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Services and materials outsourcing to low-wage countries and employment: Empirical evidence from EU countries☆

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Abstract

This paper presents further insights into the employment effects of the international outsourcing of services to low-wage countries based on a sample of manufacturing and non-manufacturing industries for five EU countries. For the non-manufacturing sector, our results indicate that while the total of internationally purchased services is not important, purchased services from low-wage countries have a statistically significant but rather small negative impact on employment. In terms of the magnitude of its impact, the results suggest that outsourcing of services to low-wage countries has decreased employment by 0.2 percentage points per year from 1995 to 2000. However, we do not find any negative effect of the change of internationally purchased business services from low-wage countries on the demand for labour, suggesting in turn that other types of purchased services are responsible for the negative employment effects. For the manufacturing sector, while purchased services from low-wage countries is not significant, the outsourcing of intermediate materials to low-wage countries appears to have a relatively small negative impact on the demand for labour. The effect is more pronounced for intermediate materials from China and the East Asian countries than for those from Central and East European countries.

JEL classification: F10; J31

Keywords: International outsourcing of materials and services; Trade in intermediate inputs; Labour demand; Cross-country analysis

1. Motivation

Increased vertical specialization across countries (international outsourcing) has spurred trade in intermediate goods. Many empirical studies have documented a rising share of imported materials in production in OECD and EU countries (Feenstra and Hanson, 1996, 1999; Egger and Egger, 2001; Falk and Koebel, 2002; Chen and Yi, 2003; Geishecker, 2005; Falk and Wolfmayr, 2005) or emphasise the role of cross-border outsourcing in fostering world trade (Hummels

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et al., 2001; Yi, 2003; Yeats, 2001).[2] While international outsourcing as such is not a new phenomenon and has existed for decades in the manufacturing sector, there are two trends that have brought in new elements into the discussion of the possible effects of outsourcing on the domestic economy.

The first is the increased sourcing of material inputs from low-wage countries. While outsourcing to high-wage countries (including intra-EU15 trade) is still dominant, recent expansions in international outsourcing activities are clearly weighted towards low-wage countries. In Europe this trend is mainly driven by the integration of Central and Eastern Europe since the beginning of the 1990s. For a sample of five EU15 countries, our data shows that between 1995 and 2000 the ratio of imported materials from the same industry to gross output increased from 7.3% to 8.9% on average (weighted mean across industries and five EU countries), with the ratio of imported materials from low-wage countries growing by an average rate of 9% p.a. over the same period compared to 2.6% p.a. for sourcing activities from high-wage countries.[3]

The other important new feature of international outsourcing is the emergence of cross-border services outsourcing, which also comes with a general increase in the tradability of services due to major advances in the information and communication technologies as well as de-regulations in some of the services sectors. Empirical analysis is sparse in this field, but from the direct and indirect evidence available one can conclude that while the overall extent of international outsourcing of services is still very small, and much lower than material outsourcing, international purchases of services inputs have been on the rise in recent years (Borga, 2005; Landefeld and Mataloni, 2004; Amiti and Wei, 2005, 2006). Based on outsourcing intensity ratios constructed by the use of input/output coefficients, Amiti and Wei (2005, 2006) show that the share of service imports in total non-energy inputs in the UK increased from 3.5% in 1992 to 5.5% in 2001, while in the US, the figures are much lower and increased from 0.4% to 0.8% over the same period.

Both of these trends have increased the fears regarding employment prospects especially for low-skilled workers and have generated a lively debate on the impact of international sourcing activities on labour demand in the domestic markets. The public debate concerning cross-border services outsourcing has again mostly focused on a loss of services jobs to low-wage countries and has increased specific worries that previously non-traded, sheltered parts of the economy will increasingly come under competitive pressure cutting across sectors, occupations, and skill groups. The types of services most likely associated with services offshoring tend to be those that are capable of being performed from a distance and whose products can be delivered through relatively new forms of advanced telecommunications (Internet). Software programming, accounting, or telephone call centre services are among the service categories that are most easily outsourced to low-wage locations such as India or Central Eastern Europe. Blinder (2006) characterises the kind of services that are the most susceptible to international outsourcing, as services that require no face-to-face interaction and services that can be impersonally delivered. Blinder (2006) also convincingly argues that the future dividing line between safe jobs and jobs that are at risk of being outsourced and prone to international competition is not so much drawn by different qualifications and skills, but rather the capability of the service jobs to serve clients at long distances without a loss of quality. Based on this division, Blinder calculates approximately 28 million service jobs (of the 132 million jobs at the end of 2004) – or roughly 20% of all occupations – in the US as those that are potentially subject to outsourcing.

Empirical work to quantify the impact of increased trade and international sourcing of service inputs on domestic labour markets has clearly lagged behind the public debate, which to a large extent is due to a general lack of reliable, complete data on the services trade. The evidence available thus far mostly refers to the US (Baily and Lawrence, 2004; Amiti and Wei, 2006; Schultze, 2004) and the UK (Amiti and Wei, 2005). Common to these contributions is also that they are unable to distinguish between imported service inputs from developed countries and low-wage countries, while most concerns regarding job losses in turn refer to the latter. The overall finding of this empirical literature is that international sourcing of services inputs is unlikely to have accounted for a meaningful part of the job losses. One of the more rigorous studies of the effects of material and services outsourcing of the manufacturing sector on labour demand and labour productivity is provided by Amiti and Wei (2005, 2006). They estimate the relationships

[2] The term cross-border outsourcing ("offshore outsourcing") thereby often refers to purchasing of intermediates from abroad at an arm's length from foreign suppliers. "Offshoring" adverts to a transfer of a particular task within an organisation to a foreign affiliate. In this present paper we use the terms cross-border outsourcing, or international outsourcing to refer to both of the arms's length purchases of inputs and purchases from foreign affiliates.

[3] See Table 1 below for the summary statistics.

for manufacturing employment in the US from 1992 to 2000, and similarly for the UK from 1995 to 2001. They also find that services outsourcing is small and plays a small role in explaining the changes in aggregate labour demand. In their paper on the US, they note that the effect of services outsourcing crucially depends on the level of industry disaggregation, finding a negative effect on employment if the economy is broken down into 450 industrial sectors and a disappearing negative effect when looking at slightly more broadly defined sectors (96 sectors). The authors take this as an indication that there is sufficient growth in demand in other industries within the broadly defined classifications to offset any negative effects. The effect on productivity is clearly positive in both papers with the international outsourcing of services accounting for more of the labour productivity growth than the international sourcing of materials.

