Trade, outsourcing and skilled to unskilled wage bill ratio in CEECs manufacturing*

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Abstract

In this paper we investigate whether the outsourcing process in recent years induced a change in wage and employment inequalities between skilled and unskilled workers in the Czech Republic, Hungary and Poland. The outsourcing process is proxied by trade in intermediates and FDI. We analyse the three countries separately and further disentangle the impact of trade in parts and components from that of trade in primary and processed commodities. The main result is that outsourcing from Western to Eastern Europe exerted a different effect on each of the three CEECs. In all countries there is a specialisation in the export of unskilled intensive intermediates and this effect is driven relatively more by parts and components. The latter are also the main force behind the negative effect of intermediate imports in Poland. In this country the increased growth of final goods export exerts a skill biased impact. On the contrary, in Hungary it is the import of parts and components to be skill biased. In the Czech Republic, although intermediate imports are not significant, there is evidence of a positive effect of imported processed goods.

JEL: F16, F21, J23, J21
Keywords: Trade, outsourcing, skill premia

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1 Introduction

The redirection of trade from CMEA to Western Europe has been one of the main engines in fostering the transition process of Central and Eastern European Countries (CEECs). The evolution of trade during the 1990s has shown a rising integration of trade and production with the EU (see for example Kaminski and Ng, 2005). Further, together with trade increases, Eastern European countries experienced a massive inflow of FDI. The geographical proximity and possibility to exploit both the abundant labour force and the low wages has been by no mean one of the main determinants for the Multinationals' choice to locate in these countries.

In the early 1990s FDI in manufacturing were mainly horizontal, that is market seeking, while vertical FDI accounted for a low share and were directed mainly to labour intensive industries with a low technological requirement, like Food processing and Textiles. In the recent years there has been a movement away from these industries and toward more capital and skill intensive branches. At the same time, vertical FDI started to gain importance in the total foreign capital (see Geishecker and Hunya 2005).

The existing evidence is that the export specialisation pattern of CEECs to the EU15, in the recent years, is mainly unskilled intensive (see Egger and Stehrer 2003), but a general quality upgrading of the product lines took place (Landesmann and Stehrer 2003, Dulleck et al. 2005). At the same time, the main feature of the industrial evolution in CEECs is the shift from traditional industries, which required a low content of both technology and skills, toward the medium and high skill intensive branches, which started with a higher gap of productivity in comparison with western Europe and, over time, engaged in a strong catching up process with the Western Europe (see Landesmann and Stehrer 2003, Landesmann and Woerz 2006, Landesmann, Leitner and Stehrer 2007).

. Foreign capital contributed to this process by bringing about a substantial technological and organisational improvement, which fostered the restructuring process (Bruno et al) and increased both the demand and supply of skills (Kataria and Trabold 2004, Radosevic 2004). Furthermore, as found by Kaminski and Ng (2005), in CEECs processing and production of parts replaced the simple assembling of imported components. Together with this pattern, these countries strongly reduced their trade balance, becoming net exporter of parts and products from 1999 and, in the recent years, many industries recorded a surplus in total trade.

The outsourcing process is also one of the main determinants of the evolution of trade. This is because the delocalisation of production can take place not only via FDI, but also via sub contracting and in both cases, though more intensively in the second one, import and export flows include to a large extent intermediate inputs used in the EU-wide production process.

The main aim of this paper is to update the analysis of Egger and Stehrer (2003) by including the years up to 2005 and excluding the early '1990s from the sample. The global imbalances of the first years of transition are likely affect the validity of their results, as well as those of other studies, like Bruno et al. (2004). Further, given that these countries have shown evidence of a change in specialisation, from assembling to production and processing, we are interested in verifying whether the export specialisation, in terms of relative use of skilled and unskilled workers, changed in comparison with the former results. Compared to Egger and Stehrer, we expand the analysis in three ways: first, following Feenstra and Hanson (1999) we include R&D expenditure and the capital stock as additional controls; second, we analyse the three countries separately; third, we further disaggregate trade in intermediates considering

trade in primary and processed commodities alone. This gives us information on the different effect of these commodities from that of trade in parts and components.

It must be said that transition countries are not the ideal sample to test the prediction of a theoretical model. Given the many forces at work, like the restructuring and privatisation processes, the growth of a new private sector and the increase in services, it is difficult to understand the determinants of the evolution of whatever variable. To these problems we have to add the scarcity and the poor quality of the data (included those used in this analysis). From another side, the features of the transition economies of Eastern Europe after mid 1990s, i.e. strong and rapid growth, fast structural change and a catching up with Western Europe, make them an interesting case study, especially for what concerns the outsourcing process. We try to take into account these problems by giving to our result only the character of suggestive evidence rather than that of a rigorous and robust conclusion.

Having in mind that, we find suggestive evidence that the outsourcing process exerts a significant impact on the three countries. As we will see, we find a specialisation in trading unskilled intensive intermediate goods in Poland. A specialisation in exporting unskilled intensive goods is found also in the other two countries, but while in Hungary imported intermediate goods have a skill biased impact, in the Czech Republic, probably because of the features of its transition process, we find no other significant impact. For what concern Poland, the increase in the market size for exports improved the relative position of skilled workers. When considering only trade in primary and processed commodities, we find that the unskilled biased effect of all intermediates traded is eliminated in Poland and the Czech Republic, while in Hungary this happens only on the export side. In this latter country, contrary to the others, the skill biased effect of intermediate imports is strongly reduced when excluding parts and components.

The structure of the paper is as follow: the next section surveys the main empirical contributions concerning CEECs. In section 3, after describing the data used, we describe the evolution of production, trade and FDI, as well as the evolution of wages and employment of skilled and unskilled workers in the three countries. In section 4 we describe the econometric analysis and the relative results. Section 5 concludes.

2 Empirical literature on trade, outsourcing and demand for skills in CEECs

The empirical literature on the evolution of the relative wages and relative employment of skilled workers in CEECs consists of a small, but growing number of papers. The main constraint to this kind of researches in transition countries is the availability of data on employment and wages of the different skill groups as well as on the capital stock. The existing studies can be divided into two categories, those aiming at understanding the impact of external variables, like trade, FDI and outsourcing (Egger and Stehrer 2003, Bruno et al 2004, Lorentowicz et al. 2005, Geishecker 2004, Skuratowicz 2001) and those aiming at estimating directly the nature of both the relation between inputs and the changes in the wage-skill employment composition (Esposito and Stehrer 2007, Tarjani 2004, Kertesi and Köllö 2002, Kézdi 2002).

In the second strand of literature, industry level data are used only by Tarjàni (2004) and Esposito and Stehrer (2007), while the other contributions use micro data gathered from several sources. The main result from the second strand of literature is the evidence of a skill biased technical change (SBTC). In particular, the studies on Hungary find a skill biased effect of FDI, (Kézdi 2002); skill biased effects are also

found in the scale and technology expansion (Kertesi and Köllö 2002) and in the capital accumulation (Tarjàni 2004). Esposito and Stehrer (2007) found that SBTC is concentrated in the skill intensive industries and is an important determinant of the increases in the skilled labour wage bill share in Hungary and Poland.

Turning to the first strand of literature, which is directly related to the present work, most of the studies use only industry level data (Egger and Stehrer 2003, Bruno et al. 2004, Lorentowicz 2005), while some other integrate with micro data (Geishecker 2004) or have a regional breakdown (Skuratowicz 2001). Differences arise also concerning the control variables introduced, but this point is discussed more in detail below.

