon the request.

Table 9: The Contribution of Outsourcing to Wage Inequality in Selected Countries

	Poland 1994-2002	Mexico 1975-1988	Austria 1995-2002	USA 1979-1990
	changes (in percent)			
outsourcing	70.61[a]	-	50.45[b]	50.98[c]
wage bill share[d]	34.18	21.35	8.29	19.92
relative wages[e]	41.39	19.63	-2.00	-
relative employment[e]	10.23	-	16.89	-
	contribution of outsourcing (in percent)			
wage bill share[d]	34.1 - 51.8	52.4 - 56.2	6.8 - 13.6	30.9 - 51.3
relative wages [e]	33.3 - 35.9	-	33.0 - 38.1	-
relative employment [e]	181.0 - 378.1	-	18.4 - 25.2	-

[a] 1+(foreign fixed assets/domestic fixed assets), manufacturing
[b] narrow definition of outsourcing: (imported inputs from own sector/value added of sector)*100, mining and manufacturing
[c] (imported inputs from the same sector/total non-energy material purchases)*100, manufacturing
[d] (non-production to production workers' wage*number of non-production to production workers)/((non-production to production workers' wage*number of non-production to production workers)+(production to production workers' wage*number of production to production workers)) in manufacturing for Poland, USA and Mexico, in mining and manufacturing for Austria
[e] non-production to production workers in manufacturing for Poland, Germany, USA and Mexico, in mining and manufacturing for Austria
Source: Poland: own calculations; Mexico: Feenstra and Hanson (1997); USA: calculations taken from Feenstra and Hanson (1996); Austria: own calculations.

(as measured by the share of imported inputs in total inputs excluding energy) has risen by 51 percent in the period 1979 to 1990. Both low income countries, Poland and Mexico, experienced an increase in their skill premium, but Poland's rise in the skill premium was more than twice as large (41 percent between 1994 to 2002) compared to Mexico's (19.6 percent between 1975 to 1988). Second, in Austria, the high income country, relative wages for skills declined by 2 percent in the period 1995 to 2002, while it increased by 41 percent in the period 1994 to 2002 in Poland, the low income country. We suggest in the paper that this has happened in Austria, because Austria is poor in human capital relative to its trading partners. We also show that in the absence of an aggressive R&D policy pursued

by the Austrian government, the decline in the skill premium would have been much more pronounced. Third, in spite of the larger increase of outsourcing in Poland compared to Austria, outsourcing is as important in Austria as in Poland in explaining the evolution of the skill premium, In both countries.outsourcing contributes roughly 35 percent to the change in the relative wage for skilled workers. In other words, in the absence of outsourcing relative wages for human capital would have declined by 35 percent less in Austria and they would have increased by 35 percent less in Poland.

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Appendix

A Data

Notes on calculation of variables

wages: Since Austria's wages are recorded according to at most to the social security contribution ceiling, an accurate measure of mean wages is not possible. However, the statistics of the Association of Austrian Social Insurance report different percentile wages for production and non-production workers.

imported intermediate goods: As in most countries, input-output tables for Austria are not published annually. The most recent input-output tables available are from 1995 and 2000. We estimate the input-output tables for the missing years by interpolating the input-output coefficients and multiplying them by imported inputs. These imported inputs result from the interpolate share of intermediate goods in total imports. We receive the total imports by transforming HS-classification import data at the 6-digit level to NACE categories at 4-digit level. The import data in HS-classification are taken from the Eurostat Comext database. Since the data on labor market determine the level of sectoral aggregation, we aggregate the imported inputs to the chosen NACE 2-letter level of analysis. Therefore, Austria's imports at the sectoral level formulate the estimated input-output tables for the missing years.

capital stock: Gross fixed capital stocks are calculated according to the perpetual inventory method using data on gross fixed capital formation (GFCF), which are deflated by a general price index for investment goods.[24] The initial capital stock for the year 1994, K_{1994}, is estimated by using the values of capital formation in the preceding years, 1990 to 1993.

$$K_{1994} = (GFCF_{1990} + GFCF_{1991} + GFCF_{1992} + GFCF_{1993} + GFCF_{1994}) * 2$$

The gross fixed capital stocks for the sample period are calculated according the following simple formula, assuming a constant depreciation rate of 10 percent.

$$K_t = 0.9 * K_{t-1} + GFCF_t$$

To check the validity of this estimation, we compare the aggregate estimate for NACE D with the net capital stocks provided by Statistics Austria. The size of these stocks differ somewhat, but the development is very similar.

