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International Outsourcing and Productivity Growth

Martin Falk, Yvonne Wolfmayr

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Please refer to: Martin.Falk@wifo.ac.at, yvonne.wolfmayr@wifo.ac.at

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Martin Falk
Address: Arsenal Objekt 20, A-1030 Vienna
Phone: + 43-1-798 26 01 – 226
Fax: + 43-1-798 93 86
E-mail: Martin.Falk@wifo.ac.at

Yvonne Wolfmayr
Address: Arsenal Objekt 20, A-1030 Vienna
Phone: + 43-1-798 26 01 – 253
Fax: + 43-1-798 93 86
E-mail: Yvonne.Wolfmayr@wifo.ac.at

Das Wichtigste in Kürze

Diese Studie hat eine tief greifende empirische Analyse der Auswirkungen der zunehmenden Auslagerungsaktivitäten von Geschäftsprozessen auf die Entwicklung der gesamten Faktorproduktivität zum Inhalt. Die Datenbasis besteht aus 14 OECD-Ländern und 12 Industrien in der Sachgütererzeugung für den Zeitraum 1995 - 2000. Eine Besonderheit der Analyse ist die Untersuchung, ob sich die Produktivitätseffekte der Auslagerungsaktivitäten hinsichtlich der Zielregionen (z. B. Mittel– und Osteuropa, EU15 und neue dynamische Industrieländer in Asien) unterscheiden. Zudem wird zwischen der Auslagerung von Dienstleistungsaktivitäten und Sachgüterproduktionsauslagerung differenziert.

Die Ergebnisse auf Basis von Input–Output Tabellen, welche mit der Außenhandelsstatistik verknüpft sind, zeigen, dass die österreichische Industrie beim Outsourcing von Geschäftsprozessen vor allem auf inländische Partner setzt. Im Jahr 2000 entfallen 85% der gesamten importierten Vorleistungen aus der gleichen Industrie auf Unternehmen in Industrieländern mit einem ähnlichen BIP pro Kopf. Bei den zugekauften Dienstleistungen aus dem Ausland beträgt dieser Anteil sogar 90%. In Österreich ist die Auslagerungsintensität der Produktion am höchsten im Fahrzeugbau; dort hat sie auch zwischen 1995 und 2000 am stärksten zugenommen.

Die empirische Analyse kommt zu dem Ergebnis, dass die Entwicklung der Auslagerung von Dienstleistungen an ausländische Unternehmen einen positiven Effekt auf die Entwicklung der Faktorproduktivität hat. Der Produktivitätsbeitrag der zunehmenden Auslagerung von Dienstleistungen in das Ausland beträgt im Durchschnitt der OECD–Länder 20%. Sicherlich stellt dieser Wert eine Obergrenze dar, da der Produktivitätszuwachs auch von vielen anderen Faktoren (z. B. F&E–Aktivitäten, Innovationsaktivitäten) bestimmt wird, die in dieser Studie nicht betrachtet wurden.

Die Auslagerung von Produktionsaktivitäten in Niedriglohnländer innerhalb des gleichen Industriezweigs hat tendenziell einen positiven Effekt auf die Entwicklung der Faktorproduktivitäten in den betrachteten OECD–Ländern, welcher allerdings nicht signifikant ist. Auch für Österreich zeigt sich ein positiver Zusammenhang zwischen der Zunahme der Faktorproduktivität und der Entwicklung der Auslagerungsintensität. Dies gilt auch für den Zusammenhang zwischen dem Ausgangsniveau der Auslagerungsintensität und der Zunahme der gesamten Faktorproduktivität. Allerdings ist dieser Zusammenhang im Allgemeinen nicht signifikant. Betrachtet man importierte Vorleistungen aus allen Sektoren der Sachgütererzeugung so ist der Zusammenhang signifikant negativ.

Abstract

This study investigates the impact of international outsourcing to low– and high income countries on total factor productivity growth based on manufacturing industry data for 14 OECD-countries from 1995 – 2000. We find that the broad measure of international outsourcing of material inputs to low-income countries is significantly negatively related to productivity growth. Furthermore, while the narrow measure of international outsourcing of materials is not significant, purchased services from abroad have a significant and positive effect on TFP growth. In particular, international services outsourcing accounted for 20 percent of the growth of total factor productivity in the manufacturing sector in the selected OECD-countries.

Keywords: international outsourcing, total factor productivity growth

JEL Classification: F14, F23, L23.