Egger and Stehrer (2003) analyse the effect of outsourcing and FDI on the relative wage bill between non manual (skilled) and manual (unskilled) workers in the Czech Republic, Hungary and Poland.[1] They use a panel of 14 industries over the period 1993-1999. The outsourcing process is proxied by trade in intermediate goods and FDI is proxied by the number of Multi National Enterprises (MNE). Their main finding is that both imports and exports of intermediate goods have a negative impact on the wage bill ratio. This lead to the conclusion that outsourcing in CEECs indeed uses unskilled workers more intensively (pag. 68). An interesting point is that the impact of intermediate imports is higher than that of exports, implying that "to some extent, this may indicate that outsourcing to the CEEC takes the form of producing intermediate goods from raw materials and exporting them to the EU rather than intermediate goods are first imported to the CEEC for further procession and then be exported again" (pag. 68).

Another study is the one carried out by Bruno et al (2004). They analyse the same countries as in Egger and Stehrer and investigate the effect of FDI penetration on the skilled labour share in the total wage bill in manufacturing between 1993 and 2001. Their finding is that the activity of MNE contributed to the rise in the skill premium by fostering the structural change and by helping to decompress the inherited rigid wage structure. In line with Egger and Stehrer, they find a negative impact of trade variables.[2]

A finer skill classification is exploited in the paper of Geishecker (2004). The author analyses the impact of FDI and outsourcing on the demand for low, medium and high skilled workers in CEECs. The analysis is carried out on a large industry panel for seven CEEC. FDI are found to negatively influence the demand for medium skilled workers, while high and low skilled workers are positively influenced.[3] As pointed out by the author "this result is thus not consistent with an unequivocal technology spill-over effect that is biased toward skilled workers" (pag. 14). In all cases international outsourcing, proxied by trade in intermediate goods, is found to have a skill upgrading effect by raising the share of high skilled workers and reducing that of medium skilled workers. This last result comes from the significance of intermediate imports, while intermediate exports are not significant.

Skuratowicz (2001) analyses the impact of FDI on the skilled labour demand in Poland over the period 1993-1998. The author, in line with the theoretical framework of Feenstra and Hanson (1996, 1997), assesses the impact of the increase in the foreign capital share in total capital on the relative labour demand between skilled (non manual)

[1] Although it is well known that manual and non manual workers are not a precise proxy for skilled and unskilled workers, they are used in the majority of the empirical literature. Due to lack of data in the present work we follow this line.

[2] In their work only total trade is considered.

[3] These impacts are, in any case, not significant.

and unskilled (manual) workers. This study uses regional data and trade variables are not included as controls. The conclusion is that FDI has a significant and positive impact on the skilled labour share in total wage bill. At the same time they found that inequalities between skilled and unskilled workers are stronger in the most developed regions, which received the larger share of foreign capital.

A similar line is followed by Lorentowicz et al. (2005). They use an industry level panel of 23 Polish industries over the period 1994-2002. After controlling for R&D and the privatisation process, the authors find that FDI account for 34% of the increase in the relative demand for skills and that the increase was partly due to a technological upgrading.[4] Imports are found, on the opposite, to favour manual workers by increasing their wage bill share. These results, according to a standard trade theory, indicates that the unskilled abundant Poland specialises in trading unskilled intensive goods.

Summarising, most of these studies found evidence of a skill biased effect of FDI, while total trade variables are found to be unskilled biased. Trade in intermediates is found as well to be unskilled biased, but Geishecker (2004) found a skill biased impact from intermediate imports. Our analysis expands on these studies. In particular, we update the analysis of Egger and Stehrer including the years until 2005 in the sample and excluding the first years. The global imbalances of the first years of transition are likely to influence the results and to make less reliable the data. Given the recent evidence, we want to understand whether the outsourcing process in the last years induced a different specialisation pattern compared to the former results. In addition we investigate the contribution of the two categories of primary and processed commodities and parts and components to this pattern. Finally, we analyse the three countries separately and, as in Lorentowicz et al. (2005), we follow Feenstra and Hanson (1999) in controlling for the effect of both the capital stock and R&D expenditure.

3 The evolution of CEECs manufacturing: descriptive evidence

3.1 Data description

The relevant data for the present analysis have been collected from various sources. Data for production, wages and employment come from the WIIW Industrial Database on Eastern Europe. The series are deflated sector by sector using the Eurostat Total Output Price Index. Employment data for Hungary suffer from a break in series between 1998 and 1999, when the sample changed from including only enterprise with more than 20 employees to include also enterprise with more than 5 employees. In order to make less severe the effect of the structural break, we used for 1998 data gathered from the ILO Laborsta Database. This includes enterprises with more than 10 employees from 1998, while from 1999 data are identical to those of the WIIW database. In this way the structural break is reduced and we do not have to eliminate one year from the already short Hungarian sample.

Data on the FDI inward stock are obtained from the WIIW FDI database. For Poland only data for 10 out of 14 sector (figures for DC, DE, DI and DN are missing)[5] are available.

Data on trade with the EU15 are from the Eurostat Comext Database. In order to collect data for the necessary number of years we consider the EU15 as reporting country because data for CEECs are note available for the ‘1990s. The difference is that

[4] This comes from the positive and significant impact of R&D expenditure.
[5] See the appendix for the industry codes

exports are evaluated at the EU CIF prices, while imports use the EU FOB prices. The division of trade in intermediates and final goods is made by matching the data classified in SITC3 (5 digits) with the BEC classification, which classifies goods according to their destination. These data are then aggregated at NACE subsections (14 industries DA-DN) by using standard correspondence tables.[6] Data on the capital stock are from the EU-KLEMS project[7] and data on the R&D expenditure are from Eurostat.

Finally, data for wages and employment of manual and non manual workers are collected from the statistical yearbooks of the respective countries. Data until 1999 are the same as in Egger and Stehrer (2003), while data until 2001 are the same as Bruno et al. (2004). For the Czech Republic only data on manual workers' wages were available in the yearbook, while data on manual employment have been kindly provided by the Czech Statistical Office. We then estimated wages and employment of non manual workers using the procedure applied in Bruno et al. (2004).

With wages and employment of the two categories we built the wage bill ratio. This is defined as the ratio between the total wage bill of skilled and unskilled workers. This variable is commonly used as indicator of both the overall workers' inequalities and of the relative use of each of the two inputs in production.

All data are expressed in constant Euro by using the above described deflator and the average exchange rate gathered from the IMF IFS. The initial year is dictated by the availability of FDI data and is 1996 for Poland, 1997 for the Czech Republic and 1998 for Hungary, while the last year is 2005 for all countries.

3.2 Descriptive statistics

The dynamics of the skilled to unskilled wage bill ratio, as well as that of its two components, has been different in each of the three countries. The Czech Republic started with a much higher skill intensity and cost ratio[8] in all branches compared to the other countries. Consequently, over time the wage bill ratio experienced almost no growth because, on average, the generalised increase of the relative wage has been offset by reductions in the skill intensity. This reduction, as shown in figure 1, took place mainly in the medium to high skill industries, especially Mechanics (DM), Electronics (DL) and Transports equipments (DM), together with Paper and Publishing (DE). [9]

In Hungary (figure 2) both the relative wage and skill intensity increased, with the latter driving the dynamics. As result, the wage bill ratio increased on average by 2.7% each year. The skill upgrading took place in all branches, except in DM, while the reduction of the wage premium in Textiles (DB) and Wood products (DD) suggests that a substitution in the context of a general loss of importance of these traditional sectors took place.

Finally, in Poland the overall reduction in the skill intensity is more than counterbalanced by the strong growth of the relative wage, which caused the wage bill ratio to increase by 3.6% every year. The general skill downgrading is, nevertheless, the result of a sectorally differentiated dynamics (see figure 3), with strong increases in the high skill intensive industries DE to DG and in DI, while DL and DM, as well as DC,

[6] See Fontagnè et al. 1996 for the division between intermediates and final goods

[7] www.euklems.org

[8] Throughout this work we use the word cost ratio and relative wage bill as synonymous for the wage bill ratio.

