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IS GERMANY A HUB OF FACTORY EUROPE FOR CEE COUNTRIES? THE SINK APPROACH IN GVC DECOMPOSITION

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Is Germany a hub of Factory Europe for CEE countries? The sink approach in GVC decomposition

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Abstract

The goal of the paper is to decompose gross exports/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, to identify the role of German in absorbing, reflecting, and redirecting CEE trade. We use a gross trade decomposition proposed by Borin and Mancini (2017), which is the extended version of the methodology of Koopman, Wang, and Wei (KWW; 2014). Our analysis shows the deep integration of CEE into 'Factory Germany' as well as also the overestimated role of Germany as a market of final destination. Germany plays the increasing role in CEE export redirection (and vice versa) to extra-European destinations, especially to the US, China, and Russia. Additionally, we state that the Baltic countries and Poland export domestic value added mostly included in services, while the Visegrád countries do so in manufacturing.

Keywords: value-added exports, CEE economies, trade linkages, GVC decomposition

JEL: E16, F1, F14, F1

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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 offshoring (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 of 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 was 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 Manzini (2017) methodology, who make 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 US 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 the US, 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, showing a 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, 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 US 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 the hub of Germany and its role in selected CEE trade (the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, and Slovakia) in 2000–2014. Based on the input-output tables from the WIOD database and on the value-added decomposition proposed by Borin and Manzini (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.

The Role of Germany in CEE FDI Flows, Trade, and the GVC: 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. German inward FDI in CEE countries (2015)

Country	Value [EUR millions]	Share of total inward FDI [%]	Germany's rank among foreign investors
Czech Rep.	12599.5	12.6	3
Estonia	250.4	1.4	15
Hungary	17157.8	22.4	2
Latvia	719.7	5.3	7
Lithuania	1246.5	9.2	3
Poland	27356.0	16.4	2
Slovakia	2546.1	6.3	7

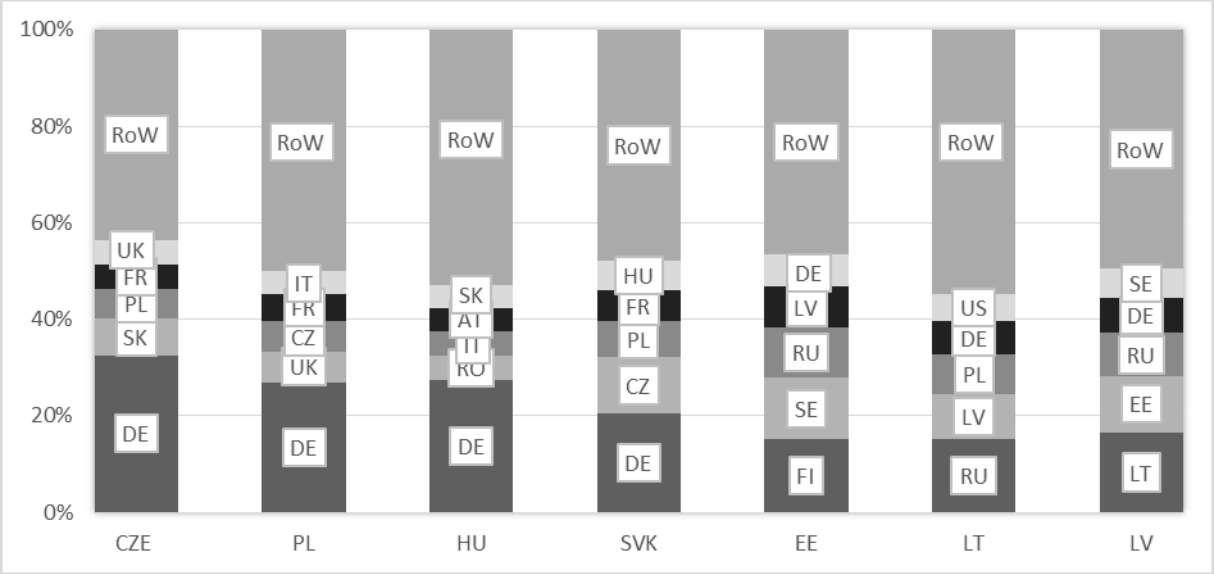
Note: Data for Czech Republic are for 2014.
Source: Ambroziak (2018), based on WIIW Foreign Direct Investment Database.

