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Can we really trust offshoring indices?

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CAN WE REALLY TRUST OFFSHORING INDICES?

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Can we really trust offshoring indices?

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Zusammenfassung/ Abstract

This paper argues that indices of (business) service and material offshoring built on sectoral input-output data may actually measure something different than what we think they should. Applying shift-share analysis we decompose the variation over time of a commonly used class of such indices into two components: one related to the intensity in the import of intermediate inputs, and the other associated with the use of such inputs in the production of manufacturing goods. Using data from input-output tables of 21 European countries from 1995 to 2006, we show that in the case of service offshoring, in most countries a larger part of the variance is driven by the raising share of (domestically produced) services used in manufacturing production, while the share of imported services contributes to a much smaller extent. When we focus on the subset of business services, evidence shows a relatively larger tendency towards relying on imported rather domestically produced inputs. Instead, in the case of material offshoring there is evidence that foreign suppliers have substituted domestic ones. However, this pattern is strongest in countries, such as Estonia, Hungary and Slovenia, where incoming multinationals, rather than domestic firms offshoring production may be the driving force.

JEL-Klassifikation / JEL-Classification: F14, F10

Schlagworte / Keywords: outsourcing, import penetration, offshoring; index, measurement

1 Introduction

Offshoring is one of the main ingredients of contemporary international trade. Its relevance is growing widely all over the world, and is both orienting the political agenda of countries as well as shaping the way economists think about international trade and its consequences (Feenstra and Hanson, 1996a,b, 1999; Arndt, 1997, 1998a,b; Grossman and Rossi-Hansberg, 2008). Parallel to its relevance, the use of the term is somehow fuzzy and its quantification is problematic.

From a terminological point of view, offshoring can be broadly defined as a firm's allocation of business activities to another country, either by obtaining goods and services from an unaffiliated foreign supplier or by investing in a foreign affiliate or joint venture. Resorting to foreign unaffiliated companies is often dubbed as offshore outsourcing, including pure supply relationships as well as more comprehensive partnership subcontracting. Offshoring within the boundaries of MNEs is also referred to as offshore in-house sourcing (OECD, 2006). Since these activities are usually difficult to observe at the firm-level, direct comparative evaluation is highly improbable. The relevance of the phenomenon and its possible consequences on the domestic labor and goods markets have encouraged quantification based on indirect evidence. Thus various proxies for the main unobserved variable of interest, i.e the offshoring activities of a representative domestic firm, have been proposed in the literature. Since offshoring involves a substantial flow of imports of intermediate goods and services (Feenstra, 1998), input-output tables have been extensively used to compute indices of offshoring at the sectoral and aggregate level.¹ Most of these indices relate imported intermediates used in the production of an industry to some kind of normalization, as e.g. the total value of the industry's production. This incorporates the idea, along the lines of Feenstra (1998), that the share of imports of intermediate goods and services over production should be associated with a higher relevance of offshoring. Empirical contributions using this family of indices present strong evidence of increasing offshoring activity for different economies. Concerning material offshoring, Campa and Goldberg (1997) e.g. calculate the offshoring activity for the US, Canada, UK, and Japan, whereas Strauss-Kahn (2003) presents statistics

¹See Horgos (2009) for an overview of different indices to proxy offshoring activities, their quality, and their performance when being used in estimating labor market effects. Chen et al. (2005) discusses the many advantages of using input-output tables in the calculation of offshoring indices. The most evident is the possibility of tracking domestic and international intersectoral linkages and, in particular, the possibility to quantify the purchase of imported inputs by domestic sectors.

for France. Geishecker and Görg (2005) or Horgos (2011) examine offshoring in Germany and Falzoni and Tajoli (2010) and (Jona-Lasinio, 2010) do the same for the Italian economy. With respect to service offshoring, see e.g. Winkler (2010) for evidence on Germany or Crinò (2009) for a comparative overview. The evidence put forward by all this literature is highly consensual: offshoring is strong and is here to stay.

Investigating the characteristics of the indices used to quantify offshoring, it becomes evident that the variation in the index is driven by different components. Since the offshoring index can be decomposed in two parts, (i) the first one measuring the share of imported inputs relative to the total use of inputs and (ii) the second one measuring the share of inputs used in production in the manufacturing or services industries, the main question this paper addresses is: Can we be confident that the offshoring indices used in empirical research are really capturing offshoring? Can we really trust them?

The economic question that immediately follows is if the strong increase of the offshoring indices observed in the last decades is driven by an increase in the first component of the index (the share of imported intermediate inputs) or by the second component (outsourcing). The implication is clear: while the former component has an international dimension, the latter is linked to domestic factors, such as technological and structural change (e.g. the increasing use of services in manufacturing production). A prevalence of the second component and a minor role of the first one would indicate that what is defined as an offshoring index has little to do with offshoring. Moreover, also a prevalence of the first component is no guarantee for a correct quantification of offshoring in presence of substantial FDI and mergers and acquisitions.