There are several empirical contributions on the impact of either import competition or intermediate material imports on labour demand. Studies for the US and UK find a negative correlation between employment growth and change in import volumes (Sachs and Shatz, 1994; Greenaway et al., 1999) or a change in import prices (Revenga, 1992). Using a panel of 167 manufacturing industries over the period of 1979–1991 in the UK, Greenaway et al. (1999) find that import penetration has a negative impact on industrial employment. However, the authors find that North–North trade has greater effects on employment than North–South trade. By contrast, based on US manufacturing data, Sachs and Shatz (1994) conclude that industry employment levels fall due to imports from developing, rather than developed, countries. Revenga (1992) argues that increased import competition is a major factor in declining employment in US manufacturing. Freeman and Revenga (1999) find for the OECD countries some moderate effects of import competition on employment. Moreover, the authors find evidence that the impact on employment of intra-OECD trade is more important than the impact of non-OECD trade. Neven and Wyplosz (1996) use import prices rather than trade flows as an indicator of international competitive pressure, in which they also find that European industries are affected by competition with developing and developed countries to the same extent. Based on a panel of OECD countries, Landesmann et al. (2001) find that import penetration from emerging countries (i.e. Southern Europe and the Asian Tigers) had a significant negative effect on employment growth from 1982 to 1988, but this effect in turn disappears in the 1990s. Furthermore, the authors find that the effect of outsourcing seems to have been stronger in high-skill intensive industries rather than in low-skill intensive industries. This effect, however, disappears again in the 1990s. Falk and Wolfmayr (2005) investigated the impact of international outsourcing of material inputs on total employment using two-digit manufacturing data for seven EU countries from 1995 to 2000 and show that imported materials from low-wage countries have a significant and negative impact on total employment. Sample split regressions indicate a negative impact in industries with low-skill intensity but not in skill intensive manufacturing industries such as machinery, electrical, optical, and transport equipment.

This present paper fills out some important gaps in the empirical literature on the employment effects of international outsourcing. For the first time we are able to provide evidence on services outsourcing in the manufacturing and services sectors for a set of five selected EU15 countries. Based on input–output tables we construct several different measures of international outsourcing as well as of domestic outsourcing. Within the manufacturing sector, we distinguish between a conceptually narrow measure of outsourcing that includes only material imports from the same industry class, an indicator comprising overall imported services inputs, and another pertaining to imports of business services that include types of services that are probably the most susceptible to outsourcing (computer services, management and consulting services, research and development, and "others"). Likewise, within the services sector we differentiate between a narrow measure of outsourcing including only services inputs from the same services sector, a wide measure including all the types of imported services inputs, and finally a measure comprising only business services imports. These different measures will enable us not only to test for different employment impacts of international outsourcing with respect to the type of the sector that is outsourcing (manufacturing or services sector), but also with respect to the type of inputs (materials, services, business services) that that sector is outsourcing. Furthermore, we combine the trade statistics for goods and services imports and information from input–output tables. This enables us to identify the imported intermediates by their country of origin. Specifically, we distinguish between imported materials and (for the first time) imported services both from low-wage countries (i.e. new EU member states and developing and newly industrialised countries (NICS)) and high-wage countries (i.e. former EU15 member states and the remaining OECD countries). The labour demand model is estimated by OLS using a cross-section of long-differences (i.e. changes in logarithms between 1995 and 2000). Furthermore, we apply several different estimation techniques and specifications in order to check for the robustness of our findings. We use the robust regression method that provides robust estimates particularly in the presence of outliers.

2. Empirical model and hypotheses

One approach to estimate the effect of international outsourcing of services and materials on employment is to regress employment against a number of explanatory variables that are derived from a standard labour demand framework. The standard labour demand augmented by indicators of outsourcing of services and materials may be specified by the following regression equation:

$$\ln L_{it} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln \mathrm{WP}_{it} + \beta_3 \ln \mathrm{PURSER}_{it} + \beta_4 \ln \mathrm{OUTMAN}_{it} + \beta_5 T + \mu_i + \varepsilon_{it}.$$

where the left-hand-side variable, L_{it} is total employment. Y_{it} denotes value added in constant prices and WP_{it} real wages. The parameters β_1 and β_2 can be interpreted as the wage and output elasticities of labour demand. PURSER_{it} denotes total purchased services from abroad, OUTMAN_{it} denotes imported materials, μ_i is a sector effect, T is the time trend, and ε_{it} is the error term. Taking "long differences" across the whole of our time period gives the following labour demand equation for the manufacturing sector.

$$\Delta \ln L_i = \alpha_0 + \alpha_1 \Delta \ln Y_i + \alpha_2 \Delta \ln \mathrm{WP}_i + \alpha_3 \Delta \mathrm{PURSER}_i + \alpha_4 \Delta \mathrm{OUTMAN}_i + \nu_i,$$

where the new error term, $\nu_i = \varepsilon_{it} - \varepsilon_{i,t-1}$, has a zero mean and constant variance. Δ refers to the average annual change of the variables from 1995 to 2000. Time differencing of the time trend generates the constant α_0.

For the non-manufacturing sector, the regression equation is straightforward:

$$\Delta \ln L_i = \tilde{\alpha}_0 + \tilde{\alpha}_1 \Delta \ln Y_i + \tilde{\alpha}_2 \Delta \ln \mathrm{WP}_i + \tilde{\alpha}_3 \Delta \mathrm{PURSER}_i + \nu_i.$$

Taking "long differences" between two points also eliminates industry effects and so we can estimate this model using OLS. The coefficient on real wages should be negative, whereas the coefficient on output should be positive. In addition to including the share of total intermediate imports and purchased services from abroad, we also disaggregate both variables by country of origin. In particular, we distinguish between high-wage, low-wage and medium-wage countries. In the next step we also split up low-wage and medium-wage countries into CEEC and China plus the East Asian countries. Finally, we also control for domestic purchased services.

