This is an Accepted Manuscript of an article published by Taylor & Francis in Eastern European Economics on 18/04/2018, available online: http://www.tandfonline.com/doi/full/10.1080/00128775.2018.1459194

CEE Trade in Services: Value-Added Versus Gross Terms Approaches

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Abstract
This paper assesses the impact of the determinants of service exports in both value-added terms and gross terms for seven Central Eastern European economies in 1995–2011. The results confirm the importance of increasing labor productivity and highly-skilled and medium-skilled workers in the growth of trade in services. Exports of services are also supported by linkages between domestic services, especially business services, and the manufacturing sector. The results show that the impacts of the determinants are fairly similar when exports are measured in value-added or gross terms; however, the strength of the impact differs across the countries analyzed.

JEL classification codes: C23, D54, F14, L80
Keywords: CEE economies, gross exports, trade in services, value-added exports

Introduction

Over the past decade, global value chains (GVCs) have evolved rapidly. They come in different shapes and sizes, and it may be neither possible nor desirable to create a one-size-fits-all policy to support the position and participation of countries in them. Government policy decisions require new data—new indicators to estimate and evaluate the position of countries in the new global economy. A possible solution is an analysis of trade in value added (VA), which takes into account the added value embodied in intermediate flows, in contrast to gross trade statistics, in which this flow is overlooked and so might lead to biased estimations (Foster-McGregor and Stehrer 2013; Stehrer 2013). Member countries in the European Union (EU) encounter competition in GVCs from emerging economies such as Brazil, China, and India and increasingly for high-value products. For this reason, the European Commission has "refocused attention on the central importance of a strong, competitive and diversified industrial manufacturing value chain for the EU's competitiveness and job creation potential" (EUR-Lex 2010). The importance of GVCs measured as a percentage of a country's total exports is even greater for Central Eastern European (CEE) countries than for other developed EU countries (i.e., 62.4% in the Czech Republic, 56.6% in Hungary, 50.2% in Lithuania, 49.5% in Germany, 45.9% in France),[1] and exporters in CEE

countries are usually located farther "downstream"—that is, closer to the customer buying the finished product—than in their eurozone competitors.

Although the European Commission is paying attention to the competitiveness of the manufacturing sector, the growing role of services in manufactured goods makes it worthwhile to examine the service sector closely. The problem is how the importance of services in an economy should be measured, in gross terms or in value-added terms. Differences between these measures of trade in services can be seen in the results of studies that focus on the distribution of revealed comparative advantage (RCA) as a measure of competitiveness—for example, RCA indices on German business services are significantly higher in value-added terms than in gross export terms, leading to the conclusion that the German business services sector has comparative advantages rather than disadvantages (Deb and Hauk 2017). Similar calculations for business services in India indicate that RCAs based on value added are lower than indices based on gross exports (Wang, Wei, and Zhu 2013). This leads to a new, more important, and still open question regarding the factors that determine the growth of trade in services measured in terms of value added.

So far, few analyses have been conducted on the determinants of trade in services, and they are mainly based on gross trade data. They mostly use gravity models, which often only show the impact of a few determinants on exports: market size, geographic location, language, and gaps between economies in terms of resources and technology (Dao, Pham, and Doan 2015; Grunfeld and Moxnes 2013; Guardia Bueno, Molero Zayas, and Valadez 2005; Kimura and Lee 2008; Walsh 2008). Kimura and Lee's (2008) results imply that a gravity model performs better for trade in services than for trade in goods and that geographic distance has a greater influence on services than on goods. Many studies confirm the significant role of the gross domestic product (GDP) for both importing and exporting countries (Dao, Pham, and Doan 2015), the flow of foreign direct investment (FDI) (Grunfeld and Moxnes 2013), and a common language (Walsh 2008) in explaining trade in services. Additionally, according to Wörz's (2008) analysis of the Austrian economy, a highly skilled workforce and high levels of labor productivity also have a positive effect on the competitiveness of the service sector. Marel (2011), in turn, indicates the quality of a country's governance as an important determinant of comparative advantage in conventional trade in services.

The main weakness of all these analyses is their use of service trade data in gross terms. The approach proposed by Landesmann, Leitner, and Stehrer (2015) partly eliminates this gap. Their study is an econometric analysis of the determinants of exports for 35 industries and 40 countries over the period 1995–2007 in both gross and VA terms and for both manufacturing and services. Their model includes explanatory variables highlighted by traditional and new trade theories, such as labor productivity, skill composition, the vertical cross-border production integration ratio, and domestic and foreign business service linkages. However, a weakness of their analysis is the high heterogeneity of the economies grouped in the same sample. In the present study, we focus on CEE countries, which form quite a homogeneous group of economies in terms of their GDP per capita, the large share of manufacturing goods in their total exports, and the importance of the EU market as the main destination of their exports. We also analyze the character of the linkages between the manufacturing sector and specific service sectors in more detail.

The goal of this study is thus to fill the gap in the empirical literature by finding the determinants of the export flows of services measured in both value-added and gross terms for seven CEE economies—the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, and Slovakia—using data on seven tradable service sectors (NACE 1.1) for 1995–2011.

The structure of the paper is as follows. In the first section, the significance of services in trade, in GVCs, and in manufacturing is discussed. This is followed by the research methodology and model specification. The next section contains a presentation of the data used in the analysis. In the subsequent section, we present the results of our empirical analysis of the importance of the selected determinants on trade in services in CEE countries in the period 1995–2011. The final section concludes.

The Role of Services in Trade, Global Value Chains, and Manufacturing

Especially in advanced countries, services now represent the largest share of their domestic economy, almost 70 percent of global GDP, and more than 55 percent of global employment (World Bank 2016a). In the EU, the share of services is even higher: in 2016 services accounted for 73.9 percent of the EU 28's gross value added (Eurostat 2017) and about 71 percent of total EU employment (World Bank 2016a). An increasing role of services can also be observed in international trade for two main reasons. First, the tradability of services has risen strongly over the past decade—that is, the range of services that can be digitized and traded globally has greatly expanded, such as processing insurance claims, call centers, desktop publishing, compiling audits, completing tax returns, transcribing medical records, and online education (Ghani, Goswami, and Kharas 2012). For this reason, trade in newer types of services, particularly those that can be conducted via the internet, has grown rapidly in recent years (OECD 2016). Second, deregulation in the service sector and liberalization in service trade connected with the multilateral rules on service trade established in the Uruguay Round of World Trade Organization negotiations have made a large contribution to the growth in service trade. The result of all this is that on average during the decade 2005–15, commercial service trade grew a full two percentage points faster than merchandise trade.[2] Two factors—human capital and information technologies—are crucial in explaining the dynamic growth in the exportation of modern services, especially in developing countries (Goswami, Mattoo, and Saez 2011).

Evidence at the micro-level also confirms the special role of services in trade intensity. According to Lodefalk (2013), the probability of exporting is associated with the availability and quality of services. Additionally, this availability of services is associated with the share of firms that export (Lodefalk 2014).

However, if we analyze statistics on international transactions drawn from balance of payments (BOP) figures, which reflect transactions between residents and nonresidents, the share of services in world trade appears to have been quite stable over the past two decades and oscillated only around 20 percent (Lanz and Maurer 2015). In contrast, when the role of services in trade is assessed using the share of services in the value added of gross exports, service exports become much more important. The content of services in gross exports is around 50 percent of world cross-border trade, but for five of the seven CEE countries analyzed here this share is even larger (Figure 1). This discrepancy between the "BOP

approach" and the "value-added approach" to measuring service trade can be explained by the new role of services in world trade as intermediate services: they are not only directly exported but traded indirectly as part of the exportation of goods.