In this paper, we apply a shift-and-share analysis to decompose the offshoring index previously described² into two components, one measuring the share of imported intermediate inputs and the other one related to the domestic outsourcing of activities of intermediate goods and services. We measure the extent and development of these components for 21 European countries from 1995 - 2006. While results vary considering services, business services, or material offshoring, the

²As mentioned above, several indices have been used in literature. However, since most of them relate imported inputs to some form of denominator indicating the industries' production level, we use "imported inputs in total production" as an index representative for this kind of literature. As discussed in (Horgos, 2009) one could implement various alternative normalizations. In particular, one frequently used alternative to total production is total imports or gross output. As it will become clearer later, the line of argument in this paper is not affected by the normalization used.

bottom line of our analysis maintains: We cannot really trust offshoring indices.

2 The Offshoring Index

Since the vast majority of the literature on offshoring has been using data on imported intermediate goods and service as a measure of offshoring at the sectoral and aggregate level,³ normalizing it for the size of the using industry, we decide to focus the analysis on the value of imported inputs expressed as a share of total production.⁴ This yields the following offshoring index Off_{jt} , e.g. the share of “imported inputs in total production”:

$$\text{Off}_{jt} = \frac{\sum_{w \in W} m_{wjt}}{p_{jt}} \quad (1)$$

with Off_{jt} as the extent of offshoring activity in industry j at time t . The index relates the sum of imported inputs m_{wjt} supplied from industries w and used in industry j , to industry j 's total production value p_{jt} . In our analysis the set of inputs W includes either all service inputs, the subset of business service activities, or intermediate material goods.

The index in equation 1 can be decomposed into two parts:

$$\text{Off}_{jt} = \frac{\sum_{w \in W} m_{wjt}}{p_{jt}} = \left[\frac{\sum_{w \in W} m_{wjt}}{\sum_{w \in W} d_{wjt}} \right] \left[\frac{\sum_{w \in W} d_{wjt}}{p_{jt}} \right] = M \cdot O \quad (2)$$

where d_{wjt} denotes the value of domestic inputs w , used by sector j at time t .

Equation 2 highlights that the offshoring index used in the literature is in fact composed of two parts (M and O). On the one hand, there is the ratio of imported to domestic inputs used in the production of sector j , which reflects the extent to which a given set of inputs is imported rather than sourced domestically. This will tell us e.g. how much business services used in production of a given good is bought from foreign suppliers (i.e. imported), rather than being purchased from

³See e.g. Feenstra and Hanson (1996a,b), Hummels et al. (2001), Yeats (2001), Egger and Egger (2002), Strauss-Kahn (2003), Hijzen et al. (2004), Amiti and Wei (2005a,b), Geishecker and Görg (2005, 2008), Hijzen (2007), or Horgos (2011).

⁴Others have used the amount of total non-energy intermediate inputs used by industry as a denominator, instead of total production (Jona-Lasinio, 2010). It can be easily shown that our argument is valid also under this different normalization. In particular, the import-related part would be unchanged.

domestic companies. We refer to this ratio as the import share of intermediate inputs (M). On the other hand, the index includes the share of domestic inputs used in the total value of production, which indicates the extent to which production of good j uses inputs produced by domestic producers (O). This can be thought as a measure of the degree of domestic outsourcing in industry j , that is how much a firm buys, for example, business services from other domestic firms rather than producing them within the firm. While M reflects the contribution of international transactions, O depends on domestic activities only.⁵

The contribution of international transactions, as opposed to domestic outsourcing, to the dynamics of the offshoring index can be examined using shift-share analysis to equation 2. The change (denoted by Δ) in the index over time is the sum of change of the different components, when keeping the other component fix (denoted by a “bar” over the variables).⁶

$$\Delta \text{Off}_j = \Delta O_j M_j = \Delta O_j \bar{M}_j + \bar{O}_j \Delta M_j \quad (3)$$

Thus, an increase in Off_{jt} over time can be driven by either increasing imported inputs W (e.g. business services) as a share of domestically produced ones ($\bar{O}_j \Delta M_j$), which is consistent with a more intense use of international offshoring, or by deepening the share of the set of inputs W bought from domestic suppliers and used in production ($\bar{M}_j \Delta O_j$). This latter contribution is not linked to any international transactions and, thus, describes the process of domestic outsourcing, which in the case of (business) services suggests some tertiarization and structural change of the economy.

3 Offshoring in European economies

We use data from the Eurostat’s input-output tables of 21 EU countries to shed light on the contribution of import of intermediate inputs and domestic outsourcing to

⁵One alternative decomposition could be $\text{Off}_{jt} = \frac{\sum_{w \in W} m_{wjt}}{p_{jt}} = \left[\frac{\sum_{w \in W} m_{wjt}}{\sum_{w \in W} u_{wjt}} \right] \left[\frac{\sum_{w \in W} u_{wjt}}{p_{jt}} \right]$, with u denoting total inputs. However, in this case the second component would also be affected by imported inputs (since total inputs u include imported inputs m and domestically produced inputs d as well). Therefore, we prefer to multiply and divide by $\sum_{w \in W} d_{wjt}$ (rather by $\sum_{w \in W} u_{wjt}$) since in this case the second part of the decomposition (O in Equation 2) would not depend on any international transactions.