The main research question to be examined is whether purchased services from abroad are a complement or substitute for domestic employment. In order to check the robustness of our results we also investigate the relationship between the initial level of purchased services from abroad and employment growth. Furthermore, because of concerns that the impact of outsourcing of business services might be fundamentally different in ways that are not captured simply by total purchased services, we estimate the models separately for purchased business services. Finally, we work with alternative definitions of outsourcing of services (purchased services broadly defined and purchased services narrowly defined). A more detailed explanation with respect to the construction of the variables is given in the next section.

3. Data and descriptive statistics

The data used in the empirical study is drawn from a number of sources. We used data from the OECD STAN database on total employment, real and nominal value added, total wage and compensation, as well as gross production. Real wages are calculated as total wage costs divided by the number of employees and deflated by the value added deflator. Employment includes part- and full-time employees. We use EU input–output tables in order to construct various measures of international outsourcing. Note that EU input–output tables are only available from 1995 onwards. First, we distinguish between international outsourcing by the manufacturing and services sector. Subsequently, for each of the sectors, we define different measures with respect to the type of input purchased from abroad. For the manufacturing sector, we first calculate a narrow measure of international outsourcing including imported materials from the same two-digit industry. This measurement concept was first introduced by Feenstra and Hanson (1996, 1999). It probably best captures the idea of material outsourcing, especially because we must rely on the relatively high aggregation level of two-digit industries. We then construct two different measures to indicate the international outsourcing of services inputs by the manufacturing sector: one including all the imported services inputs, the other comprising imported business services inputs. We included the latter measure because business services comprise most of the types of services that can be most easily delivered over longer distances, need less face-to-face contact, and therefore are probably the most affected by international outsourcing, but may also be categorised as more skill intensive as compared to construction and transportation services. The business services sector defined in this study subsumes

computer services, management and consulting services, research and development, accounting, architectural services, and others.

Analysing services sector outsourcing, we distinguish between a narrow measure of services outsourcing including only services inputs from within the same services sector, a wide measure including all of the types of imported services inputs, and finally a measure comprising business services imports only. These different measures will enable us not only to test different employment impacts of international outsourcing regarding the type of the sector that is outsourcing, but also the type of inputs that the sector is outsourcing.

The various outsourcing indicators are calculated based on the input–output tables for five EU countries (Austria, Finland, Germany, Italy and the Netherlands), which in contrast to other countries' input–output tables, provide direct information on imported material inputs. This data is made available by Eurostat for 1995 and 2000. However, the imported intermediate inputs of an industry are usually not disaggregated by way of country of origin. Therefore, it is not possible to directly distinguish between intermediate imports from advanced and less advanced countries. To derive a regional breakdown of intermediate imports we combine data on intermediate materials with the trade statistics derived from the UN COMTRADE Database and the Newcronos Database. We multiply each type of imported inputs (MI_{ij}), which are obtained from the input–output tables, by the respective country's (regional) import shares for total imports (M_{jc}/M_j), which are in turn obtained from trade statistics. That is, imported inputs of type (j), purchased by industry (i) from country (country group) (c) are given by:

$$IM_{ic} = \sum_{j=1}^{N} MI_{ij} \frac{M_{jc}}{M_j}.$$

Note that we must assume that the breakdown by country of origin of intermediate imports of type (j) is the same across all of the input purchasing sectors (i). Furthermore, with respect to international services outsourcing we can only make use of information related to a subsample of five EU countries due to a lack of the relevant services trade data for Denmark and Sweden.

In this manner, we separate each of the outsourcing measures for two different groups of countries, namely high- and low-wage countries. Low-wage countries include the new EU member states and the NICs (China, Hong Kong, South Korea, Malaysia, Singapore, Taiwan, and Thailand) and other East Asian countries (Indonesia, India, Philippines, Brunei, Myanmar, Vietnam, Laos, and Cambodia). High-wage countries include the EU15 countries and other industrialised OECD countries (e.g. the USA, Japan, Australia et cetera, but excluding Mexico, South Korea, and the four large new EU member states).

Table 1 summarises the level and development of imported inputs of the various types as a share of gross production for the individual countries considered in the analysis and for the average of all five EU countries in the sample. The international outsourcing of materials in 2000 was most intensive for Austria and the Netherlands with imported intermediates accounting for 14% and 11% of their gross production, respectively. The magnitude of international material outsourcing does not vary excessively across the rest of the countries in turn reaching levels of approximately 9% of their production.

From the mid-1990s to the year 2000, growth in intermediate imports was the most pronounced for Austria, Germany, and Finland. Taking the average of all five countries in the sample, we find the share of imported intermediates to have risen by an average rate of 3.8% p.a. or 1.5 percentage points for the sample period.

Note that outsourcing to high-wage countries (including intra-EU trade) is still dominant, reaching far higher levels than outsourcing to low-wage countries. Roughly 80% of the total EU5 imported materials are from other industrialised countries. However, imports of intermediates from low-wage countries have developed very dynamically in all of the reporting countries, growing at an average rate of 9% p.a. for the EU5; this rate was significantly larger than the outsourcing of materials to other countries. Thereby, material imports from the new EU members in Central and Eastern Europe are the highest, and developed the most dynamically, for Austria, followed by Germany and Finland.

In looking at the data on international outsourcing of services by the manufacturing sector in Table 1, several important points emerge. First, the extent of services offshoring is still very small reaching only 1.1% of gross output for the average EU5 country, and thus arrives at far lower levels than imports of material inputs. Growth in international outsourcing of services by the EU5 at an annual average of 4.8% compares with an average growth rate of 3.8% for materials. Among the countries in the sample international services outsourcing of the manufacturing sector is highest for Finland and the Netherlands, it is lowest for Germany. Outsourcing activities are again mostly oriented towards

Table 1
International outsourcing of the manufacturing sector in selected European countries 1995–2000