[9] We use the industry codes in order to avoid frequent repetitions of the industries names'. In the appendix we list the industries, with their codes and classification according to the skill (non manual) intensity.

DD and DN, increased the share of manual workers. In DM the reduction of the skill intensity took place at a rate of 3% each year.

For what concerns the evolution of production, trade flows and FDI (table 1), in aggregate all countries experienced similar growth rates in imports and labour productivity, between 8% and 16%. The growth of the foreign capital stock has been similar as well, with increases of 20% every year in Hungary and Poland and 19% in the Czech Republic. The export growth is more differentiated among countries, but the interesting fact is that everywhere the growth of exports is higher than that of imports, indicating an increased international competitiveness.[10] In Hungary final goods exports grew relatively more, while in Poland the export of intermediate goods has been the best performing flow. In the Czech Republic intermediate and final goods exports grew at similar rates.

	Czech Rep		Hungary		Poland	
	abs	p.c.	abs	p.c.	abs	p.c.
Y	7.5	9.5	15.2	15.1	12.1	15.5
FDI	18.8	21.0	23.0	22.9	22.6	26.3
MF	8.4	10.5	12.5	12.4	14.2	17.7
XF	14.8	17.0	21.0	20.9	17.2	20.8
MI	11.0	13.0	12.3	12.2	16.4	20.0
XI	12.7	14.8	11.8	11.7	21.6	25.2

Table 1 Average annual growth rates in absolute and per employee values

	Czech Republic			Hungary			Poland		
	low	med	high	low	med	high	low	med	high
MIgr	9.6	20.3	16.8	1.7	10.2	15.9	9.4	19.6	18.3
MPPgr	9.6	16.3	13.6	1.7	10.3	6.3	9.3	18.7	9.6
MFgr	9.7	11.2	12.2	5.7	14.1	13.6	10.2	15.4	32.7
XIgr	9.7	22.1	20.2	5.6	11.6	12.8	16.7	24.7	14.4
XPPgr	9.4	13.3	11.6	5.6	6.8	7.4	16.5	14.4	2.5
XFgr	8.7	22.4	32.9	-0.9	17.1	30.2	10.6	21.8	47.2

Table 2 Average annual growth rates of trade flows by industries

Considering the sectoral behaviour, the integration of trade with Western Europe, as well as the FDI inflow, shaped the production structure of the three countries. Over time the medium to high tech industries gained importance in manufacturing, with stronger increases in productivity and exports and a drastic reduction in the unit labour costs. On the opposite, the traditional sectors on average, and in particular DB and DC, lost in production and international importance, as well as in productivity and unit labour cost dynamics. The only exception is Food processing (DA) which accounts still for a relatively high share and, especially in Poland, gained strategic importance as supplier for the European market.

[10] See Landesman and Wörz 2006.

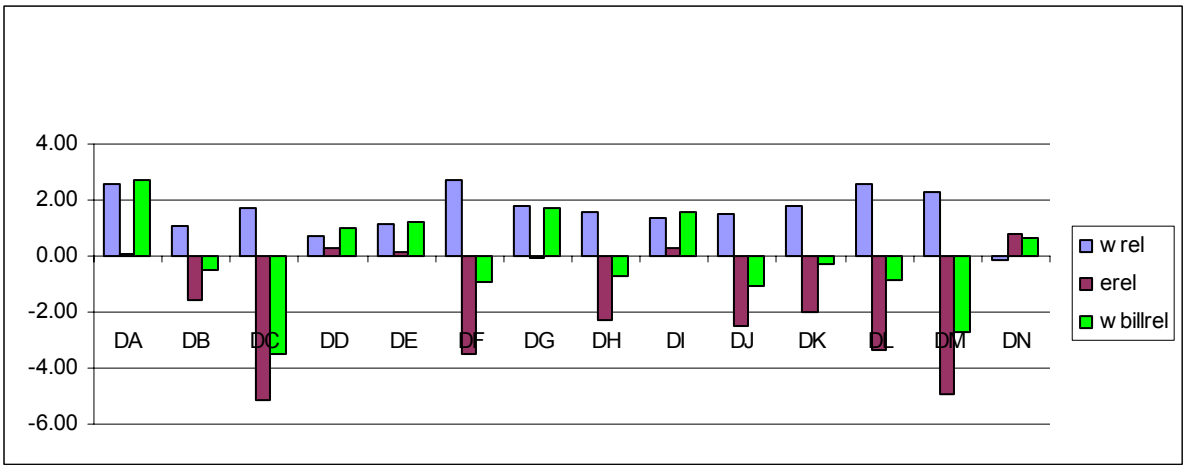

Figure 1 Average annual growth rate of the wage bill ratio and its components in the Czech Republic

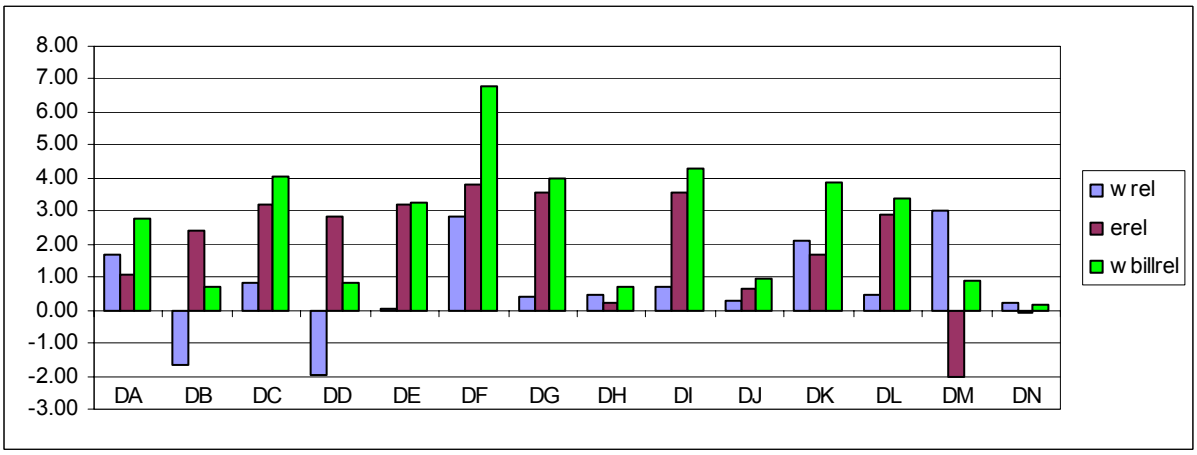

Figure 2 Average annual growth rate of the wage bill ratio and its components in Hungary

