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# Is Germany a Hub of 'Factory Europe' for CEE Countries?

## Introduction

The rise of global value chains (GVCs) has significantly changed the nature of international trade. Nowadays, more than two-thirds of world trade occurs through GVCs in which production crosses at least one border, and typically many borders, before final assembly (World Bank 2017). At the same time, GVCs increase the complexity and sophistication of cross-border production. This is connected with the increasing importance of production's fragmentation in GVCs (Jones and Kierzkowski 1990), with off-shoring (Arndt 1997) and outsourcing activities (Grossman and Helpman 2002), with a vertical specialisation (Hummels et al. 2001, Yi 2003) and vertical production networks in GVCs (Hanson et al. 2003), and with trade in different tasks in GVCs (Grossman and Rossi-Hansberg 2008). Additionally, services, which have an overwhelming share in overall economic activities in GVCs, are delivered across borders under various and complicated modes of supply (Kordalska and Olczyk 2018). The increasing sophistication of global trade raises interest in answers to fundamental economic questions, such as: who produces what for whom in such a highly globalised and complex world.

Traditional trade statistics no longer suffice to answer this question, because gross trade data include substantial double-counting and traded inputs. A possible solution is to use trade data in value-added terms. The first method of calculating trade in value added was proposed by Hummels et al. (2001) and then developed and improved by Johnson and Noguera (2012), Koopman et al. (2008, 2014), and Nagengast and Stehrer (2014). One of the most recent achievements in this strand of value-added decomposition is Borin and Mancini (2017) meth-

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odology, which makes it possible not only to isolate the contribution of different countries' final demand and demand for intermediate inputs to production in any given economy, but also to conduct this analysis from two different perspectives: the country where the value added originates and the country that ultimately absorbs it. Although available decomposition methods allow us to track traded products almost globally (via the entire GVC), few of these kinds of analyses have been done.

Additionally we notice that contemporary production systems are not configured as a linear sequence of production stages such as chains but, rather, consist of complex networks of hubs and spokes (Meng 2019). This implies that value chains are organised regionally rather than globally. The empirical analyses confirm that the global economy is regionally divided into three economic hubs: Factory Asia, Factory Europe, and Factory North America (Baldwin and Lopez–Gonzalez 2015). The U.S. is surrounded by the two other members of its free trade area: Canada and Mexico, three large Asian countries: Japan, South Korea and India, and two other large economies: Brazil and Australia (OECD 2013). Japan is also considered a regional supply hub in the Asia–Pacific region, because it is the most important value-added supplier in final products trade for USA, China, South Korea, Taiwan, Thailand, Singapore, and other Asian countries (Meng 2019). Germany is the largest supply hub in Europe because the majority of value-added imports in final products for almost all European countries come from Germany (Nordström and Flam 2018). How important is the role of a regional hub, is showed by the story of Asia's integration into GVCs, captured by the 'flying geese' model. Export-oriented industrial activities flow from more advanced countries in the region to less economically developed countries in geographic proximity, i.e. the Republic of Korea and Taiwan are integrated into Japanese GVCs, and China relies on its connection to Hong Kong and Singapore (UNIDO 2018). Analyses also show that the proximity of a country to the hub increases the prospects for integration into a GVC (Inomata 2017).

However, previous studies concentrated on the identification of three global hubs (UNIDO 2018, Nordström and Flam 2018, Meng 2019), ignoring its changing role in regional GVC development. What has been largely missing is a comprehensive and detailed picture of hubs' functions in the regional GVC structure. Normally, each hub can play an important role in export absorption (exports satisfy a country's own final demand), in export reflection (exports go back to the country of origin to be consumed), and in export redirection (exports are forwarded by the hub to third countries to meet final demand). Knowledge on how a hub deals with the exports of countries has a huge impact on their economic policy. For example, if we know that in motor vehicles manufacturing a considerable share of the intermediate components exported from Poland to Germany are used to produce cars for the American market, we should observe changes in U.S. demand (not only in German demand) to predict the changes in Polish exports of motor vehicles to the German market.

So, the goal of this study is to fill the existing gap in the literature by analysing the role of hubs in regional GVCs by examining the example of Germany and its role in selected CEE trade (the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, and Slovakia) in the period of 2000–2014. Based on the input-output tables from the WIOD database and on the value-added decomposition proposed by Borin and Mancini (2017), we try to answer the following questions: what share of CEE exports, measured in value-added terms, is actually consumed in Germany, and what share is re-exported and to where? Does the role of this hub differ in CEE trade of manufactured goods compared to trade in services? Is Germany's role as a supplier of inputs to CEE exports larger than its role as an exporter of value added originating in the CEE?

The paper is organised as follows. We end our introduction with stylised facts about the role of Germany in CEE trade. Then, we begin our empirical analysis by introducing our methodology. The next section is devoted to describing the data, then the results are presented, and the last section offers our conclusions.

## 1. The role of Germany in the CEE's FDI flows, trade, and the GVCs: stylised facts

Since the late nineteenth century, Germany has been an important partner for countries in Central and Eastern Europe. But in the 1990s, after the collapse of communism, the relationships changed diametrically and qualitatively. Large labour cost differentials, together with geographic proximity and cultural similarity, have led many German firms to shift large parts of their production to the CEE countries, most notably to the Czech Republic, Hungary, Poland, and Slovakia (IMF 2013). The intensive FDI flow (see Table 1) enabled German companies to incorporate CEE subsidiaries into their production chain by the early 2000s (Gross 2013). In the past two decades, the German–Central European Supply Chain (GCESC) has expanded rapidly, especially in the automobile, electronic, electrical, chemical, and machinery industries, where increasing competition in both domestic and foreign markets has triggered the continual outsourcing of manufacturing activities (Elekdag et al. 2015).

Table 1 shows that Germany has been a major investor in most of the CEE countries, particularly in the Visegrád economies (the Czech Republic, Hungary, Slovakia, Poland).

Over the past two decades, FDI inflow as an aggregation of capital stocks, know-how, and technology has become a component in enhancing growth in CEE countries (Popescu 2016). According to the theory of the multinational enterprise (MNE) and the theory of international factor movements, high FDI inflow has a positive effect on the volume of host country exports (Popovici 2018). Empirical analyses have confirmed that CEE countries benefited from FDI through specific effects, such as technology transfer and influence on their export performance (Kalotay 2017). Germany has become the largest export partner of CEE coun-

**Table 1**
**German inward FDI in CEE countries in 2015**

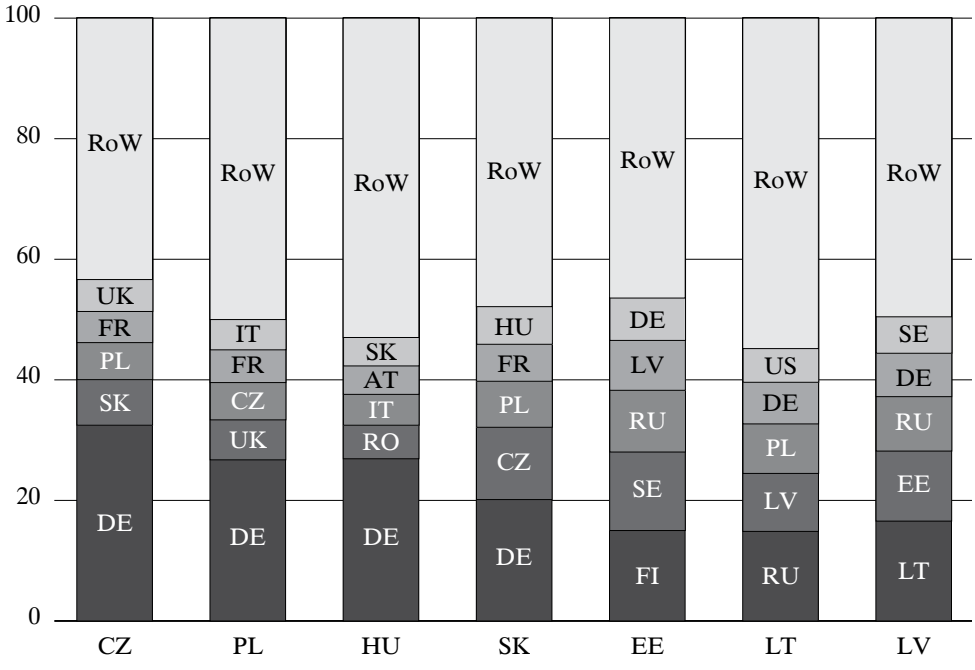
| Country | Value (EUR millions) | Share of total inward FDI (%) | Germany's rank among foreign investors |
|---|---|---|---|
| Czech Republic | 12,599.5 | 12.6 | 3 |
| Estonia | 250.4 | 1.4 | 15 |
| Hungary | 17,157.8 | 22.4 | 2 |
| Latvia | 719.7 | 5.3 | 7 |
| Lithuania | 1,246.5 | 9.2 | 3 |
| Poland | 27,356.0 | 16.4 | 2 |
| Slovakia | 2,546.1 | 6.3 | 7 |

Note: Data for Czech Republic are for 2014.

Source: Ambroziak (2018), based on WIIW Foreign Direct Investment Database.

tries, especially in Visegrád countries, where it has accounted for 20–33% of their exports (German trade has the largest share in the Czech Republic and the smallest share in Slovakia). If we look at the five largest export partners in the Baltic countries, Germany's role in the Visegrád countries is less remarkable (Figure 1).