<figure 1>

The dynamic growth of intermediate services in trade is connected with the rapid growth of GVCs, which are characterized by a large fragmentation of production, specialization in tasks/activities, and the outsourcing of activities. In GVCs, services provide the "link" or the "glue" at each point in the chain without which it could not happen—for example, transportation, telecommunications, logistics, distribution, marketing, design, and R&D. UNCTAD (2013) finds evidence that the quality and cost of services determine a country's participation in GVCs. How services are linked to the worldwide value chain can be shown in the case of car production in the US, where service inputs are supplied all along the value chain, and they represent nearly 30 percent of the value of the finished car (WEF 2012).[3] The size of the demand for services in GVCs is shown in another case study. The Swedish machine tool firm Sandvik Tooling uses over 40 different types of services in the various stages of production, in addition to supplying about 15 different types of services (OECD, WTO, and World Bank 2014).[4] At a macro scale, more than 70 percent of world service imports today are intermediate services used in production organized in GVCs (OECD 2012).

Services play an exceptional role in the manufacturing sector. The Organization for Economic Cooperation and Development (OECD; 2014) finds a strong positive correlation between business service productivity and labor productivity in manufacturing. Three key drivers encourage manufacturers to incorporate more services at all stages in product value chains (USITC 2013): first, an increasing geographical dispersion of specialized supply chains, which causes low-skill production work to move to low-wage locations; second, a need to cut costs and improve efficiency, which forces firms to use a variety of new technologies (often information, communications, and technology [ICT] services); and, third, opportunities for premium pricing or improved market positions by providing services (often business services) to better differentiate and customize products.

The increasing role of services in manufacturing is often described in the literature as the "servicification" of manufacturing,[5] that is, manufacturing in which value added by the service sector is becoming more important (Baldwin, Forslid, and Ito 2015). The great intensity of servicification is an effect of modern manufacturing production processes, which form a U-shaped curve and are characterized by three major stages: pre-fabrication services (high value added), fabrication (low value added, with activities offshored to emerging and developing economies), and post-fabrication services (high value added).[6] This means that the content of service-added value is high in manufacturing trade and in CEE manufacturing exports, where service-added value accounts for almost 40 percent of the gross exports of manufacturing industries (Figure 2).

<figure 2>

Even though the domestic sourcing of services accounts for most of the servicification in world manufacturing, international sourcing of services, as captured by the foreign service–added value content of exports, is significant in CEE countries such as the Czech Republic, Estonia, Hungary, and Slovakia. Among these services, financial intermediation and business

services play an extremely important role. They are an integral part of GVCs and are often outsourced or offshored by companies in GVCs. Both sectors—financial intermediation (sector J) and business services (subsectors K71–74)—have the highest shares of the total trade in services in 2011, unlike 10 years ago (OECD 2012).

In sum, the service sector is making an increasingly significant contribution to export growth in all countries and, at the same time, represents a great opportunity to find new comparative advantages in trade.

Research Methodology and Model Specification

We take two concepts into consideration in order to evaluate the trade in service sectors and its determinants. The first approach is based on total gross exports, and the second uses domestic value-added exports.

The decomposition of gross export flows uses a methodology proposed by Wang, Wei, and Zhu (henceforth WWZ; 2013).[7] WWZ's approach provides detailed information on 16 components of exports, in particular about the domestic value-added (*DVA*) exports absorbed abroad. In the general case of G countries and N sectors, WWZ's model of the decomposition of total exports is expressed as follows:[8]

$$
\begin{aligned}
E^{s*} = {} & \underbrace{(V^s B^{ss})^T \# \sum_{r\neq s}^{G} Y^{sr}}_{DVA\_FIN} + \underbrace{(V^s L^{ss})^T \# (\sum_{r\neq s}^{G} A^{sr} B^{rr} Y^{rr})}_{DVA\_INT1} + \underbrace{(V^s L^{ss})^T \# (\sum_{r\neq s}^{G} A^{sr} \sum_{t\neq s,r}^{G} B^{rt} Y^{tt})}_{DVA\_INTrexI1} \\
& + \underbrace{(V^s L^{ss})^T \# (\sum_{r\neq s}^{G} A^{sr} B^{rr} \sum_{t\neq s,r}^{G} Y^{rt})}_{DVA\_INTrexF} + \underbrace{(V^s L^{ss})^T \# (\sum_{r\neq s}^{G} A^{sr} \sum_{t\neq s}^{G} \sum_{ru\neq s,t}^{G} B^{rt} Y^{tu})}_{DVA\_INTrexI2} \\
& + (V^s L^{ss})^T \# (\sum_{r\neq s}^{G} A^{sr} B^{rr} Y^{rs}) + (V^s L^{ss})^T \# (\sum_{r\neq s}^{G} A^{sr} \sum_{t\neq s,r}^{G} B^{rt} Y^{ts}) \\
& + (V^s L^{ss})^T \# (\sum_{r\neq s}^{G} A^{sr} B^{rs} Y^{ss}) + (V^s L^{ss})^T \# (\sum_{r\neq s}^{G} A^{sr} \sum_{t\neq s}^{G} B^{rs} Y^{st}) \\
& + (V^s B^{ss} - V^s L^{ss})^T \# (\sum_{r\neq s}^{G} A^{sr} X^r) + (\sum_{r\neq s}^{G} V^r B^{rs})^T \# Y^{sr} + (\sum_{t\neq s,r}^{G} V^t B^{ts})^T \# Y^{sr} \\
& + (\sum_{r\neq s}^{G} V^r B^{rs})^T \# (A^{sr} L^{rr} Y^{rr}) + (\sum_{t\neq s,r}^{G} V^t B^{ts})^T \# (A^{sr} L^{rr} Y^{rr}) \\
& + \sum_{r\neq s}^{G} (V^r B^{rs})^T \# (A^{sr} L^{rr} E^{r*}) + \sum_{t\neq s,r}^{G} (V^t B^{ts})^T \# (A^{sr} L^{rr} E^{r*}),
\end{aligned}
\qquad (1)
$$

where E^{s*} is an N×1 vector of the total gross exports by country *s*, A^{sr} is an N×N block matrix of input-output coefficients, B^{sr} is an N×N block global Leontief inverse matrix, X^{sr} is an N×1 vector of gross output, Y^{sr} is an N×1 vector for global use, V^s is a 1×N vector of the direct value-added coefficients of country *s*, and L^{rr} is an N×N local Leontief inverse matrix.

When considering DVA that is absorbed abroad, we take both exports of final goods (*FIN*) and exports of intermediate goods (*INT*) into account. Two patterns emerge in the trade of intermediate goods: they can be exported to direct trade partners (*DVA_INT1*) or re-exported to third countries via a direct partner (*DVA_INT2*). Additionally, DVA in intermediate exports that are re-exported to third countries as intermediate goods can be used to produce domestic final goods (*DVA_INTrexI1*) or to produce exports (*DVA_INTrexI2*). They can also be re-exported as final goods (*DVA_INTrexF*). We note that, according to WWZ's decomposition, DVA that is absorbed abroad is described by the proportion of the country-sector's gross exports that is produced domestically. This is the so-called backward-

linkage-based value-added approach for the exporting sector, and it explains the phenomenon from the importer's or user's perspective.

In our investigation, in addition to the levels of total gross exports and DVA, we use revealed comparative advantage (RCA) indices constructed on the basis of both gross exports and DVA. The RCA indices use the classic formula proposed by Balassa (1965),

$$RCA_{i,j} = \frac{X_{i,j}}{\sum_j X_{i,j}} \Bigg/ \frac{\sum_i X_{i,j}}{\sum_i \sum_j X_{i,j}}, \tag{2}$$

and express the relative comparative advantage of a particular tradable service subsector *i* of country *j* in relation to the total exports of the country as a share of world exports.