	Imported material inputs from			Imported services inputs from			Imported business services inputs from		
	World	High-wage countries	Low-wage countries	World	High-wage countries	Low-wage countries	World	High-wage countries	Low-wage countries
Shares in gross output as percent, 2000									
Austria	14.03	11.70	2.33	1.42	1.32	0.10	0.36	0.32	0.04
Finland	8.27	6.07	2.20	2.15	2.12	0.04	1.62	1.61	0.01
Germany	8.44	6.35	2.09	0.85	0.74	0.11	0.38	0.34	0.04
Italy	8.28	6.40	1.88	1.19	1.14	0.05	0.28	0.27	0.01
Netherlands	11.04	8.77	2.27	2.04	1.92	0.11	1.39	1.31	0.08
EU5[a]	8.85	6.79	2.06	1.13	1.05	0.09	0.49	0.46	0.03
Average annual percentage change 1995/2000									
Austria	6.12	5.07	12.58	10.19	11.34	−0.56	6.04	6.69	1.03
Finland	2.68	0.18	12.35	−3.42	−2.26	−28.27	0.39	1.80	−38.19
Germany	5.34	3.74	11.32	7.97	8.27	5.99	13.93	14.33	10.67
Italy	2.09	1.55	4.07	2.57	2.54	3.29	6.14	6.14	6.36
Netherlands	0.86	−0.28	6.10	4.24	4.15	5.72	13.74	13.67	14.86
EU5[a]	3.81	2.60	8.54	4.82	4.94	3.45	10.50	10.79	6.84
Difference in percentage points 1995/2000									
Austria	3.61	2.56	1.04	0.54	0.55	0.00	0.09	0.09	0.00
Finland	1.03	0.05	0.97	−0.41	−0.26	−0.15	0.03	0.14	−0.11
Germany	1.93	1.07	0.87	0.27	0.24	0.03	0.18	0.17	0.02
Italy	0.81	0.47	0.34	0.14	0.13	0.01	0.07	0.07	0.00
Netherlands	0.46	−0.12	0.58	0.38	0.35	0.03	0.66	0.62	0.04
EU5[a]	1.51	0.82	0.69	0.24	0.22	0.01	0.19	0.18	0.01

Source: Eurostat, input–output tables; OECD, STAN; UN, COMTRADE, own calculations.
[a] Weighted average across countries and industries.

other high-wage countries. Outsourcing to low-wage countries only accounts for a very small fraction of total services imports used in manufacturing, and for the period considered has also grown at a lower rate than services outsourcing to high-wage countries. The data for international business services outsourcing accentuate the picture drawn for total services imports by the manufacturing sector.

Table 2 presents international outsourcing intensities for the services sectors of the five EU countries. International outsourcing of services is most intensive for the Netherlands and Austria with total imported services used by the services sectors at home accounting for 3.9% and 3.4% of gross production, respectively. Growth in international services outsourcing by the services sector was the most pronounced for Austria and Germany. Averaged over the five EU countries, we find international sourcing of service inputs to have increased at an annual rate of 6.4% from 1995 to 2000. The levels of international outsourcing by the services sector and growth rates are higher compared to international outsourcing of services by the manufacturing sector, when we consider total services inputs. The difference is less pronounced with a look at business services outsourcing. Note again that outsourcing to high-wage countries dominates, and continues to expand at higher rates than sourcing activities in low-wage countries.

Summarising the evidence, we find that the outsourcing of services in the manufacturing and services sectors in the five EU countries considered in the analysis is still at very low levels and thus unlikely to account for a large part in explaining poor labour market performances. Our data confirms the tendency for a shift of material outsourcing towards low-wage countries, while this shift is not yet discernable in the data on services outsourcing.

4. Estimation results

We now present the estimation results for the services and manufacturing sector. In order to test the robustness of the basic regression results, we conduct a number of sensitivity and specification tests. First, we checked the results

Table 2
International outsourcing of the services sector in selected European countries 1995–2000

	Imported services inputs from any other services sector			Imported services inputs from the same services sector			Imported business services inputs		
	World	High-wage countries	Low-wage countries	World	High-wage countries	Low-wage countries	World	High-wage countries	Low-wage countries
Shares in gross output as percent, 2000									
Austria	3.36	3.01	0.35	1.73	1.56	0.17	0.88	0.79	0.09
Finland	2.07	1.99	0.08	0.42	0.40	0.02	0.94	0.93	0.01
Germany	2.61	2.36	0.25	1.40	1.26	0.14	0.51	0.46	0.05
Italy	2.21	2.08	0.13	0.54	0.52	0.02	0.50	0.48	0.01
Netherlands	3.92	3.69	0.23	1.55	1.45	0.10	1.69	1.59	0.10
EU5[a]	2.66	2.45	0.21	1.14	1.05	0.10	0.67	0.63	0.04
Average annual percentage change 1995/2000									
Austria	5.12	5.27	3.87	6.97	7.15	5.47	1.78	2.44	−3.36
Finland	4.23	5.03	−8.64	−0.16	−0.06	−1.66	11.81	13.36	−30.98
Germany	9.92	10.29	6.82	14.27	14.99	8.74	14.10	14.69	9.25
Italy	2.41	2.24	5.27	4.04	4.28	−1.12	0.27	0.29	−0.30
Netherlands	3.04	3.00	3.68	2.89	2.96	1.79	4.59	4.50	6.13
EU5[a]	6.37	6.46	5.36	9.59	9.95	6.10	7.20	7.36	5.12
Difference in percentage points 1995/2000									
Austria	0.74	0.68	0.06	0.50	0.46	0.04	0.07	0.09	−0.02
Finland	0.39	0.43	−0.05	0.00	0.00	0.00	0.40	0.43	−0.03
Germany	0.98	0.91	0.07	0.68	0.63	0.05	0.25	0.23	0.02
Italy	0.25	0.22	0.03	0.10	0.10	0.00	0.01	0.01	0.00
Netherlands	0.54	0.51	0.04	0.21	0.20	0.01	0.34	0.31	0.03
EU5[a]	0.71	0.66	0.05	0.42	0.40	0.02	0.20	0.19	0.01

Source: Eurostat, input–output tables; OECD, STAN; Newcronos, international trade in services, own calculations.
[a] Weighted average across countries and industries.

of an alternative specification in which the outsourcing variable is specified as the initial level instead of its change. Second, all regression coefficients were re-estimated using the robust regression method in order to reduce the impact of extreme outliers that may result from errors in the outsourcing variables. Third, we estimate the models separately for purchased business services and other services. Fourth, we also look at the impact of purchased services from the same industry as well as the impact of purchased services from domestic sources. Fifth, for the manufacturing sector we also distinguish between imported materials from CEEC on one hand and from China and East Asian countries on the other hand.