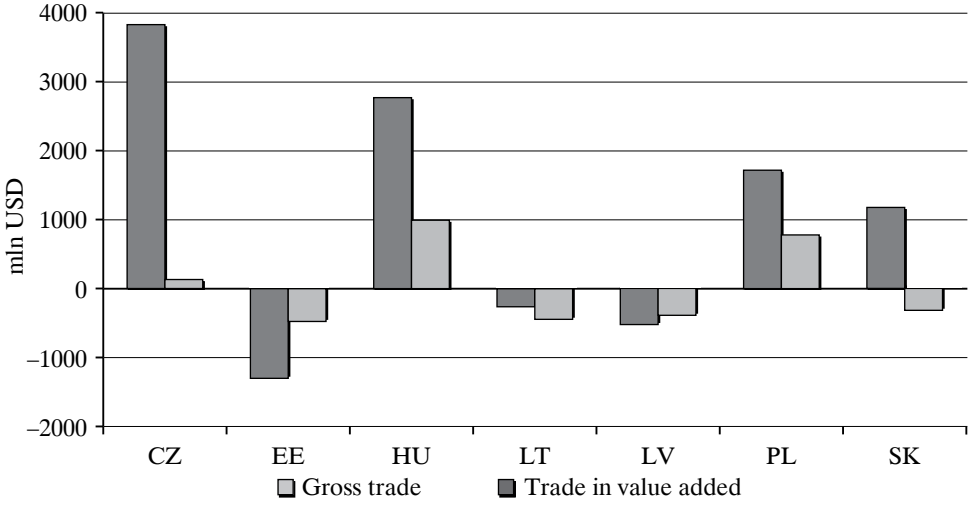
**Figure 1**
**Five largest export partners of CEE countries, 2017 (% of total gross exports)**




Note: RoW – rest of the world.

Source: own calculation based on WITS (2019) database.

**Figure 2**
**Trade balance of the CEE countries with Germany in gross and value-added terms, 2014**




Note: Bilateral trade balances in value added are calculated as a difference between domestic value added embodied in foreign final domestic demand and foreign value added embodied in final domestic demand.
Source: own calculation based on WIOD.

Germany's great importance in CEE trade, unfortunately, does not mean a positive trade balance for the CEE countries. In 2014, the Baltic countries had negative trade balances with Germany, regardless of how the trade balance was measured (Figure 2). The Visegrád countries seem to be in a much more favourable position, achieving a surplus in trade with Germany, but the value of the trade balance is much higher when computed in traditional statistics than in value-added terms. This difference between bilateral trade balances in gross and value-added terms has two causes: a higher content of value added imported from abroad (FVA) in the CEE exports to Germany than in the CEE imports from Germany and a high share of final demand from third countries in explaining the trade balance.

The role of Germany in CEE trade can be also assessed by the degree of participation in GVCs. Integration in GVCs brings benefits beyond those traditionally associated with international trade in final goods, allowing countries to specialise in single tasks and benefit from economies of scale and scope. To assess how much of a country's exports is created in a supply chain, we use an 'international fragmentation of production' index, which shows the share of intermediates (for further processing in third countries), foreign value added and double counting in countries' gross export (Rahman and Zhao 2013). Table 2 indicates that in 2014 almost 70% of gross exports from Visegrád countries (except Poland) participated in GVCs, while the rate in Baltic countries (including Poland) was around 50%.

To identify how CEE countries benefit from participation in production networks with Germany, we need to look at their forward and backward linkages in

**Table 2**
**Degree of participation in GVCs in 2014 (%)**

| Country | Forward participation: Domestic VA embodied in German exports (as % of total German gross exports) | Backward participation: German VA embodied in exports, (as % of total gross exports of the exporting country) | International fragmentation of production (German exports to CEE countries) | International fragmentation of production (CEE exports to Germany) |
|---|---|---|---|---|
| CZ | 0.50 | 5.0 | 67.1 | 68.7 |
| EE | 0.01 | 1.3 | 58.2 | 62.4 |
| HU | 0.30 | 3.5 | 73.3 | 72.4 |
| LT | 0.03 | 1.6 | 47.7 | 53.1 |
| LV | 0.01 | 1.7 | 44.3 | 55.7 |
| PL | 0.90 | 4.9 | 53.6 | 56.0 |
| SK | 0.20 | 3.7 | 68.5 | 71.5 |

Note: VA – value added.

Source: own calculation based on WIOD.

GVCs. The difference between forward linkages (in which the country provides inputs to exports from other countries, generating DVA, which goes into other countries' gross exports) and backward linkages (in which the country imports intermediate products to be used in its exports, leading other countries to generate foreign value added that goes into the domestic country's gross exports) offers useful insights in the gains that go to a country from its participation in GVCs (Jona-Lasinio et al. 2016). If gains are measured in terms of net value added by participation in GVCs, then the higher the forward linkages are, the higher the gains are (Banga 2013). Table 2 shows that in 2014 all CEE countries had much lower forward linkages than backward linkages in the GCES. This implies that CEE economies have negative net value added gains from their participation in the GCES. They create and export less domestic value added than the foreign value added imported.

In sum, the German industry-based and export-oriented economy has close and intensive economic relations with CEE countries, especially the Visegrád economies. Germany is a major trading partner in most of the CEE countries, one of main FDI investors, and the leading partner in GCES. Germany's precise role in the global supply chain for the CEE countries is the subject of our empirical analysis.

## 2. Methodology of the research

In the paper, we explore whether Germany is a hub of 'Factory Europe' for the CEE countries. We focus on export flows measured in terms of domestic value

added (DVA), both from CEE countries to Germany and from Germany to the CEE countries. We are interested in identifying the downstream structure of final consumers for CEE countries and German value added. This means that not only do we need to take a closer look at the part of DVA absorbed by direct importers, but we also need to define economies that import DVA from CEE countries or Germany indirectly and become its final consumers.

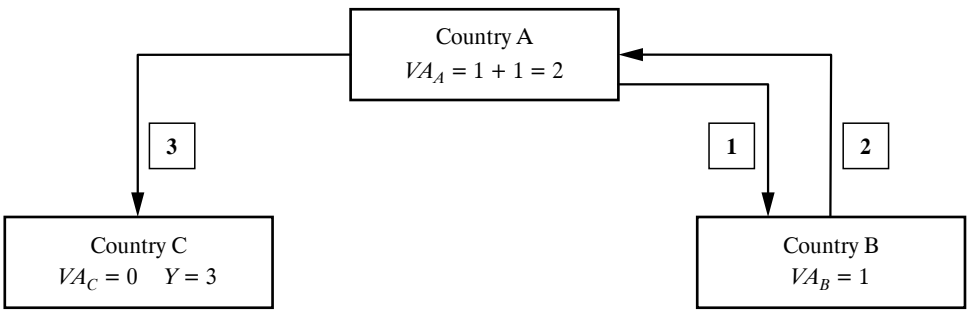
To do that, we need to conduct a detailed decomposition of gross exports. Our research relies on a methodology proposed by Borin and Mancini (2017), denoted here as BM. Their approach is based directly on seminal work by Koopman, Wang and Wei (2014), denoted here as KWW. Considering the goal of our paper, in the KWW methodology the partition of DVA included in exports of intermediate goods and services is somewhat ambiguous as regards the distribution between intermediate goods and services absorbed by direct importers and by third countries (Nagengast and Sterher 2016). The BM procedure provides a fully correct decomposition in this area as well as a correct breakdown of the foreign content of export flows and introduces a new measure of international trade that is generated within GVCs.

Considering the domestic value added, two alternative approaches can be used: a source-based approach and a sink-based approach (Nagengast and Sterher 2016). The source-based decomposition takes the perspective of a country where the DVA originates, whereas the sink-based one measures DVA that crosses national borders for the last time. Figure 3 illustrates situation, when a country A produces USD 1 of value added that is exported to country B as intermediates. After additional production processes, it returns to A and then is used to produce final goods which are exported to country C and are finally absorbed there.

In the source-based approach, USD 1 of value added that is exported by country A to country B is treated as DVA, whereas the same dollar reflects double counting when it reaches country C. In the sink-based approach, the same USD 1 measures DVA when it is exported to country C and 'double counted' in the shipments to B.

**Figure 3**

**Domestic value added and double counting in bilateral trade flows**




Source: Borin and Mancini (2017).

As it was mentioned before, in our paper we focus on downstream linkages of CEE countries, and that is why the sink-based perspective is more accurate.