⁶In order to fix one of the components, we use the mean of the values between 1995 and 2005.

the dynamics of the offshoring indices. Since different countries provide data for different time periods (from 1995 to 2006), with yearly data not always available, we compute ΔOff_j using the first and last year for each country.

3.1 Degree and trends in offshoring

In Table 1 we report the values of the share of imported business services in total manufacturing production for the manufacturing industry as a whole. This choice allows us to address the interdependence between business services and manufacturing.⁷ We have also computed indices of both the aggregate of service and material inputs. The three indices differ because they consider a different set of inputs W . For business service offshoring, we consider only inputs from NACE 71-74, for material offshoring we consider all inputs from primary and secondary non-energy industries (NACE 01-37, except for NACE 10-12), while for service offshoring we consider all market services (NACE 50-74).

The degree of offshoring is clearly higher for materials than for services (as shown e.g. by Amiti and Wei (2005a,b) for the US and the UK, as well as in Horgos (2011) for Germany), and even more so than for business services. However, remarkable differences emerge across countries. The share of imported materials in total production ranges from over 30% in Estonia and Hungary, to less than 15% in France, Germany, Greece, Italy and Romania. Import of service and business service inputs account for about 2% and 1% respectively, but again with striking differences across countries.

In Figure 1 we plot the business services offshoring index, as well as the outsourcing and imported inputs component, over time, normalizing them to one in the first year of observation. Results show that the share of imported business services in total manufacturing production rose substantially over the 1995-2006 period in most countries. However, while in countries such as Germany and Austria, the growth in the share of domestically purchased business services in total production is negligible, other countries, such as France, Spain, Italy, Denmark, Estonia, Hungary and Slovenia, witnessed a substantial increase in the degree of outsourcing of business services. As a result, in this latter group of countries the growth in the ratio of imported over domestic business services used in manufacturing production is lower than the growth in imported business

⁷Results on the service industry, as well as on specific 2-digits NACE sectors are available from the authors upon request.

services in total manufacturing production.

This pattern is even more pronounced for service inputs as a whole. As depicted in Figure 2, the domestic outsourcing component grew at the same (or an even higher) rate than the import-related component of the service offshoring index in Italy, France, Belgium, Greece, Finland, Netherlands, Portugal, Estonia and Romania. Conversely, in the case of material intermediate inputs, Figure 3 shows that domestic outsourcing has been declining in most countries, while the ratio of imported material inputs to domestically purchased ones has increased.

3.2 Shift-share analysis

This section analyzes the different contributions of the import-related and the domestic outsourcing component to the increase/decrease in import of services (including the details for business services) and materials in total production (i.e. what in the existing literature has been used to measure offshoring) in greater detail. In particular, using data on the manufacturing industry of the 21 European countries described above, we report the shift-share decomposition proposed in equation 2. For each country, Tables 2 and 3 report the absolute change in the offshoring index (ΔOff), the change of import in intermediate inputs ($\bar{O} \cdot \Delta M$), the change of outsourcing ($\bar{M} \cdot \Delta O$), as well as the contribution of the import component to the overall change of the offshoring index ($\frac{\bar{O} \cdot \Delta M}{\Delta\text{Off}}$).

Results in Table 2 reveal that the share of imported business services in total manufacturing production (ΔOff) increased in 17 of 21 countries. With the exception of Ireland (where it increased by 13.6 percentage points), Sweden (1.79 percentage points) Finland (1.41) and Netherlands (1.22), ΔOff rose by less than 1 percentage point in most countries. However, given the low level of Off_t documented in Table 1, the growth rate is often close or above 100%, as shown in Figure 1. This growth would lead to conclude, in line with existing literature, that in the 1995-2005 period, business services have been substantially offshored. However, the shift-share decomposition, allows to appreciate that this important growth is the result of the joint contribution of an increase both in the ratio of imported to domestically purchased inputs and in domestic outsourcing. Only in five countries (Austria, Finland, Germany, Greece and Ireland) the increase in imported business services is not accompanied by a significant structural change that raised the share of business services purchased locally. In sum, the usual indices of offshoring would tend to overestimate the actual change in the organi-

zation of production of business services used in the manufacturing industries of most European countries.