4.1. Impact of international outsourcing of materials and services on employment in the manufacturing sector

Table 3 shows the results for the labour demand model for the manufacturing sector using two alternative specifications. While the upper panel shows the results for the impact of the change in the various indicators for international outsourcing (measured as the average annual (absolute) change), the lower panel displays the results of the impact of international outsourcing measured at its 1995 level.[4] For each of the five EU countries, we have 18–22 industries that result in a total of 105 observations.

Our results show that internationally purchased services from low-wage and high-wage countries do not have a significant impact on employment in the manufacturing sector, not even at the 10% significance level. This also holds for purchased services from domestic suppliers. When purchased services are measured by the initial level we find that the ratio of purchased services from domestic sources is significantly related to the change in employment.

[4] We also estimated specifications that included indicators of outsourcing for the year 2000 instead of 1995 values. The results are quite similar to those given in the lower panel of Table 4. For brevity, we do not present the coefficients in following tables; these results are available upon request from the authors.

Table 3
OLS estimates of the labour demand equation for the manufacturing sector of the EU5 countries

	(i) coeff./*t*	(ii) coeff./*t*	(iii) coeff./*t*	(iv) coeff./*t*	(v) coeff./*t*	(vi) coeff./*t*	(vii) coeff./*t*	(viii) coeff./*t*	(ix) coeff./*t*
Impact of the change in imported materials and purchased services from abroad									
Δ ln real value added	0.19*** (2.79)	0.17*** (3.69)	0.18*** (2.77)	0.18*** (2.99)	0.17***** (3.02)	0.17*** (2.89)	0.17*** (2.87)	0.17*** (2.86)	0.16*** (2.79)
Δ ln real wages	−0.30*** (−5.38)	−0.30*** (−7.31)	−0.29*** (−5.01)	−0.34*** (−4.64)	−0.31*** (−5.99)	−0.30*** (−5.78)	−0.30*** (−5.74)	−0.30*** (−5.77)	−0.30*** (−5.86)
Δ imported materials from low-wage count., % prod.	−3.20* (−1.73)								
Δ imported materials from CEEC, % prod.		0.006 (0.24)							
Δ imported mat. from China and East Asian count., % prod.			−6.03 (−2.86)						
Δ imported materials from high-wage count., % prod.				0.71 (1.18)					
Δ purchased services from domestic suppliers, % prod.					0.52 (0.74)				
Δ purchased services from low-wage count., % prod.						2.51 (0.17)			
Δ purchased services from high-wage count., % prod.							−0.13 (−0.13)		
Δ purchased business services from low-wage count., % prod.								8.37 (0.45)	
Δ purchased business services from high-wage count., % prod.									1.75 (0.89)
Constant	−0.002 (−0.76)	−0.006* (−1.87)	−0.003 (−0.83)	−0.007* (−1.86)	−0.008* (−1.68)	−0.006 (−1.60)	−0.006* (−1.66)	−0.006 (−1.53)	−0.007 (−1.65)
Adj-R^2	0.56	0.56	0.57	0.54	0.55	0.54	0.54	0.54	0.54
Impact of the initial value of imported materials and purchased services from abroad									
Δ ln real value added	0.17*** (2.85)	0.15*** (2.62)	0.17*** (2.93)	0.15*** (2.71)	0.18*** (3.10)	0.17*** (2.89)	0.17*** (2.88)	0.17*** (2.86)	0.17*** (2.87)
Δ ln real wages	−0.27*** (−4.49)	−0.29*** (−5.19)	−0.27*** (−4.53)	−0.32*** (−5.99)	−0.29*** (−5.37)	−0.30*** (−5.65)	−0.31*** (−5.85)	−0.30*** (−5.64)	−0.30*** (−5.73)
Imported materials from low-wage countries, % prod.	−0.49*** (−2.72)								
Imported materials from CEEC, % prod.		−1.34** (−2.40)							
Imported materials from China and East Asian co., % prod.			−0.54*** (−2.63)						
Imported materials from high-wage count., % prod.				0.07 (1.55)					
Purchased services from domestic suppliers % prod.					−0.17** (−2.56)				
Purchased services from low-wage count., % prod.						−2.32 (−0.80)			
Purchased services from high-wage countries, % prod.							0.02 (0.07)		
Purchased business services from low-wage co., % prod.								−2.37 (−0.58)	
Purchased business services from high-wage co., % prod.									−0.10 (−0.29)
Constant	−0.001 (−0.16)	−0.001 (−0.12)	−0.002 (−0.61)	−0.011** (−2.28)	0.168 (1.53)	−0.004 (−0.74)	−0.006 (−1.21)	−0.005 (−1.19)	−0.005 (−1.32)
Adj-R^2	0.58	0.58	0.58	0.55	0.57	0.55	0.55	0.55	0.55

Notes. ***, ** and * denote significance at the 1%, 5%, and 10% levels. The dependent variable is the average annual growth rate of total employment from 1995 to 2000. Value added and real wages are measured as average annual growth rates. The sample contains 105 observations. *t*-Values in parentheses are based on heteroscedasticity consistent standard errors.

However, we find a significant and negative impact of imported materials from low-wage countries on employment. The coefficient of −3.20 is significant at the 10% significance level using OLS first differences with heteroscedasticity consistent standard errors. The coefficient for imported materials from low-wage countries becomes more negative and significant based on the robust regression technique that controls for the effects of outliers (coefficient of 6.12 and corresponding *p*-value of 0.01, see Table A2 in Appendix A). Overall the results with respect to imported materials are consistent with our earlier work covering seven EU countries (see Falk and Wolfmayr, 2005). Turning to the magnitude, we find that the elasticity of employment regarding the international outsourcing of materials to low-wage countries evaluated at sample means is very small at approximately −0.004.[5] Furthermore, we find that the negative effect is much more pronounced for intermediate materials from China and the East Asian countries than for those from Central and East European countries.

Based on OLS we find that the coefficient for intermediate materials from Central and East European countries is not significantly different from zero. The results based on the robust regression analysis, however, indicate that intermediate materials from China and the East Asian countries and those from Central and East European countries are both negative and significant. Turning to the effects of the initial level of international outsourcing we find a significant and negative impact of the initial level of imported materials from low-wage countries indicating that employment growth is lower the higher the share of imported materials from low-wage countries is.