1. Introduction[1])

In the last 20 years there has been rise in the fragmentation of the production processes in OECD-countries. This is manifested in the increase of international outsourcing of materials and services inputs, in particular to low– and medium income countries (see Ahn et al., 2008, Feenstra and Hanson, 1999; Falk and Wolfmayr, 2008). However, there is little empirical evidence on the productivity effects of international outsourcing to date (for a survey see Olsen, 2006). Using US industry data for the period 1992 - 2000, Amiti and Wei (2006) find a significant positive effect of services outsourcing and a somewhat smaller positive effect of manufacturing outsourcing on labor productivity. In particular, the authors find that international service outsourcing accounted for 11 percent to 13 percent of the total growth in labor productivity in the US manufacturing sector and that material offshoring accounted for 3 percent to 6 percent. Ten Raa and Wolff (2001) emphasize the role of domestic outsourcing of services. Using US industry data, the authors find that the increase of purchased services explains 20 percent of productivity growth. Using industry data for Austria, Egger et al. (2001) find that outsourcing to Central and Eastern European countries is significantly positively related to growth of total factor productivity. The positive TFP effect of outsourcing is less pronounced in low–skill, labor–intensive industries and more pronounced in capital–intensive ones. Furthermore, there are some studies investigating the productivity effect of outsourcing at the firm level (see among others Girma and Görg, 2004; Görg et al., 2008). For instance, Görg et al. (2008) find that outsourcing of services inputs is positively related to productivity growth based on firm–level data for the Irish manufacturing sector.

This paper re–investigates the productivity effects of international outsourcing distinguishing between outsourcing of service and material inputs at the industry level. Based on Input-Output tables, we construct several different measures of international outsourcing. We distinguish between a narrow measure of outsourcing that includes only imported intermediate inputs from the same industry class, a broad measure of outsourcing comprising all imported materials and an indicator of international outsourcing of service inputs. Furthermore, we combine the trade statistics for goods and services imports with 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 industrialized countries (NICS)) and high–wage countries (i.e. former EU15 member states and the remaining OECD-countries). The total factor productivity equation 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

[1]) We would like to thank Mariya Hake for proof-reading.

robust regression method that provides robust estimates particularly in the presence of outliers.

The structure of this paper is the following. Section 2 introduces the empirical model and the hypotheses. Section 3 presents the data used, while the empirical results are discussed in section 4. Some concluding remarks are provided in section 5.

2. Empirical model

In order to investigate the productivity gains from international outsourcing we use industry data for several countries. The relationship between the level of total factor productivity and international outsourcing can be described as:

$$\ln TFP_{ijt} = \beta_0 + \beta_1 Z^k_{ijt} + \beta_3 T + \mu_j + \varepsilon_{ijt},$$

where t denotes time, j denotes industry and i denotes country. TFP is the quality adjusted level of total factor productivity based on the EUKLEMS database, Z^k_{ijt} are various k indicators of international outsourcing measured as imported materials in relation to the industry's output. μ_j is a sector effect, T is the time trend, and ε_{ijt} is the error term. Taking "long differences" across the whole of our time period and adding industry and country dummy variables gives the following TFP equation:

$$\Delta \ln TFP_{ijt} = \alpha_0 + \alpha_1 \Delta Z^k_{ijt} + \sum_{j=1}^{J} \alpha_j DSEC_j + \sum_{l=1}^{L} \alpha_l DCO_{il} + v_{ijt},$$

where the new error term, $v_{ijt} = \varepsilon_{ijt} - \varepsilon_{ijt-1}$, has a zero mean and constant variance. Δ refers to the change of the variables from 1995 to 2000. Time differencing of the time trend generates the constant α_0. However, a positive association between TFP growth and the change in international outsourcing may reflect reverse causality, that is, increased outsourcing activities is rather the result of productivity growth and not the source of it. It may be the case that industries with a high productivity growth rate are increasing their outsourcing activities more than average. In order to control for the reversed causality problem we estimate the relationship between the initial level of international outsourcing and total factor productivity growth:

$$\Delta \ln TFP_{ijt} = \alpha_0 + \alpha_1 Z^k_{1995,ij} + \sum_{j=1}^{J} \alpha_j DSEC_j + \sum_{l=1}^{L} \alpha_l DCO_{il} + v_{ijt},$$

