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### Can we really trust offshoring indices?☆

Davide Castellani<sup>a,b,e,\*</sup>, Luca De Benedictis<sup>c</sup>, Daniel Horgos<sup>d,e</sup>

<sup>a</sup> Department of Economics, Finance and Statistics, University of Perugia, Italy

<sup>b</sup> IWH, Halle, Germany

<sup>c</sup> Department of Economic and Financial Institutions, University of Macerata, Italy

<sup>d</sup> Department of Economics, Helmut Schmidt University, Hamburg, Germany

<sup>e</sup> Centro Studi Luca d'Agliano, Milan, Italy

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#### ABSTRACT

This paper argues that offshoring indices often measure something different than what we think they are. Using data from input–output tables of 21 European countries from 1995 to 2006 we decompose an offshoring index, distinguishing between a domestic (structural change) and an international component (imported inputs ratio). Regarding offshoring of business services, a large share of the index variation is driven by the domestic component. This is even more pronounced for overall service offshoring. In the case of material offshoring, by contrast, the international component drives the main variation of the indices. Our results therefore show that, regarding (business) services, the typical calculation of offshoring indices tends to over estimate the role of the imported inputs component, neglecting the role played by structural changes in the economy.

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### 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. Since there is no standardized term yet, various attempts have been made to give the phenomenon a proper name. This paper uses throughout the term offshoring.<sup>1</sup>

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\* Corresponding author at: Department of Economics, Finance and Statistics, University of Perugia, Italy.

E-mail addresses: [davide.castellani@unipg.it](mailto:davide.castellani@unipg.it) (D. Castellani), [debene@unimc.it](mailto:debene@unimc.it) (L. De Benedictis), [horgos@hsu-hh.de](mailto:horgos@hsu-hh.de) (D. Horgos).

<sup>1</sup> While the term international outsourcing is also very common, offshoring has a much longer history and can be traced back to 1895 (Amiti and Wei, 2005a; Horgos, 2009b). Especially in recent years, with numerous contributions on (business) services and firm level trade, the term offshoring experienced a renaissance (Winkler, 2010; Crinò, 2009; Crinò, 2012; Amiti and Wei, 2005a,b; Wagner, 2011; Schwörer, 2012; Falzoni

Since offshoring activities are usually difficult to be observed through firm-level information, direct comparative evidence and evaluation is actually highly improbable. However, 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.<sup>2</sup>

Most of the offshoring 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. What most of the literature using these kind of indices for empirical examinations neglects is that the indices are driven by two very different components: the share of imported to domestically produced intermediates, which is the true international component, and the share of domestically produced inputs in total production of the industry, which instead is related to the structural change of the economy (domestic component).

In this paper, we contribute to this domestic vs. international dimension debate on an empirical ground. In order to separate the two components, we apply a shift-and-share decomposition of a commonly used offshoring index over time. In particular, (i) the first component measures the share of imported business services relative to the use of domestically produced business services, and can be the result of a process of offshoring; (ii) the second component measures the share of domestically produced business services used in production in the manufacturing industry, which is a proxy for the degree of domestic outsourcing, entailing the process of structural change. For comparison, we also compute the same decomposition for the case of overall services and material inputs and we additionally focus on the service industry as the using sector.

The main result of our contribution is that the increase in import of business services in manufacturing production, used as an indicator of the rise in business service offshoring, is grossly overestimating the actual increase in the reliance on foreign produced services in many countries. The same is true for overall services and to a less extent to material inputs. Thus, the advice that we obtain from

and Tajoli, 2010; Jona-Lasinio, 2010; OECD, 2006). In the contribution at hand we stick to this tradition, even when being aware of that several cited papers use international outsourcing instead. It is important to note that when using offshoring we do not distinguish if the imported intermediate is produced in house or bought from an unaffiliated supplier.

<sup>2</sup> See Horgos (2009a) for an overview of different indices used as proxies for offshoring activities, their quality, and their performance when being used in estimating labor market effects. The main advantages and limitations of using input–output tables have been highlighted in Chen et al. (2005), Feenstra et al. (2010).

this paper's analysis is that we should not really trust offshoring indices, when being calculated in a traditional way (especially when assessing service offshoring).

The rest of the paper is organized as follows. Section 2 discusses the relevant literature, while Section 3 provides the formal details of index calculation and decomposition into the domestic and international component. Our empirical analysis along with the results obtained is presented in Section 4. Section 5 concludes.

## 2. A brief sketch of the relevant literature

Empirical contributions using offshoring indices present strong evidence of an increasing offshoring activity for a large set of different economies. Concerning material offshoring, Campa and Goldberg (1997) calculate the offshoring activity for the US, Canada, UK, and Japan, whereas Strauss-Kahn (2003) presents statistics for France. Geishecker and Görg (2005) or Horgos (2011) examine offshoring in Germany and Daveri and Jona-Lasinio (2008) as well as Falzoni and Tajoli (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), Crinò (2012) for a comparative overview. Liu et al. (2011) examine location determinants of service offshoring. The evidence put forward by all this literature is highly consensual: offshoring is strong and is here to stay.

At the same time, after a setback during the 1980s, structural transformation in the manufacturing sector has been accelerating both in advanced and newly industrialized economies (Memedovic and Iapadre, 2009).

In the tradition of Chenery et al. (1986) a number of studies look at the long term and persistent shifts in the sectoral composition of economic systems. Among others, McMillan and Rodrik (2011) emphasize that when, in developing countries, resources move from less productive to more productive activities the economy grows even if there is no productivity growth within sectors. Accordingly, they show that a reshuffling of resources (e.g. labor) from low to high-productivity sectors, and the consequent change in the composition of value added shares in the economy, are key drivers of development and economic growth. In advanced economies, it has been documented that the decrease in the share of manufacturing activities has coexisted with an increasing importance of service activities related to production and with a growing interdependence between manufacturing and services. For example, Montesor and Vittucci Marzetti (2011) apply a subsystem approach originally developed by Momigliano and Siniscalco (1982) and show that the integration of business services into the manufacturing subsystem increased (in terms of employment) in 7 OECD countries (Canada, Denmark, Germany, France, Japan, UK and USA) from 19.9% in the early 80s to 25.9% in the mid-90s. This explains most (although not all) of the decline in the share of employment in the manufacturing subsystem over the same period.<sup>3</sup> The

<sup>3</sup> Similar results have been found for Italy by Momigliano and Siniscalco (1982) and, more recently, Foresti et al. (2007).

process of tertiarization that takes place in most industrialized economies results mainly from the outsourcing of service activities that were previously carried out within manufacturing firms. The reasons why the manufacturing industry increases the use of external services are manifold. In modern, specialized economies, the complexity of new production processes demands for additional coordination and control (Greenfield, 1996). Especially with regard to an increase in (vertical) specialization, demand for additional service links to organize production rises (Jones and Kierzkowski, 1990; Francois, 1990a,b). Also, product differentiation may increase the need for additional service tasks. The supply of modern, innovative services that complement core competencies of manufacturing firms may also increase outsourcing activities in the manufacturing sector (MacPherson and Vanchan, 2010; Greenhalgh and Gregory, 2001). This process of outsourcing non-core service activities allows manufacturing firms to focus more on their core competencies enhancing firms' productivity (Prahalad and Hamel, 1990).<sup>4</sup>

The question that immediately follows from the observation of the recent coevolution of offshoring and structural change is if the strong increase of the offshoring of services that has been reported in the last decades is capturing, somehow spuriously, the widespread increase in service inputs demanded by the manufacturing industry more than an actual increase in the share of imported services used by the manufacturing industry. We submit that the commonly used indices of service offshoring based on input–output tables, which calculate the share of imported service intermediates in total production (or input use), are not separating, as they should do, the international dimension of offshoring from the domestic dimension of technological and/or structural change, i.e. for example 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 captured by the offshoring indices may have little to do with offshoring.