Value added in constant prices has a positive and highly significant impact on employment. However, the output elasticities ranging from 0.15 to 0.19 are rather low. As expected, real wages have a significant negative impact on employment.

4.2. *Impact of international outsourcing of services on employment in the services sector*

Table 4 shows the regression results for the impact of international outsourcing of services in the services sector using various specifications. We pool the data again across the five EU countries and sectors resulting in a total of 100 observations. The upper panel contains standard OLS estimates on the impact of changes in the outsourcing variables on labour demand. The lower panel displays the OLS results for the impact of the initial level of international outsourcing of services rather than its change. To ensure that the results are robust with respect to outliers, we re-estimate the labour demand model using the robust regression method. A comparison of the mean and median indicate that the means of some variables are influenced by some extreme observations (see Table A1 in Appendix A). Therefore, we use the robust regression, which is an iterative, weighted least squares procedure that controls for outliers. Table A2 in Appendix A shows the results using the robust regression method.

The results in Table 4 show that EU imports of services from low-wage countries have a significant and negative impact on total employment (see specification iv). This suggests that domestic employment and purchased services from low-wage countries are substitutes. In contrast, purchased services from high-wage countries are insignificant (see specification v). This indicates the importance of disaggregating purchased services into imports from low-wage and high-wage countries. Evaluated at the average change in purchased services from low-wage countries of approximately 0.00009 per year, the implied employment elasticity with respect to purchased services from low-wage countries is −0.002. The coefficient on total purchased services is negative but only significant using the robust regression method. This is partly consistent with Amiti and Wei (2005) who find that international sourcing of intermediate service inputs decreases employment in the UK services sector.

Furthermore, we find a significant and negative impact of the initial level of imported services inputs from low-wage countries indicating that employment growth is lower the higher the share of imported services is from low-wage countries (see specification iv in the lower panel). Overall the empirical results suggest that an initial high share of purchased services from low-wage countries and an increase in the share of purchased services from low-wage countries lead to a lower employment growth rate.

Finally, unreported results for the impact of purchased services from abroad from the same industry indicate that the outsourcing of services to low-wage countries has a negative impact while outsourcing of services to high-wage

[5] The elasticity is calculated by multiplying the coefficient of −3.20 by the average annual (absolute) change of the share of imported materials from low wage countries, which is 0.001 per year.

Table 4
OLS estimates of the labour demand equation for the services sector of the EU5 countries: impact of total purchased services

	(ii) coeff./*t*	(iii) coeff./*t*	(iv) coeff./*t*	(v) coeff./*t*
Impact of the change in purchased services				
Δ ln real value added	0.46*** (6.64)	0.48*** (5.50)	0.48*** (5.97)	0.48*** (5.45)
Δ ln real wages	−0.33*** (−4.07)	−0.33*** (−4.03)	−0.30*** (−3.76)	−0.33*** (−4.07)
Δ purchased services domestic, % prod.	−0.08 (−0.99)			
Δ purchased services abroad, % prod.		−1.24 (−1.21)		
Δ purchased services from low-wage countries, % prod.			−20.42*** (−3.25)	
Δ purchased services from high-wage countries, % prod.				−1.18 (−1.03)
Constant	0.004 (1.19)	0.004 (1.36)	0.005 (1.55)	0.004 (1.32)
Adj-R^2	0.56	0.57	0.60	0.57
Impact of the initial level of purchased services				
Δ ln real value added	0.46*** (5.73)	0.49*** (6.00)	0.49*** (6.05)	0.49*** (5.99)
Δ ln real wages	−0.32*** (−3.91)	−0.31*** (−3.88)	−0.32*** (−3.95)	−0.31*** (−3.88)
Purchased services domestic, % prod.	0.04** (1.33)			
Purchased services abroad, % prod.		−0.11** (−2.51)		
Purchased services from low-wage countries, % prod.			−1.10 (−3.48)	
Purchased services from high -wage countries, % prod.				−0.12 (−2.38)
Constant	0.007 (2.21)	0.007 (2.21)	0.006 (2.07)	0.007 (2.19)
Adj-R^2	0.57	0.59	0.60	0.59

Notes. ***, ** and * denote significance at the 1%, 5%, and 10% levels. The dependent variable is the average annual growth rate of total employment from 1995 to 2000.The sample contains 100 observations. *t*-Values are based on heteroscedasticity consistent standard errors.

countries has a positive impact on employment. However, standard errors are much higher compared to a wide definition of the outsourcing of services.[6]

Regression results for the impact of business services (NACE 72, 73 and 74) are summarised in Table 5.

The coefficient on the change in purchased services from abroad is insignificant. This result may be explained by the fact that these sectors are the more skill intensive services sectors, in which the EU5 have a comparative advantage compared to low-wage countries. This also holds true for the change in purchased business services from low-wage countries. Turning to the specification when the internationally purchased business services are measured at their initial level share, we find positive and significant coefficients (see specifications i–iii).

In order to provide an indication of the magnitude of the results a decomposition of the employment change is performed. In particular, we decompose the predicted change in employment into the output and wage effect and the effect of purchased services from abroad. The results of the decomposition are presented in Table 6. Columns (i)–(iv) show the results when the change of purchased services is used, whereas columns (v)–(viii) include the results when the level of the share of internationally purchased services is used as the explanatory variable.

According to the results of the decomposition analysis, the observed change in the EU5 international outsourcing of services to low-wage countries from 1995 to 2000 accounts for an employment reduction of 0.2 percentage points per year. In contrast, the observed increase in the outsourcing of services to high-wage countries accounts for an increase in employment of approximately 0.1 percentage points. Therefore, the impact of purchased ser-

[6] The coefficient on purchased services from low-wage countries from the same industry is −28.35 and is significant at the 1% significance level using the robust regression method. OLS estimates with heteroscedasticity consistent standard errors yield a coefficient of −17.80 and a *t*-value of −1.28. The results are available upon request from the authors.