The sink-based decomposition of $E_{sr}$ – gross exports, from country $s$ to country $r$ and for $G$ countries and $N$ sectors, is portrayed as follows[1]:

$$
\begin{aligned}
\mathbf{u}_N\mathbf{E}_{sr} = {} & \underbrace{\mathbf{V}_s\mathbf{B}_{ss}\mathbf{Y}_{sr}}_{1} \\
& + \mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\left[\underbrace{\mathbf{Y}_{rr}}_{2a} + \underbrace{\sum_{j\neq r}^{G}\mathbf{A}_{rj}\hat{\mathbf{B}}^{\$}_{jr}\mathbf{Y}_{rr}}_{2b} + \underbrace{\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\hat{\mathbf{B}}^{\$}_{jk}\mathbf{Y}_{kk}}_{2c}\right] \\
& + \mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\left[\underbrace{\sum_{j\neq r,s}^{G}\mathbf{Y}_{rj}}_{3a} + \underbrace{\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{l\neq s,r}^{G}\hat{\mathbf{B}}^{\$}_{jr}\mathbf{Y}_{rl}}_{3b} + \right. \\
& \qquad \left. + \underbrace{\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\hat{\mathbf{B}}^{\$}_{jk}\mathbf{Y}_{kr}}_{3c} + \underbrace{\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\sum_{l\neq s,r}^{G}\hat{\mathbf{B}}^{\$}_{jk}\mathbf{Y}_{kl}}_{3d}\right] \\
& + \mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\left[\underbrace{\mathbf{Y}_{rs}}_{4a} + \underbrace{\sum_{j\neq r}^{G}\mathbf{A}_{rj}\hat{\mathbf{B}}^{\$}_{jr}\mathbf{Y}_{rs}}_{4b} + \underbrace{\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\hat{\mathbf{B}}^{\$}_{jk}\mathbf{Y}_{ks}}_{4c}\right] \\
& + \underbrace{\mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\sum_{j\neq r}^{G}\mathbf{A}_{rj}\hat{\mathbf{B}}^{\$}_{js}\mathbf{Y}_{ss}}_{5} \\
& + \underbrace{\mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\sum_{j\neq r}^{G}\mathbf{A}_{rj}\hat{\mathbf{B}}^{\$}_{js}\mathbf{Y}_{s^*}}_{6} \\
& + \underbrace{\sum_{t\neq s}^{G}\mathbf{V}_t\mathbf{B}_{ts}\mathbf{Y}_{sr}}_{7} + \underbrace{\sum_{t\neq s}^{G}\mathbf{V}_t\mathbf{B}_{ts}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\mathbf{Y}_{rr}}_{8} \\
& + \mathbf{V}_r\mathbf{B}_{rs}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\left[\underbrace{\sum_{j\neq r}^{G}Y_{rj}}_{9a} + \underbrace{\sum_{j\neq r}^{G}\mathbf{A}_{rj}\left(\mathbf{I}-\mathbf{A}_{jj}\right)^{-1}\mathbf{Y}_{jj}}_{9b}\right] \\
& + \underbrace{\sum_{t\neq s,r}^{G}\mathbf{V}_t\mathbf{B}_{ts}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\mathbf{E}_{r^*}}_{9c} + \underbrace{\mathbf{V}_r\mathbf{B}_{rs}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\sum_{j\neq r}^{G}\mathbf{A}_{rj}\left(\mathbf{I}-\mathbf{A}_{jj}\right)^{-1}\mathbf{E}_{j^*}}_{9d} \quad (1)
\end{aligned}
$$

where $\mathbf{A}_{rs}$ reflects the $N \times N$ matrix of coefficients for intermediate inputs that are produced in country $s$ and used by country $r$, $\mathbf{B}_{rs}$ is the $N \times N$ Leontief inverse matrix, and $\hat{\mathbf{B}}^{\$}$ is the Leontief inverse matrix based on a new input coefficient matrix $\mathbf{A}^{\$}$ which does not contain the input requirement of other economies from

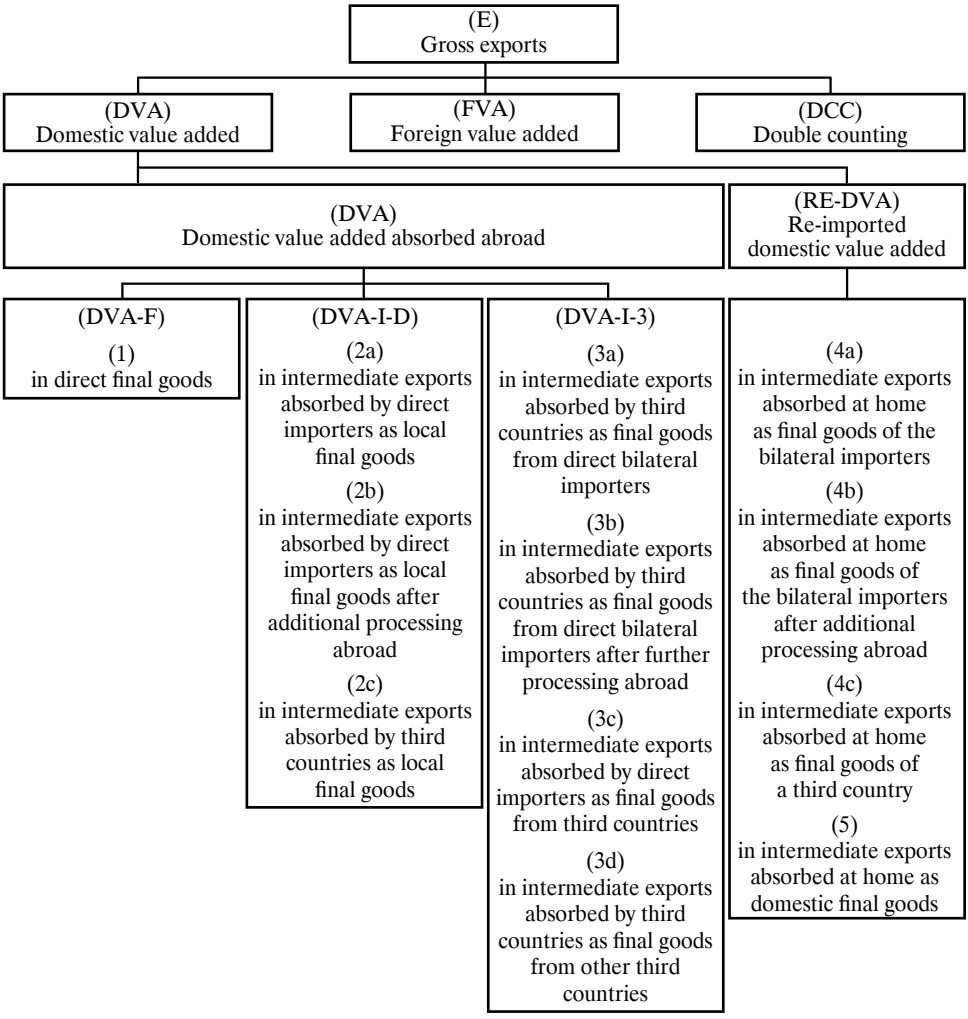
[1] For the decomposition details, see Borin and Mancini (2017), appendices A and B.

country *s*.[2] $\mathbf{V}_s$ denotes the direct value added share of gross output, and $\mathbf{Y}_{sr}$ describes the final demand for goods produced in country *s* in the country of destination *r*.

The BM procedure produces 18 components of gross exports. To understand their importance better, especially in terms of DVA, we illustrate particular elements in Figure 4.

**Figure 4**

**Decomposition of gross exports**



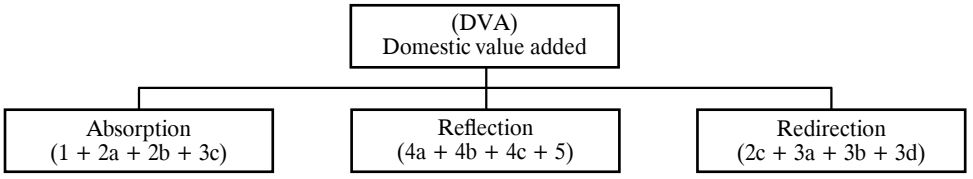

Source: own elaboration based on equation (1).

[2] $\mathbf{A}^s = \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1s} & \cdots & A_{1G} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & A_{ss} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ A_{G1} & A_{G2} & \cdots & A_{Gs} & \cdots & A_{GG} \end{bmatrix}$

Borin and Mancini (2015) provide a new classification of decomposed elements which reflect value added embedded in exports (Figure 5). Absorption represents the part of domestic value added that is consumed by direct importers and consists of DVA contained in final goods exports, in intermediate goods and services consumed as local final goods, and in intermediate goods and services that are absorbed by direct importers after additional production. Additionally, contrary to the KWW decomposition, absorption is broadened by DVA in intermediates that are imported by direct importers first, then go to a third country where the final goods are produced, and ultimately return to direct importers to be absorbed. Reflection covers DVA in intermediate exports absorbed at home as final goods of both direct importers and third countries. For our purposes, redirection is the most interesting part of exported domestic value added. It consists of DVA in exported intermediate goods and services that is absorbed by third countries from direct bilateral importers, but after additional production abroad, and from other third countries. In line with the BM break-down, as opposed to KWW decomposition, redirection is completed by DVA in intermediate exports absorbed by third countries as local final goods.

**Figure 5**

**Domestic value added in exports broken down by country of final absorption**




Source: own elaboration based on Borin and Mancini (2015).

In order to classify the components of DVA and to assess the portion of CEE countries' value added which is directly absorbed in Germany (or German value added directly absorbed by CEE countries), the portion redirected via German/CEE economies to third countries and the part of value added which is ultimately repatriated, we employ an approach similar to the one proposed by Borin and Mancini (2015). Additionally, we want to determine the differences in the structure of DVA by the country of absorption in separate analyses of the manufacturing and service sectors.

## 3. Data Description

Our study focuses on Germany and seven CEE countries: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, and Slovakia. We compare export flows expressed in value added between Germany and CEEs in 2000 and 2014. In detailed analyses, we focus our attention on two industrial sectors, with the first group consisting of 19 manufacturing subsectors and the second one covering

29 service subsectors. The sectoral breakdown uses NACE rev. 2 and is linked to our main database, the WIOD (Timmer et al. 2015)[3].

The basic decomposition of CEE gross export flows (Table 3) clearly shows that DVA exported to Germany is the largest portion of gross exports; however, that share decreases strongly over the period analysed in all the countries. A large decline is observed especially in the Czech Republic (13.7 p.p.) and Slovakia (10.3 p.p.). In comparison to the other economies, Hungary has the lowest DVA (46.2% in 2000 and 43.4% in 2014) and has a negligible decline.

In all countries (except for Hungary), FVA is stable, with a slight growth over time. The last component of gross exports that contains value added in intermediate goods which crosses borders many times shows a significant increase. This reflects production processes which, with aid of CEE value added, are increasingly fragmented.