This is even more evident in the case of overall services. Table 3 (right panel) shows that service offshoring grew in all but five countries (Lithuania, Norway, Poland, Romania and Slovakia), but only in 8 countries the increased share in imported inputs over domestic ones contributes to more than 50% of the change in the offshoring index. In some countries, including Belgium, France, Italy, Netherlands and Hungary, there has been a larger increase in the share of services bought from domestic producers than from foreign ones (suggesting domestic outsourcing). For example, in the case of large EU countries such Italy and France, the service offshoring index rose by 0.49 and 0.36 percentage points respectively, but the contribution of the growth of imported services is just about 0.2 percentage points. In a few cases, such as Finland, Greece, Norway, Estonia, Romania and Slovenia, the share of imported services has declined, while the share of domestically purchased services in total manufacturing production has risen. This pattern may even be consistent with a substitution of foreign service producers with domestic ones. In other words, in many countries the observed growth in the share of imported services in total production depends crucially on the growth of services used in production, most likely due to the fact that firms outsourced services that were previously produced internally.

On the contrary, the index of material offshoring has been growing in all but four countries (Table 3, left panel) and this change can be attributed entirely to an increasing importance of imported intermediate goods as a share of those produced domestically. As a matter of fact, in parallel with this rising trend of imported intermediate materials, in all but two countries (Poland and Romania) the share of domestic inputs in total manufacturing production has actually decreased. This may reveal either that firms have internalized activities previously outsourced to domestic suppliers, or that these have been substituted by foreign ones. The latter interpretation is particularly consistent with the observation that a decrease in $\bar{M} \cdot \Delta O$ is associated with an increase in $\bar{O} \cdot \Delta M$.

In sum, the share of intermediate materials, service and business services in total manufacturing production has been on the rise in a large number of European countries, but in the case of business services (and even more for the aggregate of all services) the growth in imports is the result of both: a higher intensity in the use of such inputs by the manufacturing industry (due to outsourcing and structural change) and a higher propensity to import them (relative to buying

them from domestic producers), which is consistent with a process of offshoring those tasks abroad. Conversely, the evidence suggests that the manufacturing industry is indeed increasingly buying intermediate material inputs from foreign suppliers, consistently with the idea that these activities have been offshored. However, a closer look at the data cast some general doubts on this interpretation as well. In fact, the largest increase in the ratio between imported and domestically produced intermediate materials have been registered in countries, such as Estonia, Hungary and Slovenia, which have been characterized by a massive flow of inward foreign direct investments (FDIs) over the last decade. This may be due to the fact that import of intermediates occurs not only when domestic firms offshore production abroad, but also when foreign firms locate plants in a country and import intermediates from the headquarters or other plants within the multinational supply network.

4 Concluding remarks

Empirical literature has provided rather strong evidence of increasing offshoring activities, both for material and service (including business services) inputs and for different economies in the last decades. Most of these works have used indices based on import of intermediates from input-output tables. In this paper we investigate these indices in greater detail and show that their variance is driven by different components. Using shift-share analysis we decompose the variation of these indices over time into two components: (i) one capturing the change in the ratio between imported and domestic inputs and (ii) one reflecting the changing share of inputs used bought from independent firms as a share of total production. While the former may actually capturing the offshoring of some tasks, which end up being imported; the latter results from a change in the organization of production within the national boundaries (outsourcing or structural change)

Results from 21 European countries over the 1995-2006 period, show that the share of imports of intermediate services (including business services) and material inputs have grown in most of the countries analyzed. However, in the case of service inputs, this increase is driven mainly by the raising share of (domestically produced) services used in manufacturing production, while contribution from the increased share of imported services is much lower. When we focus on the subset of business services, evidence shows a relatively larger tendency towards

relying on imported rather domestically produced inputs. Instead, in the case of material offshoring there is evidence that foreign suppliers have substituted domestic ones. However, this is strongest in countries, such as Estonia, Hungary and Slovenia, where incoming multinationals, rather than domestic firms offshoring production may be the driving force.

In sum, our analysis raises serious concerns about the use of data on imports of intermediate inputs to measure offshoring of material, service or business services. On the one hand, we submit that it is crucial that one distinguishes to what extent the higher imports are related to a more intensive use of such inputs into manufacturing output, which would result from a process of outsourcing and would determine a proportional increase in imports, or whether they actually derive from a higher propensity to import rather source those inputs locally, thus reflecting the offshoring of such tasks. Furthermore, one needs to be aware that importing of intermediates may not be related to a process of offshoring. Rather, our evidence suggests that in some countries, an increase in the propensity to import intermediate material goods may be due to the entry and expansion of foreign multinationals in the country, which import intermediate goods from their affiliates or suppliers worldwide. This is relevant if we use the offshoring indices to assess the effects on productivity or employment. For example, while domestic firms shutting down production activities at home and offshoring them abroad (substituting it with imported intermediates) may have negative employment effects, foreign firms increasing production in the country (and thus importing more intermediates) may have positive employment effect. In other words, the same offshoring index may capture different phenomena under different circumstances, what makes interpretations of its effects questionable.