The literature review above identifies the factors that determine trade in services. In addition to labor force composition and labor productivity, because of the growing role of indirect exports of services through manufacturing sectors, our model takes into account the servicification of manufacturing. The phenomenon is reflected in the service-value-added share of manufacturing exports (*SMlink*). Depending on the locus of service production, we distinguish between domestic (*domestic_SMlink*) and foreign (*foreign_SMlink*) service contents of exported manufactured goods. The lack of a complete database on the phenomenon forced us to devise the necessary variables.[9] To calculate them, we use the OECD TiVA methodology (OECD 2015). The DVA by services and the foreign value added by services embodied in a country's manufacturing exports are calculated as follows:

$$domestic\_SMlink = V_{domSERV}(I - A)^{-1} TEXP_{manuf}, \tag{3}$$

$$foreign\_SMlink = V_{forSERV}(I - A)^{-1} TEXP_{manuf}, \tag{4}$$

where *V* is an N×GN matrix with the share of the value added in the total output of the particular tradable service sector of interest and zero otherwise, $(I\text{-}A)^{-1}$ is a GN×GN inverse global Leontief matrix, and $TEXP_{manuf}$ is a GN×G matrix reflecting the gross exports of the manufacturing sector in the CEE countries and zero otherwise.

All the calculations are conducted separately for each country and each year. In our case, for the domestic linkages calculations, *V* is a 34×1,394 matrix, where 34 is the number of sectors in the economy. In this matrix, only seven non-zero values are observed, one value per row for particular service sector. These values reflect the value-added share of gross output for an individual service sector *i* (e.g., for sector I60, inland transport) and for an individual country *j* (e.g., the Czech Republic). $TEXP_{manuf}$ is a 1,394×1 vector for a particular CEE country *j* in the analysis (e.g., the Czech Republic). The vector $TEXP_{manuf}$ contains data on manufacturing exports (sectors 15–36) for the country and is zero otherwise. The inverse Leontief matrix is a 1,394×1,394 matrix. The calculations are done using equation (3).

The only differences between the domestic and foreign linkages calculations are observed in matrix *V*. When the calculations for the foreign linkages are done, the 34×1,394 *V* matrix contains the value-added share of gross output for a given service sector *i* (e.g., for sector I60, inland transport) and for all countries apart from country *j* (we consider all the countries in the World Input-Output Database [WIOD] after extracting, e.g., the Czech Republic). We note, at the same time, that country *j* is an exporter of manufactured goods, and its manufacturing exports are reflected in vector $TEXP_{manuf}$, which looks identical to that for the domestic linkages calculations. Further calculations are based on equation (4).

The total service sector content of the manufacturing exports of country *j* is the sum of the domestic and foreign content.[10]

Before evaluating trade in services in the CEE countries, we assess the unit root of the variables used in the analysis. To do this, we employ the adjusted Dickey-Fuller–Fisher test for unbalanced panels. The selection of lag length is based on the Akaike information criterion.

The relationship between an export performance measure and its determinants for tradable service sectors *i* and for selected CEE countries *j* over the period 1995–2011 is expressed by the following equation:

$$EXP\_IND_{ijt} = \beta_0 + \beta_1 HS_{ijt} + \beta_2 MS_{ijt} + \beta_3 \ln LPRO_{ijt} + \beta_4 SMlink_{ijt} + \mu_i + \upsilon_j + \varepsilon_{ijt}. \quad (5)$$

In our model, we use four indicators as an export performance measure (*EXP_IND*). First, we compare the logarithm of exports of services in gross terms (*lnTEXP*) and flows expressed as the logarithm of DVA exports in services (*lnDVA*). The second approach compares the results obtained for RCA indices calculated on the basis of both gross exports (*RCA_TEXP*) and DVA (*RCA_DVA*). The source of *TEXP* is the WIOD (Timmer et al 2015), World Input-Output Tables.[11] The same tables are used in WWZ's decomposition and in calculation of the *DVA* variable. Both RCA indices are based on equation (2).

We do not use explanatory variables, which are often used in a gravity model (such as GDP per capita, language, or distance), because they do not explain the nature of services trade. From the perspective of export growth, an increase in highly skilled labor is a good indicator of labor productivity growth. Thus, the structure of employment is taken into account. *HS* and *MS* denote the respective shares of hours worked by highly skilled and mediumskilled workers in total hours worked. Both variables are derived directly from the WIOD Socio-Economic Accounts.

LnLPRO is the logarithm of labor productivity, which is obtained as the relation between value added based on 1995 prices corrected using the current exchange rate and the total hours worked by employees. Value added at current prices in national currency, price indices of gross value added (1995 = 100), and total hours worked by employees are taken from the WIOD Socio-Economic Accounts. The source for exchange rates is the OECD database.

SMlink reflects the sum of domestic linkages calculated according to equation (3), and foreign linkages calculated according to equation (4). All calculations use the WIOD.

Additionally, given the high importance of financial intermediation and business services, we assess whether this specific group of services, comprising sector J and sector K71t74 and its linkages to the manufacturing sector, influence export performance. To do this, interactive variables, *SMlink_J* and *SMlink_K71t74,* are calculated as the product of *SMlink* and dummy variables constructed for sector J and sector K71t74. Analogous variables are computed for domestic and foreign linkages.

Data Description

Our investigation uses an unbalanced panel, which consists of country-sector annual data for seven CEE countries—the Czech Republic, Estonia, Hungary, Latvia, Lithuania,

Poland, and Slovakia—and for seven service subsectors treated as tradable. The analysis covers the period 1995–2011. The tradable service sector taken into consideration in NACE 1.1 consists of transport services—inland transport (I60), water transport (I61), air transport (I62), other transport services (I63), post and telecommunication services (I64), financial intermediation services (J) and business services (K71t74)[12]—which comprise rental services for machinery and equipment, computer and related services, research and development, and other business activities.

For all the countries and for the entire period, the VAX (domestic value added to gross exports) ratio (Johnson and Noguera 2012) is higher for the service sector than for the entire economy (Figure 3). The ratio fluctuates between 72 percent in Estonia and 83 percent in Lithuania at the end of the period. However, the highest ratio is observed in 1995 in Poland (90%). The VAX ratio for the entire economy declines in all the countries except Estonia, where slight growth is observed. The main reason for this downward trend is a drop in the DVA for manufacturing sectors because of growth in the importance of vertical specialization over the years analyzed.

<figure 3>

Regardless of which economy and period are analyzed, the share of DVA by service activities in total domestic value added is higher than that of gross service exports in total gross exports. At the end of the period, the highest level is observed in Latvia, with 85 percent of the total DVA generated in the economy represented by DVA in services. Moreover, the other Baltic countries achieve a higher share than the other CEE countries: 56 percent and 47 percent respectively in Lithuania and Estonia. At the end of 2011, DVA in services constituted less than 20 percent of the total DVA in the Czech Republic, Poland, and Slovakia.

Regarding RCA indices (Figure 4), especially those measured in DVA, the advantage revealed in the Baltic countries in trade in services should be highlighted. Latvia and Estonia achieve advantages over the whole period, whereas in Lithuania stable growth in its RCA is seen, with comparative advantages beginning in 2004 in Lithuanian trade in services (the RCA index based on gross exports is greater than 1 for the whole period). The patterns of the RCAs in the Czech Republic, Hungary, and Slovakia are similar. For Czech and Slovak trade in services after 1998 and for Hungarian trade after 1999, the RCA based on DVA is higher than the RCA based on gross exports, but it does not provide comparative advantages in these countries.

<figure 4>

Taking intersectoral linkages into consideration, in 2011, the highest service-value-added content in manufacturing exports is 37 percent and 32 percent respectively in Hungary and the Czech Republic (Figure 5). In the Baltic countries, this share ranges from 24 percent to 27 percent. The results differ slightly in comparison to Figure 2, where the Baltic countries and Latvia in particular play key roles in the service contribution to manufacturing exports. The difference is a result of the number of service sectors taken into account: seven tradable sectors, rather than divisions 45–95. However, when we compare the structure of the service-value-added contribution, the importance of foreign services emerges. For the service sectors analyzed at the end of the period, domestic service content exceeds foreign content only in Latvia and Estonia.

<figure 5>

Regarding the structure of the total service contribution to manufacturing exports by the type of service sector, the growing role of financial intermediation and business service sector K71t74 (Figure 6) are worth highlighting. At the end of the period, the joint input of both service sectors to manufacturing exports is the highest in Hungary, at 27 percent, and in the Czech Republic (21%) and Slovakia (19%). Their significance in indirect exports through manufacturing is also visible in the growth in this contribution over the years analyzed. Between 1995 and 2011, Hungary enlarged its service sector share in exported manufactured goods by sixteen percentage points, the Czech Republic by thirteen percentage points, and Estonia, Latvia, Poland, and Slovakia by about ten percentage points. The lowest growth is observed in Lithuania, at seven percentage points of growth, which is relatively high in comparison to growth in the other sectors.