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

Over the past two decade, 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 countries, especially in Visegrád countries, where it has accounted for 20–33 per cent 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).

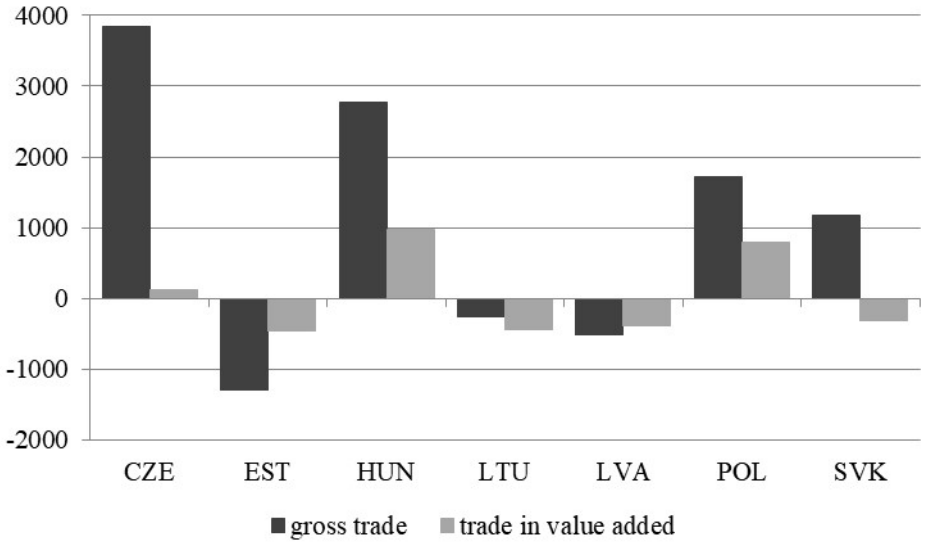
Figure 1. Five largest export partners of CEE countries (% of total gross exports in 2017)



Note: RoW = rest of world.
Source: Author calculation based on WIOT database.

Germany's great importance in CEE trade, unfortunately, does not mean a positive trade balance by the CEE countries. In 2014 the Baltic countries achieved 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: the higher value added imported from abroad (FVA) content of CEE exports to Germany than of CEE imports from Germany and the high share of final demand from third countries in explaining the trade balance.

Figure 2. Trade balance of the CEE countries with Germany in gross and value-added terms (USD million in 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: Author calculation based on WIOD.

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 show 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 per cent of the gross exports from Visegrád countries (except Poland) participated in GVCs, while the rate in Baltic countries (including Poland) this was around 50 per cent.

Table 2. Degree of participation in GVCs (in %, 2014)

	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)
CZE	0.5	5.0	67.1	68.7
EST	0.01	1.3	58.2	62.4
HUN	0.3	3.5	73.3	72.4
LTU	0.03	1.6	47.7	53.1
LVA	0.01	1.7	44.3	55.7
POL	0.9	4.9	53.6	56.0
SVK	0.2	3.7	68.5	71.5

Source: Author calculation based on WIOD. VA = value added.

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

Methodology of the Research

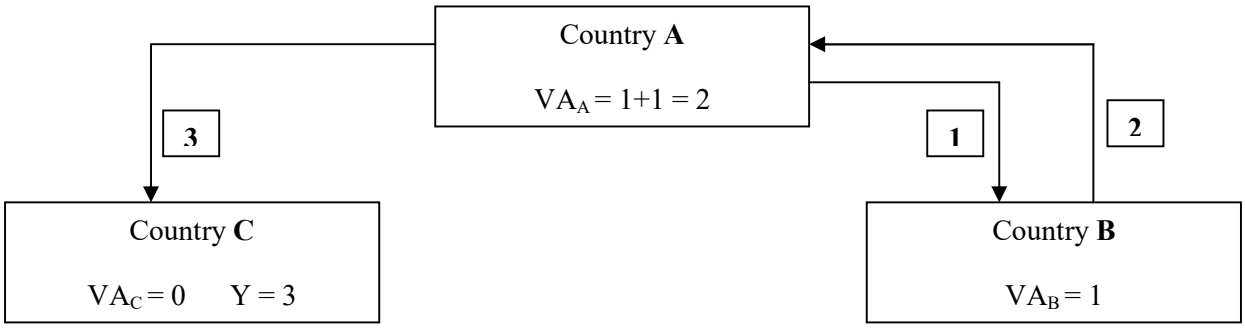
In the paper, we explore whether Germany is a hub of Factory Europe for the CEE countries. We focus on export flows measured in terms of domestic value added (DVA), both from CEE