**Table 3**

**Decomposition of CEE countries' gross export to Germany in 2000 and 2014 (%)**

| Country | Year | DVA | FVA | DCC | ΔDVA | ΔFVA | ΔDCC |
|---|---|---|---|---|---|---|---|
| CZ | 2000 | 65.1 | 26.3 | 8.6 | | | |
| | 2014 | 51.4 | 32.3 | 16.3 | –13.7 | 6.0 | 7.8 |
| EE | 2000 | 64.4 | 27.4 | 8.2 | | | |
| | 2014 | 57.4 | 27.8 | 14.7 | –7.0 | 0.5 | 6.5 |
| HU | 2000 | 46.2 | 41.5 | 12.3 | | | |
| | 2014 | 43.4 | 39.0 | 17.6 | –2.8 | –2.5 | 5.3 |
| LT | 2000 | 76.3 | 20.2 | 3.5 | | | |
| | 2014 | 67.3 | 20.6 | 12.1 | –9.0 | 0.4 | 8.6 |
| LV | 2000 | 71.2 | 20.6 | 8.2 | | | |
| | 2014 | 66.9 | 21.1 | 12.0 | –4.4 | 0.5 | 3.9 |
| PL | 2000 | 73.5 | 20.2 | 6.3 | | | |
| | 2014 | 68.0 | 21.1 | 10.9 | –5.5 | 0.9 | 4.6 |
| SK | 2000 | 56.9 | 33.8 | 9.3 | | | |
| | 2014 | 46.6 | 35.1 | 18.4 | –10.3 | 1.3 | 9.0 |

Source: own calculation based on BM decomposition.

Table 4 shows a basic decomposition of German gross exports to CEE countries. As in Table 3, DVA also reveals a downward trend over time, but DVA is higher in German gross exports than in CEE economies, in both 2000 and 2014. Important changes are also observed in double-counted components. DCC shows

[3] A complete WIOD database release 2016 (WIOD Tables and Socio-Economic Accounts) provides annual time series for the period 2000–2014 and it is the most comprehensive database for sectoral analyses. Analogous tables for further years are not currently available.

an increasing German involvement in GVCs, especially when its intermediate goods and services are exported to the Czech Republic, Slovakia, and Estonia.

**Table 4**

**Decomposition of German gross exports to CEE countries in 2000 and 2014 (%)**

| Country | Year | DVA | FVA | DCC | ΔDVA | ΔFVA | ΔDCC |
|---|---|---|---|---|---|---|---|
| CZ | 2000 | 73.3 | 15.2 | 11.6 | | | |
| | 2014 | 65.5 | 12.5 | 22.1 | –7.8 | –2.7 | 10.5 |
| EE | 2000 | 78.6 | 16.9 | 4.5 | | | |
| | 2014 | 69.0 | 17.1 | 13.8 | –9.6 | 0.2 | 9.4 |
| HU | 2000 | 72.1 | 11.2 | 16.7 | | | |
| | 2014 | 66.5 | 9.3 | 24.2 | –5.7 | –1.9 | 7.5 |
| LT | 2000 | 77.1 | 19.1 | 3.8 | | | |
| | 2014 | 70.7 | 19.7 | 9.6 | –6.5 | 0.6 | 5.8 |
| LV | 2000 | 77.5 | 19.3 | 3.2 | | | |
| | 2014 | 71.5 | 20.6 | 7.8 | –5.9 | 1.3 | 4.6 |
| PL | 2000 | 74.6 | 18.0 | 7.4 | | | |
| | 2014 | 67.4 | 18.7 | 13.9 | –7.2 | 0.7 | 6.5 |
| SK | 2000 | 73.6 | 15.5 | 10.9 | | | |
| | 2014 | 67.2 | 11.3 | 21.6 | –6.4 | –4.3 | 10.7 |

Source: own calculation based on BM decomposition.

## 4. Results of analysis

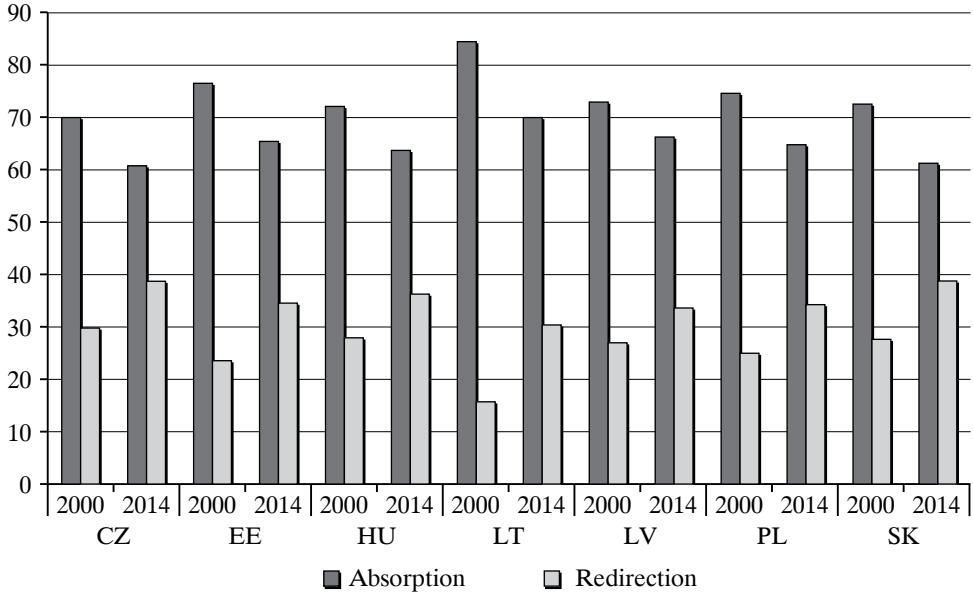
In a deeper analysis of DVA exported from CEE countries to Germany and from Germany to CEEs, we focus first on its structure by country of final absorption.

Figure 6 illustrates the absorption of DVA by the German economy and redirection of DVA by Germany to third countries, with both measures obtained according to Figure 5. The relation between those two components clearly changes over time. The figure shows the strongly declining amount of value added in both final and intermediate goods and services consumed by a direct importer, Germany. In 2000, Lithuanian DVA had the highest value of absorption (84.4%), and at the same time Lithuania had the largest decline (15 p.p.) in this indicator among CEE countries.

In turn, we observe the increase of CEE countries' DVA in intermediate goods and services directed to Germany but consumed by third countries. In 2014 redirection fluctuates between 30% for Lithuania (it still had the lowest level among the countries analysed) and 39% for the Czech Republic and Slovakia.

**Figure 6**

**Structure of domestic value added in exports from CEE countries to Germany (%)**

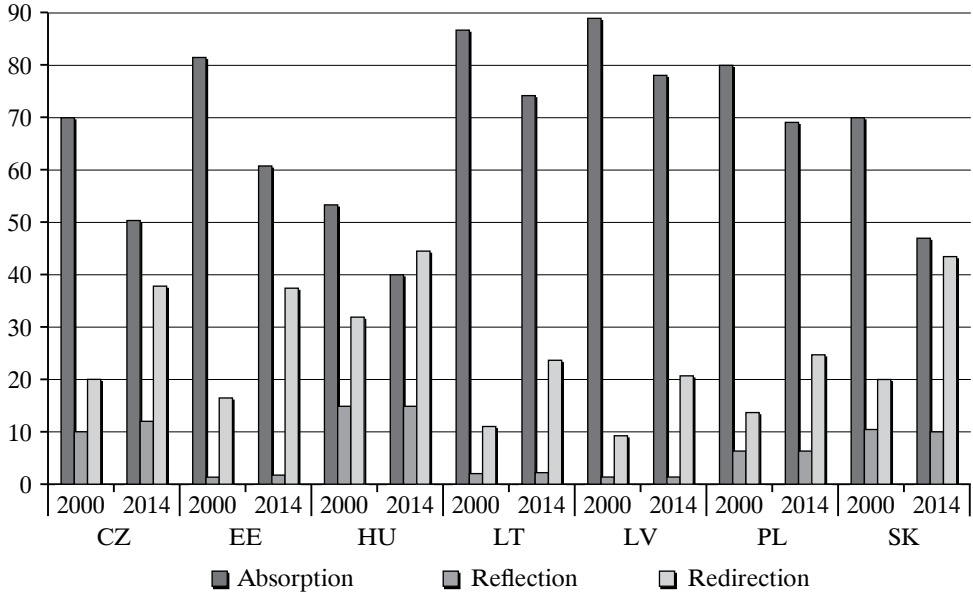



Note: The reflection share of DVA is omitted if it fluctuates between 0.0% and 0.6%.

Source: own calculation based on BM decomposition.

**Figure 7**

**Structure of domestic value added in exports from Germany to CEE countries (%)**




Source: own calculation based on BM decomposition.

The structure of German DVA directed to the CEE by the place of its final consumption (Figure 7) reveals that, unlike in Figure 6, German DVA is partly absorbed by its own economy, especially when it is exported to the Visegrád countries first (e.g. 14.8% of German DVA exported to Hungary returns home and is consumed in the country of origin).

As in Figure 6, in the period analysed, we notice an important tendency: a substantial decline in absorption and a solid growth of redirection. In case of Hungary in year 2014 a redirection value was even higher than direct absorption; it means that majority of German export to Hungary was redirected to third countries rather than consumed finally by Hungarian consumers and firms.

Comparing the results in Figures 6 and 7, we observe two differences. First, CEE countries (except for Hungary) redirect more German DVA to other countries compared to the redirection of the CEE's DVA through Germany. Second, Germany absorbs more DVA from Visegrád countries than is ultimately consumed in those countries (the absorption gap for Hungary is 23.5 p.p). For the Baltic countries and Poland, we see the advantage of Germany in terms of its DVA absorbed by those countries.