<figure 6>

The second sector that contributes strongly to manufacturing is inland transport (sector I60). In this area, the leading countries are Lithuania, with a contribution of 9 percent, and then Estonia and the Czech Republic (both 5.5%).

Estimation Results

The estimation procedure consists of two stages. First, we use exports measured in gross terms and in value added terms as dependent variables in equation (5). Next, we use RCA indices determined using both gross exports and value added in exports as the explained variable in the same model.

The results for exports measured in the two ways are in Table 1. When we compare all four estimations, we find only slight discrepancies between the coefficients for particular variables. Regardless of the regression estimated, we obtain stable and statistically significant coefficients for highly skilled and medium skilled workers, labor productivity, and domestic linkages between service sectors in manufacturing.

<table 1>

Considering skill composition, contrary to the findings of, for example, Landesmann, Leitner, and Stehrer (2015) for 40 countries and analogous service sectors, the influences of highly and medium-skilled labor on export performance are quite similar. The strength of the impact does not depend on either the specification of the model or the export measure. Growth in hours worked for both groups of workers generates an increase in the export indicator of around 5 percent. Because of the concentration of CEE services exported to high-income EU countries, the role of highly and medium-skilled labor in achieving a high quality of services is not surprising (Bustos 2011).

As a main determinant of export activity in new trade theory (see the model in Melitz 2003), labor productivity affects export indicators positively and significantly, which is in line with our expectations.

Given the goal of this paper, it is interesting to look more closely at the linkages between service sectors, in particular, business service sectors and manufacturing exports. We hypothesize that a specific structure, that is, strong linkages between domestic/foreign service and manufacturing exports, indirectly supports trade in services. Services play a crucial role

as intermediate inputs in manufacturing exports, and trade is an important channel through which firms can improve their access to foreign services, in the form of either lower prices or greater choice (more variety). It has two effects. First, countries that have open service markets tend to be more competitive in manufacturing (François and Woerz 2008; Nordås 2010) and have productivity gains in downstream manufacturing firms (Arnold, Javorcik, and Mattoo 2011). Second, exposing domestic service firms to foreign competition affects the quality of service exports and supports the direct exports of tradable service industries. For these results to hold, a country must have a good business environment (Amiti and Khandelwal 2013). Because of the variable quality of institutions in CEE countries (high in Estonia, Latvia, and Lithuania and relatively low in Poland, Hungary, the Czech Republic, and Slovakia), which we analyze using the World Bank's "Doing Business Survey," (World Bank 2016c) we expect a slight, positive effect of growing foreign value added by services embodied in a country's manufacturing exports on direct service exports.

Analyzing the coefficients from regressions (1) and (3), the only significant influence is observed in the case of linkages with sector K71t74. This sector's contribution to manufacturing trade is significant (Figure 6), which might explain the impact of this sector on service trade. Our research confirms the worldwide trend toward trade in services in which business services drive manufacturing trade (Loungani et al. 2017). Business services seem to allow productivity growth through the same Kaldorian mechanisms that have traditionally made manufacturing the key engine of growth (Di Meglio et al. 2015).

More details on the relationship can be shown by dividing the total service content of manufacturing exports according to where the production of services takes place. The DVA of all the tradable service sector content of domestic manufacturing exports does not support service export performance. In order to precisely explain the negative coefficient for domestic linkages (*domestic_SMlink*) in regressions (2), (4), (6), and (8), we additionally estimate these models, replacing the variable with a new variable in which sectors J and K71t74 are removed. Keeping the other coefficients stable, the results show a strong negative and statistically significant impact of the factor when only non-business sectors are taken into consideration. This finding suggests that strong domestic service linkages hinder the performance of some service exports. This is related to domestic transport services (land, water, and air transport), that is, growing content of transport services in manufacturing exports does not support direct exports by tradable service industries. The reason could be the poorly developed market for transport services in CEE countries, which is confirmed by their low positions in the International LPI Global Ranking (World Bank 2016b).[13] By their nature, transport services are sourced externally by most manufacturers. Many manufacturing exporters sell their products in a value chain, and they expect top-quality reliability standards of transport services to reduce costs. Having low-quality or high-cost transport services, especially in poorly developed transport markets, negatively affects the competitiveness of manufacturing exports and, of course, does not support the direct export of such services (Nordås and Kim 2013).

But when we take business service sectors into consideration, we find a strong positive and statistically significant influence on export of services. This means that this dynamically growing sector, which strongly contributes to manufacturing trade, through this channel also supports trade in services. Domestically produced services matter in shaping export flows, but

services that are produced abroad as intermediate goods and are exported by manufacturing do not influence exports of services.

As a second step, we evaluate the impact of selected determinants on RCA indices, again measured in two ways: in gross terms and value-added terms (Table 2). As before, an increase in the hours worked by both highly skilled and medium-skilled employees leads to growth in the exports indicator. Both groups strongly determine the growth in the comparative advantages in CEE countries. However, the influence of the human factor is almost twice as strong when we take value-added-based RCA into account.

<table 2>

When we consider the coefficients related to the service content of manufacturing exports, we see crucial discrepancies between the influence of the determinants of RCA, measured in the two ways. The RCA index constructed on the basis of value added reacts much more strongly to changes in service-manufacturing linkages, especially in the case of totally domestically produced services. When we take into consideration total service linkages, we find a statistically significant influence only in the value-added model. As in our first step, the total linkages affect RCA in a negative way, but both business service sectors (J and K71t74), regardless of the location of their production, enlarge RCAs. The same situation is observed in the case of domestic services contributing to the manufacturing sector. Unlike foreign linkages, domestic services are able to support growth in comparative advantages.

The only difference in comparison to the results obtained in the first step is for labor productivity, which has a negative and significant impact on value-added-based RCA. The negative impact of growing labor productivity on RCA can be explained by labor migration and earlier retirement of highly skilled workers, which drives wages to grow more quickly than in the EU overall.

To sum up, our research supports the conclusions of Koopman et al. (2010) for manufacturing industries and Grater (2014) for service industries. Countries have a lower comparative advantage in their main industries when double counting of intermediate goods is removed from the equation. These authors suggest that RCA should instead be calculated on the basis of DVA data. In our study, the RCA index constructed on the basis of value added also reacts much more strongly to changes in selected factors than the RCA based on gross data.

When we compare Figures 3 and 4, we see a kind of "Baltic countries model" for Estonia, Latvia, and Lithuania and a "Visegrad countries model" for the Czech Republic, Hungary, Poland, and Slovakia. For this reason, we evaluate the differences between the impact of selected determinants on exports and value-added exports in the two groups of countries. The results are presented in Table 3.

<table 3>

The most noticeable discrepancy is in labor productivity. This factor influences both gross exports and DVA much more strongly in the Baltic countries. Each 1 percent increase in *LPro* results in about 1 percent growth in exports for the latter group, while in the Visegrad countries the increase in exports is around 0.25–0.32 percent.

Regarding labor force composition, highly skilled workers support growth in exports and value-added exports more strongly than medium-skilled workers, especially in the Visegrad group. As the analysis conducted by Rodríguez, Melikhova, and Camacho (2018)

(based only on intermediate service exports) shows, in the Baltic countries the categories of more knowledge-intensive services are gaining more importance as exports, although traditional services comprise a major share of the total volume of intermediate service exports.

In comparison to previous models, our models reveal that total foreign service linkages have a positive and significant influence on service exports only in the Visegrad countries. However, foreign financial intermediation, foreign business service sectors, and their contribution to manufacturing exports are associated with decreasing performance by service exports. According to Melikhova et al. (2015), business services in the Visegrad countries also appear to be at the heart of service vertical FDI.[14] This would normally be accompanied by growth in exports. As in Table 1, the domestic services comprising sector K71t74, which contribute to manufacturing exports, generate growth in the services trade.