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 (BM; 2017). Their approach is based directly on seminal work by Koopman, Wang, and Wei (KWW; 2014). 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). BM provide a fully correct decomposition in this area as well as a correct breakdown of the foreign content of export flows and introduce 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.

Figure 3. Domestic value added and double counting in bilateral trade flows



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.

As it mentioned before, in our paper we focus on downstream linkages of CEE countries, and that is why we regard the sink-based perspective as 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 in Equation 1 as follows[3]:

$$
\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}\Bigg[\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} \\
& \qquad + \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}\Bigg] \\
& + \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[\sum_{j\neq r}^{G}\mathbf{Y}_{rj} + \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}
\end{aligned}
\tag{1}
$$

where $\mathbf{A}_{rs}$ reflects the N×N matrix of coefficients for intermediate inputs that are produced in country *s* and used by country *r*, $\mathbf{B}_{rs}$ is the N×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

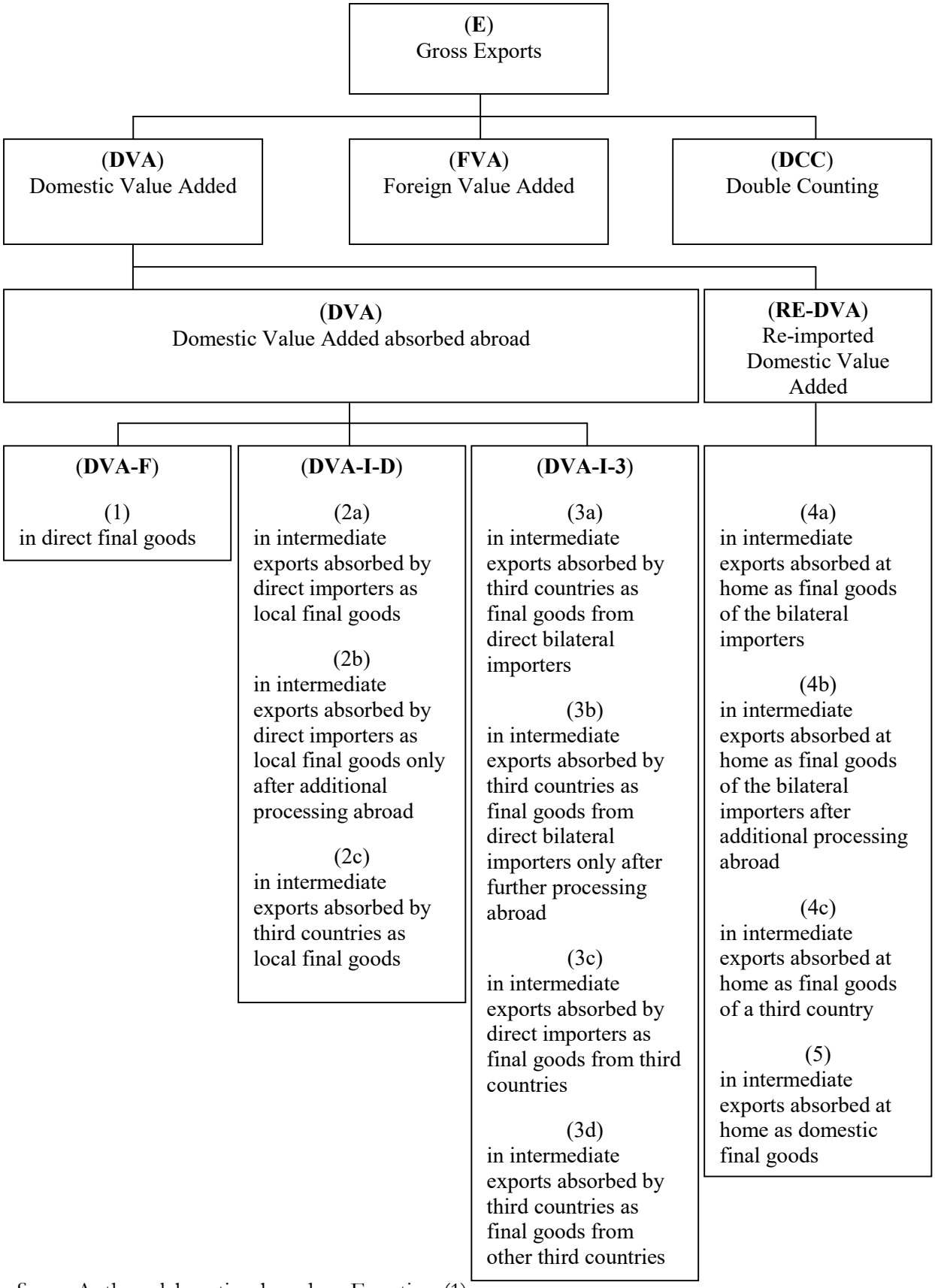
[3] For the decomposition details, see Borin and Mancini (2017), appendixes A and B.