Due to the increasing importance of redirection in Germany–CEE trade, we present in Table 5 the geographical structure of CEE's value added redirected

**Table 5**

**The structure of the CEE's DVA redirection via Germany in 2000 and 2014 (%)**

| Country | Year | CEE6 | EU14 | EU28rest | USA | China | Japan | Russia | ASIArest | ROW |
|---|---|---|---|---|---|---|---|---|---|---|
| CZ | 2000 | 3.8 | 46.5 | 1.2 | 16.7 | 2.0 | 3.3 | 1.6 | 2.9 | 22.0 |
| | 2014 | 4.4 | 35.0 | 1.5 | 11.6 | 9.8 | 2.1 | 4.3 | 3.8 | 27.4 |
| EE | 2000 | 5.2 | 46.7 | 1.3 | 13.8 | 2.0 | 3.2 | 1.5 | 2.7 | 23.4 |
| | 2014 | 5.8 | 35.0 | 1.6 | 9.5 | 8.1 | 2.0 | 3.3 | 3.5 | 31.2 |
| HU | 2000 | 3.9 | 46.5 | 1.1 | 17.8 | 1.8 | 3.5 | 1.5 | 2.6 | 21.4 |
| | 2014 | 4.9 | 34.6 | 1.4 | 11.8 | 10.0 | 2.1 | 4.3 | 3.7 | 27.1 |
| LT | 2000 | 5.2 | 47.2 | 1.3 | 13.8 | 2.0 | 3.3 | 1.6 | 2.7 | 22.9 |
| | 2014 | 6.0 | 35.7 | 1.7 | 9.6 | 7.5 | 2.1 | 3.4 | 3.4 | 30.7 |
| LV | 2000 | 5.0 | 45.9 | 1.2 | 14.8 | 2.1 | 3.3 | 1.4 | 3.0 | 23.3 |
| | 2014 | 6.2 | 37.2 | 1.7 | 9.3 | 7.7 | 2.0 | 3.3 | 3.4 | 29.3 |
| PL | 2000 | 2.7 | 47.3 | 1.2 | 17.0 | 1.9 | 3.4 | 1.6 | 2.8 | 22.2 |
| | 2014 | 3.0 | 36.2 | 1.6 | 11.5 | 9.4 | 2.1 | 4.3 | 3.8 | 28.1 |
| SK | 2000 | 4.6 | 46.0 | 1.2 | 17.1 | 1.9 | 3.3 | 1.6 | 2.9 | 21.6 |
| | 2014 | 5.2 | 34.2 | 1.5 | 11.8 | 10.0 | 2.0 | 4.5 | 3.8 | 27.0 |

Notes: CEE6 = 6 out of 7 CEE countries analysed; EU14 = EU15 except Germany; EUrest = Bulgaria, Cyprus, Croatia, Malta, Romania, and Slovenia; ASIArest = Indonesia, India, Korea, and Taiwan; ROW = rest of the world.

Source: own calculation based on BM decomposition.

to the third countries through the German economy. All the countries in the WIOD database are divided into nine mutually exclusive subgroups. The old EU member states together with USA are still the most important countries of final destination for CEE's DVA, but we observe a strong decrease of their shares over time. It turn, the rest of the countries (except for Japan) increased their indirect absorption from CEE countries, especially China, which increased its consumption of value added from the Baltic countries by about 5.6–6.0 p.p and from the Visegrád countries by about 7.5–8.1 p.p. during the period analysed. Also a role of Russian economy noticeable increases in the process of DVA indirect absorption from CEE countries.

When we consider the redirection of German value added via CEE economies (Table 6), the largest indirect demand comes from the EU14 countries, as well as from the CEE6 group. The results show a decreasing importance of old EU countries as final destinations of German DVA included in products and services exported by CEE. We observe a growing role of Russia and China as indi-

**Table 6**

**The structure of German DVA redirection via CEE in 2000 and 2014 (%)**

| Country | Year | CEE6 | EU14 | EU28rest | USA | China | Japan | Russia | ASIArest | ROW |
|---|---|---|---|---|---|---|---|---|---|---|
| CZ | 2000 | 15.4 | 41.6 | 3.1 | 8.8 | 1.1 | 1.8 | 3.2 | 1.7 | 23.3 |
| | 2014 | 13.7 | 37.7 | 3.2 | 5.5 | 4.1 | 1.0 | 7.3 | 1.9 | 25.6 |
| EE | 2000 | 10.6 | 45.9 | 0.4 | 6.7 | 1.1 | 1.9 | 4.5 | 1.4 | 27.5 |
| | 2014 | 9.1 | 37.3 | 0.7 | 5.3 | 3.1 | 1.5 | 13.3 | 2.1 | 27.7 |
| HU | 2000 | 5.0 | 44.7 | 3.9 | 15.2 | 1.1 | 2.3 | 2.0 | 1.5 | 24.3 |
| | 2014 | 9.1 | 35.0 | 7.3 | 9.5 | 5.3 | 1.6 | 3.5 | 1.9 | 26.7 |
| LT | 2000 | 11.8 | 41.5 | 0.4 | 7.7 | 0.8 | 1.6 | 7.6 | 1.5 | 27.1 |
| | 2014 | 12.9 | 25.1 | 1.0 | 4.7 | 2.5 | 1.1 | 12.5 | 1.7 | 38.5 |
| LV | 2000 | 10.1 | 37.9 | 0.7 | 10.9 | 0.8 | 1.6 | 6.3 | 1.2 | 30.5 |
| | 2014 | 19.3 | 24.0 | 0.9 | 4.0 | 2.5 | 1.1 | 12.1 | 1.6 | 34.5 |
| PL | 2000 | 7.7 | 48.7 | 2.1 | 8.0 | 1.0 | 1.3 | 4.0 | 1.4 | 25.9 |
| | 2014 | 9.5 | 41.2 | 3.0 | 5.0 | 3.3 | 1.1 | 6.1 | 1.8 | 29.1 |
| SK | 2000 | 16.1 | 49.7 | 2.9 | 4.7 | 0.5 | 3.8 | 2.6 | 1.4 | 18.2 |
| | 2014 | 15.1 | 35.9 | 3.6 | 5.2 | 8.1 | 0.8 | 7.9 | 1.1 | 22.4 |

Notes: CEE6 = 6 out of 7 CEE countries analysed; EU14 = EU15 except Germany; EUrest = Bulgaria, Cyprus, Croatia, Malta, Romania, and Slovenia; ASIArest = Indonesia, India, Korea, and Taiwan; ROW = rest of the world.

Source: own calculation based on BM decomposition.

rect importers of German DVA. Especially, the Baltic countries increase heavily their trade in German DVA with Russia (Estonia from 4.5% to 13.3%, Lithuania from 7.6% to 12.5%, and Latvia from 6.3% to 12.1%).

In the next step, we analyse the sectoral structure of DVA in CEE exports to Germany and from Germany to CEE countries (see Appendix 1 and 2). We consider two groups of industries: the first group consists of 19 manufacturing subsectors, and the second covers 29 service subsectors. The Appendices indicate the structure of DVA and, in the bottom part of the tables, the structure of redirection by country of final consumption.

Considering the relation between DVA in manufacturing and DVA in services for CEE exports to Germany, we observe significant discrepancies across countries and some kind of specialization in DVA export (Table 7).

In the Baltic countries and Poland, services play a key role in exports regardless of the place of final consumption. In terms of DVA, they export more services than manufacturing products. For the rest of Visegrád countries, trade

**Table 7**

**The relation of DVA in manufacturing and services for CEE and German exports in 2000 and 2014**

| Country | Year | DVA from CEE countries exported to Germany | | | DVA from Germany exported to CEE countries | | |
|---|---|---|---|---|---|---|---|
| | | absorption | reflection | redirection | absorption | reflection | redirection |
| CE | 2000 | 2.223 | 2.416 | 2.363 | 1.562 | 1.732 | 1.586 |
| | 2014 | 2.135 | 2.278 | 2.343 | 1.149 | 1.567 | 1.477 |
| EE | 2000 | 1.327 | 1.073 | 1.062 | 1.186 | 1.177 | 1.097 |
| | 2014 | 0.774 | 0.865 | 0.807 | 1.352 | 1.371 | 1.411 |
| HU | 2000 | 2.292 | 2.332 | 2.333 | 1.716 | 1.945 | 1.829 |
| | 2014 | 1.703 | 1.722 | 1.841 | 1.134 | 1.665 | 1.493 |
| LT | 2000 | 2.164 | 1.866 | 1.990 | 1.415 | 1.517 | 1.364 |
| | 2014 | 0.892 | 0.904 | 0.836 | 1.320 | 1.469 | 1.405 |
| LV | 2000 | 1.086 | 1.087 | 1.022 | 1.491 | 1.486 | 1.334 |
| | 2014 | 0.762 | 0.643 | 0.622 | 1.396 | 1.296 | 1.259 |
| PL | 2000 | 1.337 | 1.288 | 1.262 | 1.560 | 1.721 | 1.665 |
| | 2014 | 0.805 | 0.877 | 0.896 | 1.368 | 1.522 | 1.517 |
| SK | 2000 | 2.332 | 2.275 | 2.241 | 1.751 | 1.965 | 1.914 |
| | 2014 | 1.925 | 2.273 | 2.420 | 1.296 | 1.779 | 1.713 |

Source: own calculation based on BM decomposition.