Conclusions

In the modern economy, services are no longer nontransportable, nontradable, or nonscalable. Rather, they should be treated as a niche, in which each economy can develop comparative advantages beyond manufacturing and find a new path for increasing trade. As our results show, service sectors have made a significant contribution to CEE exports, especially if we measure it in value-added terms. Not only does the direct contribution of services to exports remain high, but so does their indirect contribution embedded in manufacturing exports.

In our analysis, we pay particular attention to potential differences resulting from the two ways of expressing the volume of the service export flows. To date, analyses comparing the determinants of exports in value-added and gross terms are rare. They often analyze the variables explaining manufacturing export using a gravity model (Choi 2013; Guilhoto, Yücer, and Siroën 2015; Nakazawa, Norihiko, and Webb 2014; Yücer, Guilhoto, and Siroën 2014) or an econometric model, as highlighted in traditional and new trade theories (Landesmann, Leitner, and Stehrer 2015; Olczyk and Kordalska 2017). Although the results of these analyses are sometimes misleading, they usually show that selected determinants on manufacturing exports, whether in value-added or in gross terms, have a similar impact. The same conclusion applies to analyses of the trade determinants in services. In our study and a few others (Landesmann, Leitner, and Stehrer 2015), calculations in value-added and gross terms do not, in most instances, show very strongly differentiated results. In our opinion, the reason for this lies in the methodology. The methodology on trade in value added is still noticeably incomplete. This prevents us from capturing some potential differences in input-output structures, which characterize export activity in an economy in comparison to production for the domestic market. According to Landesmann, Leitner, and Stehrer (2015), the available studies based on the WIOD do not differentiate between input-output relationships that characterize production for exports and those for the domestic market. This is because slicing up the value chains might distort the link between gross exports, domestic practices, and cost trends. Further research is needed to improve the trade-in-value-added methodology in these types of analysis. Moreover, a modification of the conventional

determinants of trade in value added is desirable, for example, replacing the unit labor cost with the trade-weighted unit labor cost (Lommatzsch, Silgoner, and Ramskogler 2016).

Our results also indicate that the linkages between domestic services (especially financial intermediation services and business services) and manufacturing are significant in explaining CEE export growth. Labor productivity and high-quality human capital are crucial determinants of export growth in service sectors.

The results of this study should be regarded as preliminary and requiring verification. We hope that the results of the estimations will contribute to discussion of the instruments that can help accelerate service-led export growth in CEE economies. We consider this path the largest opportunity for CEE economies to develop, generating more value-added participation in global GVCs and reducing their gaps with the most developed economies. Therefore, policy makers should be open to a change in perspective when crafting trade policies by taking into account the development of service sectors.

The main policy recommendation that emerges from our analysis is to open up the service sector to foreign participation. Having domestic service markets that are more open will foster innovation and productivity. Further regulatory reform of service markets will create opportunities for firms to develop new services, improve the quality of existing services, and meet emerging global demand. In opening service markets, the reduction of public ownership in competitive industries, such as air transport, and of barriers to entrepreneurship are particularly desirable.

We also recommend building up skills to move into more sophisticated services to generate greater value added. All the partnerships and co-financing by firms, workers, and governments to foster life-long learning are essential. In addition, the incentives for private financing of life-long learning should be improved, as well as equitable access to formal and on-the-job learning.

Finally, we suggest adapting innovation policies to the growing importance of innovation in services. Policy makers should consider how existing public R&D can better address the needs of the services sector and how to improve the links between service sector firms and manufacturing.

Further analyses are needed. Any analysis that advances understanding of how various manufacturing GVCs use and supply services is desirable. From the methodological point of view, further estimation of the models for a longer time series would be appropriate. When the data become available in different databases, new explanatory variables, such as ICT intensity or services restrictiveness, can be taken into account in our model.

Moreover, it is evident that a large and diverse range of business-related services interface with manufacturing in different ways, for example, by providing various technological, operational, distributive, and financial capabilities. We can disaggregate the business services sector into more specific groups for instance, for knowledge-intensive business services and other business services, and analyze more deeply the business services linkages to manufacturing sector.

The limitations related to data on services are very well understood. They are related to differences in reporting, reliability, definitions, and collection methods among countries. Although many international efforts have been made to improve the comparability and coverage of service trade statistics, our results should be interpreted with caution.

Acknowledgments

The authors gratefully acknowledge the comments on an earlier draft of this paper from the participants of the CASE 25th Anniversary Conference "The Future of Europe" in Warsaw and participants of seminar at Faculty of Management and Economics, Gdańsk University of Technology. We especially appreciate the comments and suggestions received from Professor Aleksandra Parteka from Gdańsk University of Technology.

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[1]https://www.ecb.europa.eu/home/pdf/research/compnet/20131212/ws_3_iossifov.pdf?12244fa23bc7a0682cd1ec77c52f6659/.

[2]Commercial service exports are defined as total services excluding government services, according to the WTO database time series on international trade.

[3]The following activities and components go into the production of a typical American car (services in italics): 1. *R&D for advanced technology* (Japan, 17.5%); 2. *Design* (worldwide, est. 3%); 3. *Assembly* (South Korea, 30%); 4. *Assembly* (US, 37%); 5. *Supply of minor parts* (Taiwan, 4%); 6. *Advertising and marketing* (UK, 2.5%); 7. *Data processing* (Ireland and Barbados, 2%); 8. *Transport and insurance* (worldwide, est. 4%) (WEF 2012).

[4]In another case study, only 9% of the value of a $450 man's suit jacket made in China and exported to the US can be traced to direct manufacturing costs. The other 91% consists of various services, intellectual property, profits, and other "invisibles" that are difficult to quantify (OECD 2014).

[5] "Servicification" of manufacturing is also called "servicizing" and "manuservice" (Low 2013).

[6]Some argue that in OECD countries the U-shaped curve has tended to deepen, from relatively flat—meaning value is evenly spread all along the chain—to fully U-shaped, in which fabrication and assembly account for a much lower share of value (OECD 2013).

[7]We use the decompr R package provided by Quast and Kummritz (2015).

[8]For the details of the decomposition, see Wang, Wei, and Zhu (2013), appendix J.

[9]In the OECD TiVA database (OECD 2015), the intersectoral linkages are available for 1995, 2000, 2005, 2008, 2009, 2010, and 2011.

[10]All our calculations of intersectoral linkages are available on request.

[11]In our investigation we use NACE rev. 1.1 because the complete WIOD database release 2016 (WIOD Tables and Socio-Economic Accounts), which uses NACE rev. 2, was not available. Among other reasons, the Socio-Economic Accounts contain data for the structure of employment, which we use in our model specification. The Socio-Economic Accounts, Release 2016 are only published in February 2018.