where $Z^k_{1995,ij}$ is the initial level share of various indicators of international outsourcing. We use the so–called broad and narrow measure of international outsourcing, Z^B_{ij} and Z^N_{ij}, omitting indices i for country and t for time:

$$Z^N_j = \frac{MI_{jj\cdot}}{Y_j}$$

$$Z_j^B = \frac{\sum_{N=1}^{N} MI_{jn}}{Y_j}.$$

MI_{jj} denotes imported manufactured intermediates from the same industry (narrow measure), whereas M_{jn} is industry j's use of imported materials from industries n (broad measure). Yj is output in industry j. Furthermore, we disaggregate both variables by country of origin. In particular, we distinguish between high–wage on the one hand and low–wage and medium–wage countries on the other hand. We multiply each type of imported inputs (MI_{jj} or MI_{jn}), which are obtained from the Input-Output tables, by the respective country's (regional) import shares for total imports (M_{nc}/M_n), which are in turn obtained from trade statistics. That is, imported inputs of type (n), purchased by industry (j) from country (country group) (c) are given by omitting indices i for country and t for time:

$$Z_{jc}^N = \frac{MI_{jj}\frac{M_{nc}}{M_n}.}{Y_j}$$

$$Z_{jc}^B = \frac{\sum_{N=1}^{N} MI_{jn}\frac{M_{nc}}{M_n}.}{Y_j}$$

Note that we must assume that the breakdown by country of origin of intermediate imports of type (n) is the same across all of the input purchasing sectors (j). Low– and medium wage countries include the new EU member states and the NIC (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 industrialized OECD-countries (e.g. the USA, Japan, Australia et cetera, but excluding Mexico, South Korea, and the four large new EU member states). Finally, we also employ the share of purchased services from abroad. However, it is not possible to disaggregate service imports by country of origin because of data availability. We expect a positive effect of international outsourcing on TFP since outsourcing allows firms to relocate their inefficient production activities to more efficient firms abroad. Amiti and Wei (2006) suggest that the TFP from offshoring service inputs is higher than that from offshoring material inputs because service offshoring is often associated with restructuring and organizational change.

3. Data and descriptive statistics

Information about the use of imported materials is from the OECD Input-Output tables for the year 1995 and 2000. TFP is drawn from the EUKLEMS database (see Inklaar et al., 2008). Overall we obtain data for 14 countries (i.e. Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, USA and United Kingdom). Table 1 shows the summary statistics of the total sample over all industries and countries. The narrow outsourcing share is about 9.3 percent in 2000 on average across industries and countries. The corresponding share of broad international outsourcing is 18.6 percent. Table 1 also shows both the narrow and broad measure for two different regions, namely low and high–wage regions. The share of narrow outsourcing to high–wage countries is about 7.4 percent in 2000. This indicates that roughly 80 percent of the total imported materials of the 14 OECD- countries are still from other industrialized countries. Therefore, it seems unlikely that the increase in international outsourcing to low–wage countries explains much of the productivity increase in manufacturing. It can be observed that international outsourcing increased between 1995 and 2000. This holds for both the narrow and broad measure of international outsourcing of manufacturing goods as well as for the share of purchased services. Furthermore, the increase of the share of international outsourcing to low– and medium countries is more pronounced than that of the high–wage countries. Note that the outsourcing measure may underestimate the magnitude of the increase in international outsourcing because imported materials are measured in current prices. It is well known that the increase in the prices of imported materials has been less than the increase of the gross output deflator.

Table 2 displays the means across countries for each manufacturing industry. The international outsourcing of materials to low– and medium wage countries is most intensive in textiles, wearing apparel and leather and electrical and optical equipment with shares of 4.3 percent and 2.9 percent. Furthermore, the evolution of the share of international outsourcing of materials to low– and medium wage is uneven across industries. From 1995 to 2000, growth in intermediate imports was the most pronounced in transport equipment, electrical and optical equipment and in textiles, wearing apparel and leather. This is consistent with the finding of Ahn et al. (2008) for Japan and Korea. Furthermore, the share of imported service inputs is still low with a share of 2.1 percent in 2000.