In this perspective, our paper connects to an important debate on whether the decline in value added in the manufacturing industry in industrialized economies is due to an increase in imported intermediates or to a more intensive use of domestically produced services instead. In this respect, Sinn (2005) reported that in the last two decades the growth of value added in the German manufacturing sector did progressively fall behind the growth in production and, because of this pattern, labeled the German economy with the nickname of a “Bazaar Economy”. He argued that firms in the manufacturing sector were acting as a wheel, importing intermediates from abroad and (after a few minor changes) selling the final commodities on the domestic and especially the world market. The critics of this thesis (e.g. Morgan Stanley, 2004a,b; Financial Times Germany, 2004a,b,c) opposed that the gap between output and value added could be explained by simple

tertiarization, with manufacturing firms sourcing service tasks from the domestic service sector. The domestic dimension was considered to be prevalent with respect to the international one associated with the “Bazaar Economy” hypothesis.

### 3. The offshoring index

In order to illuminate why and how the offshoring indices are driven by these two different components, we discuss the formal details on index calculation in this section before presenting our empirical results in Section 4. The vast majority of contributions measuring offshoring at the sectoral and aggregate level relies on indicators based on imports of intermediate goods normalized by the size of the industry.<sup>5</sup> We follow this tradition and focus our analysis on the following index:

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

The index in Eq. (1) relates the sum of imported inputs  $m_{jt}^w$  supplied by industries  $w \in W$  and used in industry  $j$  to the total value of production,  $p_{jt}$ , in industry  $j$  at time  $t$ . In our analysis we consider three different sets of inputs  $W$ : all service inputs ( $W = ser$ ), the subset of business service activities ( $W = bs$ ), and intermediate material inputs ( $W = mat$ ). As for the level of disaggregation of the using industry, we mainly focus on the aggregate of manufacturing industries ( $j = man$ ), but we also perform a comparative check for the service industry ( $j = ser$ ). It is worth mentioning that, as discussed in Horgos (2009a), one could implement various alternative normalizations. In particular, one frequently used alternative to total production  $p_{jt}$  is total imports or gross output (Yeats, 2001; Egger and Egger, 2002; Chen et al., 2005; Geishecker and Görg, 2005). Others have used the amount of total non-energy intermediate inputs (Jonas-Lasinio, 2010). It can be easily shown that our analysis can be extended to any other possible normalization, since the import-related part (the numerator in Eq. (1)) would not change under alternative normalizations (the denominator in Eq. (1)). Therefore, any alternative normalization factor,  $a_{jt}$ , will be related to the one used in equation 1 by the proportionality ratio  $\frac{p_{jt}}{a_{jt}}$ .<sup>6</sup>

<sup>5</sup> See 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), Geishecker and Görg (2008), Hijzen (2007), or Horgos (2011).

<sup>6</sup> Authors who use input–output indices often calculate them at different levels of aggregation: a “broad” and a “narrow” version of the index (see e.g. Feenstra and Hanson, 1996a,b, 1999; Olsen, 2006; Horgos, 2011). While the “broad” variant considers all possible imported inputs, the “narrow” version considers only imported inputs of the same two-digit industry  $j$ . Often, both forms are presented in order to test robustness of the results. Even when the narrow measure may exhibit some advantages, e.g. to be in line with the WTO mode 1 definition of offshoring (Olsen, 2006), it is not possible to calculate this index for the contribution at hand: a narrow index can per definition not be calculated when focusing on (business) service offshoring of manufacturing industries. Note however that all three variants calculated in this contribution (business service, service, and material offshoring) are also not of the “broad” form. They include not all but specific subsets of inputs. While comparing service

<sup>4</sup> In the business literature, the increased linkage between manufacturing and services and the so resulting rising service intensity is also denoted as servitization of business (Vandermerwe and Rada, 1988; Pilot and Wölfl, 2005).

The index in Eq. (1) can be decomposed into two parts:

$$\begin{aligned} \text{Off}_{jt}^W &= \frac{\sum_w m_{jt}^w}{p_{jt}} = \left[ \frac{\sum_w m_{jt}^w}{\sum_w u_{jt}^w - m_{jt}^w} \right] \left[ \frac{\sum_w u_{jt}^w - m_{jt}^w}{p_{jt}} \right] \\ &= \left[ \frac{\sum_w m_{jt}^w}{\sum_w d_{jt}^w} \right] \left[ \frac{\sum_w d_{jt}^w}{p_{jt}} \right] = M_{jt}^W \cdot O_{jt}^W, \end{aligned} \quad (2)$$

where  $u_{jt}^w$  and  $d_{jt}^w$  denote the value of total and domestic input  $w$  (respectively), used by sector  $j$  at time  $t$ .

Eq. (2) highlights that the offshoring index used in the literature is in fact composed of two parts:  $M_{jt}^W$  and  $O_{jt}^W$ . On the one hand, there is the value of imported inputs in the set  $W$  as a share of the value of domestically produced inputs (in the same set) used in the production of sector  $j$  at time  $t$ , which reflects the extent to which a given set of inputs is imported rather than sourced domestically. For example, when  $W$  denotes the set of business services inputs ( $W = bs$ ), this will tell us how much business services used in production of a given good is bought from foreign suppliers (i.e. imported), rather than being purchased from domestic companies. We refer to this ratio as the imported inputs ratio ( $M_{jt}^W$ ). On the other hand, the index includes the share of domestic inputs in the set  $W$  used in the total value of production of good  $j$  at time  $t$ . This can be thought as a measure of the degree of structural change or domestic outsourcing of inputs  $W$  in industry  $j$  at time  $t$  ( $O_{jt}^W$ ), that is how much a firm buys, for example, business services from other domestic firms rather than producing them within the firm. While  $M_{jt}^W$  reflects the contribution of international transactions,  $O_{jt}^W$  depends on domestic activities only.<sup>7</sup>

The contribution of international transactions, as opposed to the domestic component, to the dynamics of the offshoring index can be examined applying a shift-share analysis to Eq. (2). The change (denoted by  $\Delta$ ) 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).<sup>8</sup>

$$\Delta \text{Off}_{jt}^W = \Delta(O \cdot M)_{jt}^W = (\Delta O \cdot \bar{M})_{jt}^W + (\bar{O} \cdot \Delta M)_{jt}^W, \quad (3)$$

Thus, for any  $W = bs, serv, mat$ , an increase in  $\text{Off}_{jt}^W$  from  $t$  to  $t+r$  can be driven by either increasing imported inputs (e.g. business services if  $W = bs$ ) as a share of domestically produced ones,  $(\bar{O} \cdot \Delta M)_{jt}^W$ , which is consistent with a more intense use of offshoring, or by deepening the share of the set of inputs bought from domestic suppliers and

offshoring with the specific case of business service offshoring, we try to be as conservative as possible.