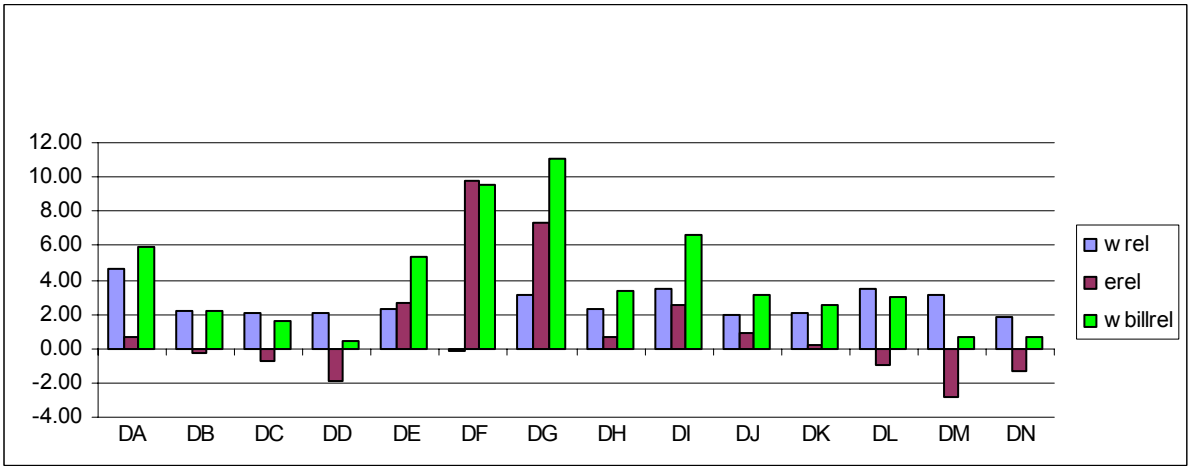

Figure 3 Average annual growth rate of the wage bill ratio and its components in Poland

Considering all trade flows, as we can see from table 2, there are striking differences in the growth rates among the three group of industries.[11] In all countries trade flows grew relatively less in the low skill intensive branches, while medium and high skill intensive branches experienced remarkable increases, especially in Electronics (DL), Transports (DM), Mechanics (DK) and Chemicals (DG). In the Czech Republic, the low skill branches increased all trade flow uniformly, while in the medium skill intensive branches trade in processed commodities increased relatively more. In the high skill intensive sectors the highest growth is recorded by trade in parts and components and by the export of final goods. The difference among group of sectors is more evident in Hungary where, in the low tech, only the export of processed commodities, together with the import of final goods recorded increases above 5% every year. At the same time, the increase in intermediate goods trade, and especially in parts and components was stronger in the high skill branches, where also the export of final goods increased at the extraordinary rate of 30% every year. In the medium skill intensive branches a remarkable increase is recorded by the import of processed goods. In Poland, the differences between sectors are lower and the higher increases in trade flows are recorded in the group of the medium skill intensive. In this group the growth of intermediate imports relied almost entirely on processed commodities, while from the export side the contribution of parts and components is of primary importance. In the high skill branches the importance of trade in parts and components is even higher and extremely high is also the growth of trade in final goods, with annual increases in export close to 50% and above 30% for imports.

4 Econometric analysis

In this part we estimate the impact of trade and outsourcing on the relative wage bill between skilled and unskilled workers. In the next section we briefly describe the conclusions of the main theoretical literature on the argument and then make the assumptions on the impact of the explanatory variables. In section 4.2 we explain the econometric strategy and in section 4.3 we comment the results.

4.1 Theoretical hypothesis

According to the traditional trade theory based on the Heckscher-Olhin model, the outsourcing of unskilled intensive stages of production from the skill abundant industrialised countries to the labour abundant less developed countries causes an increase in the relative wage of the sending economy and a reduction in the receiving country. The subsequent literature on fragmentation can be divided into two strands of literature. On one side, we have the two sectors models of fragmentation (Ardnt 1997, Jones and Kierzkowski 2001, Deardorff 1998, 2001) which mainly address the issue of outsourcing on the sending country. The results of these models are not univocal and can lead to opposite conclusions concerning the effect of outsourcing on factor prices. The outcome depends on the interplay between the factor endowment and the technology of each stage of production and of each country (Kohler 2001). Further, as pointed out by Egger and Falkinger (2003), the outcome depends on the relative

[11] The industries are aggregated in low, medium and high skill intensity according to the initial non manual intensity.

importance between the cost saving effect of outsourcing and the substitution effect induced by the changes in factor prices.

The second strand of literature, which increasingly gained ground especially for the empirical analysis, is that of Feenstra and Hanson (1996, 1997, 1999). They use a one sector model of outsourcing and lead to conclusions in line with the Heckscher Ohlin framework. The main innovation concerns the role of FDI. In their model (Feenstra and Hanson 1996), outsourcing via FDI of labour intensive stages of production can lead to a rise in the skill premium in the receiving country because the outsourced fragment can be not unskilled intensive compared to the average skill intensity in the country. This mechanism is appealing for countries at intermediate levels of development, where both the factor endowment and the environment are more favourable for the application of foreign (skill biased) technologies. Further, CEECs are of particular interest because of their existing industrial structure and because their integration with the EU reduces the impact of transport costs and trade barriers.[12] The hypotheses of Feenstra and Hanson found a confirmation in the case of outsourcing between USA and Mexico (Feenstra and Hanson 1997). The same authors then expanded the empirical strategy by introducing the R&D expenditure and the accumulation of high technology capital as additional controls. This, in their opinion, ensures better estimates of the impact of the outsourcing on the share of skilled workers in wages and employment.

Another strand of literature emphasize the importance of the skill biased effect of the scale of the economy (Epifani and Gancia 2006, 2007, Acemoglu 2003, Ekholm and Knarvik 2005). The main conclusion of Epifani and Gancia is that trade, capital accumulation and technical change are all skill biased because of the increase in market size they all bring about, independently of any bias in technology. Ekholm and Knarvik instead suggest that trade opening induces the adoption of skill biased technologies via increased market size. These conclusion are interesting for what concerns the evolution of trade in final goods, which is less connected with the outsourcing process.[13]

Although we basically expand on Egger and Stehrer (2003), we do not follow them in using the one sector model of fragmentation as theoretical framework. This is because, as we saw in the descriptive section, there are striking differences among industries both in the evolution of production, trade and FDI from one side and in the changes of the wage bill ratio and its components on the other side. These differences can only be accounted by a two (or more) sectors model. For this reason when interpreting the coefficients, although we do not refer to a particular theoretical model, we will rely on the assumption of a sectorally differentiated pattern of change.

We base the assumptions on the impacts of our regressors on the relative wage bill on the theoretical literature, on the previous empirical results and on the descriptive evidence. In any case, given our explorative approach, the results do not necessarily have to be in line with our assumptions. According to Feenstra and Hanson (1996), we assume FDI and R&D to be skill biased, leading to an increase in the relative wage bill. The same effect is expected from the capital stock, but given that a part of the stock, especially in the early years, is outdated, it can show also no significant impact.[14]

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[12] In the model of Feenstra and Hanson the conclusion about the skill biased effect of FDI is challenged when transport costs are initially high and then decline. In CEECs trade barriers are *de facto* eliminated since 1995 and transport costs are relatively low given their proximity with the sourcing countries.

[13] The impossibility to disentangle between final goods entirely produced at home and those with a content of imported intermediates hampers an interpretation of trade in final goods as expression of the outsourcing process.

[14] Esposito and Stehrer (2007) using the same data found a positive impact of the capital stock on the skilled labour wage bill share in Hungary, while no such evidence has been found in the Czech Republic and Poland. Tariáni (2004) found evidence of weak capital skill complementarity in Hungary.

Turning to trade in intermediates, the traditional trade theory would suggest a negative impact of these variables on the wage bill ratio in CEECs because of their relative abundance of unskilled labour. Although in the early 1990s it was common opinion that CEECs had a relatively skilled workforce, skill mismatches were found to be a severe problem for the transition process (see for example Boeri 2000, Boeri and Terrel 2002), so that the assumption of relative skill scarcity in Eastern Europe can be justified. Nevertheless, imported intermediate goods can have a positive impact because of imitation and spillover effects, but also because the further processing of these goods can have a higher skill content than the average of all domestic productions.