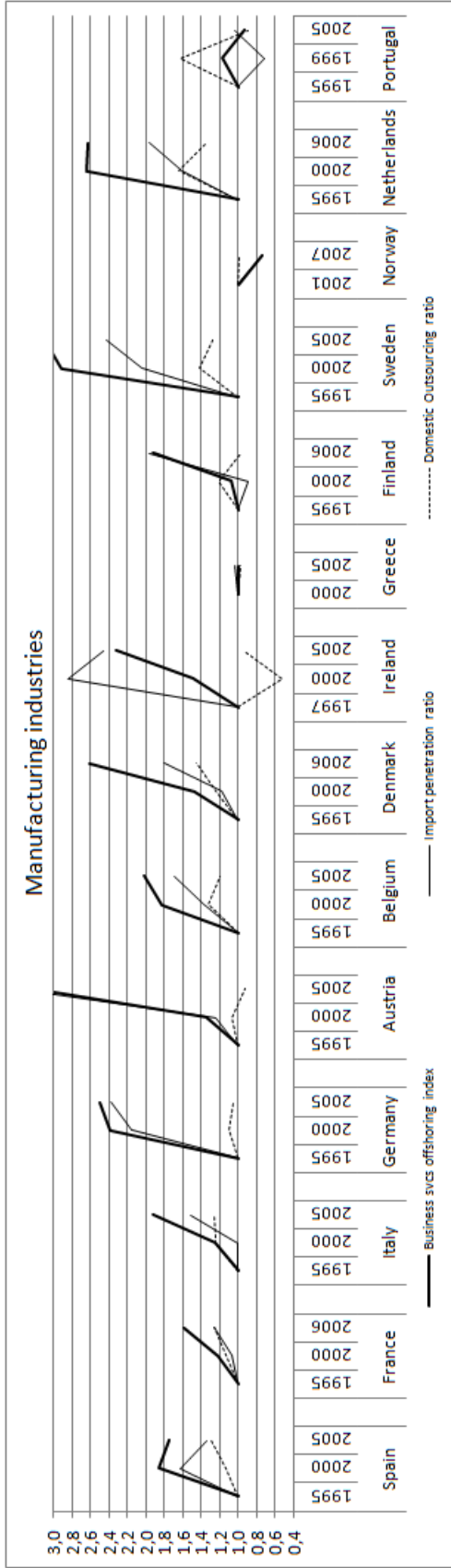
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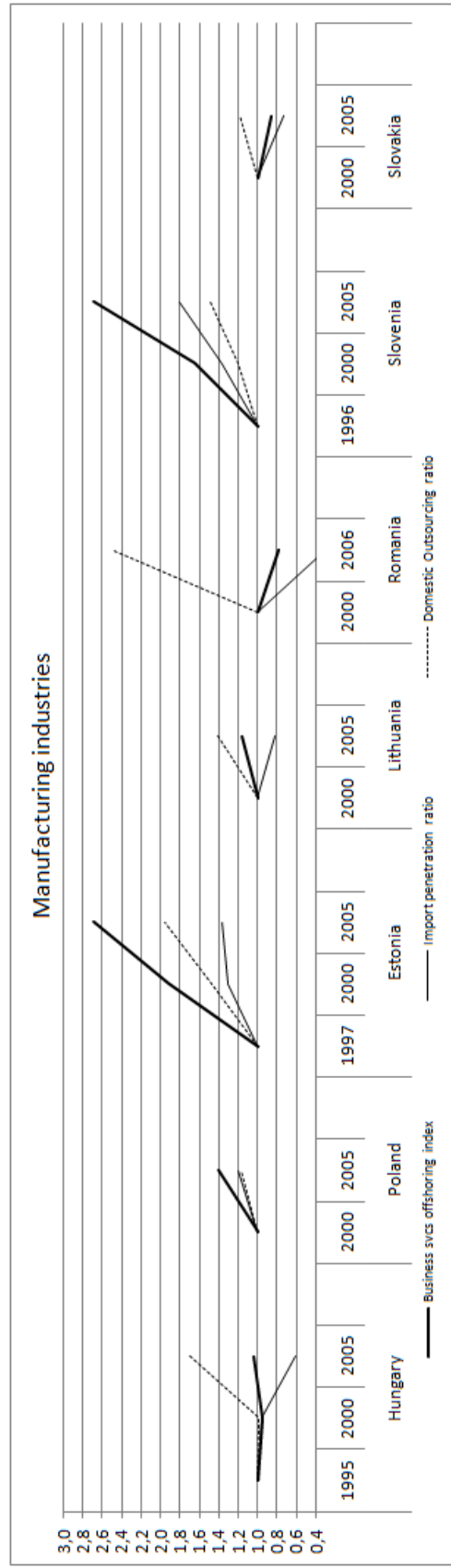
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Figure 1: Import Penetration and Outsourcing in Europe: Business Service Offshoring