Table 1: Descriptive statistics (total sample)

	Means		St.dev		Min		Max	
	1995	2000	1995	2000	1995	2000	1995	2000
Total factor productivity (2000=100)	100.0	111.3	0.0	23.5	100.0	75.6	100.0	248.1
Broad international outsourcing, % of output	17.7	18.6	9.9	10.1	1.8	1.6	51.1	52.2
Broad intern. outsourcing to low–wage c., % of output	1.6	2.2	1.7	1.8	0.1	0.2	13.1	11.3
Broad intern. outsourcing to high–wage c., % of output	15.0	15.1	8.8	8.9	1.0	0.9	45.6	47.8
Narrow international outsourcing, % of output	8.6	9.3	7.1	7.3	0.1	0.2	40.4	37.3
Narrow intern. outsourcing to low–wage c., % of output	0.9	1.2	1.3	1.5	0.0	0.0	9.4	7.9
Narrow intern. outsourcing to high–wage c., % of output	7.2	7.4	6.2	6.3	0.1	0.1	36.6	35.1
Purchased services from abroad, % of output	1.7	2.1	2.5	4.9	0.1	0.1	21.9	49.8

Notes: Narrow outsourcing measure: imported intermediate materials within the industry divided by the gross output of the industry. Unweighted figures across industries and countries. The number of observations is 167.

Table 2: Means of the variables by industry

	1516	***1719***	***20***	***2122***	***24***	***25***	***26***	***2728***	***29***	***3033***	***3435***	***3637***
TFP 1995 (1995=100)	100	100	100	100	100	100	100	100	100	100	100	100
TFP 2000 (1995=100)	99.1	109.6	112.4	107.1	112.8	109.9	107.0	106.6	104.9	146.7	112.8	106.6
Broad measure of international outsourcing in % of gross output												
Total share in 1995	7.0	23.5	12.6	13.1	19.4	22.7	9.3	18.2	20.3	24.0	27.0	15.7
Total share in 2000	8.1	23.0	13.9	12.6	21.3	23.6	9.4	19.1	21.6	26.2	29.3	15.8
Share of low–wage c. 1995	0.4	4.1	1.5	0.5	1.0	1.3	0.9	1.2	1.7	3.5	1.6	2.0
Share of low–wage c. 2000	0.5	5.0	2.1	0.7	1.2	1.7	0.9	1.6	2.2	4.7	2.8	2.7
Share of high–wage c. 1995	6.0	17.2	9.6	12.0	17.3	20.4	8.0	15.5	17.8	19.6	24.5	12.3
Share of high–wage c. 2000	6.8	15.4	10.0	11.3	18.7	20.9	7.9	15.6	18.4	20.3	25.5	11.6
Narrow measure of international outsourcing in % of gross output												
Total share in 1995	4.5	16.1	8.7	9.6	15.1	3.2	2.8	7.1	7.6	12.2	14.1	2.4
Total share in 2000	4.9	15.0	9.6	8.9	16.6	3.8	3.4	7.7	8.8	13.7	16.5	3.2
Share of low–wage c. 1995	0.2	3.7	1.2	0.2	0.6	0.3	0.2	0.4	0.3	2.2	0.4	0.7
Share of low–wage c. 2000	0.2	4.3	1.7	0.4	0.8	0.4	0.4	0.7	0.7	2.9	1.1	1.0
Share of high–wage c. 1995	3.8	10.5	6.2	9.1	13.8	2.9	2.5	6.0	7.2	9.7	13.3	1.5
Share of high–wage c. 2000	4.1	8.4	6.3	8.2	15.1	3.3	2.9	6.2	7.9	10.3	15.1	1.9
Purchased services from abroad in % of gross output												
Purch. serv. abroad, 1995	2.0	1.3	1.0	2.7	2.7	1.6	1.5	1.3	1.5	1.8	1.2	1.6
Purch. serv. abroad, 2000	1.4	1.5	1.0	4.8	4.7	1.5	1.3	1.3	1.6	2.8	1.5	1.6

Note: 1516=food, beverages and tobacco; 1719=textiles, wearing apparel, leather; 20=wood and products; 2122=Pulp, paper, publishing, printing; 24=chemicals; 25=rubber, plastic; 26=non-metallic mineral products; 2728=basic and fabricated metals; 29=machinery and equipment; 3033=office machinery, computers, electrical machinery, telecommunication equipment, medical, precision and optical instruments; 3435=motor vehicles, other transport equipment; 3637=furniture, manufactures nec, recycling.