<sup>7</sup> It is worth noting, that our index can be further decomposed into the following expression:  $\text{Off}_{jt}^W = [(\sum_w m_{jt}^w) / (\sum_w d_{jt}^w)] [(\sum_w d_{jt}^w) / (\sum_w u_{jt}^w)] [(\sum_w u_{jt}^w) / (p_{jt})]$ . While differentiating between the use of imported inputs vs. domestic inputs (the first part of the expression), the use of domestic inputs in percent (the second part), and the use of inputs in production (the third part), a foreign component would be part of any of the three parts of the decomposition (remember:  $m_{jt}^w = u_{jt}^w - d_{jt}^w$ ). Thus, it would be impossible to clearly separate the influences of changes happening at the domestic and at the foreign level.

<sup>8</sup> In order to fix one of the components, we use the mean value of the first and the last year of observation.

used in production,  $(\bar{M} \cdot \Delta O)_{jt}^W$ . We label the first one the international component and the second one the domestic component.

To distinguish between these two components is one of the core exercise in this analysis. Since most previous contributions that use input–output based indices show an increase in offshoring activities, it is important to identify to what extent such reported pattern is actually driven by a more intensive use of imported inputs, or by a (more general) rise in outsourcing of intermediates. In the latter case, the indices are not revealing any international activity, however, they may still capture some specific sourcing strategy, namely an increase in domestic outsourcing, which in the case of (business) services suggests some tertiarization and structural change of the economy.

#### 4. Offshoring in European economies

In order to shed light on the contribution of the domestic and international components to the variation of offshoring indices we use data from the Eurostat's input–output tables, combining information from 21 EU countries. As mentioned by Feenstra et al. (2010), a major drawback of most studies calculating offshoring indices on the base of input–output data is that, due to the lack of import tables for the various inputs, they need to assume that the share of import of a given intermediate input is equal to the share of import of final goods (import proportionality assumption). For the 21 European countries considered in this analysis, Eurostat provides a specific import matrix for intermediate inputs that allows us to overcome the import proportionality assumption and to track domestic and international inter-sectoral linkages.<sup>9</sup>

Since different countries provide data for different time periods (from 1995 to 2006), with yearly data not always available, we compute  $\Delta \text{Off}_{jt}^W$  for each country, using the first and last year of available data. We focus on the manufacturing industry as the using industry ( $j = man$ ) and compute the decomposition in Eq. (3) for the subset of business service inputs ( $w = NACE 71–74$  and  $W = bs$ ). The choice of this level of analysis is due to the increased relevance of the interlinkages between business services and manufacturing for the countries' economic growth (Guerrieri and Meliciani, 2005), as discussed in the introduction above. For comparison, we extend our analysis also to offshoring of all service inputs ( $w = NACE 01–37$ , except for NACE 10–12 and  $W = serv$ ) as well as intermediate material inputs ( $w = NACE 50–74$  and  $W = mat$ ) by the manufacturing industry. Finally, as a comparative check, we replicate our decomposition focusing on the service industry as the using sector ( $j = serv$ ). This allows us to investigate to what extent offshoring of service tasks has also characterized the service industry.

##### 4.1. Degree and trends in offshoring

In Table 1 we report the values of the  $\text{Off}_{man,t}^W$  indices for the 21 EU countries, considering the first period  $t_0$  of

<sup>9</sup> See Feenstra and Jensen (2012) for a recent attempt to overcome the limits imposed by the import proportionality assumption to the US input–output offshoring indices.

**Table 1**

Degree of offshoring in the manufacturing industry in 21 European countries.

Country	$Off_{man,t_0}^{bs}$	$Off_{man,t_0}^{ser}$	$Off_{man,t_0}^{mat}$
<i>Western Europe</i>			
Austria	0.27%	0.87%	21.9%
Belgium	0.53%	2.12%	31.8%
Denmark	0.45%	0.52%	19.6%
Finland	1.53%	2.58%	15.7%
France	0.32%	0.81%	13.7%
Germany	0.21%	0.53%	13.6%
Greece	0.21%	0.47%	13.6%
Ireland	10.26%	12.24%	29.2%
Italy	0.44%	1.34%	14.6%
Netherlands	0.75%	1.69%	25.2%
Norway	0.72%	1.54%	17.6%
Portugal	0.24%	0.51%	22.8%
Spain	0.75%	1.04%	15.5%
Sweden	0.85%	1.88%	18.8%
Median	0.49%	1.19%	18.2%
Inter-quartile range	(0.46%)	(1.23%)	(7.8%)
<i>Eastern Europe</i>			
Estonia	0.41%	1.41%	38.4%
Hungary	2.43%	2.55%	34.3%
Lithuania	0.11%	1.50%	17.7%
Poland	0.20%	0.53%	20.4%
Romania	0.72%	1.05%	13.2%
Slovakia	1.40%	2.75%	35.2%
Slovenia	0.27%	1.27%	26.2%
Median	0.41%	1.41%	26.2%
Inter-quartile range	(0.82%)	(0.86%)	(15.7%)
Correlation with GDP	−0.164	−0.192	−0.310

available data. The value of  $Off_{man,t_0}^{mat}$  is clearly higher than for  $Off_{man,t_0}^{ser}$  (as shown e.g. by Amity and Wei (2005a,b) for the US and the UK, as well as by Winkler (2010) for Germany), which in turn is higher than  $Off_{man,t_0}^{bs}$ . However, remarkable differences emerge across countries.  $Off_{man,t_0}^{mat}$  ranges from over 30% in Estonia and Hungary, to less than 15% in France, Germany, Greece, Italy and Romania. Import of service ( $Off_{man,t_0}^{ser}$ ) and business service ( $Off_{man,t_0}^{bs}$ ) inputs account for about 2% and 1%, respectively, but again with striking differences across countries. The median value of  $Off_{man,t_0}^{ser}$  and  $Off_{man,t_0}^{bs}$  is surprisingly similar in Eastern and Western European countries, while  $Off_{man,t_0}^{mat}$  is substantially higher in the former group. This is somewhat consistent with the idea that the share of imported intermediates in total production may be inflated by the activity of incoming multinationals, which have been very active in Eastern European countries over the last decades (we will get back to this issue in greater detail below). In the three cases considered, the level of  $Off_{man,t_0}^W$  is also negatively correlated with the size of countries (measured by GDP), suggesting that smaller countries may be more involved in offshoring, although this correlation is relatively mild.