Trade in final commodities is not directly related to the outsourcing process. Its impact is associated with the relevance of the scale economies and with the increases in market size. Although, as we already said, we do not rely to a specific theoretical model for our estimation, we assume, as suggested by Epifani and Gancia (2006, 2007) and by Ekholm and Knarvik (2005), that the increased market size is likely to be skill biased, so that a positive sign of both trade in final goods and of the production value should be expected. For what concern in specific final goods imports, they are composed of both capital and consumption goods. Their effect can be positive because imported capital goods (and consumption goods too) are likely to be technologically advanced, compared to existing technology, and skill complementary. Further, both capital and consumption goods can generate spillover effects on the receiving country and induce a skill biased effect via imitation. On the other side, there is evidence that CEECs, and especially Hungary (Podkaminer et al. 2004) depends on foreign sources for the supply of high tech consumption goods. This could cause a crowding out effect and, consequently, induce a specialisation in the unskilled intensive segments of each industry. Nevertheless, we believe that final goods imports have, if any, a positive impact.

4.2 Model and variables

In order to estimate the impact of trade and outsourcing on the wage bill ratio our starting specification is the following:

$$\ln WBR_{i,t} = a + b1 \ln Y_{it-1} + b_2 \ln FDI_{it-1} + b_3 \ln MI_{it-1} + b_4 \ln MF_{it-1} + b_5 \ln XI_{it-1} + b_6 \ln XF_{i,t-1} + \Sigma D_t + \Sigma D_i + u_{it} \qquad (1)$$

WBR is the ratio between the wage bills of non manual and manual workers; Y is the production value; FDI is the inward FDI stock; MI, MF, XI and XF are the import and export flows of intermediate and final goods respectively; D_t are year dummies and ΣD_i are the fixed effects. We estimate the equation also using trade in processed and primary commodities (MPP and MPP in the regressions) instead of MI and XI. This gives us information on the different effect of trading this kind of goods compared to trading parts and components. Expansions include the capital stock (K) and expenditure in R&D. All regressors are expressed in per employee terms.

When trying to estimate the impact of FDI and trade on the relative demand for skilled labour the main problem is that the explanatory variables are likely to be endogenous to the skill composition of each industry. There can be simultaneous causality because FDI are likely to locate where skilled workers are more abundant. For the same reason, the outsourcing process captured by trade flows can be potentially endogenous. In order to

reduce the problem of endogeneity we regressed the dependent variable on the second lag of the import and export flows and on the first lag of production and FDI.[15] [16] Further, in this last case there was still endogeneity[17] of the production value, so we decided to introduce directly this variable lagged twice. When we do so the exogeneity test is accepted. Our final specification is then:

$$lnWBR_{i,t}=a+b1lnY_{it-2}+b_2lnFDI_{it-1}+b_3lnMI_{it-2}+b_4lnMF_{it-2}+b_5lnXI_{it-2} +b_6lnXFi_{t-2} + \Sigma D_t + \Sigma D_i + u_{it} \qquad (2)$$

having reduced the possible causes of enodgeneity from the other variables, we then check the robustness of the results by running an instrumental variables estimation (IV), assuming FDI to be endogenous and instumenting them with their second lag.[18]

We estimated the model separately on each country and on a sub-sample of the Czech Republic and Hungary together. Poland cannot be pooled with the others because the lack of complete data on FDI would cause a reduction in the useful observations also for the other two countries. Further, given its relative position in the transition process, we believe the Czech Republic and Hungary are similar in their evolution while Poland, due to its lower per capita values of trade and FDI, as well as to its relative backwardness in the catching up process, is likely to behave differently.

4.3 Econometric results

4.3.1 The effect of trade in all intermediate goods

The results form the fixed effect estimations with all intermediates included are shown in tables 3 and 4. The IV estimation is shown in tables 6 in the appendix. As we can see, the regression performs good for Poland, with a R^2 above 0.8 in all the specifications. In the sub-sample of Hungary and the Czech Republic (table 3) the fit is low, but looking at the separate estimations, it is evident that this result comes from the bad performance of the Czech Republic, while for Hungary the R^2 is around 0.7 in each specification. The IV estimation returned a very similar outcome, though the exogeneity of FDI is rejected only for Hungary.

The first important result is that in all countries the export of intermediate goods has a negative and significant impact. This confirms the result of Egger and Stehrer (2003), suggesting that in these countries the EU wide fragmentation of production induced a specialisation in unskilled intensive intermediate goods. The coefficient is higher for the Czech Republic, while Poland and Hungary show rather similar values. This impact is driven by the medium and high skill intensive industries in the Czech Republic and Hungary, while in Poland the growth rates are higher in the low and medium skill branches. In the sub-sample of the Czech Republic and Hungary the

[15] Interestingly enough, in this step endogeneity of FDI have been always largely rejected.
[16] A similar specification in a dynamic panel framework has been used by Egger and Stehrer (2003).
[17] Endogenity has benn tested using the test developed by Davidson and MacKinnon (1993)
[18] We tried also by using the second and third lag but the results are very similar. Given the small number of time periods, we believe the outcome can be less robust. For this reason we only report the results with one lag as instrument.

production value as well as intermediate imports are significant and with a positive coefficient. Nevertheless, when regressing separately the two countries, only in Hungary we find a skill biased effect of intermediate imports, while for the Czech Republic they are insignificant, although their effect is positive in all the specifications. The production value instead is insignificant in the separate estimations and the further control for both the capital stock and R&D expenditure does not change the results. Moreover, the latter variable is never significant, while capital exerts a positive impact in Hungary, confirming the conclusions of other studies.[19]

The reason for the different outcome in the Czech Republic and Hungary has to be found, in our opinion, in the transition process. In the former country the first wave of privatisation was implemented by distributing vouchers to the population, which resulted in a slow restructuring in favour of a policy of low unemployment. Within this context the increased integration with the EU is likely to have fostered the restructuring process and the labour shedding. The excess of labour in the early transition was mainly composed of non manual administrative workers, both ex party officers and people involved in service activities. The latter were then reduced by the growth of the formerly inexistent service sector, but an important share of these workers was probably still employed in the industry right after mid 1990s. This is confirmed by the high initial share of non manual (skilled) workers, higher than in the other countries and high in low skill intensive branches too. Furthermore, the highest increases in the share of unskilled workers (see figure 1) took place in the medium-high skill industries, which are also the branches more interested by the integration with Western Europe and by the FDI inflows. With this evidence in mind, we believe that the restructuring process probably fostered the elimination of non manual workers of the old type, increasing by consequence the share of blue collars in production. In Hungary the transition process started earlier, already in the 1980s, so that in 1998 (the initial year of the Hungarian sample) the restructuring process was almost completed and the skill biased effect of outsourcing was probably not hidden by the still ongoing labour shedding. Moreover, intermediate imports concentrated mainly in the high skill branches (see table 2) and especially in Electronics (DL), which is the best performing industry and reached in 2004 a share in production of more than 30%.[20]

Turning back to Poland, the capital stock and R&D are never significant, while both import of intermediates and export of final goods are significant. The former has a negative sign[21] and this suggests that the country specialised in unskilled intensive intermediate stages of production. In almost all cases the FE estimation returned a higher coefficient for intermediate imports than that for exports, suggesting that the country is relatively more involved in the further processing of imported intermediates rather than in the production of those goods. Another possible explanation is that intermediate imports are more biased toward the skill intensive branches compared to exports. Final goods exports have a positive coefficient and we interpret this as evidence of the skill biased effect of the increases in the market size.

If we look at figure 3 we can see that the wage bill ratio and the relative employment increased more in the high tech industries DE to DH and the same braches experienced also the highest growth in final goods exports. In all these branches, and

[19] See footnote 13.

[20] Kaminski and Ng (2005) found evidence of a strong integration in IT markets, of which Electronics is an important part.