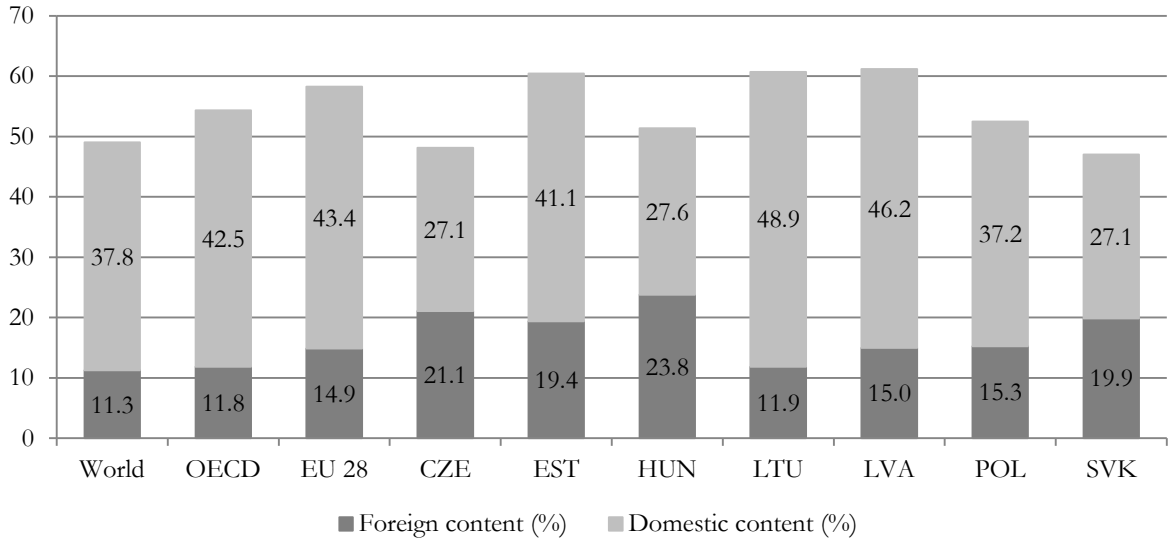
[12]The definition of business services included in one of the first documents related to the phenomenon (Commission of the European Communities 1998) does not take category K73 (research and development) into account. In newer Eurostat documents (European Commission, Eurostat 2009) business services contain only the categories K72 and K74.1 to K74.5. However, in, e.g., OECD publications (OECD 2012), the category research and development is classified as a business service sector. In the WIOD database, release 2013, the main database used for our analysis, the divisions from K71 to K74 are taken together, and there is no possibility of excluding particular categories, e.g., K73, from the wider category K71-K74. As a result, in empirical papers, the entire category K71-K74 is treated as a business services sector (Kordalska, Parteka, and Wolszczak-Derlacz 2016; Landesmann et al. 2015; Melikhova et al. 2017; Rodríguez and Camacho 2016; Wang, Wei, and Zhu 2013).

[13]The Global Ranking of Countries by Performance Logistics Index published by the World Bank ranks 160 countries on six dimensions of trade—including customs performance, infrastructure quality, and timeliness of shipments—that have been increasingly recognized as important to development (https://wb-lpi-media.s3.amazonaws.com/LPI_Report_2016.pdf).

[14] Service vertical FDI takes place when the multinational fragments the production process internationally, locating each stage of service production in the country where it can be done at the least cost.

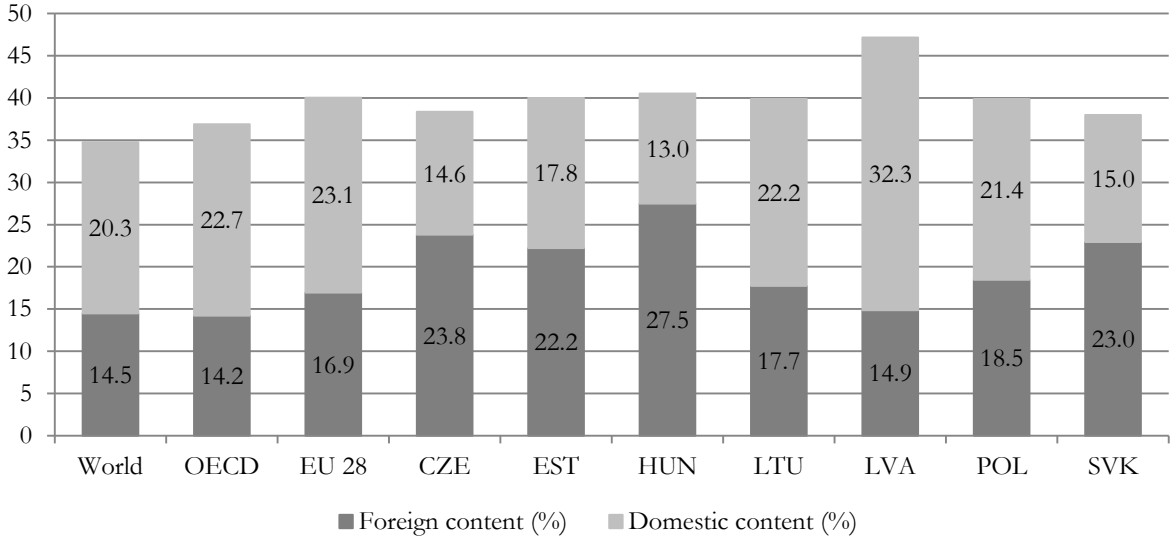
<appendix1>

Figure 1. The percentage of the value-added content of services in gross exports in 2011.



Source: OECD-WTO TiVA database.
Note. The domestic (foreign) share of the added value of services in gross exports is the share of the domestic (foreign) value added by service industries in the total gross exports by industry *i* in country *c*. For this measure, the service industries include ISIC Rev. 3 (NACE Rev. 1) divisions 45 to 95.

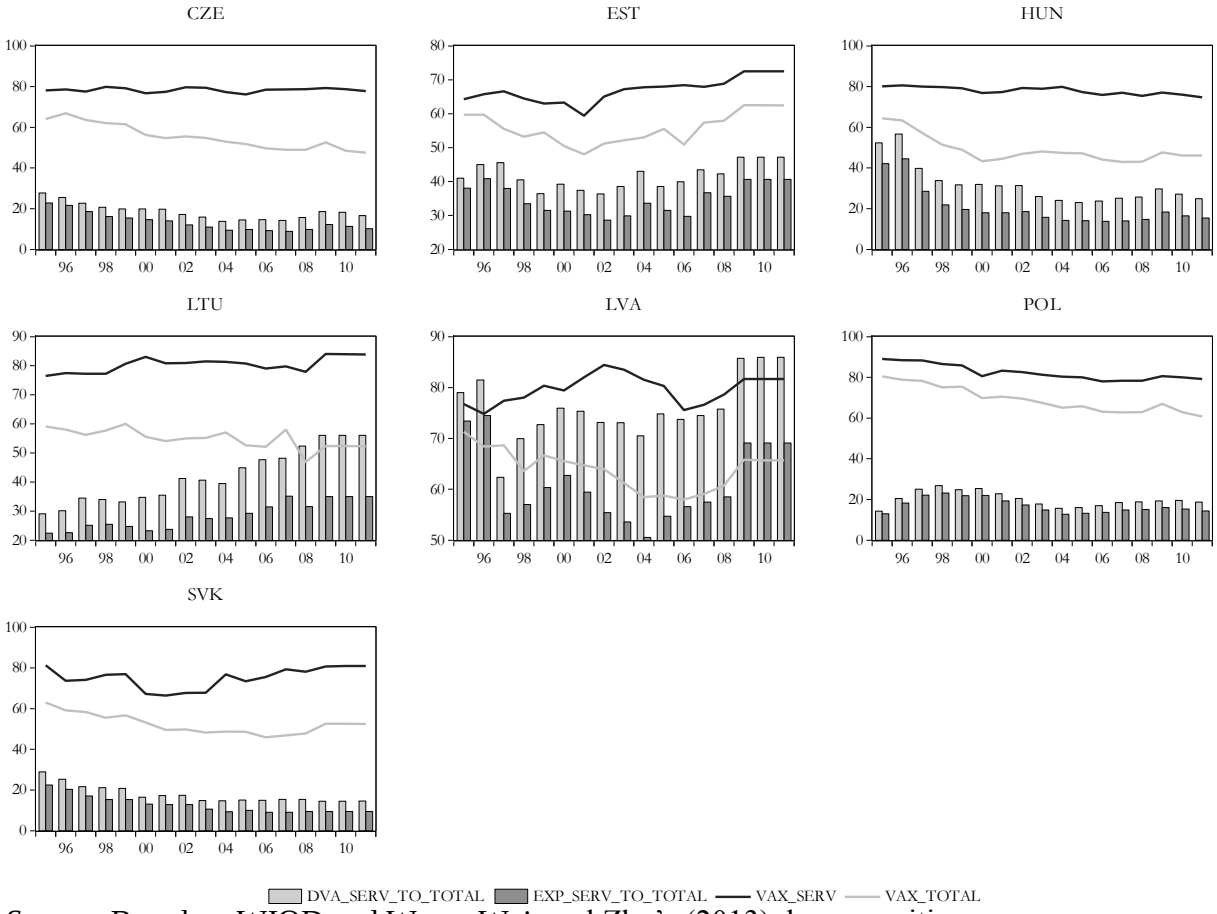
Figure 2. Percentage service-added-value content in manufacturing exports in 2011.