In Fig. 1 we plot  $Off_{man,t}^{bs}$ , as well as the  $M_{man,t}^{bs}$  and  $O_{man,t}^{bs}$  components, 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 ( $Off_{man,t}^{bs}$ ) 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 ( $O_{man,t}^{bs}$ ) is negligible, in other countries, such as France, Spain, Italy, Denmark, Estonia, Hungary and Slovenia, is not. As a result, in this latter group of countries the growth in the ratio of imported over domestically produced business services used in manufacturing production ( $M_{man,t}^{bs}$ ) is lower than the growth in imported business services in total manufacturing production.

This pattern is even more pronounced for service inputs as a whole. As depicted in Fig. 2,  $O_{man,t}^{ser}$  grew at the same (or an even higher) rate than  $M_{man,t}^{ser}$  in Italy, France, Belgium, Greece, Finland, Netherlands, Portugal, Estonia and Romania. Conversely, in the case of material intermediate inputs, Fig. 3 shows that  $O_{man,t}^{mat}$  has been declining in most countries, while  $M_{man,t}^{mat}$  has increased. To summarize, the evidence suggests that in the case of the aggregate of service inputs and (to a lesser extent) for the subset of business services, structural change may have played a significant role in inflating the measures of offshoring used in the literature. We will explore this aspect in greater detail using the shift-share decomposition proposed in equation 3.

#### 4.2. Shift-share analysis

This section analyzes the different contributions of the imported inputs ratio ( $M^W$ ) and structural change ( $O^W$ ) to the change of import of inputs  $W$  in total production ( $\Delta Off_{man}^W$ ) in greater detail. In particular, we report the shift-share decomposition proposed in Eq. (3). For each of the 21 EU countries considered in this analysis, Tables 2 and 3 report  $\Delta Off_{man}^W$ , the international component,  $(\bar{O} \cdot \Delta M)_{man}^W$ , the domestic component,  $(\bar{M} \cdot \Delta O)_{man}^W$ , as well as the percentage contribution of the international component to the overall change of the offshoring index,  $((\bar{O} \cdot \Delta M)_{man}^W / \Delta Off_{man}^W)$ .

##### 4.2.1. (Business) service inputs

Results in Table 2 reveals that the share of imported business services in total manufacturing production ( $\Delta Off_{man}^{bs}$ ) increased in 17 out of 21 countries. With the exception of Ireland (where it increased by 13.6% points), Sweden (1.79% points), Finland (1.41) and the Netherlands (1.22),  $\Delta Off_{man}^{bs}$  rose by less than 1 percentage point in most countries. However, given the low level of  $Off_{man}^{bs}$  documented in Table 1, the growth rate is often close or above 100%, as shown in Fig. 1. This growth would lead to conclude, in line with existing literature, that in the 1995–2005 period, business services have been substantially offshored. The shift-share decomposition, allows to appreciate that this pattern is the result of the joint contribution of both the international and domestic components. Only in five countries (Austria, Finland, Germany, Greece and Ireland) a positive contribution of  $(\bar{O} \cdot \Delta M)_{man}^W$  has not been accompanied by a significant substantial  $(\bar{M} \cdot \Delta O)_{man}^W$ . The median for  $\frac{(\bar{O} \cdot \Delta M)_{man}^{bs}}{\Delta Off_{man}^{bs}}$  is below 70% in Western Europe, suggesting that in half of these countries, the contribution of the domestic component,  $(\bar{M} \cdot \Delta O)_{man}^{bs}$ , to  $\Delta Off_{man}^{bs}$  has been above 30%. In the case of Eastern European countries,