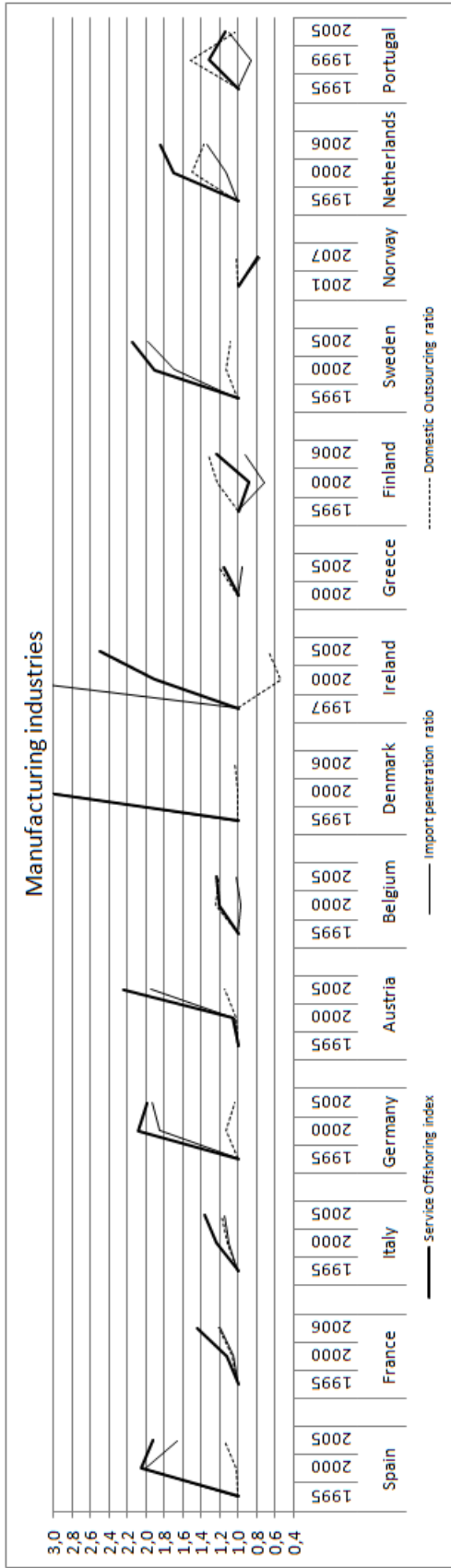


(a) Western Europe

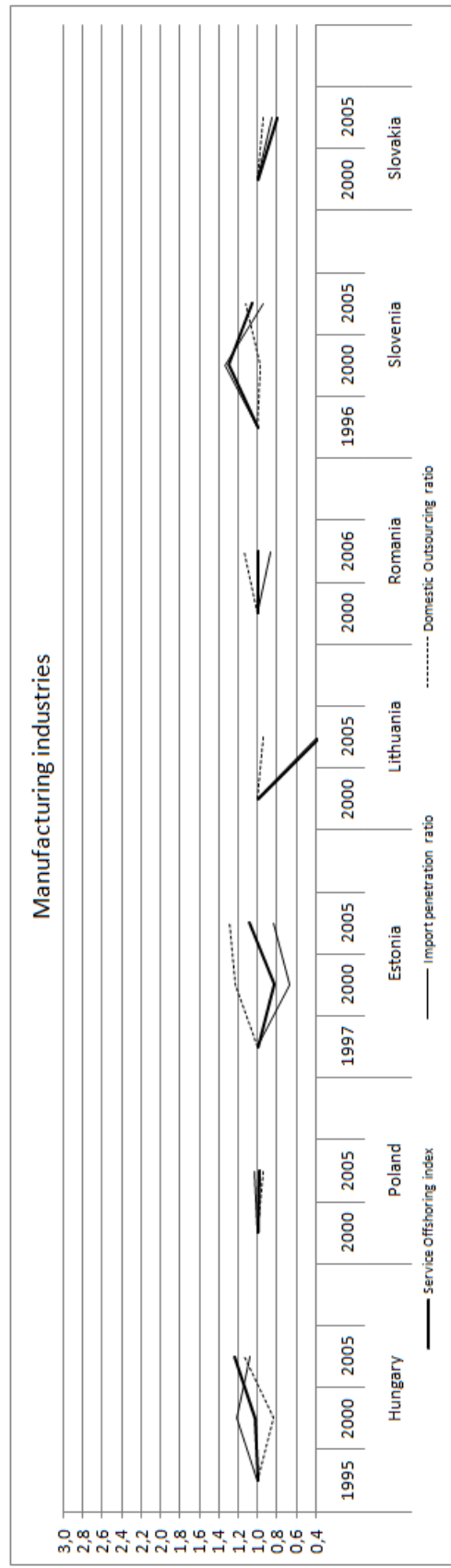


(b) Eastern Europe

Figure 2: Import Penetration and Outsourcing in Europe: Service Offshoring

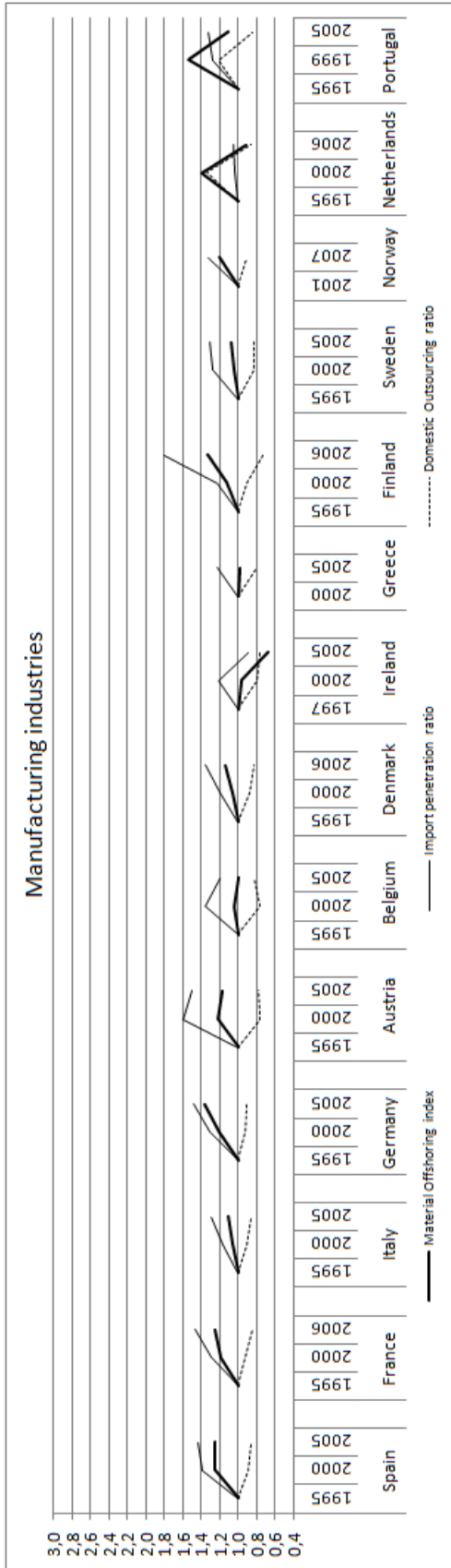


(a) Western Europe