**Table 8**

**Relation of redirected parts of DVA in manufacturing and services for CEE and German exports in 2000 and 2014**

| Country | Year | DVA from CEE exported to Germany | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CEE6 | EU14 | EU28rest | US | China | Japan | Russia | ASIArest | REST |
| CZ | 2000 | 2.407 | 2.364 | 2.329 | 2.444 | 2.357 | 2.388 | 2.522 | 2.360 | 2.284 |
| | 2014 | 2.268 | 2.295 | 2.256 | 2.453 | 2.531 | 2.365 | 2.541 | 2.477 | 2.263 |
| EE | 2000 | 1.202 | 1.116 | 1.156 | 1.078 | 1.062 | 0.998 | 1.317 | 0.996 | 0.926 |
| | 2014 | 0.869 | 0.862 | 0.832 | 0.925 | 0.913 | 0.769 | 1.011 | 0.880 | 0.665 |
| HU | 2000 | 2.288 | 2.347 | 2.246 | 2.463 | 2.251 | 2.357 | 2.465 | 2.213 | 2.224 |
| | 2014 | 1.747 | 1.817 | 1.706 | 2.042 | 2.003 | 1.919 | 2.132 | 1.921 | 1.702 |
| LT | 2000 | 2.097 | 2.017 | 1.973 | 1.997 | 2.264 | 1.943 | 2.012 | 2.006 | 1.892 |
| | 2014 | 0.924 | 0.907 | 0.901 | 0.956 | 0.857 | 0.823 | 1.025 | 0.865 | 0.692 |
| LV | 2000 | 1.091 | 1.063 | 1.044 | 1.064 | 1.124 | 0.970 | 1.071 | 1.034 | 0.903 |
| | 2014 | 0.639 | 0.647 | 0.621 | 0.640 | 0.650 | 0.608 | 0.698 | 0.635 | 0.569 |
| PL | 2000 | 1.291 | 1.267 | 1.263 | 1.280 | 1.292 | 1.249 | 1.306 | 1.282 | 1.228 |
| | 2014 | 0.874 | 0.882 | 0.867 | 0.934 | 0.949 | 0.893 | 0.936 | 0.941 | 0.873 |
| SK | 2000 | 2.249 | 2.242 | 2.215 | 2.323 | 2.230 | 2.246 | 2.386 | 2.219 | 2.171 |
| | 2014 | 2.331 | 2.380 | 2.268 | 2.617 | 2.624 | 2.467 | 2.797 | 2.542 | 2.272 |
| Country | Year | DVA from Germany exported to CEE | | | | | | | | |
| | | CEE6 | EU14 | EU28rest | US | China | Japan | Russia | ASIArest | REST |
| CE | 2000 | 1.641 | 1.671 | 1.578 | 1.505 | 1.510 | 1.575 | 1.699 | 1.611 | 1.433 |
| | 2014 | 1.380 | 1.502 | 1.459 | 1.441 | 1.363 | 1.441 | 1.639 | 1.507 | 1.479 |
| EE | 2000 | 1.253 | 1.240 | 1.232 | 1.104 | 1.067 | 0.986 | 1.334 | 1.034 | 0.829 |
| | 2014 | 1.382 | 1.448 | 1.285 | 1.443 | 1.447 | 1.423 | 1.514 | 1.447 | 1.316 |
| HU | 2000 | 1.853 | 1.855 | 1.795 | 1.846 | 1.821 | 1.829 | 1.908 | 1.830 | 1.767 |
| | 2014 | 1.438 | 1.492 | 1.344 | 1.605 | 1.643 | 1.521 | 1.626 | 1.472 | 1.472 |
| LT | 2000 | 1.342 | 1.450 | 1.477 | 1.351 | 1.289 | 1.304 | 1.383 | 1.605 | 1.241 |
| | 2014 | 1.382 | 1.423 | 1.420 | 1.251 | 1.450 | 1.420 | 1.500 | 1.442 | 1.385 |
| LV | 2000 | 1.425 | 1.434 | 1.309 | 1.358 | 1.258 | 1.254 | 1.454 | 1.243 | 1.176 |
| | 2014 | 1.368 | 1.262 | 1.186 | 1.226 | 1.234 | 1.224 | 1.358 | 1.256 | 1.178 |
| PL | 2000 | 1.656 | 1.722 | 1.627 | 1.654 | 1.642 | 1.590 | 1.607 | 1.676 | 1.585 |
| | 2014 | 1.464 | 1.530 | 1.449 | 1.507 | 1.545 | 1.534 | 1.530 | 1.525 | 1.520 |
| SK | 2000 | 1.864 | 1.943 | 1.880 | 1.898 | 1.885 | 1.969 | 1.836 | 2.006 | 1.885 |
| | 2014 | 1.552 | 1.737 | 1.639 | 1.796 | 1.906 | 1.724 | 1.896 | 1.662 | 1.651 |

Source: own calculation based on BM decomposition.

in manufacturing strongly exceeds trade in services. Looking at Germany and its DVA in exports to CEE countries, the relation between manufacturing and service trade is stable for all direct importers, and manufacturing has an advantage.

We confirm a revealed pattern of DVA export specialization (manufacturing vs. services) in the redirected part of CEE's DVA, divided into nine sub-groups of final consumers (Table 8). The Baltic countries and Poland specialize in services, regardless to which country their DVA is redirected. In turn, Visegrád countries export their DVA to Germany, which is next redirected to third countries, mostly in manufactured products.

A German DVA, wherever redirected via CEE countries, is mainly included in manufactured products.

## Conclusions

In recent decades supply chains have arisen in many different parts of the world. In Europe, a 'Factory Europe' was established, with Germany playing a dominant role as a hub for regional economies. For CEE countries, the position of Germany as a trade partner and as a leader of FDI inflows is unquestionable, but the position of Germany in final absorption, reflection, and redirection of CEE trade is still an open question.

Our results show the decreasing role of Germany as a market of final destination for CEE export and an increasing role of Germany as hub for CEE exports, especially to China and Russia. CEE economies also mostly redirect and then absorb German value added (as it was with Hungary in 2014). These findings are generally in line with previous studies (Ambroziak 2018, Ambroziak and Sawulski 2019), in which authors find that the CEE's value added embodied in other countries' exports was exported in majority by Germany.

Additionally, we discovered a clear specialisation pattern among CEE in DVA trade within the German–Central European supply chain. The Baltic countries and Poland export domestic value added included mostly in services, while the Czech Republic, Hungary, and Slovakia do so in manufactured products.

Our results have important policy implications. For example, regarding fiscal policy, we found that German stimulus is likely to have smaller than expected impact on the CEE countries. This is related to the characteristics of the supply chain, i.e. final demand in Germany is not only a determinant of CEE exports to Germany. The increasing role of American, Chinese or Russian final demand in indirect absorption of CEE exports should be also taken into account. Our results also indicate the necessity of applying different export support strategies among CEE countries. The Baltic states together with Poland should concentrate on instruments that increase the competitiveness of export services, and the Visegrád countries on increasing competitiveness of industrial products.

It would be worth conducting a more in-depth analysis, especially at a sectoral level. Because the CEE export is more and more often redirected though Germany to other countries, the question, which still remains open, is: a demand from which sectors of third countries plays most important role?

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## Bibliography

Ambroziak Ł., *The CEECs in Global Value Chains: The Role of Germany*, "Acta Oeconomica" 2018, no. 68.

Ambroziak Ł., Sawulski J., *Polska zaczyna odczuwać słabszy niemiecki eksport* [*Poland is feeling a weaker German export*], 2019; https://www.obserwatorfinansowy.pl/forma/rotator/polska-zaczyna-odczuwać-słabszy-niemiecki-eksport/

Arndt S.W., *Globalization and the Open Economy*, "North American Journal of Economics and Finance" 1997, no. 8.

Baldwin R., Lopez-Gonzalez J., *Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses*, "World Economy" 2015, no. 38.

Banga R., *Measuring Value in Global Value Chains*, UNCTAD Background Papers, 2013, no. 8.

Borin A, Mancini M., *Follow the Value Added: Bilateral Gross Export Accounting*, Bank of Italy Temi di Discussione, 2015, no. 1026.

Borin A., Mancini M., *Follow the Value Added: Tracking Bilateral Relations in Global Value Chains*, MPRA Papers, 2017, no. 82692.

Cappariello R., Felettigh A., *How Does Foreign Demand Activate Domestic Value Added? A Comparison among the Largest Euro-Area Economies*, Bank of Italy Temi di Discussione, 2015, no. 1001.

Elekdag S., Muir D., Wu Y., *Trade Linkages, Balance Sheets, and Spillovers: The German–Central European Supply Chain*, "Journal of Policy Modelling" 2015, no. 37.

Gross S., *The German Economy and East-Central Europe. The Development of Intra-Industry Trade from Ostpolitik to the Present*, "German Politics and Society" 2013, no. 31.

Grossman G., Helpman E., *Integration versus Outsourcing in Industry Equilibrium*, "Quarterly Journal of Economics" 2002, no. 117.

Grossman G., Rossi-Hansberg E., *Trading Tasks: A Simple Theory of Off-shoring*, "American Economic Review" 2008, no. 98.

Hanson G., Mataloni R., Slaughter M., *Vertical Production Networks in Multinational Firms*, NBER Working Papers, 2003, no. 9723.

Hummels D., Ishii J., Yi K.M., *The Nature and Growth of Vertical Specialization in World Trade*, "Journal of International Economics" 2001, no. 54.