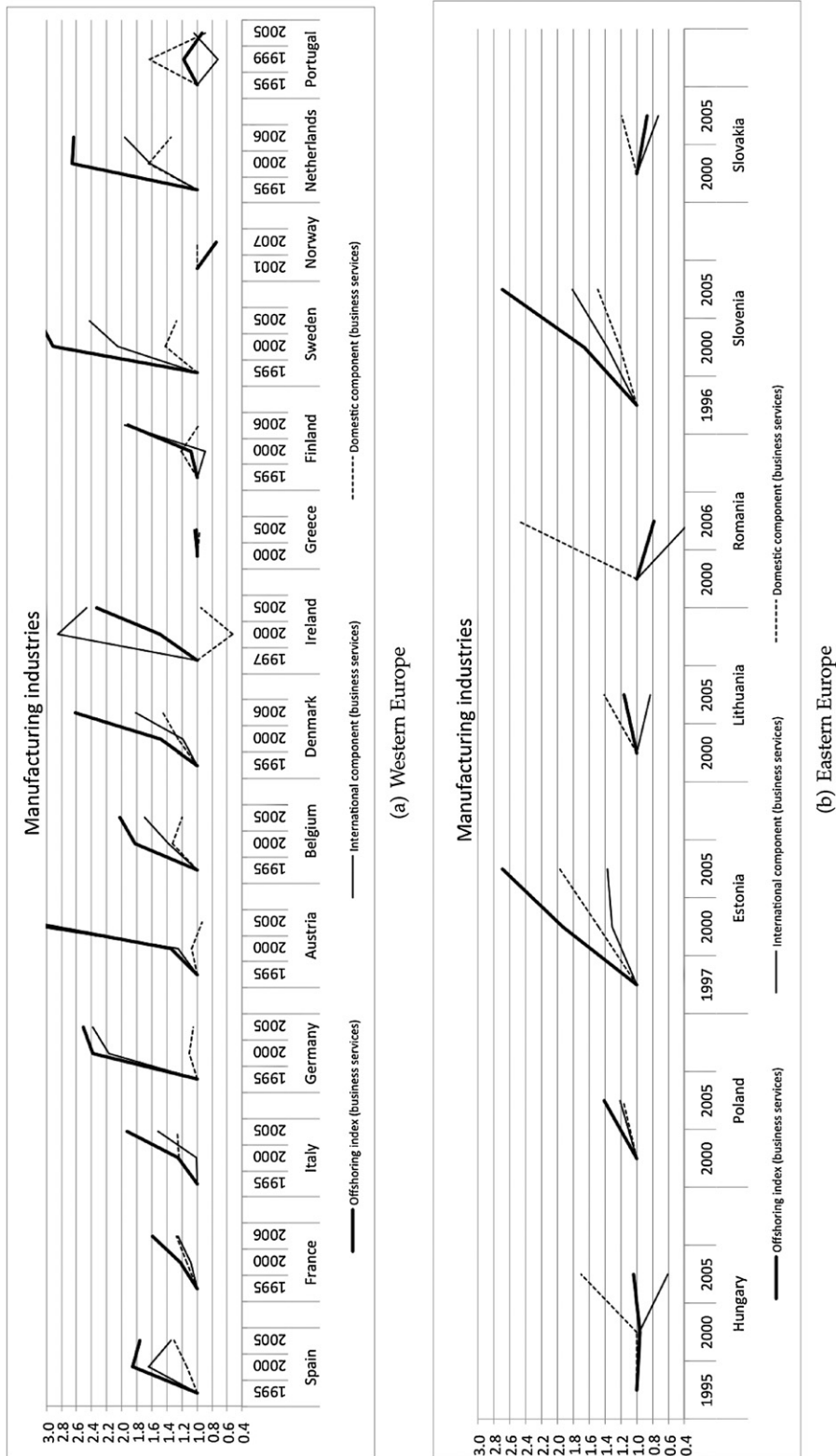
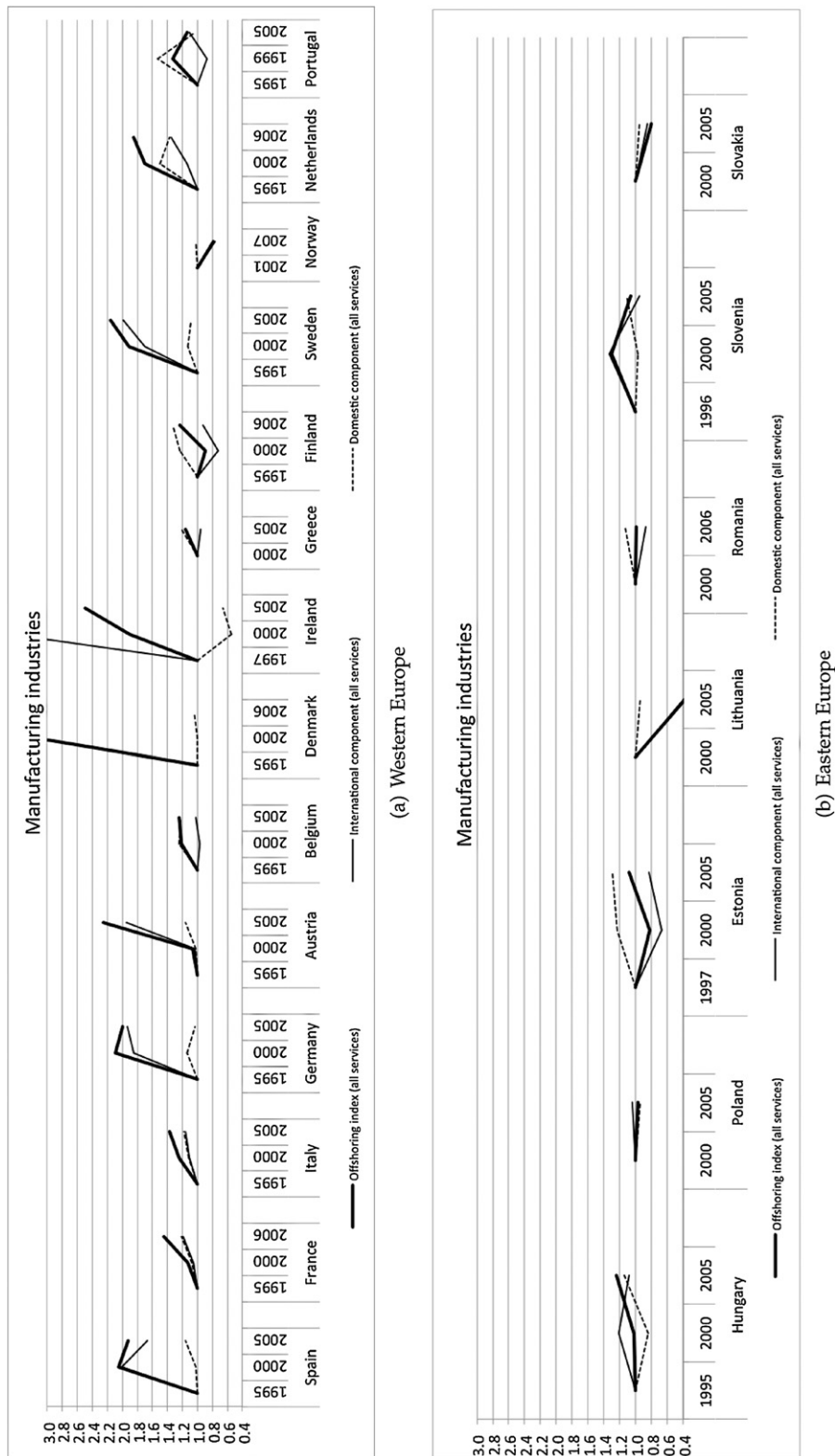


Fig. 1. Imported intermediates ratio and outsourcing in Europe: business service inputs. Numbers are normalized to 1 for the first year. Data source: Eurostat input-output tables.



**Fig. 2.** Imported intermediates ratio and outsourcing in Europe: service inputs. Numbers are normalized to 1 for the first year. Data source: Eurostat input–output tables.