requirement of other economies from country *s*[4]. $\mathbf{V}_s$ 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.
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 in final goods exports, DVA in intermediate goods and services consumed as local final goods, and DVA 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, direct bilateral importers but after additional production abroad, and from other third countries. In line with BM, as opposed to KWW, redirection is completed by DVA in intermediate exports absorbed by third countries as local final goods.

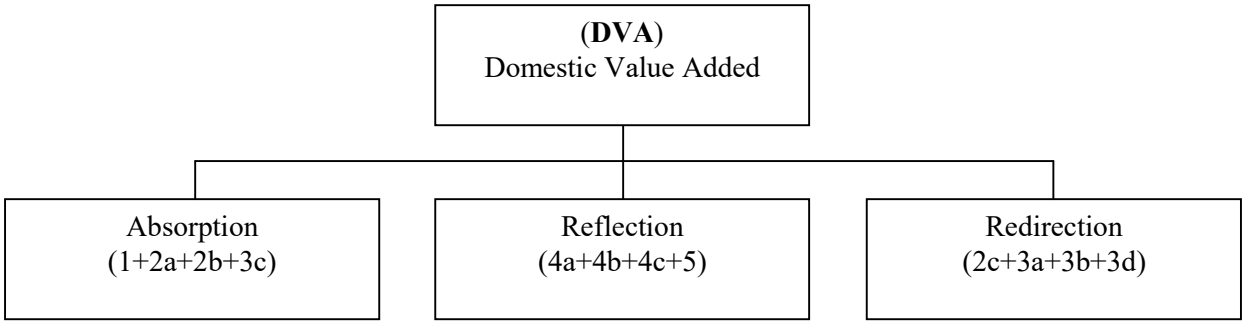
[4] $\mathbf{A}^s = \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1s} & \cdots & A_{1G} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & A_{ss} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ A_{G1} & A_{G2} & \cdots & A_{Gs} & \cdots & A_{GG} \end{bmatrix}$.

Figure 4. Decomposition of gross exports



Source: Author elaboration based on Equation (1).

Figure 5. Domestic value added in exports broken down by country of final absorption



Source: Author 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 (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.

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 groups of 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).

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 years analysed in all the countries. A large decline is observed, especially in the Czech Republic (13.7 percentage points [p.p.]) and Slovakia (10.3 p.p.). In comparison to the other economies, Hungary has the lowest DVA (46.2 per cent in 2000 and 43.4 per cent in 2014) and has a negligible decline.