Inomata S., *Analytical Frameworks for Global Value Chains: An Overview*, in: *Global Value Chain Development Report 2017: Measuring and Analyzing the Impact of GVCs on Economic Development*, 2017, pp. 15–35; https://doi.org/10.1111/imr.12031

International Monetary Fund (IMF), *IMF Multicountry Report. German–Central European Supply Chain – Cluster Report*, Institute for Monetary and Economic Studies Country Report, 2013, no. 263.

Johnson R., Noguera G., *Fragmentation and Trade in Value Added over Four Decades*, NBER Working Papers, 2012, no. 18186.

Jona-Lasinio C., Manzocchi S., Meliciani V., *Intangible Assets and Participation in Global Value Chains: An Analysis on a Sample of European Countries*, LLEE Working Paper Series, 2016, no. 129.

Jones R., Kierzkowski H., *The Role of Services in Production and International Trade: A Theoretical Framework*, in: R. Jones, A. Krueger (eds.), *The Political Economy of International Trade*, Basil Blackwell, Oxford 1990.

Kalotay K., *Post-Crisis Crossroads for FDI in CEE*, in: B. Szent-Iványi (ed.), *Foreign Direct Investment in Central and Eastern Europe: Post-Crisis Perspectives*, Palgrave Macmillan, 2017.

Koopman R., Wang Z., Wei S., *How Much of Chinese Exports Is Really Made in China? Assessing Domestic Value-Added When Processing Trade Is Pervasive*, NBER Working Paper Series, 2008, no. 14109.

Koopman R., Wang Z., Wei S., *Tracing Value-Added and Double Counting in Gross Exports,* "American Economic Review" 2014, no. 104.

Kordalska A., Olczyk M., *CEE Trade in Services: Value-Added Versus Gross Terms Approaches*, "Eastern European Economics" 2018, no. 56.

Meng B. et al., *Are Global Value Chains Truly Global? A New Perspective Based on the Measure of Trade in Value-Added*, IDE-JETRO Discussion Paper, 2019.

Nagengast A., Stehrer R., *Collateral Imbalances in Intra-European Trade?* ECB Working Paper Series, 2014, no. 1695.

Nagengast A.J., Stehrer R., *Accounting for the Differences between Gross and Value Added Trade Balances*, "World Economy" 2016, no. 39.

Nordström H., Flam H., *Production Integration in the European Union*, Cesifo Working Papers, 2018, no. 6944.

OECD, *Interconnected Economies Benefiting from Global Value Chains*, Paris 2013; https://doi.org/10.1787/9789264189560-en

Popescu G.H., *FDI and Economic Growth in Central and Eastern Europe*, "Sustainability" 2014, no. 6.

Popovici O., *The Impact of FDI on EU Export Performance in Manufacturing and Services. A Dynamic Panel Data Approach*, "Romanian Journal of Economic Forecasting" 2018, no. 21.

Rahman J., Zhao T., *Export Performance in Europe: What Do We Know from Supply Links?* IMF Working Papers, 2013, no. 62.

Timmer M.P. et al., *An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production*, "Review of International Economics" 2015, no. 23.

UNIDO, *Global Value Chains and Industrial Development*, 2018; https://www.unido.org/sites/default/files/files/2018–06/EBOOK_GVC.pdf

WITS, *World Integrated Trade Solution*, 2019; https:wits.worldbank.org

World Bank, *Measuring and Analyzing the Impact of GVCs on Economic Development*, *Global Value Chain Development Report 2017*, 2017; https://www.wto.org/english/res_e/booksp_e/gvcs_report_2017.pdf

Yi K.M., *Can Vertical Specialization Explain the Growth of World Trade?* "Journal of Political Economy" 2003, no. 111.

# Appendix 1

**Structure of DVA in exports by country of final absorption and by group of sectors, from CEE countries to Germany in 2000 and 2014**

| Specification | *Manufacturing sector* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CZ | | EE | | HU | | LT | | LV | | PL | | SK | |
| | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 |
| Absorption | 69.6 | 60.1 | 78.9 | 65.0 | 71.6 | 62.6 | 85.0 | 70.5 | 73.9 | 69.8 | 75.9 | 63.8 | 72.9 | 59.5 |
| Reflection | 0.4 | 0.5 | 0.0 | 0.0 | 0.2 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.5 | 1.1 | 0.1 | 0.2 |
| Redirection | 30.0 | 39.3 | 21.0 | 35.0 | 28.2 | 37.1 | 15.0 | 29.4 | 26.0 | 30.1 | 23.5 | 35.1 | 26.9 | 40.3 |
| CEE6 | 3.8 | 4.3 | 5.5 | 5.9 | 3.8 | 4.7 | 5.3 | 6.2 | 5.2 | 6.1 | 2.7 | 2.9 | 4.6 | 5.0 |
| EU14 | 46.3 | 34.3 | 47.5 | 35.7 | 46.5 | 34.0 | 47.1 | 36.8 | 46.6 | 37.0 | 47.4 | 35.6 | 45.9 | 33.7 |
| EU28rest | 1.2 | 1.5 | 1.3 | 1.6 | 1.0 | 1.4 | 1.3 | 1.7 | 1.2 | 1.6 | 1.2 | 1.5 | 1.1 | 1.4 |
| US | 17.0 | 12.0 | 14.0 | 10.3 | 18.3 | 12.4 | 13.9 | 10.4 | 15.1 | 9.7 | 17.2 | 11.9 | 17.3 | 12.3 |
| China | 2.0 | 10.2 | 2.0 | 8.8 | 1.8 | 10.5 | 2.1 | 7.8 | 2.2 | 8.2 | 1.9 | 9.8 | 1.9 | 10.4 |
| Japan | 3.3 | 2.1 | 3.2 | 2.0 | 3.5 | 2.1 | 3.2 | 2.1 | 3.2 | 2.0 | 3.4 | 2.1 | 3.3 | 2.1 |
| Russia | 1.6 | 4.5 | 1.8 | 3.8 | 1.5 | 4.6 | 1.6 | 3.8 | 1.4 | 3.6 | 1.6 | 4.5 | 1.6 | 4.7 |
| ASIArest | 2.9 | 3.9 | 2.6 | 3.7 | 2.5 | 3.8 | 2.7 | 3.5 | 3.0 | 3.5 | 2.7 | 3.9 | 2.9 | 3.9 |
| ROW | 21.8 | 27.2 | 22.1 | 28.2 | 21.0 | 26.5 | 22.7 | 27.9 | 22.0 | 28.3 | 21.9 | 27.8 | 21.4 | 26.5 |

| Specification | *Service sector* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CZ | | EE | | HU | | LT | | LV | | PL | | SK | |
| | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 |
| Absorption | 70.9 | 62.3 | 75.0 | 65.9 | 72.0 | 64.4 | 83.9 | 69.1 | 72.7 | 65.4 | 74.9 | 66.2 | 72.2 | 64.9 |
| Reflection | 0.4 | 0.5 | 0.0 | 0.0 | 0.2 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.6 | 1.0 | 0.1 | 0.2 |
| Redirection | 28.7 | 37.1 | 25.0 | 34.0 | 27.8 | 35.3 | 16.1 | 30.8 | 27.2 | 34.6 | 24.6 | 32.8 | 27.7 | 34.9 |
| CEE6 | 3.7 | 4.4 | 4.9 | 5.5 | 3.9 | 5.0 | 5.0 | 5.6 | 4.8 | 5.9 | 2.7 | 3.0 | 4.5 | 5.2 |
| EU14 | 46.3 | 35.0 | 45.1 | 33.4 | 46.2 | 34.4 | 46.5 | 33.9 | 44.8 | 35.6 | 47.2 | 36.1 | 45.9 | 34.3 |
| EU28rest | 1.2 | 1.5 | 1.2 | 1.5 | 1.1 | 1.5 | 1.3 | 1.6 | 1.2 | 1.6 | 1.2 | 1.6 | 1.2 | 1.5 |
| US | 16.5 | 11.5 | 13.8 | 9.0 | 17.3 | 11.2 | 13.9 | 9.1 | 14.5 | 9.4 | 16.9 | 11.4 | 16.7 | 11.3 |
| China | 2.0 | 9.5 | 2.0 | 7.8 | 1.9 | 9.6 | 1.8 | 7.6 | 2.0 | 7.9 | 1.8 | 9.3 | 2.0 | 9.6 |
| Japan | 3.3 | 2.1 | 3.4 | 2.1 | 3.4 | 2.0 | 3.3 | 2.1 | 3.4 | 2.0 | 3.5 | 2.1 | 3.3 | 2.0 |
| Russia | 1.5 | 4.1 | 1.4 | 3.0 | 1.5 | 4.0 | 1.6 | 3.1 | 1.4 | 3.2 | 1.6 | 4.3 | 1.5 | 4.1 |
| ASIArest | 2.9 | 3.7 | 2.8 | 3.4 | 2.7 | 3.7 | 2.7 | 3.3 | 3.0 | 3.4 | 2.7 | 3.7 | 2.9 | 3.7 |
| ROW | 22.6 | 28.1 | 25.3 | 34.2 | 22.1 | 28.6 | 23.9 | 33.7 | 24.9 | 30.9 | 22.5 | 28.5 | 22.1 | 28.2 |

Source: own calculations based on BM decomposition.