Finally, Table 3 shows the magnitude of international outsourcing by country. International outsourcing of materials defined narrowly in 2000 is most intensive for Belgium, Austria and the

Netherlands with imported intermediates accounting for 20 percent, 13 percent and 12 percent 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 8 percent of their gross output. The only exception is the United States where the narrow outsourcing share is about 3 percent on average across industries. Looking at the evolution over time we find an increase in the narrow measure of international outsourcing except for Ireland, Sweden and the United States where we observe a reduction between 1995 and 2000. Outsourcing to low– and medium wage countries increased rapidly in almost all countries, while outsourcing to high–wage countries is decreasing in six out of 14 countries. Table 3 also shows a wide variation of productivity growth in the manufacturing sector across countries.

Table 3: Means of the variables by country

	AT	***BE***	***DK***	***FI***	***FR***	***DE***	***IE***	***IT***	***NL***	***PL***	***ES***	***SE***	***US***	***UK***
TFP 1995 (1995=100)	100	100	100	100	100	100	100	100	100	100	100	100	100	100
TFP 2000 (1995=100)	128	110	96	116	119	111	114	102	113	114	96	120	123	97
Broad measure of international outsourcing in % of gross output														
Total share in 1995	21.3	26.2	22.3	16.6	11.3	11.9	28.8	13.1	25.6	17.9	14.6	17.6	5.5	14.9
Total share in 2000	24.6	29.9	22.6	17.3	10.7	14.9	25.1	14.3	25.6	19.8	18.2	17.2	6.6	13.6
Outsourcing to low–wage c. 1995	2.2	1.3	1.8	1.6	0.8	1.9	3.7	1.3	2.3	0.8	1.0	1.4	1.2	1.6
Outsourcing to low–wage c. 2000	3.5	2.7	2.5	2.3	1.1	2.9	2.5	1.7	3.1	0.9	1.6	1.9	1.7	1.9
Outsourcing to high–wage c. 1995	18.7	23.5	19.5	13.6	9.6	9.2	24.0	10.6	21.1	16.3	12.7	15.8	3.3	11.8
Outsourcing to high–wage c. 2000	20.5	25.2	19.1	13.4	8.6	10.8	21.5	11.2	19.6	18.1	15.1	14.9	3.6	10.5
Narrow measure of international outsourcing in % of gross output														
Total share in 1995	10.8	16.0	8.5	8.0	5.6	6.2	12.8	7.6	11.8	8.4	7.3	7.6	2.6	7.0
Total share in 2000	13.2	19.6	9.2	8.0	5.5	7.7	11.2	8.3	11.9	9.8	9.7	7.2	3.0	6.1
Outsourcing to low–wage c. 1995	1.1	0.9	0.9	1.0	0.4	1.1	1.4	0.8	1.2	0.5	0.5	0.8	0.6	0.8
Outsourcing to low–wage c. 2000	2.0	1.9	1.4	1.4	0.6	1.8	1.4	1.1	1.5	0.5	1.0	0.9	0.7	0.9
Outsourcing to high–wage c. 1995	9.4	14.3	7.2	6.5	4.6	4.6	10.6	6.1	9.6	7.5	6.3	6.7	1.6	5.4
Outsourcing to high–wage c. 2000	10.9	16.2	7.3	6.1	4.3	5.3	9.2	6.5	9.1	8.8	8.0	6.0	1.7	4.7
Purchased services from abroad in % of gross output														
Purchased services abroad, 1995	1.0	2.3	1.4	2.7	0.6	0.6	7.8	1.1	1.6	0.9	1.0	1.8	0.1	0.7
Purchased services abroad, 2000	1.0	2.7	1.5	1.8	0.5	0.9	11.6	1.2	1.9	0.9	1.6	2.6	0.1	0.8

In order to provide some first evidence for the relationship between international outsourcing and the change in TFP, we present simple scatter plots for 12 out of 14 countries and 6 out of 13 industries (see Figure 1 and Figure 2 in appendix). International outsourcing is measured as the output share of imported materials from the same industry from low–wage countries in 1995 (narrow measure). We find that both variables are positively correlated but generally not significant at the 10 percent level. This also holds for other indicators of international outsourcing.

4. Empirical results

Table 4 shows the OLS estimation results with total factor productivity growth as the dependent variable. In order to test the robustness of the basic regression results, we conduct a number of sensitivity and specification tests. First, 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. Second, we checked the results of alternative specifications in which the outsourcing variable is specified as the initial level instead of its change. Third, we use both the narrow and broad measure of international outsourcing as well as a measure of outsourcing of service inputs. For each of the 14 OECD-countries, we use data on 12 industries that results in a total of 168 observations[2]).