Source: OECD-WTO TiVA database.

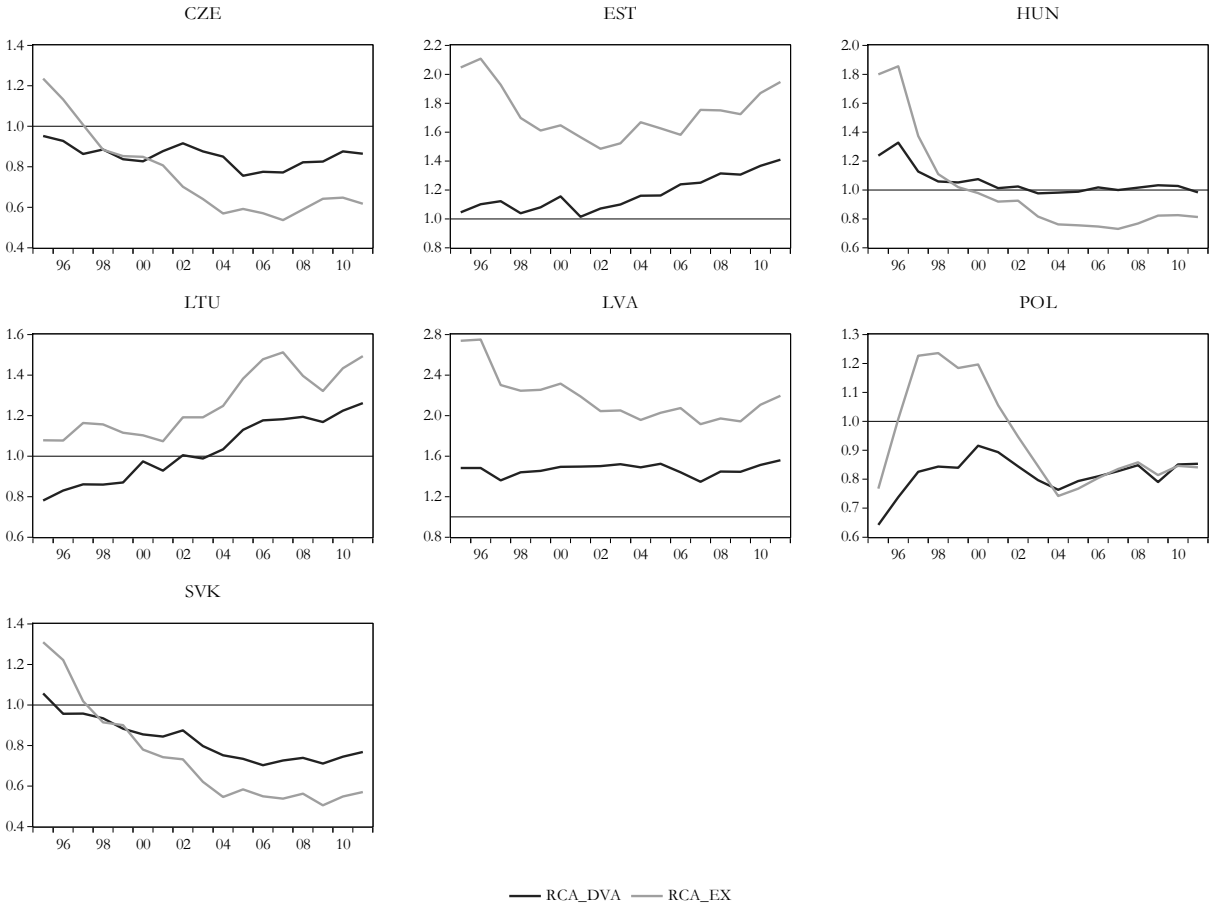
Note. The domestic (foreign) share of the added value of services in gross exports is the share of the domestic (foreign) value added by service industries in the total gross exports by industry *i* in country *c*. For this measure, the service industries include ISIC Rev. 3 (NACE Rev. 1) divisions 45 to 95.

Figure 3. VAX ratio for the service sector and the total economy, share of service DVA in total DVA, and share of service gross exports in total exports



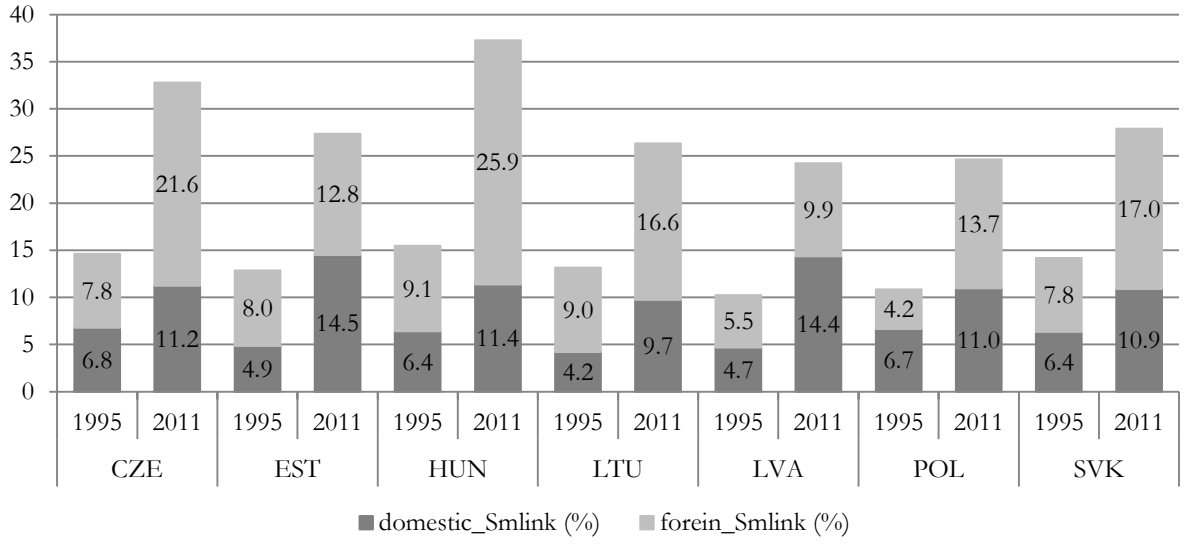
Source: Based on WIOD and Wang, Wei, and Zhu's (2013) decomposition.

Figure 4. RCA indices based on domestic value added and gross exports



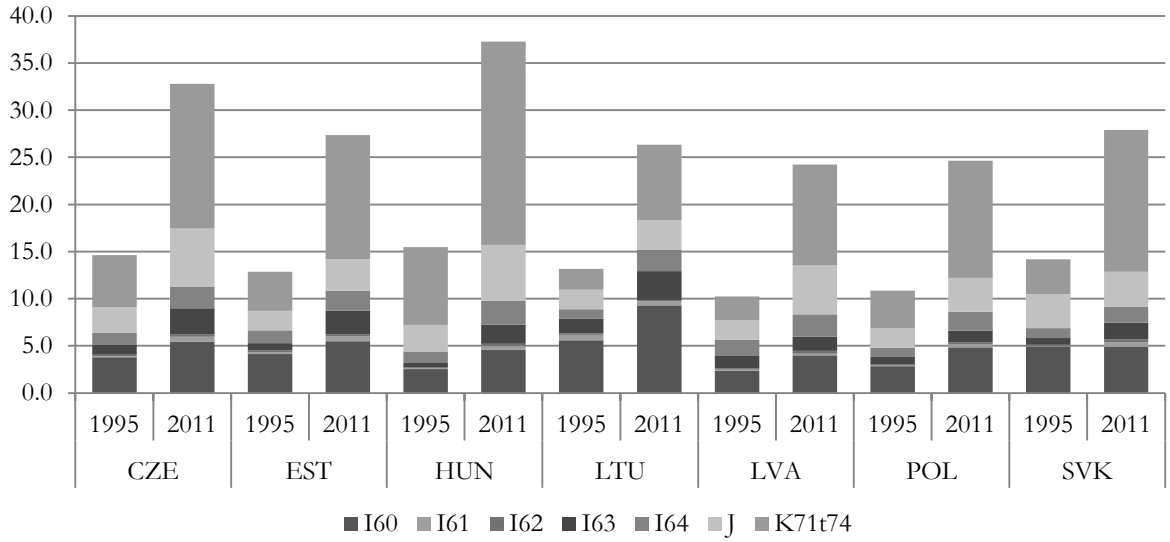
Source: Based on WIOD and Wang, Wei, and Zhu's (2013) decomposition.