[24] For this calculation see Egger (2000).

Table A.1: Definition and Source of Variables

Variable	Description	Source
	Austria	
wage bill share	share of non-production workers' wage bill in total wage bill	Association of Austrian Social Insurance
relative wages	70-percentile non-production wage relative to 30-percentile production wage	Association of Austrian Social Insurance
relative employment	non-production workers relative to production workers	Association of Austrian Social Insurance
OUTS	share of imported inputs from the same NACE 2-letter sector in value added,	Statistics Austria (input-output table), OECD STAN database
Y	output (production), deflated by sector-specific producer price indices	OECD STAN database
VA	value added, deflated by sector-specific producer price indices	OECD STAN database
K/Y	ratio of gross fixed capital stock to output	OECD STAN database
K/VA	ratio of gross fixed capital stock to value added,	OECD STAN database
R&D L	share of R&D employment in total employment,	Eurostat, OECD STAN database
R&D SUB	ratio of R&D subsidies to value added	Austrian Research Promotion Organization, OECD STAN database
FDI L	share of employment in foreign affiliates to total sector's employment in Austria	OeNB, OECD STAN database
	Poland	
wage bill share	share of non-production workers' wage bill in total wage bill	Polish Central Statistical Office
relative wages	non-production workers' wages relative to production workers' wages	Polish Central Statistical Office
relative employment	number of non-production workers relative to production workers	Polish Central Statistical Office
$(1 + \frac{K^{FDI}}{K^D})$	one plus the share of foreign-owned fixed assets in domestic fixed assets deflated by sector specific producer price indices	Polish Central Statistical Office
$(1 + \frac{E^{FDI}}{E^D})$	one plus the ratio of number of foreign firms to domestic firms	Polish Central Statistical Office
K^D	domestic fixed assets	Polish Central Statistical Office
PRIV	share of private firms in total number of firms	Polish Central Statistical Office
R&D	share of R&D expenditures in sales	Polish Central Statistical Office
M	share of imports in sales	OECD STAN database
X	share of exports in sales	OECD STAN database

B Tables and Figures

Table B.2: Foreign Investors and Demand for High-Skilled Labor in Poland

dependent variable: *wage bill share*				
	(1)	(2)	(3)	(4)
$ln\ 1+\frac{K^{FDI}}{K^D}$	0.040*	0.038*	0.035*	0.031*
	(0.021)	(0.023)	(0.020)	(0.015)
$ln\ \frac{W^S}{W^{US}}$	0.199**	0.191**	0.223***	0.246**
	(0.084)	(0.091)	(0.079)	(0.096)
$ln\ K^D$	0.006	0.006	0.011	0.009
	(0.013)	(0.014)	(0.013)	(0.014)
$ln\ PRIV$		-0.007	-0.011	-0.006
		(0.006)	(0.009)	(0.007)
$ln\ R\&D$			0.005***	0.005***
			(0.002)	(0.002)
$ln\ M$				-0.020*
				(0.010)
$ln\ X$				-0.002
				(0.009)
year dummies	no	no	no	no
constant	0.059	0.336	-0.031	-0.027
	(0.265)	(0.204)	(0.269)	(0.251)
Centered R^2	0.961	0.958	0.958	0.958
Hansen J statistic	2.424	2.716	2.047	1.769
$P-value$	[0.489]	[0.437]	[0.562]	[0.621]
N	124	126	120	110