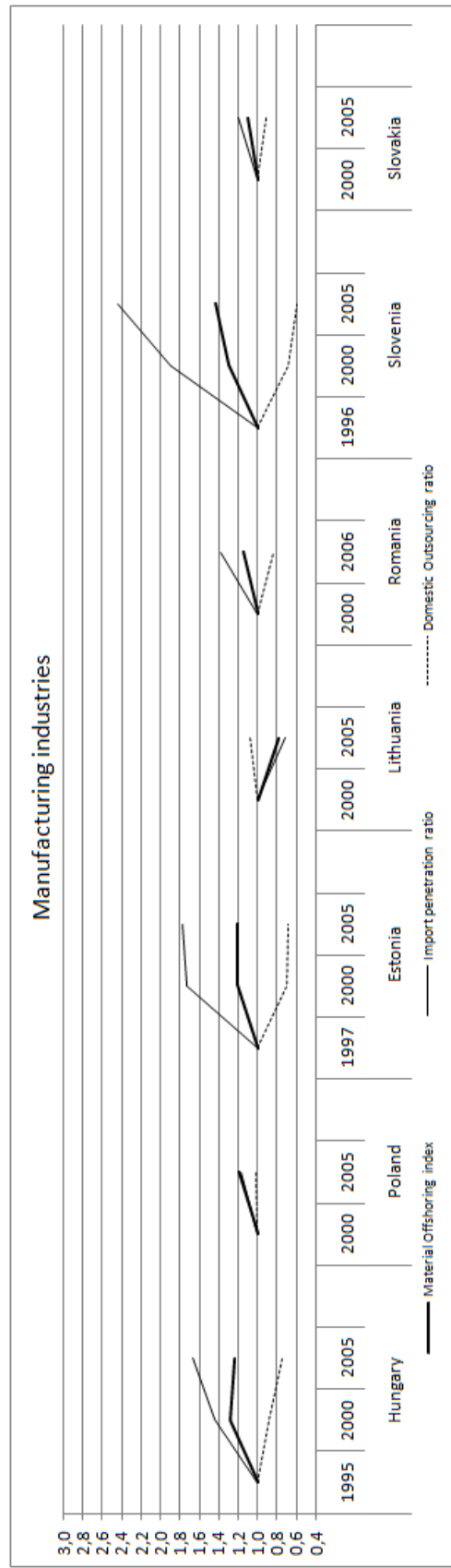


(b) Eastern Europe

Figure 3: Import Penetration and Outsourcing in Europe: Material Offshoring



(a) Western Europe



(b) Eastern Europe

Table 1: Degree of offshoring in the manufacturing industry in 21 European countries