OLS estimates show that the change in the broad measure of international outsourcing of material inputs to low–wage countries has a significant and negative impact on productivity growth. The coefficient for the broad measure of imported materials from low–wage countries becomes more significant based on the robust regression technique that controls for the effects of outliers. Therefore we conclude that the increase in international outsourcing to low wage countries is associated with a lower growth rate of technological change. The magnitude of the effects indicate that international outsourcing of material inputs has decreased TFP by 1 percentage point over 1995 - 2000, on average. However, the correlation might reflect the opposite direction of causality that is, industries with a low or declining rate of productivity growth are more likely to expand their outsourcing activities.

Table 4: Impact of international outsourcing on the change in TFP

	OLS			Robust regression		
	Coeff.		t	Coeff.		t
Δ intern. outsourcing of materials, broad, % of output	-1.50	*	-1.77	-1.42	***	-4.25
Δ intern. outsourcing of mat. to low-wage c., broad, % of output	-1.95	*	-1.95	-1.85	***	-4.98
Δ intern. outsourcing of mat. to high-wage c., broad, % of output	3.35		1.30	-1.02		-0.70
Δ intern. outsourcing of materials, narrow, % of output	-0.20		-0.37	0.16		0.41
Δ intern. outsourcing of mat. to low-wage c., narrow, % of output	6.71	*	1.77	-0.59		-0.32
Δ intern. outsourcing of mat. to high-wage c., narrow, % of output	-0.63		-0.73	0.29		0.65
Δ purchased services from abroad, % of output	1.51	***	4.43	1.43	***	3.95
Intern. outsourcing of materials, broad, % of output, 1995	0.03		0.09	0.11		0.54
Intern. outsourcing of mat. to low-wage c., broad, % of output, 1995	0.04		0.11	0.07		0.31
Intern. outsourcing of mat. to high-wage c., broad, % of output, 1995	-0.92		-0.59	0.60		0.63
Intern. outsourcing of materials, narrow, % of output, 1995	0.11		0.32	0.05		0.24
Intern. outsourcing of mat. to low-wage c., narrow, % of output, 1995	-1.25		-0.65	1.14		0.98
Intern. outsourcing of mat. to high-wage c., narrow, % of output, 1995	0.16		0.42	-0.04		-0.16
Purchased services from abroad, % of output, 1995	2.30	***	3.31	2.17	***	3.67

Notes: ***, ** and * denote significance at the 1 percent, 5 percent and 10 percent level. Sector and country dummy variables are included.

[2]) Data for industry NACE 23 is excluded because the data seems to be erratic.

While the broad measure of international outsourcing to low– and medium wage is significantly negatively related to TFP growth, the narrow measure of international outsourcing to low– and medium is positively related to TFP growth but only marginally significant. Overall the results indicate that the TFP effect of the change in international outsourcing of materials is sensitive to the definition of outsourcing. Furthermore, we find that international outsourcing to high–wage countries does not have an impact on productivity growth. This holds for both the narrow and broad measure of international outsourcing. When international outsourcing of manufactured inputs is measured by the initial level we find that TFP growth is unrelated to the magnitude of international outsourcing.

Concerning outsourcing of service inputs, we find a significant and positive impact of both the initial share of purchased services from abroad as well as the change in purchased services from abroad on TFP growth. The coefficient on the change in purchased services amounts to 1.51 and is significant at the 1 percent significance level using OLS estimates. In order to provide an indication of the magnitude of the results we calculate the contribution of the change in purchased services on TFP growth. Given the coefficient and the average change in the share of imported services over the sample we find that international outsourcing of service inputs has increased TFP by 2.4 percentage points over the sample period. Given the productivity growth of 11 percent between 1995 and 2000, international services outsourcing accounted for 20 percent of the growth of total factor productivity in the manufacturing sector in the selected OECD-countries. Amiti and Wei (2006), find for the U.S that service outsourcing accounted for 11 percent to 13 percent of the total growth in labor productivity in the manufacturing sector from 1992 - 2000.

5. Conclusions

This paper presents further insights into the productivity effects of the international outsourcing of services and materials. We estimate the relationship between the change in TFP and various indicators of international outsourcing based on a sample of manufacturing industries for 14 OECD-countries from 1995 - 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. The results for 14 OECD-countries controlling for industry and country effects show, that while the narrow measure of international outsourcing of manufactured inputs is not significant, the broad measure of international outsourcing to low–wage countries is significantly negatively related to the change in TFP. In terms of the magnitude of its impact, the results suggest that outsourcing to low–wage countries has decreased TFP growth by about 1 percentage point from 1995 - 2000, on average.