[21] As shown in table 6, in the IV estimation intermediate imports are not significant, but given the result of the DM test, we consider this outcome not robust.

especially in Chemicals, foreign penetration increased substantially, so that this impact is also induced by the EU-wide specialisation in production.
In the Polish case we further added a specification without FDI (columns 6 to 8 in table 4) in order to estimate the impact of trade variables on all the 14 industries. The result in term of R^2 are very similar, while the impacts of both import and export of intermediates are higher. In any case, we cannot say whether this result is driven mainly by the exclusion of FDI or by the inclusion of the remaining industries.

4.3.2 The effect of trade in primary and processed goods

In table 5 we show the estimation results for equation (2) when we include as intermediate goods only primary and processed commodities (MPP and XPP). In this way we can separate the effect of these goods from that of trade in parts and components, and indirectly capture the effect f the latter variable[22] (columns 2 and 4 of each country box). Starting from the export side, in all countries the negative effect of intermediates goods is drastically reduced when including only primary and processed commodities, further in the case of Poland the sign changes and keep significant, indicating a skill biased effect of these goods. These results indicate that the export of parts and components uses intensively unskilled workers in all countries and, in the Czech Republic and Hungary, this effect is stronger than the unskilled biased effect of exporting primary and processed goods. Further, as shown in table 2, the export of primary and processed commodities is more uniformly distributed among sectors (Hungary) or is biased toward medium (Czech Rep. and Poland) and low (Poland) skill intensive branches, so that the sectoral differences are again an important determinant of the results.

Turning to intermediate imports, we find a more differentiated picture. In the Czech Republic parts and components are significant and with a strong positive impact (column 4). This results does not hold in column 3, but here final goods exports turn to be significantly positive. In Hungary most of the positive impact of intermediate imports vanishes when parts and components are not included, but at the same time final goods imports become significant and with a positive impact. The possible explanation is that the import of parts and components is highly correlated with the import of capital goods,[23] both because they are traded in the same industries and because among industries they show very similar growth rates, suggesting complementarity between these two categories. By consequence, we believe that the effect of parts and components is captured by the evolution of the imports of capital goods when the former are excluded from the analysis. Finally in Poland, the outcome is straightforward: as for intermediate exports, the unskilled biased effect of intermediates is entirely driven by the dynamics of part and components, while imported processed commodities exert no significant impact. This result is evidence of a still strong engagement in assembling activities, especially in the manufacturing of Transports Equipments which accounts for the largest share of imported parts and components.

[22] Given that parts and components are traded only in some particular industries, a direct estimation of their impact would problematic for the econometrics.
[23] The correlation is 0.84

	Czech Republic and Hungary				Czech Republic				Hungary			
	1	2	3	4	1	2	3	4	1	2	3	4
Y-2	0.142	0.143	0.148	0.149	0.096	0.097	0.105	0.106	0.138	0.093	0.148	0.111
	[0.067]**	[0.067]**	[0.069]**	[0.069]**	[0.086]	[0.087]	[0.088]	[0.089]	[0.111]	[0.112]	[0.112]	[0.118]
FDI-1	0.007	0.007	0.007	0.007	0.014	0.014	0.016	0.016	0.007	0.009	0.008	0.009
	[0.009]	[0.009]	[0.009]	[0.009]	[0.017]	[0.017]	[0.016]	[0.016]	[0.009]	[0.007]	[0.009]	[0.007]
MI-1	0.189	0.187	0.163	0.162	0.152	0.15	0.119	0.116	0.264	0.236	0.245	0.232
	[0.083]**	[0.082]**	[0.086]*	[0.085]*	[0.110]	[0.110]	[0.110]	[0.109]	[0.078]***	[0.077]***	[0.081]***	[0.081]***
MF-1	-0.002	0.001	0.024	0.028	-0.048	-0.043	-0.017	-0.012	0.025	0.008	0.046	0.027
	[0.067]	[0.066]	[0.066]	[0.066]	[0.084]	[0.083]	[0.080]	[0.079]	[0.067]	[0.067]	[0.072]	[0.073]
XI-1	-0.223	-0.225	-0.222	-0.224	-0.224	-0.227	-0.226	-0.229	-0.172	-0.187	-0.122	-0.166
	[0.039]***	[0.041]***	[0.046]***	[0.048]***	[0.065]***	[0.067]***	[0.073]***	[0.076]***	[0.046]***	[0.046]***	[0.049]**	[0.058]***
XF-1	0.006	0.005	0.007	0.006	0.018	0.018	0.021	0.02	0.002	-0.008	-0.002	-0.006
	[0.016]	[0.017]	[0.017]	[0.017]	[0.018]	[0.019]	[0.020]	[0.020]	[0.025]	[0.026]	[0.026]	[0.027]
K-1		-0.004		-0.004		-0.005		-0.005		0.211		0.168
		[0.011]		[0.011]		[0.010]		[0.011]		[0.080]**		[0.105]
RD-1			-0.004	-0.004			0.004	0.004			-0.007	-0.007
			[0.011]	[0.011]			[0.031]	[0.031]			[0.010]	[0.010]
Const	-0.199	-0.208	-0.151	-0.159	-0.661	-0.675	-0.566	-0.583	0.411	0.485	0.679	0.611
	[0.340]	[0.347]	[0.390]	[0.400]	[0.337]*	[0.351]*	[0.545]	[0.568]	[0.351]	[0.304]	[0.368]*	[0.333]*
Obs	196	196	188	188	112	112	110	110	84	84	78	78
R2	0.39	0.39	0.37	0.37	0.33	0.33	0.33	0.34	0.67	0.71	0.66	0.68

Table 3 Fixed effect estimation for the Czech Republic and Hungary

	1	2	3	4	5	6	7	8
Y-2	-0.147	-0.117	-0.138	-0.101	0.086	0.102	0.059	0.085
	[0.114]	[0.108]	[0.116]	[0.108]	[0.083]	[0.078]	[0.086]	[0.082]
FDI-1	0.049	0.027	0.045	0.017				
	[0.050]	[0.048]	[0.056]	[0.055]				
MI-2	-0.12	-0.134	-0.14	-0.153	-0.175	-0.185	-0.145	-0.161
	[0.065]*	[0.063]**	[0.063]**	[0.061]**	[0.049]***	[0.050]***	[0.060]**	[0.063]**
MF-2	0.092	0.099	0.1	0.108	0.061	0.063	0.069	0.073
	[0.063]	[0.059]*	[0.060]	[0.057]*	[0.052]	[0.051]	[0.055]	[0.054]
XI-2	-0.121	-0.114	-0.122	-0.115	-0.16	-0.155	-0.159	-0.155
	[0.035]***	[0.038]***	[0.035]***	[0.037]***	[0.027]***	[0.028]***	[0.026]***	[0.027]***
XF-2	0.034	0.036	0.037	0.037	0.04	0.038	0.038	0.036
	[0.014]**	[0.013]***	[0.015]**	[0.013]***	[0.011]***	[0.011]***	[0.013]***	[0.013]***
K-1		-0.103		-0.111		-0.072		-0.08
		[0.086]		[0.083]		[0.072]		[0.076]
RD-1			0.036	0.037	126		0.025	0.026
			[0.024]	[0.023]			[0.018]	[0.018]
Const	-1.542	-1.285	-0.764	-1.027	-1.268	-1.424	-1.423	-1.668
	[0.389]***	[0.389]***	[0.353]**	[0.427]**	[0.307]***	[0.378]***	[0.459]	[0.557]***
Obs	90	90	88	88	126	126	119	119
R2	0.81	0.82	0.8	0.81	0.81	0.81	0.81	0.81

Table 4 Fixed effect estimation for Poland

5 Conclusions

In this paper we analysed the impact of trade and outsourcing from Western Europe to three CEECs. We updated the analysis of Egger and Stehrer (2003) in order to investigate the changes occurred in most recent years. The effect of outsourcing is proxied by the impact of FDI and trade in intermediates, while final goods trade is assumed to capture the effect of the increased market size. We further disaggregated intermediate goods into processed commodities and parts and components. The main finding is that trade integration, of which outsourcing is an important component, shaped the evolution of both the production and trade structures. Moreover, this pattern is sectorally differentiated, with stronger increases in the medium and high skill intensive industries in all countries. In particular in Hungary trade integration is strongly biased toward the skill intensive industries.