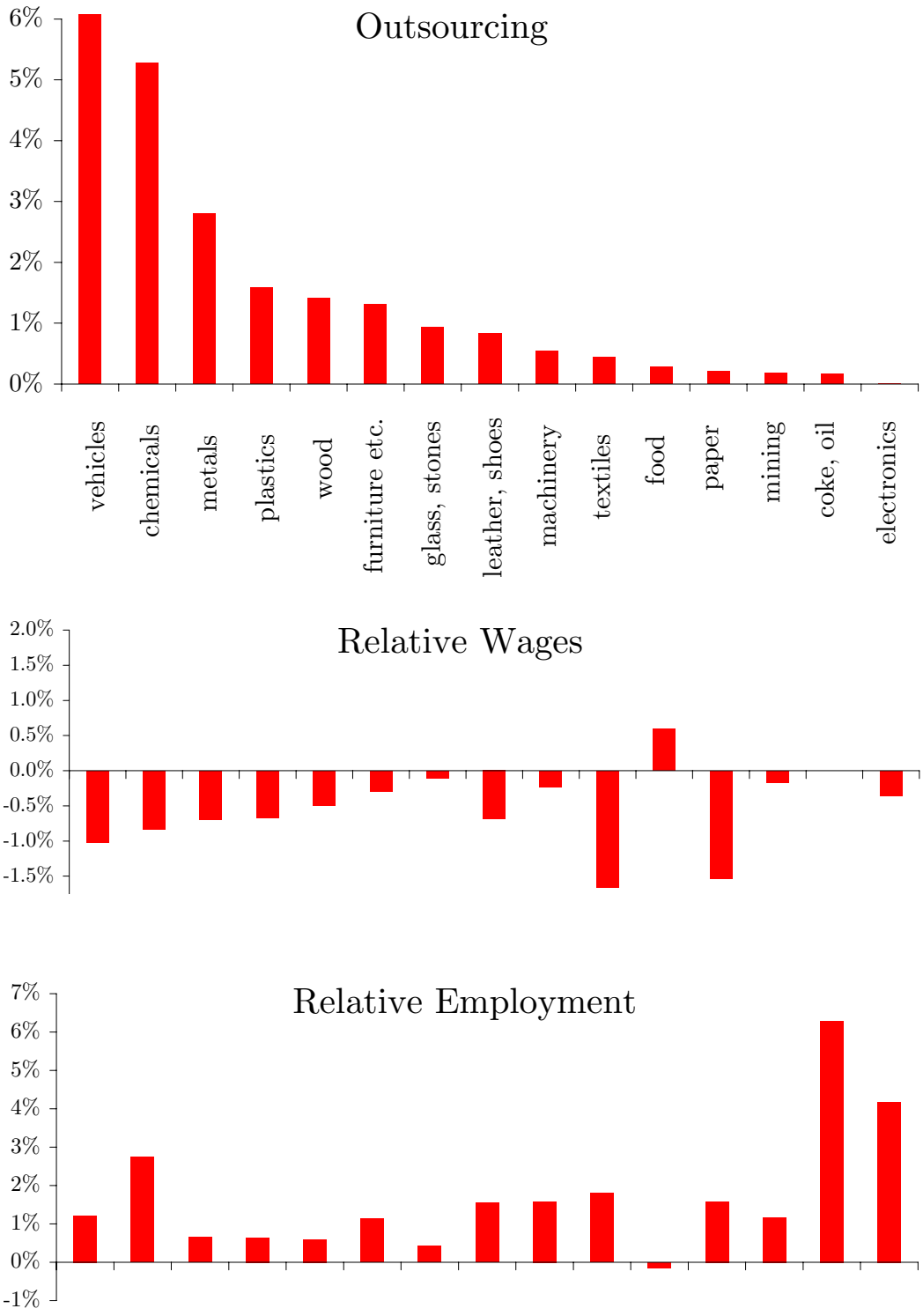
Notes: Parameters are estimated by instrumental variable regressions (GMM); Instruments: 1st, 2nd and 3rd lag of log foreign fixed assets share in domestic fixed assets and 2nd and 3rd lag of log relative wage; *** (**) [*] indicates significance at the 1 (5) [10] percent level; robust standard errors are reported in parentheses; industry and time dummies are included but for expositional ease are not shown.
Variables are defined as follows: *wage bill share* = wage bill of non-production workers/manufacturing wage bill; $ln\ (1+\frac{K^{FDI}}{K^D})$ = log [1 + (foreign fixed assets/domestic fixed assets)]; $ln\ K^D$ = log (domestic fixed assets); $ln\ PRIV$ = log (number of private firms/total number of firms); $ln\ R\&D$ = log (R&D expenditures/sales); $ln\ M$ = log (import/sales); $ln\ X$ = log (export/sales).