Figure 5. Percentages of domestic and foreign service content of total manufacturing exports



Source: WIOD.

Figure 6. Structure of the total service content in the manufacturing sector by service sector



Source: WIOD and Appendix 1.

Table 1. The impact of selected determinants on gross exports and on domestic value added (N = 733)

	lnTEXP		*lnDVA*	
	1	2	3	4
HS	0.052**	0.048**	0.048**	0.044**
	(0.021)	(0.021)	(0.021)	(0.021)
MS	0.053**	0.048**	0.051**	0.046**
	(0.021)	(0.021)	(0.021)	(0.022)
lnLPRO	0.642***	0.640***	0.671***	0.669***
	(0.076)	(0.077)	(0.076)	(0.078)
total_SMlink	-0.028		-0.050	
	(0.037)		(0.037)	
total_Smlink_J	-0.010		0.015	
	(0.076)		(0.075)	
total_Smlink_K71t74	0.099**		0.121***	
	(0.040)		(0.039)	
domestic_SMlink		-0.193***		-0.194***
		(0.056)		(0.054)
domestic_Smlink_J		0.200*		0.217**
		(0.110)		(0.108)
domestic_Smlink_K71t74		0.307***		0.314***
		(0.068)		(0.066)
foreign_ SMlink		0.086		0.050
		(0.053)		(0.052)
foreign_ Smlink_J		-0.153		-0.125
		(0.110)		(0.109)
foreign_ Smlink_K71t74		-0.037		-0.004
		(0.055)		(0.055)
R^2	0.7384	0.7427	0.7517	0.7551

Note: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard errors in parentheses. The panel is specified using country-industry pairs. In all the specifications, time-invariant fixed effects are included for both countries and individual service sectors.

Table 2. The impact of selected determinants on RCA based on gross exports and on domestic value added (N = 733)

	RCA_TEXP		*RCA_DVA*	
	5	6	7	8
HS	0.080***	0.071***	0.046***	0.034***
	(0.017)	(0.018)	(0.009)	(0.010)
MS	0.065***	0.058***	0.043***	0.033***
	(0.017)	(0.018)	(0.009)	(0.010)
lnLPRO	-0.059	-0.058	-0.074***	-0.075***
	(0.041)	(0.040)	(0.028)	(0.026)
total_SMlink	-0.043		-0.246***	
	(0.074)		(0.059)	
total_Smlink_J	0.136*		0.227***	
	(0.082)		(0.060)	
total_Smlink_K71t74	0.068		0.226***	
	(0.074)		(0.058)	
domestic_SMlink		-0.445***		-0.771***
		(0.125)		(0.134)
domestic_Smlink_J		0.356***		0.566***
		(0.135)		(0.140)
domestic_Smlink_K71t74		0.371***		0.674***
		(0.129)		(0.135)
foreign_ SMlink		0.240**		0.122*
		(0.122)		(0.074)
foreign_ Smlink_J		-0.002		0.011
		(0.133)		(0.080)
foreign_ Smlink_K71t74		-0.157		-0.095
		(0.123)		(0.075)
R^2	0.4840	0.4694	0.5438	0.5413

Note: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard errors in parentheses. The panel is specified using country-industry pairs. In all the specifications time-invariant fixed effects are included for both countries and individual service sectors.

Table 3. The impact of selected determinants on gross exports and on domestic value added for Baltic and Visegrad countries

	lnTEXP				*lnDVA*			
	Baltic Countries		Visegrad Countries		Baltic Countries		Visegrad Countries	
	9	10	11	12	13	14	15	16
HS	0.057***	0.057***	0.083***	0.067**	0.056***	0.056***	0.077***	0.063**
	(0.014)	(0.013)	(0.026)	(0.026)	(0.013)	(0.013)	(0.027)	(0.027)
MS	0.040***	0.041***	0.058**	0.043*	0.040***	0.040***	0.059***	0.045*
	(0.014)	(0.014)	(0.023)	(0.023)	(0.014)	(0.013)	(0.023)	(0.024)
lnLPRO	0.997***	1.001***	0.277**	0.256**	1.017***	1.021***	0.321***	0.303***
	(0.037)	(0.037)	(0.111)	(0.111)	(0.036)	(0.035)	(0.116)	(0.116)
total_SMlink	-0.093**		-0.013		-0.094**		-0.060	
	(0.039)		(0.051)		(0.037)		(0.050)	
total_Smlink_J	0.028		-0.166		0.031		-0.115	
	(0.069)		(0.119)		(0.068)		(0.117)	
total_Smlink_K71t74	0.079*		0.098*		0.082*		0.145***	
	(0.045)		(0.056)		(0.043)		(0.054)	
domestic_SMlink		-0.294***		-0.372***		-0.274***		-0.381***
		(0.054)		(0.094)		(0.050)		(0.091)
domestic_Smlink_J		0.199*		0.172		0.181		0.196
		(0.116)		(0.177)		(0.112)		(0.173)
domestic_Smlink_K71t74		0.310***		0.465***		0.302***		0.473***
		(0.062)		(0.120)		(0.059)		(0.118)
foreign_ SMlink		0.028		0.311***		0.015		0.231***
		(0.040)		(0.093)		(0.039)		(0.088)
foreign_ Smlink_J		-0.068		-0.454***		-0.051		-0.380**
		(0.117)		(0.161)		(0.118)		(0.158)
foreign_ Smlink_K71t74		-0.074		-0.224**		-0.067		-0.143
		(0.051)		(0.096)		(0.051)		(0.091)
R^2	0.7069	0.7426	0.7902	0.7999	0.7174	0.7501	0.8010	0.8091
N	315	315	418	418	315	315	418	418

Note: * p < 0.10, ** p < 0.05, *** p < 0.01. Robust standard errors in parentheses. The panel is specified using country-industry pairs. In all the specifications time-invariant fixed effects are included for both countries and individual service sectors.

Appendix 1. Structure of the total service content in the manufacturing sector by service sector (in %)

		I60	I61	I62	I63	I64	J	K71t74
CZE	1995	3.8	0.1	0.2	1.1	1.2	2.7	5.5
	2011	5.5	0.5	0.3	2.8	2.3	6.1	15.3
EST	1995	4.1	0.2	0.2	0.8	1.4	2.1	4.1
	2011	5.5	0.6	0.2	2.5	2.1	3.3	13.2
HUN	1995	2.5	0.1	0.1	0.5	1.2	2.8	8.3
	2011	4.6	0.4	0.2	2.0	2.5	5.9	21.6
LTU	1995	5.6	0.6	0.2	1.5	1.0	2.0	2.2
	2011	9.3	0.4	0.1	3.1	2.2	3.1	8.0
LVA	1995	2.4	0.1	0.1	1.3	1.7	2.1	2.5
	2011	4.0	0.2	0.3	1.5	2.4	5.2	10.7
POL	1995	2.8	0.1	0.1	0.8	1.0	2.0	4.0
	2011	4.8	0.3	0.2	1.2	2.0	3.6	12.4
SVK	1995	5.0	0.1	0.1	0.7	1.1	3.6	3.7
	2011	4.9	0.5	0.3	1.8	1.7	3.7	15.0

Source: WIOD.