Manufacturing Industry (Nace 15-37)			
Country	Bus. Svcs.	Material	Services
<i>Western Europe</i>			
Austria	0.27%	21.9%	0.87%
Belgium	0.53%	31.8%	2.12%
Denmark	0.45%	19.6%	0.52%
Finland	1.53%	15.7%	2.58%
France	0.32%	13.7%	0.81%
Germany	0.21%	13.6%	0.53%
Greece	0.21%	13.6%	0.47%
Ireland	10.26%	29.2%	12.24%
Italy	0.44%	14.6%	1.34%
Netherlands	0.75%	25.2%	1.69%
Norway	0.72%	17.6%	1.54%
Portugal	0.24%	22.8%	0.51%
Spain	0.75%	15.5%	1.04%
Sweden	0.85%	18.8%	1.88%
<i>Eastern Europe</i>			
Estonia	0.41%	38.4%	1.41%
Hungary	2.43%	34.3%	2.55%
Lithuania	0.11%	17.7%	1.50%
Poland	0.20%	20.4%	0.53%
Slovakia	1.40%	35.2%	2.75%
Slovenia	0.27%	26.2%	1.27%
Romania	0.72%	13.2%	1.05%

Table 2: Shift-share decomposition of offshoring indices for European countries

Manufacturing Industry (Nace 15-37)				
Business svcs. Offshoring				
Country	ΔOff	$\bar{O} \cdot \Delta M$ import	$\bar{M} \cdot \Delta O$ outs.	$\frac{\bar{O} \cdot \Delta M}{\Delta Off}$
<i>Western Europe</i>				
Austria	0.60	0.64	-0.04	107%
Belgium	0.54	0.41	0.14	75%
Denmark	0.73	0.44	0.28	61%
Finland	1.41	1.45	-0.05	103%
France	0.19	0.09	0.10	49%
Germany	0.31	0.30	0.02	94%
Greece	0.00	0.01	-0.01	975%
Ireland	13.60	14.60	-1.00	107%
Italy	0.40	0.26	0.15	64%
Netherlands	1.22	0.84	0.38	69%
Norway	-0.18	-0.18	-0.01	-97%
Portugal	-0.02	0.01	-0.03	62%
Spain	0.56	0.30	0.26	53%
Sweden	1.79	1.38	0.40	77%
<i>Eastern Europe</i>				
Estonia	0.69	0.22	0.47	32%
Hungary	0.09	-1.28	1.37	-1449%
Lithuania	0.02	-0.02	0.04	-135%
Poland	0.08	0.04	0.04	55%
Romania	-0.16	-0.86	0.70	-544%
Slovakia	-0.19	-0.42	0.23	-220%
Slovenia	0.45	0.27	0.18	59%

Table 3: Shift-share decomposition of offshoring indices for European countries

Manufacturing Industry (Nace 15-37)								
Country	Material Offshoring				Service Offshoring			
	ΔOff	$\bar{O} \cdot \Delta M$ import	$\bar{M} \cdot \Delta O$ outs.	$\frac{\bar{O} \cdot \Delta M}{\Delta Off}$	ΔOff	$\bar{O} \cdot \Delta M$ import	$\bar{M} \cdot \Delta O$ outs.	$\frac{\bar{O} \cdot \Delta M}{\Delta Off}$
<i>Western Europe</i>								
Austria	3.94	9.85	-5.91	250%	1.09	0.89	0.20	82%
Belgium	-0.15	5.65	-5.80	3886%	0.51	0.04	0.47	8%
Denmark	2.63	6.53	-3.90	249%	2.34	2.27	0.07	97%
Finland	5.30	11.03	-5.74	208%	0.60	-0.22	0.82	-37%
France	3.47	5.99	-2.52	173%	0.36	0.17	0.19	48%
Germany	4.96	6.39	-1.43	129%	0.53	0.50	0.03	95%
Greece	-0.32	2.74	-3.06	867%	0.08	-0.02	0.10	-27%
Ireland	-9.36	-2.73	-6.63	-29%	18.33	28.14	-9.81	154%
Italy	1.60	3.90	-2.30	244%	0.49	0.23	0.27	46%
Netherlands	-2.05	1.39	-3.45	68%	1.44	0.70	0.74	49%
Norway	3.57	5.52	-1.96	155%	-0.33	-0.36	0.03	-109%
Portugal	2.59	6.77	-4.18	262%	0.07	0.05	0.02	74%
Spain	3.87	6.40	-2.53	166%	0.96	0.75	0.22	77%
Sweden	1.46	5.33	-3.87	365%	2.17	1.93	0.25	89%
<i>Eastern Europe</i>								
Estonia	7.82	24.94	-17.12	319%	0.12	-0.26	0.38	-229%
Hungary	8.00	19.82	-11.82	248%	0.62	0.23	0.38	38%
Lithuania	-3.87	-5.14	1.26	-133%	-0.95	-0.88	-0.06	-94%
Poland	3.88	3.60	0.28	93%	-0.01	0.02	-0.03	175%
Romania	2.04	4.68	-2.65	230%	-0.01	-0.15	0.13	-1287%
Slovakia	3.39	6.92	-3.53	204%	-0.53	-0.40	-0.13	-76%
Slovenia	11.39	29.92	-18.53	263%	0.08	-0.07	0.15	-91%

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