In the econometric analysis we found robust evidence of a specialisation of the three countries in the export of unskilled intensive intermediate goods and the export of parts and components is the main force behind this dynamics. Further, in Poland the export of primary and processed commodities is skill biased. In Hungary we found evidence that the intermediate imports, mainly that of parts and components, contributed to the overall skill upgrading. On the contrary, in the Czech Republic, although we do not find a significant effect of intermediate imports as a whole, we find it in the imports of processed commodities. In Poland we found evidence of a negative impact of intermediates imports, suggesting a pattern of specialisation in the unskilled intensive stages of production. In particular this result is driven by the imported parts and

components, suggesting that this country is probably still highly involved in assembling activities, especially of transports equipments. Alongside this pattern we found in Poland a skill biased effect of the export of final commodities. This outcome is probably due to the effect of the increased market for those product and this result is driven by the extremely high growth rates in the high skill intensive industries DE and DG.

Given these findings, the picture is that the catching up with western Europe is faster in Hungary, but there are signs of an important catching up in Poland too. Nevertheless, because of the high unemployment, mainly composed of unskilled workers, the latter will probably need more time to absorb this excess of labour force before the outsourcing process will show a skill bias effect as in Hungary. From the other side, as pointed out by Hunya and Geishecker (2005), the low per capita levels of trade and FDI and the size of the economy give to the country a high potential for a trade and outsourcing induced growth, while this potential is almost exhausted in the other two countries. In the Czech Republic, although the evidence of catching up from the sectoral evolution of trade flows is present, a skill biased effect is found only in the further processing of imported processed commodities. This is probably the by product of the Czech transition, where the excess of labour took more time to vanish, and in the next years a complete catching up of the country is not questioned.

	Czech Rep				Hungary				Poland			
Y-2	0.096	-0.036	0.126	0.038	0.093	0.044	0.085	0.042	-0.147	-0.429	-0.174	-0.447
	[0.086]	[0.085]	[0.086]	[0.087]	[0.112]	[0.114]	[0.111]	[0.114]	[0.114]	[0.105]***	[0.137]	[0.120]***
FDI-1	0.014	0.011	0.013	0.011	0.009	0.008	0.01	0.01	0.049	0.061	0.034	0.047
	[0.017]	[0.017]	[0.018]	[0.017]	[0.007]	[0.007]	[0.007]	[0.007]	[0.050]	[0.051]	[0.051]	[0.052]
MI-2	0.152	0.085			0.236	0.221			-0.12	-0.109		
	[0.110]	[0.112]			[0.077]***	[0.084]**			[0.065]*	[0.059]*		
MPP-2			0.069	0.157			0.028	0.023			-0.011	-0.013
			[0.043]	[0.067]**			[0.013]**	[0.018]			[0.011]	[0.011]
MF-2	-0.048	-0.051	-0.02	-0.073	0.008	0.006	0.113	0.106	0.092	0.08	0.065	0.056
	[0.084]	[0.090]	[0.065]	[0.073]	[0.067]	[0.074]	[0.044]**	[0.048]**	[0.063]	[0.064]	[0.058]	[0.061]
XI-2	-0.224		-0.199		-0.187		-0.169		-0.121		-0.119	
	[0.065]***		[0.054]***		[0.046]***		[0.048]***		[0.035]***		[0.037]***	
XPP-2		-0.044		-0.099		-0.123		-0.109		0.015		0.015
		[0.027]		[0.038]**		[0.040]***		[0.048]**		[0.005]***		[0.006]***
XF-2	0.018	0.026	0.028	0.021	-0.008	-0.012	-0.003	-0.009	0.034	0.024	0.034	0.025
	[0.018]	[0.018]	[0.011]**	[0.014]	[0.026]	[0.029]	[0.030]	[0.032]	[0.014]**	[0.012]**	[0.015]**	[0.014]*
Kap					0.211	0.199	0.275	0.259				
					[0.080]**	[0.086]**	[0.091]***	[0.097]***				
Constant	-0.661	-0.574	-0.562	-0.288	0.529	0.383	0.441	0.303	-1.542	-1.709	-1.29	-0.958
	[0.337]*	[0.286]**	[0.360]	[0.315]	[0.343]	[0.381]	[0.326]	[0.366]	[0.389]***	[0.417]***	[0.427]***	[0.341]***
Obs	112	112	112	112	84	84	84	84	90	90	90	90
R2	0.33	0.23	0.31	0.27	0.71	0.69	0.65	0.63	0.81	0.78	0.8	0.77

Table 5 Estimation results for the effect of trade in primary and processed commodities on the wage bill ratio

References

Acemoglu, Daron (2003) "Patterns of Skill Premia" *Review of Economic Studies* vol.70 n.2.

Arndt, Sven, W. (1997) "Globalisation and the open economy" *North America Journal of Economics & Finance,* 8 (1), pag. 71-79.

Boeri, Tito (2000). "Structural Change, Welfare Systems and Labour Reallocation: Lessons from the transition of Formerly Planned Economies" *Oxford: Oxford University Press*.

Boeri Tito, Terrel Katherine (2002). "Institutional Determinants of Labour Reallocation in Transition" *Journal of Economic Perspective* Vol.16 n.1, pag.51-76.

Bruno, G., Crinò, R. and Falzoni, A. (2004) "Foreign direct investment, wage inequality and skilled labour demand in EU accession countries" Cespri-WP 154, 2004.

Commander, S. and Köllo, J. (2004) "The changing demand for skills, evidence from the Transition" *IZA Discussion Paper* 1073.

Davidson, R. and MacKinnon, J. (1993) "Estimation and inference in econometrics" Oxford University Press, New York.

Deardorff, Alan, V. (1998) "Fragmentation in simple trade models" *The University of Michigam, Research Seminars in International Economics, Discussion Paper n. 422*

Deardorff, Alan, V. (2001) "Fragmentation across cones" in S.W. Arndt and H. Kierzkowski (eds.), *Fragmentation and International Trade,* Oxford University Press, Oxford.

Dulleck, U., Foster, N., Stehrer, R. and Wörz, J. (2005) "Dimensions of quality upgrading in CEECs", *The Economics of Transition* vol. 13 n. 1

Egger, E. and Egger, P., (2003) "Outsourcing and skill-specific employment in a small economy: Austria and the fall of the iron curtain" *Oxford Economic Papers* 55, pag. 625-643.

Egger, P. and Stehrer, R. (2003) "International outsourcing and skill-specific wage bill in Eastern Europe", The World Economy, 26/1.

Ekholm, K. and Knarvik, K. H. M. (2005) "Relative wages and trade induced changes in technology" *European Economic Review* vol.49 n.6 (August).

Epifani, Paolo and Garcia, A.Gino (2004) "The Skill Bias of World Trade" *CREI WP*126/2002, revised 2004.

Esposito, P. and Stehrer, R. (2007) "The sector bias of skill biased technical change and the rising skill premium in transition economies" *WIIW mimeo.*

Feenstra, R. C. and Hanson, G. H. (1996) "Foreign investment, outsourcing and relative wages" *in Feenstra, Grossman and Irwin, eds.* "Political Economy of Trade Policy: Essays in Honour of Jagdish Bhagwati," *MIT Press, Cambridge, Mass.*

Feenstra, R. C. and Hanson, G. H. (1997) "Foreign direct investment and relative wages: evidence from Mexico's maquiladoras" *Journal of International Economics* , 42.