Furthermore, while the narrow measure of international outsourcing of materials is not important, the change in purchased services from abroad has a significant and positive effect on TFP growth. The magnitude of the effects indicate that international outsourcing of service inputs has increased TFP by 2.4 percentage points over the sample period. Given the productivity growth of 11 percent from 1995 - 2000, the increase in the intensity of international services outsourcing accounted for 20 percent of the growth of total factor productivity in the manufacturing sector in the 14 OECD-countries.

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7. Appendix

Figure 1: Relationship between the share of narrow international outsourcing in 1995 and TFP growth between 1995 - 2000

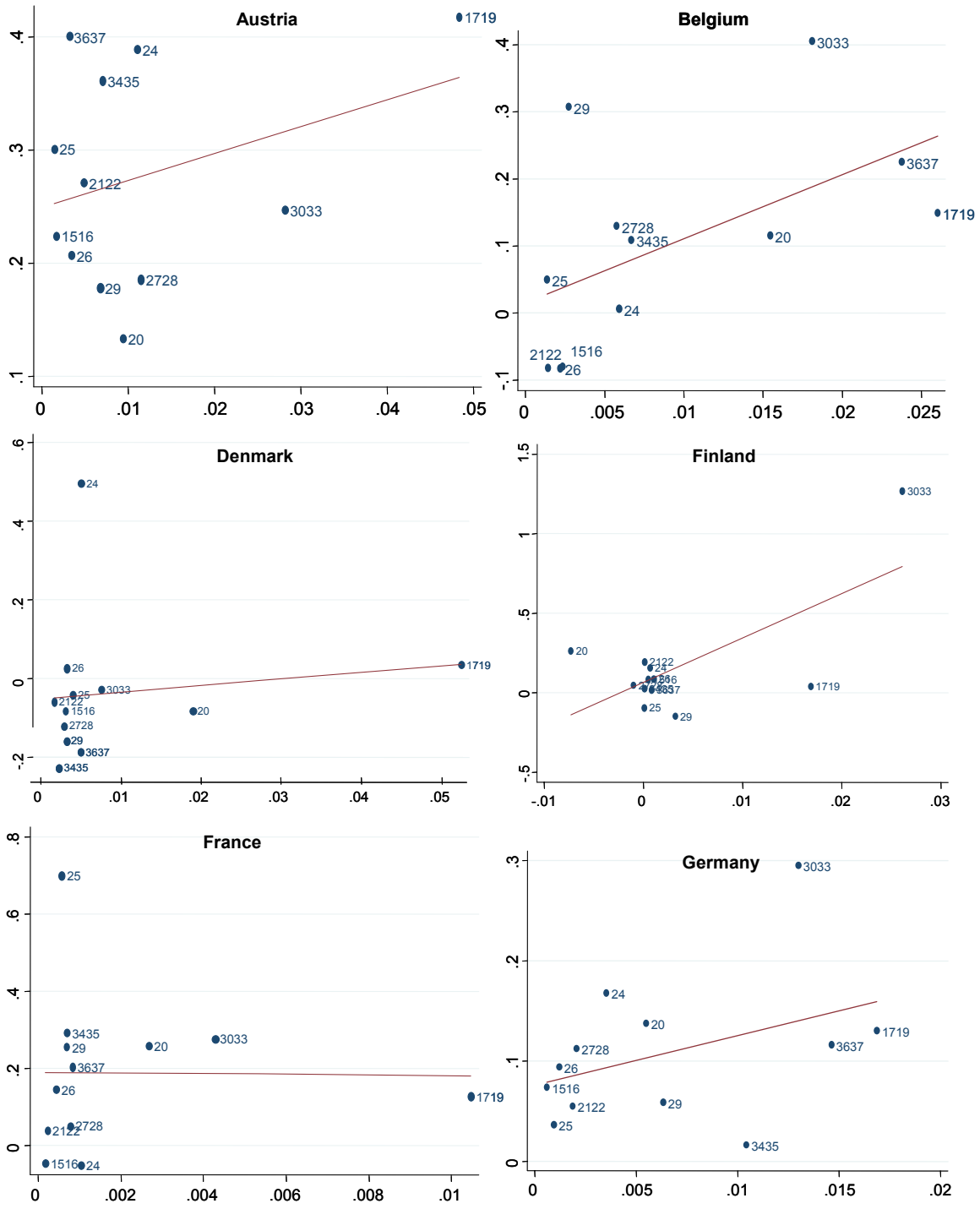

Figure 1/continued

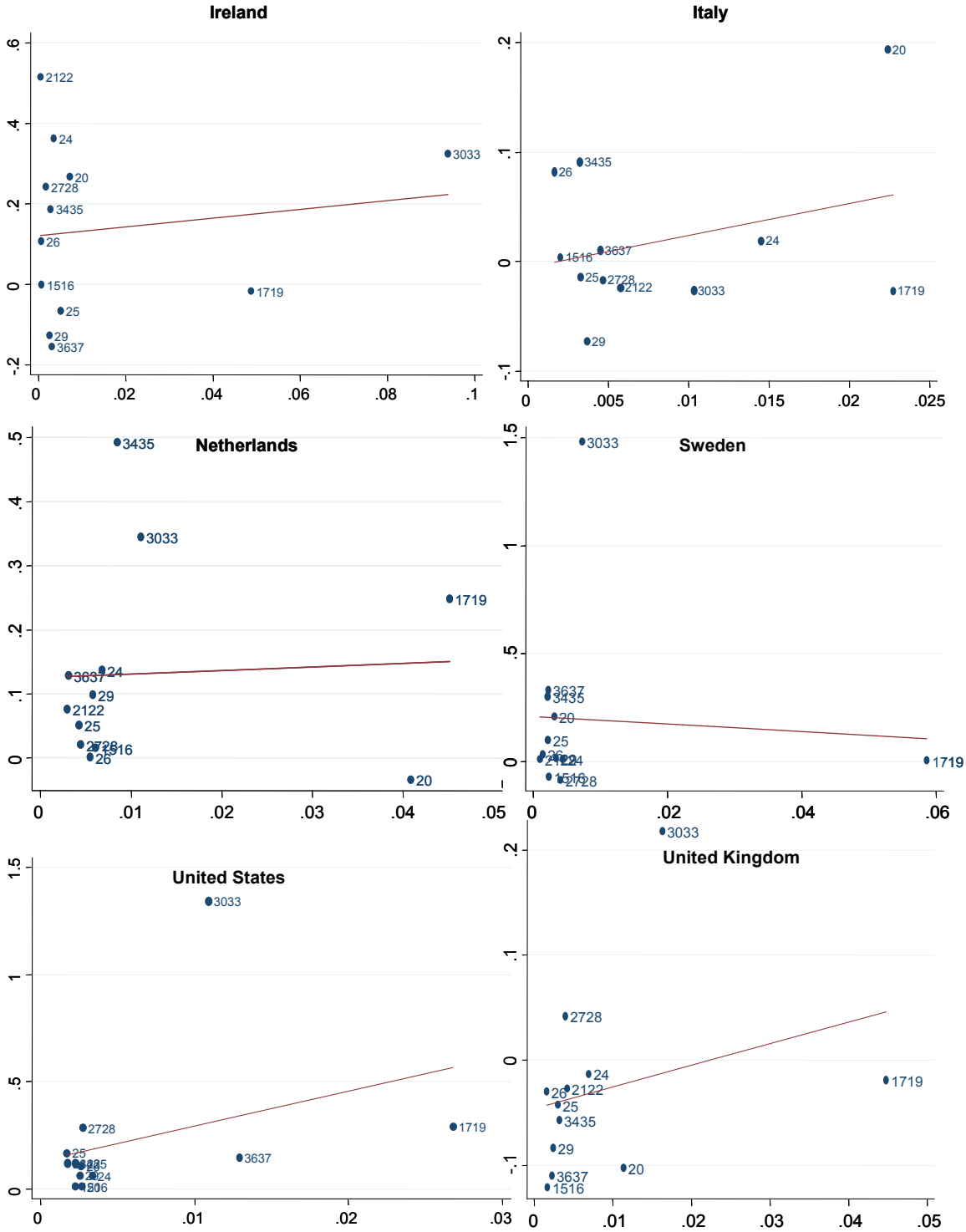

Figure 2: Relationship between the share of narrow international outsourcing to low-income countries in 1995 and TFP growth between 1995 - 2000 (selected industries)