Table B.3: Foreign Investors and Decomposed Demand for High-Skilled Labor in Poland

dependent variables: *(1)-(4): relative employment, (5)-(8): relative wages*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ln\ (1+\frac{K^{FDI}}{K^D})$	0.101*	0.097*	0.091*	0.072	0.325**	0.333**	0.296**	0.385*
	(0.052)	(0.057)	(0.050)	(0.048)	(0.159)	(0.169)	(0.148)	(0.217)
$ln\ \frac{W^S}{W^{US}}$	-0.137	-0.157	-0.078	0.004				
	(0.203)	(0.229)	(0.191)	(0.238)				
$ln\ K^D$	0.016	0.017	0.019	0.007	0.177	0.186	0.175	0.250
	(0.035)	(0.036)	(0.035)	(0.035)	(0.123)	(0.134)	(0.122)	(0.175)
$ln\ PRIV$		-0.014	-0.020	-0.012		0.001	-0.011	-0.040
		(0.015)	(0.014)	(0.016)		(0.032)	(0.030)	(0.042)
$ln\ R\&D$			0.011**	0.011**			-0.002	0.009
			(0.005)	(0.005)			(0.006)	(0.008)
$ln\ M$				-0.046				0.124
				(0.029)				(0.0101)
$ln\ X$				0.023				-0.085
				(0.028)				(0.069)
year dummies	no	no	no	no	yes***	yes***	yes***	yes***
constant	-0.043	-0.045	-0.059	0.110	-2.170	-2.377	-2.195	-3.681
	(0.713)	(0.742)	(0.717)	(0.641)	(2.782)	(3.127)	(2.812)	(3.910)
Centered R^2	0.903	0.903	0.880	0.882	0.816	0.808	0.829	0.827
Hansen J statistic	2.502	2.612	2.080	1.924	0.061	0.020	0.014	0.142
P-value	[0.475]	[0.455]	[0.556]	[0.588]	[0.805]	[0.886]	[0.904]	[0.707]
N	124	124	120	110	124	124	120	110

Notes: Parameters are estimated by instrumental variable regressions (GMM); Instruments: 1st, 2nd and 3rd lag of log foreign fixed assets share in domestic fixed assets and 2nd and 3rd lag of log relative wage; *** (**) [*] indicates significance at the 1 (5) [10] percent level; robust standard errors are reported in parentheses; industry and time dummies are included but for expositional ease are not shown. Variables are defined as follows: *relative employment* = number of non-production workers/number of production workers; *relative wage* = wage of non-production workers/wage of production workers; $ln\ (1+\frac{K^{FDI}}{K^D})$ = log [1 + (foreign fixed assets/domestic fixed assets)]; $ln\ K^D$ = log (domestic fixed assets); $ln\ PRIV$ = log (number of private firms/total number of firms); $ln\ R\&D$ = log (R&D expenditures/sales); $ln\ M$ = log (import/sales); $ln\ X$ = log (export/sales).