# Appendix 2

**Structure of DVA in exports by country of final absorption and by group of sectors, from Germany to CEE countries in 2000 and 2014**

| Specification | *Manufacturing sector* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CZ | | EE | | HU | | LT | | LV | | PL | | SK | |
| | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 |
| Absorption | 69.4 | 47.3 | 82.5 | 60.2 | 52.1 | 36.5 | 86.7 | 73.7 | 89.6 | 79.2 | 79.3 | 67.9 | 68.5 | 42.9 |
| Reflection | 10.5 | 13.1 | 1.5 | 2.0 | 15.4 | 16.3 | 2.4 | 2.4 | 1.6 | 1.3 | 6.7 | 6.7 | 11.1 | 10.6 |
| Redirection | 20.1 | 39.6 | 16.0 | 37.7 | 32.5 | 47.2 | 10.9 | 23.9 | 8.8 | 19.5 | 14.0 | 25.4 | 20.4 | 46.4 |
| CEE6 | 15.6 | 13.1 | 11.2 | 8.9 | 5.0 | 8.9 | 11.6 | 12.6 | 10.4 | 19.9 | 7.6 | 9.3 | 15.7 | 13.8 |
| EU14 | 42.7 | 38.0 | 48.8 | 37.9 | 45.0 | 35.0 | 43.1 | 25.1 | 39.3 | 24.2 | 49.5 | 41.3 | 50.2 | 36.3 |
| EU28rest | 3.1 | 3.2 | 0.4 | 0.6 | 3.8 | 6.9 | 0.5 | 1.0 | 0.7 | 0.9 | 2.1 | 2.9 | 2.8 | 3.5 |
| US | 8.6 | 5.4 | 6.7 | 5.3 | 15.3 | 9.9 | 7.6 | 4.2 | 10.6 | 3.9 | 7.9 | 5.0 | 4.7 | 5.4 |
| China | 1.1 | 4.0 | 1.0 | 3.1 | 1.1 | 5.6 | 0.7 | 2.6 | 0.8 | 2.5 | 1.0 | 3.3 | 0.5 | 8.6 |
| Japan | 1.8 | 1.0 | 1.8 | 1.5 | 2.3 | 1.6 | 1.5 | 1.1 | 1.6 | 1.1 | 1.2 | 1.1 | 3.9 | 0.8 |
| Russia | 3.3 | 7.7 | 4.9 | 13.7 | 2.0 | 3.6 | 7.5 | 13.0 | 6.6 | 12.3 | 3.9 | 6.1 | 2.6 | 8.4 |
| ASIArest | 1.7 | 1.9 | 1.4 | 2.1 | 1.5 | 1.9 | 1.6 | 1.8 | 1.1 | 1.6 | 1.4 | 1.8 | 1.5 | 1.1 |
| ROW | 22.3 | 25.7 | 23.7 | 26.9 | 24.0 | 26.6 | 25.8 | 38.6 | 28.9 | 33.7 | 25.3 | 29.2 | 18.1 | 22.1 |

| Specification | *Service sector* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CZ | | EE | | HU | | LT | | LV | | PL | | SK | |
| | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 | 2000 | 2014 |
| Absorption | 70.4 | 53.9 | 81.5 | 61.2 | 54.1 | 43.8 | 86.5 | 74.9 | 88.7 | 77.4 | 80.5 | 70.1 | 70.6 | 50.0 |
| Reflection | 9.6 | 10.9 | 1.5 | 2.1 | 14.1 | 13.3 | 2.2 | 2.2 | 1.6 | 1.4 | 6.2 | 6.2 | 10.2 | 9.0 |
| Redirection | 20.1 | 35.1 | 17.0 | 36.7 | 31.7 | 42.9 | 11.3 | 22.8 | 9.8 | 21.1 | 13.4 | 23.7 | 19.2 | 41.0 |
| CEE6 | 15.0 | 14.0 | 9.8 | 9.1 | 4.9 | 9.3 | 11.8 | 12.8 | 9.7 | 18.3 | 7.6 | 9.6 | 16.2 | 15.3 |
| EU14 | 40.5 | 37.4 | 43.2 | 36.9 | 44.4 | 35.0 | 40.5 | 24.8 | 36.6 | 24.1 | 47.9 | 41.0 | 49.5 | 35.8 |
| EU28rest | 3.1 | 3.2 | 0.4 | 0.7 | 3.9 | 7.6 | 0.4 | 1.0 | 0.7 | 1.0 | 2.1 | 3.0 | 2.9 | 3.6 |
| US | 9.1 | 5.5 | 6.6 | 5.2 | 15.2 | 9.2 | 7.7 | 4.7 | 10.4 | 4.0 | 8.0 | 5.0 | 4.7 | 5.1 |
| China | 1.2 | 4.3 | 1.1 | 3.0 | 1.1 | 5.1 | 0.8 | 2.5 | 0.9 | 2.5 | 1.0 | 3.2 | 0.5 | 7.8 |
| Japan | 1.8 | 1.0 | 2.0 | 1.5 | 2.3 | 1.6 | 1.6 | 1.1 | 1.7 | 1.1 | 1.3 | 1.1 | 3.8 | 0.8 |
| Russia | 3.0 | 6.9 | 4.0 | 12.7 | 1.9 | 3.3 | 7.4 | 12.2 | 6.0 | 11.4 | 4.0 | 6.0 | 2.7 | 7.6 |
| ASIArest | 1.6 | 1.9 | 1.5 | 2.1 | 1.5 | 1.9 | 1.4 | 1.7 | 1.2 | 1.6 | 1.4 | 1.8 | 1.4 | 1.1 |
| ROW | 24.7 | 25.7 | 31.4 | 28.9 | 24.8 | 27.0 | 28.4 | 39.2 | 32.8 | 36.0 | 26.6 | 29.1 | 18.4 | 23.0 |

Source: own calculations based on BM decomposition.

## IS GERMANY A HUB OF 'FACTORY EUROPE' FOR CEE COUNTRIES?

**Abstract**

The goal of the paper is to decompose gross exports and imports to/from Germany for seven selected economies in Central and Eastern Europe (CEE): the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland and Slovakia for 2000 and 2014, in order to identify the role of Germany in absorbing, reflecting and redirecting CEE trade. The authors use a gross trade decomposition proposed by Bonin and Mancini (2017), which is the extended version of the methodology of Koopman et al. (2014). The analysis shows a deep integration of CEE into 'Factory Germany' as the European industrial centre and a smaller role of Germany as a market of final destination. Germany plays an increasing role in the redirection of CEE exports to extra-European destinations, especially to the USA, China, and Russia. Additionally, it is found that the Baltic countries and Poland export domestic value added mostly included in services, while the Visegrád countries do so in manufacturing.

**Keywords:** international trade, global value chains, value-added flows, CEE economies, Germany

**JEL:** E16, F1, F14

## CZY NIEMCY SĄ EUROPEJSKIM CENTRUM PRZEMYSŁOWYM DLA KRAJÓW EŚW?

**Streszczenie**

Celem artykułu jest dekompozycja eksportu oraz importu brutto do Niemiec i z Niemiec dla siedmiu wybranych gospodarek Europy Środkowo-Wschodniej (EŚW): Czech, Estonii, Litwy, Łotwy, Polski, Słowacji i Węgier w latach 2000 i 2014, a także określenie roli Niemiec w absorpcji, reeksporcie i redystrybucji wartości dodanej wytworzonej w krajach EŚW. W analizie wykorzystywana jest dekompozycja eksportu brutto zaproponowana przez Borina i Manciniego (2017), będąca rozszerzeniem metody Koopmana i in. (2014). Przeprowadzona analiza wskazuje na silną integrację krajów EŚW z europejskim centrum przemysłowym ulokowanym w Niemczech, a jednocześnie mniejszą rolę Niemiec jako miejsca ostatecznego przeznaczenia eksportowanych wyrobów. Gospodarka niemiecka odgrywa coraz większą rolę w redystrybucji towarów eksportowanych przez kraje EŚW do krajów trzecich, takich jak USA, Chiny i Rosja. Ponadto stwierdzono, że eksportowana do Niemiec wartość dodana pochodząca z krajów bałtyckich i Polski zawarta jest głównie w usługach, natomiast w przypadku pozostałych krajów Grupy Wyszehradzkiej – w wyrobach przemysłowych.

**Słowa kluczowe:** handel międzynarodowy, globalne łańcuchy wartości, przepływ wartości dodanej, kraje EŚW, Niemcy

**JEL:** E16, F1, F14

## ЯВЛЯЕТСЯ ЛИ ГЕРМАНИЯ ГЛАВНЫМ ЕВРОПЕЙСКИМ ПРОМЫШЛЕННЫМ ЦЕНТРОМ ДЛЯ СТРАН ЦЕНТРАЛЬНОЙ И ВОСТОЧНОЙ ЕВРОПЫ?

**Резюме**

Целью статьи является декомпозиция экспорта и импорта брутто в Германию и из Германии для семи избранных экономик Центральной и Восточной Европы (ЦВЕ): Чехии, Эстонии, Литвы, Латвии, Польши, Словакии и Венгрии в 2000 и 2014 гг., а также определение роли Германии в абсорбции, реэкспорте и перераспределении добавленной стоимости, произведенной в странах ЦВЕ. В анализе использована декомпозиция экспорта брутто, предложенная Бореном и Манчини (2017), являющаяся расширением метода Коопмана и др. (2014). Проведенный анализ указывает на сильную интеграцию стран ЦВЕ с европейским промышленным центром, находящимся в Германии и одновременно на менее значительную роль Германии как места конечной поставки экспортируемых изделий. Немецкая экономика играет все большую роль в перераспределении товаров, экспортируемых странами ЦВЕ в третьи страны, такие как США, Китай и Россия. Кроме того отмечено, что экспортируемая в Германию добавленная стоимость, созданная в прибалтийских странах и Польше, заключена главным образом в услугах, зато в случае остальных стран Вышеградской группы – в промышленных изделиях.

**Ключевые слова:** международная торговля, глобальные цепочки стоимости, протекание добавленной стоимости, страны ЦВЕ и Германия

**JEL:** E16, F1, F14