In all countries (except for Hungary), FVA is stable, with 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 exports to Germany in 2000 and 2014 (%)

		DVA	FVA	DCC	ΔDVA	ΔFVA	ΔDCC
CZE	2000	65.1	26.3	8.6			
	2014	51.4	32.3	16.3	-13.7	6.0	7.8
EST	2000	64.4	27.4	8.2			
	2014	57.4	27.8	14.7	-7.0	0.5	6.5
HUN	2000	46.2	41.5	12.3			
	2014	43.4	39.0	17.6	-2.8	-2.5	5.3
LTU	2000	76.3	20.2	3.5			
	2014	67.3	20.6	12.1	-9.0	0.4	8.6
LVA	2000	71.2	20.6	8.2			
	2014	66.9	21.1	12.0	-4.4	0.5	3.9
POL	2000	73.5	20.2	6.3			
	2014	68.0	21.1	10.9	-5.5	0.9	4.6
SVK	2000	56.9	33.8	9.3			
	2014	46.6	35.1	18.4	-10.3	1.3	9.0

Source: Author calculation based on BM decomposition.

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

		DVA	FVA	DCC	ΔDVA	ΔFVA	ΔDCC
CZE	2000	73.3	15.2	11.6			
	2014	65.5	12.5	22.1	-7.8	-2.7	10.5
EST	2000	78.6	16.9	4.5			
	2014	69.0	17.1	13.8	-9.6	0.2	9.4
HUN	2000	72.1	11.2	16.7			
	2014	66.5	9.3	24.2	-5.7	-1.9	7.5
LTU	2000	77.1	19.1	3.8			
	2014	70.7	19.7	9.6	-6.5	0.6	5.8
LVA	2000	77.5	19.3	3.2			
	2014	71.5	20.6	7.8	-5.9	1.3	4.6
POL	2000	74.6	18.0	7.4			
	2014	67.4	18.7	13.9	-7.2	0.7	6.5
SVK	2000	73.6	15.5	10.9			
	2014	67.2	11.3	21.6	-6.4	-4.3	10.7

Source: Author calculation based on BM decomposition.

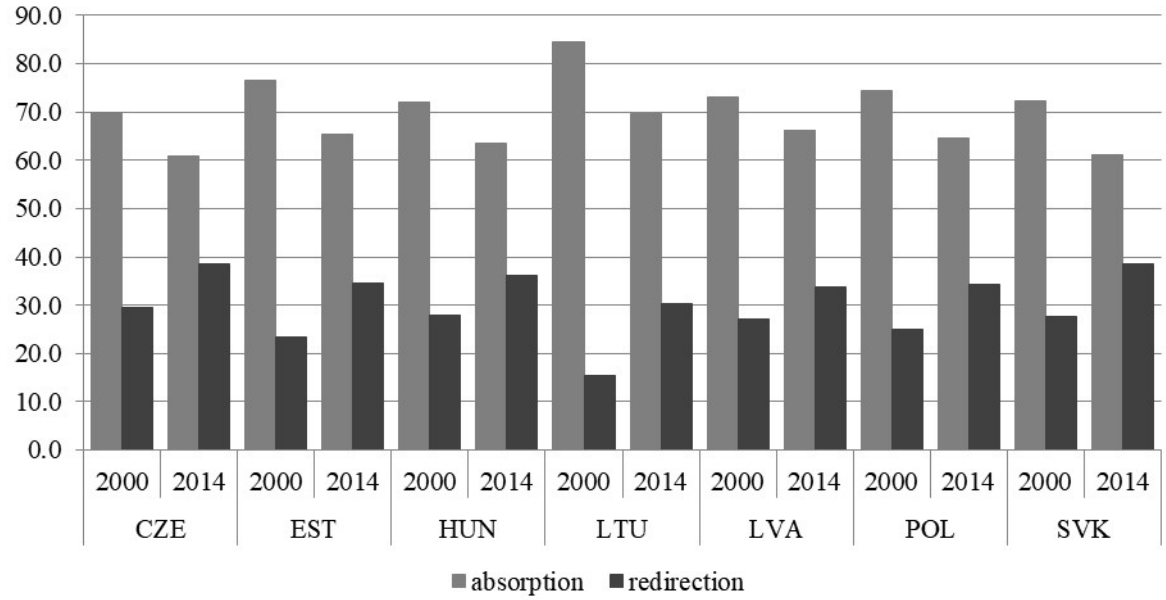
Results of analysis

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 has the highest value of absorption (84.4%), and at the same time Lithuania has the largest decline (15 p.p.) in the redirection advantage 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 has 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