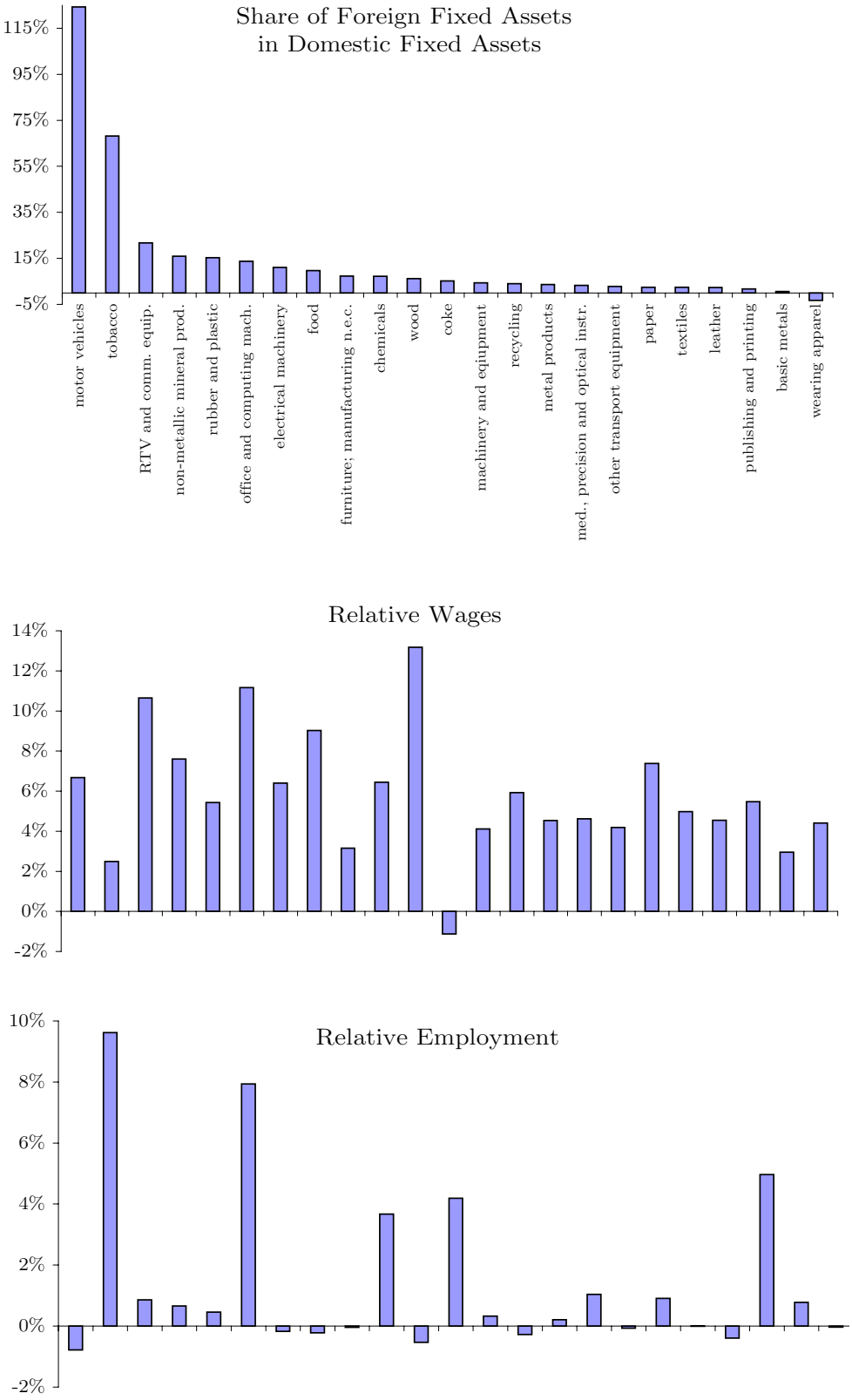
Figure B. 1: Outsourcing, Relative Wages and Relative Employment in Austria.



[1] averages for the years 1995-2002

Notes: Average annual changes in percentage points (1995-2002), sectors ranked by outsourcing; outsourcing defined in the narrow way.
Source: Own calculations based on data gathered from Statistics Austria.

Figure B. 2: Outsourcing, Relative Wages and Relative Employment in Poland.



Note: Average annual changes in percentage points (1994-2002), sectors ranked by foreign fixed assets share in domestic fixed assets.
Source: Own calculations based on data gathered from Central Statistical Office of Poland and PAIiIZ.

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