Feenstra, R. C. and Hanson, G. H. (1999) "The impact of outsourcing and high technology capital on wages: estimates for the United Stated 1979-1990" *Quarterly Journal of Economics* vol 114, n.3 , pag 907-940.

Fontagné, L., Freundenberg, M., Űnal-Kezenci, D. (1996) "Statistical analysis of EC trade in intermediate products." Eurostat, Series 6D, March.

Geischecker, Ingo (2004) "The skill bias of Foreign Direct Investments in Central and Eastern Europe" *Economic restructuring and labour markets in the Accession Countries.* EU DG Employment, Social Affairs and Equal Opportunities.

Geishecker, I. and Hunya, G. (2005) "Employment Effect of Foreign Direct Investment in Central and Eastern Europe" *WIIW Research Report* 321b.

Jones, R., W., Kierzkowski, H., (2001) "A framework for fragmentation" in S.W. Arndt and H. Kierzkowski (eds.), *Fragmentation and International Trade,* Oxford University Press, Oxford.

Kaminski, B. and Ng, F., (2005) "Production disintegration and integration of Central Europe into global markets" *International Journal of Economics and Finance,* 14, pag. 377-390

Kataria, K. and Trabold, H. (2004) "FDI and the skill composition of the workforce: the case of electronics industry in Hungary" *Economic restructuring and labour markets in the Accession Countries.* EU DG Employment, Social Affairs and Equal Opportunities.

Kertesi, G. and Köllö, J. (2002) "Labour demand with heterogenous laour inputs after the transition process in Hunagry, 1992-1999" *Budapest Working Papers on the Labour Market* 2002/5.

Kézdi, G. (2002) " Two phases of labour market transition in Hungary: intersecotral reallocation and skill biased technical change" *Budapest Working Papers on the Labour Market* 2002/3.

Kohler, Wilhelm (2001) "A specific factors view on outsourcing" *North American Journal of Economics & Finance,* 12, pag. 31-53.

Landesmann, M. and Stehrer, R. (2003) "Evolving competitiveness of CEECs in an enlarged Europe" *Rivista di Politica Economica,* XCII, n I-II, pag. 23-88.

Landesmann, M. and Wörz, J. (2006) "CEECs competitiveness in a global context" *WIIW Research Report* forthcoming.

Landesmann, M., Leitner, S. and Stehrer, R. (2007) "Skill problems in european industria sectors" *WIIW mimeo.*

Lorentowicz, A., Marin, D. and Raubold, A. (2005) "Is human capital losing from outsourcing? Evidence from Austria and Poland" *CESifo Working Paper* 1616.

Podkaminer, Leon et. Al. (2004) "Transition countries on the eve of EU enlargement" *WIIW Research Report 303*

Radosevic, S. (2004) "Foreign direct investment and restructuring in the automotive industry in Central and Eastern Europe." *Economic restructuring and labour markets in the Accession Countries.* EU DG Employment, Social Affairs and Equal Opportunities.

Tariáni, H. (2004) "Estimating the impact of SBTC on input demand elasticities in Hungary" *Magyar Nemzety Bank Working Paper* 2004/3

Appendix

Industry classification according to NACE subsections

DA Food products; beverages and tobacco (low)

DB Textiles and textile products (low)

DC Leather and leather products (low)

DD Wood and wood products (low)

DE Pulp, paper & paper products; publishing & printing (high)

DF Coke, refined petroleum products & nuclear fuel (high)

DG Chemicals, chemical products and man-made fibres (high)

DH Rubber and plastic products (med)

DI Other non-metallic mineral products (med)

DJ Basic metals and fabricated metal products (med)

DK Machinery and equipment n.e.c. (high)

DL Electrical and optical equipment (high)

DM Transport equipment (med)

DN Manufacturing n.e.c. (low)

Low= low skill intensive

Med= medium skill intensive

High= high skill intensive

	Czech Rep. And Hungary				Czech rep.				Hungary				Poland			
Y-2	0.168	0.168	0.173	0.173	0.132	0.132	0.138	0.138	0.162	0.118	0.166	0.133	-0.285	-0.254	-0.215	-0.136
	[0.072]**	[0.070]**	[0.071]**	[0.072]**	[0.149]	[0.151]	[0.152]	[0.159]	[0.124]	[0.123]	[0.126]	[0.133]	[0.144]*	[0.130]*	[0.157]	[0.162]
FDI-1	-0.02	-0.02	-0.02	-0.02	0.166	0.163	0.171	0.173	-0.022	-0.014	-0.023	-0.016	0.024	0.006	-0.03	-0.083
	[0.033]	[0.031]	[0.032]	[0.031]	[0.729]	[0.708]	[0.701]	[0.702]	[0.027]	[0.020]	[0.027]	[0.019]	[0.084]	[0.084]	[0.087]	[0.100]
MI-1	0.269	0.269	0.246	0.246	0.123	0.125	0.083	0.081	0.26	0.238	0.245	0.234	-0.035	-0.07	-0.049	-0.102
	[0.107]**	[0.102]***	[0.105]**	[0.104]**	[0.548]	[0.529]	[0.540]	[0.536]	[0.094]***	[0.088]***	[0.099]**	[0.094]**	[0.085]	[0.075]	[0.082]	[0.084]
MF-1	0.006	0.006	0.038	0.038	-0.199	-0.197	-0.171	-0.173	-0.004	-0.012	0.012	0.003	0.06	0.079	0.049	0.075
	[0.077]	[0.074]	[0.074]	[0.075]	[0.702]	[0.688]	[0.721]	[0.726]	[0.082]	[0.078]	[0.091]	[0.088]	[0.074]	[0.062]	[0.061]	[0.057]
XI-1	-0.23	-0.23	-0.224	-0.224	-0.362	-0.36	-0.362	-0.364	-0.164	-0.179	-0.119	-0.155	-0.11	-0.099	-0.111	-0.096
	[0.046]***	[0.045]***	[0.051]***	[0.053]***	[0.386]	[0.379]	[0.362]	[0.369]	[0.053]***	[0.051]***	[0.058]**	[0.068]**	[0.035]***	[0.034]***	[0.031]***	[0.032]***
XF-1	0.008	0.008	0.009	0.009	0.04	0.04	0.046	0.046	-0.011	-0.017	-0.015	-0.016	0.032	0.034	0.035	0.038
	[0.014]	[0.013]	[0.013]	[0.013]	[0.117]	[0.114]	[0.123]	[0.124]	[0.027]	[0.028]		[0.028]	[0.017]*	[0.014]**	[0.016]**	[0.015]**
K-1		0		0.001		0.001		-0.001		0.18		0.134		-0.118		-0.188
		[0.012]		[0.012]		[0.016]		[0.016]		[0.097]*		[0.138]		[0.101]		[0.108]*
RD-1			-0.004	-0.004			0.03	0.031			-0.003	-0.004			0.032	0.037
			[0.012]	[0.011]			[0.115]	[0.114]			[0.011]	[0.011]			[0.023]	[0.022]*
Obs	182	182	174	174	98	98	96	96	84	84	78	78	80	80	78	78
R2C	0.38	0.38	0.35	0.35	-0.12	-0.1	-0.19	-0.21	0.53	0.62	0.48	0.56	0.78	0.79	0.76	0.75
DM	0.22	0.21	0.22	0.21	0.74	0.73	0.72	0.71	0.07	0.03	0.04	0.02	0.96	0.94	0.44	0.48

Table 6 Instruemental Variables estimation