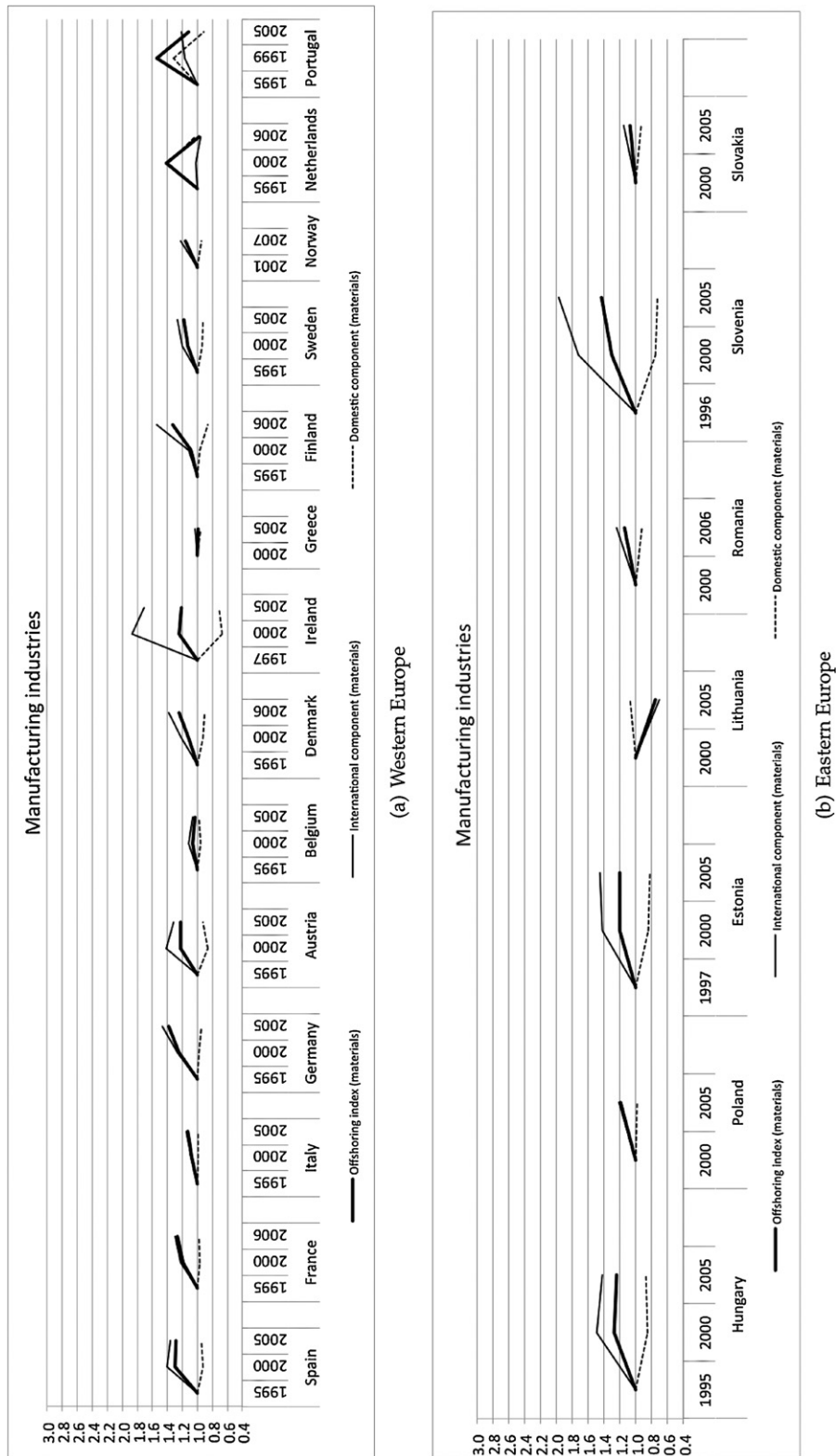


Fig. 3. Imported intermediates ratio and outsourcing in Europe: material inputs. Numbers are normalized to 1 for the first year. Data source: Eurostat input-output tables.



**Table 2**

Shift-share decomposition of offshoring indices for European countries: business services inputs.

Country (time period)	Manufacturing (15–37) (percentage points change)			
	$\Delta \text{Off}_{man}^{bs}$	$(\bar{O} \cdot \Delta M)_{man}^{bs}$	$(\bar{M} \cdot \Delta O)_{man}^{bs}$	$((\bar{O} \cdot \Delta M)_{man}^{bs}) / (\Delta \text{Off}_{man}^{bs})$
<i>Western Europe</i>				
Austria (1995–2005)	0.60	0.64	−0.04	107%
Belgium (1995–2005)	0.54	0.41	0.14	75%
Denmark (1995–2006)	0.73	0.44	0.28	61%
Finland (1995–2006)	1.41	1.45	−0.05	103%
France (1995–2006)	0.19	0.09	0.10	49%
Germany (1995–2005)	0.31	0.30	0.02	94%
Greece (2000–2005)	0.00	0.01	−0.01	–
Ireland (1997–2005)	13.60	14.60	−1.00	107%
Italy (1995–2005)	0.40	0.26	0.15	64%
Netherlands (1995–2006)	1.22	0.84	0.38	69%
Norway (2001–2007)	−0.18	−0.18	−0.01	−97%
Portugal (1995–2005)	−0.02	0.01	−0.03	62%
Spain (1995–2005)	0.56	0.30	0.26	53%
Sweden (1995–2005)	1.79	1.38	0.40	77%
Median	0.555	0.353	0.058	68.89%
Inter-quartile range	(0.875)	(0.657)	(0.256)	(33.13%)
<i>Eastern Europe</i>				
Hungary (1995–2005)	0.09	−1.28	1.37	–
Lithuania (2000–2005)	0.02	−0.02	0.04	−135%
Poland (2000–2005)	0.08	0.04	0.04	55%
Romania (2000–2006)	−0.16	−0.86	0.70	−544%
Slovakia (2000–2005)	−0.19	−0.42	0.23	−220%
Slovenia (1996–2005)	0.45	0.27	0.18	59%
Estonia (1997–2005)	0.69	0.22	0.47	32%
Median	0.080	−0.023	0.227	−51.44%
Inter-quartile range	(0.339)	(0.771)	(0.472)	(247.69%)
Correlation with GDP	−0.082	−0.063	−0.087	0.207

it is striking to notice that, while the international component is positive only in 3 out of 7 countries, the domestic component is always positive and (with the exception of Slovenia) bigger than the international component.<sup>10</sup> This is consistent with the idea that, while a trend towards the increase in business service content of manufacturing production has been characterizing the advanced economies in the 70s through the 90s, it has reached Eastern European countries between the end of the 20th and the beginning of the 21st century.

To summarize, our decomposition suggests that the usual indices of business service offshoring would tend to overestimate the actual increase in the dependence on imported inputs, due to a concurrent significant change in the organization 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 (left panel) shows that  $\Delta \text{Off}_{man}^{ser}$  is positive in all but five countries (Lithuania, Norway, Poland, Romania and Slovakia), but only in 8 countries the international component contributes to more than 50% of the change in the offshoring index. The median for  $((\bar{O} \cdot \Delta M)_{man}^{ser}) / (\Delta \text{Off}_{man}^{ser})$  is 61.5% in Western Europe and −83.4% in Eastern Europe. In some countries, including Belgium, France, Italy, Netherlands and Hungary, the contribution of  $(\bar{M} \cdot \Delta O)_{man}^{bs}$

was even larger than the contribution of  $(\bar{O} \cdot \Delta M)_{man}^{bs}$ . For example, in the case of large EU countries such as 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 0.23 and 0.17% points, respectively. In a few cases, such as Finland, Greece, Norway, Estonia, Romania and Slovenia, the international component is even negative, while the domestic component is positive. 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.

#### 4.2.2. Material inputs

Rather different considerations emerge when we consider the subset of material inputs:  $\text{Off}_{man,t}^{mat}$  has been growing in all but five countries (Table 3, right panel) and this change can be attributed entirely to an increasing importance of imported intermediate goods as a share of those produced domestically,  $(\bar{O} \cdot \Delta M)_{man}^{mat}$ . 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,  $(\bar{M} \cdot \Delta O)_{man}^{mat}$ , has actually decreased. This may reveal either that firms have internalized activities previously outsourced to domestic suppliers, or that these

<sup>10</sup> It is worth noting that  $\Delta \text{Off}_{man}^{bs}$  and  $((\bar{O} \cdot \Delta M)_{man}^{bs} / \Delta \text{Off}_{man}^{bs})$  are only mildly correlated with GDP and with opposite signs.

**Table 3**  
Shift-share decomposition of offshoring indices for European countries: service and material intermediate inputs.