Table 5
OLS estimates of the labour demand equation for the services sector of the EU5 countries: impact of purchased business services

	(i) coeff./*t*	(ii) coeff./*t*	(iii) coeff./*t*	(iv) coeff./*t*	(v) coeff./*t*	(vi) coeff./*t*
Impact of the change in purchased services						
Δ ln real value added	0.47^{***} (5.14)	0.45^{***} (4.48)	0.46^{***} (5.08)	0.47^{***} (5.64)	0.46^{***} (5.78)	0.46^{***} (5.78)
Δ ln real wages	-0.34^{***} (−4.19)	-0.30^{***} (−3.23)	-0.34^{***} (−4.19)	-0.33^{***} (−4.09)	-0.31^{***} (−4.20)	-0.31^{***} (−4.20)
Δ purchased business services from abroad, % prod.	−0.38 (−0.18)					
Δ purchased business services from low-wage countries, % prod.		−22.0 (−0.93)				
Δ purchased business services from high-wage countries, % prod.			−0.28 (−0.12)			
Δ purchased other services from abroad, % prod.				−1.04 (−1.09)		
Δ purchased other services from low-wage countries, % prod.					-18.35^{***} (−2.87)	
Δ purchased other services from high-wage countries, % prod.						−1.00 (−0.93)
Constant	0.003 (1.03)	0.003 (0.92)	0.003 (1.04)	0.004 (1.32)	0.005 (1.62)	0.004 (1.28)
Adj-R^2	0.57	0.57	0.57	0.58	0.60	0.58
Impact of the initial level of purchased services						
Δ ln real value added	0.45^{***} (5.84)	0.46^{***} (5.77)	0.45^{***} (5.84)	0.50^{***} (6.40)	0.50^{***} (6.32)	0.50^{***} (6.40)
Δ ln real wages	-0.33^{***} (−4.53)	-0.31^{***} (−4.22)	-0.33^{***} (−4.55)	-0.33^{***} (−3.86)	-0.31^{***} (−3.95)	-0.31^{***} (−3.85)
Purchased business services from abroad, % prod.	0.57^{**} (2.79)					
Purchased business services from low-wage countries, % prod.		6.86^{***} (4.27)				
Purchased business services from high-wage countries, % prod.			0.61^{**} (2.68)			
Purchased other services from abroad, % prod.				-0.17^{***} (−4.98)		
Purchased other services from low-wage countries, % prod.					-1.44^{***} (−5.84)	
Purchased other services from high-wage countries, % prod.						-0.19^{***} (−4.75)
Constant	−0.002 (−0.48)	−0.001 (−0.34)	−0.001 (−0.47)	0.007^{**} (2.39)	0.006^{**} (2.04)	0.007^{**} (2.41)
Adj-R^2	0.57	0.57	0.57	0.58	0.60	0.58

Notes. ***, ** and * denote significance at the 1%, 5%, and 10% levels. The dependent variable is the average annual growth rate of total employment from 1995 to 2000.The sample contains 100 observations. *t*-Values are based on heteroscedasticity consistent standard errors.

Table 6
Contribution of the sources of labour demand in the services sector in percentage points

	Impact of the change of share of purchased services from abroad				Impact of the initial level of the share of purchased services from abroad			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Actual Δ ln employment	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Δ ln real value added	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3
Δ ln real wages	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Δ purchased services from abroad, % prod.	−0.2							
Δ purchased services from low-wage countries, % prod.		−0.2		−0.2				
Δ purchased services from high-wage countries, % prod			−0.1	0.1				
Purchased services from abroad, % prod.					−0.4			
Purchased services from low-wage countries, % prod						−0.4		−0.6
Purchased services from high-wage countries, % prod.							−0.4	0.3
Constant	0.4	0.5	0.4	0.5	0.7	0.6	0.7	0.5

Notes. These calculations are based on the (unweighted) average annual change in the explanatory variables multiplied by the regression coefficients.

vices is generally very small. The most important determinant of the increase in employment is the output effect explaining 75% of the increase in employment. The effect of the fall in wage costs, however, is quite small. In the services sector the decrease in wage costs accounts for an increase in employment of about 0.4 percentage points.

5. Conclusions

This paper presents further insights into the employment effects of the international outsourcing of services and materials. We estimate a labour demand equation for a sample of manufacturing and service two-digit industries for EU countries from 1995 to 2000. A key feature of our analysis is the use of disaggregated bilateral trade data enabling in turn a separation between purchased services from high- and low-wage countries.

For the services sector, our results for five EU countries show, that while the total of purchased services is not important, purchased services from low-wage countries have a statistically significant and negative impact on employment. In other words, domestic employment and purchased services from low-wage countries are substitutes, whereas purchased services from high-wage countries have no effect on employment. In terms of the magnitude of its impact, the results suggest that outsourcing to low-wage countries has decreased employment by 0.2 percentage points per year from 1995 to 2000, while the change in outsourcing to high-wage countries has increased employment by 0.1 percentage points. The results are robust not only to the model specification but also the econometric methodology. In particular, we find that the impact of purchased services from low-wage countries remains negative and significant when the initial level of purchased services is used rather than its change. This indicates that the higher the initial level of total purchased services from low-wage countries the lower the growth of employment.

However, we do not find any negative effect of the change of purchased business services to low-wage countries on the demand for labour suggesting that other types of purchased services are responsible for the negative employment effects. Indeed the results suggest that employment growth is higher the higher the share of purchased business services is from abroad.

For the manufacturing sector, the indicators of purchased services from abroad were not statistically significant in any of our regressions. However, the outsourcing of intermediate materials (narrowly defined) appears to have a negative impact on the demand for labour. This is consistent with previously conducted work.

What do our findings imply for economic policy? Consistent with the popular view, we find that outsourcing of services to low-wage countries takes away some jobs. However, the effects of the outsourcing of services on employment

are nearly negligible. In manufacturing, while purchased services from low-wage countries is not significant, the outsourcing of intermediate materials to low-wage countries appears to have a relatively small negative impact on the demand for labour. Concerning the magnitude of the effects, we find that the outsourcing of intermediate materials has a stronger impact on the demand for labour than outsourcing of services. However, the output growth remains the major determinant in explaining employment performance. Therefore, national policies should give highest priority to encourage economic growth.

Finally, the present paper points to some potentially interesting questions for future research. One interesting research question is the impact of internationally purchased services on the skill structure of labour demand. It is expected that the negative impact of purchased services from low-wage countries is higher for unskilled workers than it is for skilled workers. Second, the inclusion of other major determinants of labour demand such as technological innovations merit further investigation. Furthermore, future work should address the impact of purchased services based on annual industry surveys instead of input–output tables. For some EU countries annual industry surveys are available that contain information on external contract work and purchased services based on the four-digit NACE level (see Fritsch et al., 2004 for Germany). This data can be linked with information for intermediate vs. final imports based on the annual industry statistics. Some statistical offices in the EU countries also allow in site access to these firm level data. There are several advantages of using large panel data sets at the detailed industry or firm level. Firstly, one could throw light on the impact of purchased and/or materials for broad industry groups as well as for different countries. Secondly, the use of large panel data sets would allow to apply dynamic panel data models that can control for potential endogeneity and allow for time persistence in employment.

Appendix A

See Appendices Tables A1–A3.

Table A1
Sample means, services sector

	Mean	Median	S.D.	Min	Max
Δ ln employment in %	0.02887	0.02334	0.0455	−0.0501	0.2210
Δ ln real value added in %	0.04635	0.03457	0.0537	−0.0920	0.3070
Δ ln real wages in %	−0.01217	−0.00284	0.0508	−0.2743	0.1124
Δ purchased services from domestic suppliers, % prod.	0.00457	0.00094	0.2269	−0.0167	0.2046
Δ purchased services from low-wage countries, % prod.	0.00009	0.00001	0.0004	−0.0009	0.0021
Δ purchased services from high-wage countries, % prod.	0.00120	0.00059	0.0038	−0.0127	0.0183
Δ total purchased services from abroad, % prod.	0.00129	0.00060	0.0041	−0.0125	0.0204
Δ purchased services from domestic suppliers, % prod., 1995	0.25561	0.24470	0.1057	0.0000	0.6230
Δ purchased services from domestic suppliers, % prod., 2000	0.27729	0.25718	0.1316	0.0000	0.6640
Total purchased services from abroad % prod., 1995	0.03848	0.01598	0.0652	0.0004	0.4199
Total purchased services from abroad % prod., 2000	0.04488	0.02036	0.0717	0.0006	0.4838
Purchased services from low-wage countries, % prod., 1995	0.00340	0.00115	0.0076	0.0000	0.0566
Purchased services from low-wage countries, % prod., 2000	0.00384	0.00104	0.0089	0.0001	0.0667
Purchased services from high-wage countries, % prod., 1995	0.03508	0.01454	0.0581	0.0003	0.3633
Purchased services from high-wage countries, % prod., 2000	0.04104	0.01891	0.0632	0.0005	0.4171
Δ purchased business services from low-wage countries, % prod.	−0.00001	0.00000	0.0001	−0.0009	0.0003
Δ purchased business services from high-wage countries, % prod.	0.00047	0.00025	0.0016	−0.0089	0.0070
Δ purchased business services from abroad, % prod.	0.00045	0.00026	0.0017	−0.0095	0.0073
Purchased business services from low-wage countries, % prod., 1995	0.00072	0.00028	0.0016	0.0000	0.0109
Purchased business services from low-wage countries, % prod., 2000	0.00066	0.00017	0.0014	0.0000	0.0075
Purchased business services from high-wage countries, % prod., 1995	0.00863	0.00326	0.0163	0.0000	0.1167
Purchased business services from high-wage countries, % prod., 2000	0.01096	0.00582	0.0165	0.0000	0.1124
Purchased business services from abroad, % prod., 1995	0.00936	0.00352	0.0177	0.0000	0.1240
Purchased business services from abroad, % prod., 2000	0.01162	0.00610	0.0177	0.0000	0.1199

Source: Eurostat, input–output tables; OECD, STAN, own calculations. *Notes*. Unweighted means, the number of observations is 100.

Table A2
Estimates of the labour demand equation for the manufacturing sector of the EU5 countries: robust regression method

	(i) coeff./*t*	(ii) coeff./*t*	(iii) coeff./*t*	(iv) coeff./*t*
Δ in real value added	0.39*** (7.39)	0.33*** (6.03)	0.35*** (6.66)	0.35*** (6.66)
Δ in real wages	−0.18*** (−6.29)	−0.26*** (−5.05)	−0.17*** (−4.03)	−0.17*** (−4.03)
Δ imported materials from low-wage countries, % prod.	−6.29*** (−4.49)			
Δ imported materials from high-wage countries, % prod.		0.77 (1.65)		
Δ imported materials from CEEC, % prod.			−0.049*** (−2.11)	
Δ imported materials from China and East Asian countries, % prod.				−8.18*** (−4.25)
Constant	−0.006 (−1.91)	−0.009** (−3.14)	−0.007** (−2.38)	−0.006** (−2.21)

Notes. ***, ** and * denote significance at the 1%, 5%, and 10% levels. The dependent variable is the average annual growth rate of total employment from 1995 to 2000. All of the variables are measured as average annual change in percent and as average absolute annual change in percentage points in case of the outsourcing variables. The sample contains 105 observations measured as long differences from 1995 to 2000. *t*-Values are based on heteroscedasticity consistent standard errors.

Table A3
Estimates of the labour demand equation for the services sector of the EU5 countries: impact of purchased services

	(i)	(ii)	(iii)	(iv)	(v)
Δ ln real value added	0.51*** (11.58)	0.56*** (13.20)	0.52*** (12.63)	0.56*** (13.17)	0.54*** (12.69)
Δ ln real wages	−0.25*** (−5.22)	−0.22*** (−5.14)	−0.21*** (−4.83)	−0.23*** (−5.20)	−0.22*** (−4.80)
Δ purchased services domestic, % prod.	−0.05 (−0.50)				
Δ purchased services abroad, % prod.		−1.71*** (−3.24)			
Δ purchased services from low-wage countries, % prod.			−21.18*** (−4.28)		−17.63*** (−2.63)
Δ purchased services from high-wage countries, % prod.				−1.77*** (−3.10)	−0.58 (−0.76)
Constant	0.004 (1.44)	0.005 (1.68)	0.005* (1.95)	0.004*** (1.64)	0.005* (1.91)

See Table A2. The number of observations is 100.

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