Country (time period)	Manufacturing (15–37)							
	Service inputs (percentage points change)				Material inputs (percentage points change)			
	$\Delta \text{Off}_{man}^{ser}$	$(\bar{O} \cdot \Delta M)_{man}^{ser}$	$(\bar{M} \cdot \Delta O)_{man}^{ser}$	$((\bar{O} \cdot \Delta M)_{man}^{ser}) / \Delta \text{Off}_{man}^{ser}$	$\Delta \text{Off}_{man}^{mat}$	$(\bar{O} \cdot \Delta M)_{man}^{mat}$	$(\bar{M} \cdot \Delta O)_{man}^{mat}$	$((\bar{O} \cdot \Delta M)_{man}^{mat}) / \Delta \text{Off}_{man}^{mat}$
<i>Western Europe</i>								
Austria (1995–2005)	1.09	0.89	0.20	82%	3.94	9.85	–5.91	250%
Belgium (1995–2005)	0.51	0.04	0.47	8%	–0.15	5.65	–5.80	–
Denmark (1995–2006)	2.34	2.27	0.07	97%	2.63	6.53	–3.90	249%
Finland (1995–2006)	0.60	–0.22	0.82	–37%	5.30	11.03	–5.74	208%
France (1995–2006)	0.36	0.17	0.19	48%	3.47	5.99	–2.52	173%
Germany (1995–2005)	0.53	0.50	0.03	95%	4.96	6.39	–1.43	129%
Greece (2000–2005)	0.08	–0.02	0.10	–27%	–0.32	2.74	–3.06	867%
Ireland (1997–2005)	18.33	28.14	–9.81	154%	–9.36	–2.73	–6.63	–29%
Italy (1995–2005)	0.49	0.23	0.27	46%	1.60	3.90	–2.30	244%
Netherlands (1995–2006)	1.44	0.70	0.74	49%	–2.05	1.39	–3.45	68%
Norway (2001–2007)	–0.33	–0.36	0.03	–109%	3.57	5.52	–1.96	155%
Portugal (1995–2005)	0.07	0.05	0.02	74%	2.59	6.77	–4.18	262%
Spain (1995–2005)	0.96	0.75	0.22	77%	3.87	6.40	–2.53	166%
Sweden (1995–2005)	2.17	1.93	0.25	89%	1.46	5.33	–3.87	365%
Median	0.563	0.363	0.192	61.47%	2.606	5.821	–3.658	208.29%
Inter-quartile range	(0.960)	(0.811)	(0.222)	(69.71%)	(3.535)	(2.237)	(2.826)	(95.13%)
<i>Eastern Europe</i>								
Estonia (1997–2005)	0.12	–0.26	0.38	–229%	7.82	24.94	–17.12	319%
Hungary (1995–2005)	0.62	0.23	0.38	38%	8.00	19.82	–11.82	248%
Lithuania (2000–2005)	–0.95	–0.88	–0.06	–94%	–3.87	–5.14	1.26	–133%
Poland (2000–2005)	–0.01	0.02	–0.03	175%	3.88	3.60	0.28	93%
Romania (1995–2006)	–0.01	–0.15	0.13	–	2.04	4.68	–2.65	230%
Slovakia (2000–2005)	–0.53	–0.40	–0.13	–76%	3.39	6.92	–3.53	204%
Slovenia (1996–2005)	0.08	–0.07	0.15	–91%	11.39	29.92	–18.53	263%
Median	–0.011	–0.146	0.134	–83.36%	3.876	6.920	–3.525	229.94%
Inter-quartile range	(0.369)	(0.310)	(0.310)	(102.22%)	(5.196)	(18.239)	(13.284)	(106.86%)
Correlation with GDP	–0.067	–0.084	0.112	0.042	–0.175	–0.216	0.203	0.549

activities have been substituted by foreign ones. The latter interpretation is particularly consistent with the observation that an increase in  $(\bar{O} \cdot \Delta M)_{man}^{mat}$  is associated with a decrease in  $(\bar{M} \cdot \Delta O)_{man}^{mat}$ .

To summarize, the share of intermediate business services, services and materials 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, consistent with the idea that these activities have been offshored. However, a closer look at the data casts some general doubts on this interpretation as well. In fact, the median values of both  $\Delta Off_{man}^{mat}$  and are similar in Western and Eastern European countries. This suggests that the extent of material offshoring is similar in the two groups of countries. On the contrary, one would expect that offshoring has characterized relatively more advanced economies. Instead, Eastern European countries are not expected to be offshoring, but, eventually, receiving offshored production. This is confirmed by data on individual countries. 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 reflects the fact that the import of intermediates occurs not only when domestic firms offshore production abroad, but also when foreign firms locate plants in a country and source intermediates from the headquarters or other plants within the multinational supply network.

#### 4.3. Service industry

Results obtained when we use NACE 50–74 (services) as the using industries ( $j=ser$ ), reported in Table 4 are qualitatively similar and reinforce our conclusions. Not surprisingly the values of  $Off_{ser,t_0}^{bs}$  and  $Off_{ser,t_0}^{ser}$  are larger (twice as much) than the same indices for the manufacturing industry, while  $Off_{ser,t_0}^{mat}$  is negligible, since the material inputs play obviously a minor role when producing services. Similarly,  $\Delta Off_{ser}^W$  is positive for most countries and it is larger for (business) service inputs. However, in the case of the service industry, the contribution of the domestic component  $(\bar{M} \cdot \Delta O)_{ser}^W$  seems even more relevant than in the case of manufacturing. As a matter of fact, the median contribution of the imported (business) services ratio to the overall change in the offshoring measure is below 50% in Western European countries, suggesting that in more than half of these countries, the increase in  $\Delta Off_{ser}^{bs}$  and  $\Delta Off_{ser}^{ser}$  is mainly due to the rising share of services externalized to domestic producers.

#### 5. Concluding remarks

Empirical literature has provided rather strong evidence of increasing offshoring activities, both for service (including business service) and material inputs for different economies in the last decades. Most of these contributions have used indices based on imports 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 contribution of a change in the imported inputs ratio and (ii) one reflecting structural shifts in the economy. While the former may actually capture offshoring of some tasks, the latter results from a change in the organization of production within the national boundaries.

In this empirical analysis we use data for 21 European countries over the 1995–2006 period and show that the share of imported inputs in total production has grown in most of the countries. In the case of business service inputs, this increase is significantly affected by the raising share of (domestically produced) services used in manufacturing production. This is particularly true for Eastern European countries, where the imported inputs ratio has even decreased. Also in Western European countries, however, the contribution of structural shifts in domestic production is quite relevant: its median value accounts for above 30% of the total variation of the business offshoring index, reaching almost 40% in the case of aggregate services. This finding provides supporting evidence of an ongoing tertiarization process, which may wrongly be attributed to offshoring when trusting the commonly applied indices. Instead, in the case of material offshoring there is evidence that the imported inputs ratio has increased, while the degree of domestic shifts in production has decreased. This is consistent with the fact that foreign suppliers have substituted domestic ones, what could be interpreted at first sight that offshoring indices might be reliable in this case. However, this pattern is most pronounced in countries such as Estonia, Hungary and Slovenia, where incoming multinationals, rather than the offshoring process of domestic firms 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 business services, services or materials. We submit that it is crucial to distinguish to what extent higher imports are related to a more intensive use of such inputs into manufacturing production, which would result from a process of (domestic) outsourcing, or whether they actually derive from a higher propensity to import rather source those inputs domestically and thus reflecting offshoring of such tasks. For future econometric analyses this would suggest that one should additionally control for a structural change or domestic outsourcing component when using the discussed indices to estimate the effects of offshoring. Furthermore, it is necessary to be aware of the fact that importing intermediates may not be related to a process of offshoring per se. Rather, our evidence suggests that in some countries, an increase in the propensity to import intermediate material goods may be due to the

**Table 4**  
 Offshoring indices for European countries: service industries.

Country (time period)	Services (50–74)								
	Business service inputs (percentage points change)			Service inputs (percentage points change)			Material inputs (percentage points change)		
	$Off_{ser}^{bs}$	$\Delta Off_{ser}^{bs}$	$((\bar{O} \cdot \Delta M)_{ser}^{bs}) / (\Delta Off_{ser}^{bs})$	$Off_{ser}^{ser}$	$\Delta Off_{ser}^{ser}$	$((\bar{O} \cdot \Delta M)_{ser}^{ser}) / (\Delta Off_{ser}^{ser})$	$Off_{ser}^{mat}$	$\Delta Off_{ser}^{mat}$	$((\bar{O} \cdot \Delta M)_{ser}^{mat}) / (\Delta Off_{ser}^{mat})$
<i>Western Europe</i>									
Austria (1995–2005)	1.17%	0.42	–77%	3.61%	1.06	–53%	2.36%	0.58	176%
Belgium (1995–2005)	1.68%	1.12	69%	5.50%	2.26	72%	2.67%	0.76	239%
Denmark (1995–2006)	0.09%	1.50	87%	4.12%	7.72	89%	2.51%	2.52	149%
Finland (1995–2006)	0.73%	1.30	13%	2.36%	1.57	48%	2.25%	1.32	169%
France (1995–2006)	0.63%	0.25	43%	1.68%	0.09	–210%	1.71%	0.40	190%
Germany (1995–2005)	0.38%	0.54	87%	1.78%	1.77	69%	1.01%	0.33	196%
Greece (2000–2005)	0.30%	–0.02	–169%	3.47%	0.20	–3%	3.17%	0.15	568%
Ireland (1997–2005)	5.28%	1.87	–611%	9.43%	6.68	43%	4.87%	–1.32	–206%
Italy (1995–2005)	0.42%	0.30	54%	1.66%	0.27	–31%	1.65%	–0.14	7%
Netherlands (1995–2006)	1.97%	0.32	–125%	4.74%	2.79	43%	3.42%	–0.75	–45%
Norway (2001–2007)	1.39%	0.30	118%	6.86%	–0.72	–156%	4.23%	1.30	26%
Portugal (1995–2005)	0.99%	–0.17	–290%	2.71%	–0.76	–188%	2.63%	0.53	315%
Spain (1995–2005)	0.51%	0.71	65%	1.36%	1.31	44%	1.26%	0.29	125%
Sweden (1995–2005)	1.15%	1.16	76%	3.13%	1.64	79%	3.83%	0.30	427%
Median	0.86%	0.48	48.73%	3.30%	1.44	42.96%	2.57%	0.36	172.76%
Inter-quartile range	(0.89%)	(0.85)	(187.77%)	(2.66%)	(1.92)	(111.87%)	(1.51%)	(0.53)	(178.09%)
<i>Eastern Europe</i>									
Estonia (1997–2005)	2.63%	–0.51	–159%	6.96%	0.00	–	9.42%	–2.66	214%
Hungary (1995–2005)	2.64%	–0.76	–118%	3.81%	–0.07	–539%	3.04%	1.90	86%
Lithuania (2000–2005)	0.69%	–0.17	–230%	2.89%	–1.38	–110%	3.98%	0.19	535%
Poland (2000–2005)	0.34%	0.27	85%	2.23%	–0.48	–129%	2.49%	0.63	124%
Romania (2000–2006)	0.58%	0.36	–234%	1.17%	0.50	4%	6.67%	0.08	–
Slovakia (2000–2005)	2.40%	–0.73	–88%	4.05%	0.60	253%	3.01%	–0.64	–238%
Slovenia (1996–2005)	1.15%	0.80	112%	2.13%	1.40	64%	3.64%	1.33	695%
Median	1.15%	–0.17	–117.56%	2.89%	0.00	–53.03%	3.64%	0.19	169.12%
Inter-quartile range	(1.88%)	(0.94)	(193.03%)	(1.75%)	(0.82)	(173.01%)	(2.30%)	(1.27)	(359.08%)
Correlation with GDP	–0.322	0.071	0.358	–38.28%	–0.014	0.023	–0.518	–0.018	–0.114

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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 effects. In other words, the same offshoring index may capture different phenomena under different circumstances, which makes an interpretation of the effects questionable. As the title of our contribution suggest, the take-home message of our analysis is that we should not really trust offshoring indices based on input–output data.

The sad side of the story is that even if these indices provide a distorted image of offshoring, we still have to live with them. The most natural alternative, which is moving from indirect evidence of offshoring to a direct one is still far from being systematically available to researchers. Feasible alternatives relying on firm-level data are scarce and must be handled with care. As shown in Wagner (2011), also the research potential of hitherto existing firm-level data is limited: in order to achieve information both on offshoring activities and on the characteristics of firms and their performance, it is still necessary to combine different data sources, some of them expressly made for the purpose of the research.<sup>11</sup> More generally, the fundamental question in the use of survey data, exacerbated by the common practice of merging different datasets coming from different surveys with different survey designs, is that often the population of reference is, or becomes, unclear and the representativeness of the results doubtful. Moreover, since firm-level data are often available at the national level, the question of the external validity of the results at the international level must be always taken into consideration. Other sources of firm-level information on offshoring, such as the fact-sheet data from the European Restructuring Monitor<sup>12</sup> may yield supplemental insights but, as clearly mentioned on the ERM website, these data, which are based on company announcements, are indicative rather than comprehensive.

The happy side of the story is that, in spite of the questionable interpretation of offshoring indices, input–output data still represent a fundamental source of information on the extent of national and international linkages in production of manufacturing and service goods. We might not call it offshoring (always), but it still shows something that cannot be ignored. Paying attention to the distinction between international offshoring and structural change in domestic activities may still provide interesting insights. Moreover, the possibilities offered by multivariate analysis to control for possible confounders associated to offshoring (e.g.

the relevance of MNEs activities) can help interpreting the effect associated to input–output offshoring indices.

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<sup>11</sup> Specifically, Wagner (2011) draws on the “relocation of economic activities” special-purpose survey from the German Federal Statistical Office.

<sup>12</sup> Consult the Eurofound webpage <http://www.eurofound.europa.eu/emcc/erm/index.htm> for further information.

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