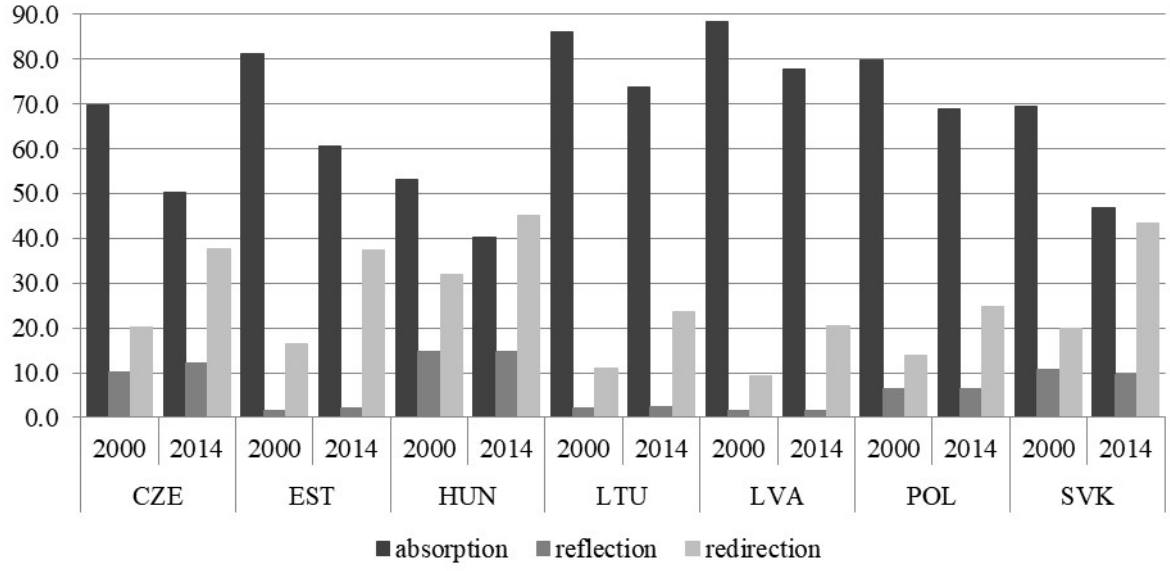
Notes: The reflection share of DVA is omitted if it fluctuates between 0.0% and 0.6%.
Source: Author calculation based on BM decomposition.

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 than consumed finally by Hungarian consumers and firms.

Figure 7. Structure of domestic value added in exports from Germany to CEE countries



Source: Author calculation based on BM decomposition.

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 compare to the redirection of CEE 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 increasing importance of redirection in Germany-CEE trade, in Table 5 the geographical structure of CEE value added redirected to the third countries through the German economy is presented. 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 DVA, but we observe strong decrease of their shares over time. It turn, the rest of the countries/subgroup of 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.

Table 5. The structure of CEE redirection via Germany (%) in 2000 and 2014

		CEE6	**EU14**	**EU28rest**	**USA**	**China**	**Japan**	**Russia**	**ASIArest**	**REST**
		i	ii	iii	iv	v	vi	vii	viii	ix
CZE	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
EST	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
HUN	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
LTU	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
LVA	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
POL	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
SVK	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; REST = Australia, Brazil, Canada, Mexico, Norway, Switzerland, and Turkey; ROW = rest of world.
Source: Author calculation based on BM decomposition.

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 CEE6 group. The results show a decreasing importance of old EU countries as final destinations of German DVA included in CEE exported products and services. We observe a Russia's and China's growing role as an indirect importers of German DVA. Especially, the Baltic countries increase heavily their trade in German DVA with Russia (Estonia, from 4.5 per cent to 13.3 per cent; Lithuania, from 7.6 per cent to 12.5 per cent; and Latvia, from 6.3 per cent to 12.1).

Table 6. The structure of German redirection via CEE countries (%) in 2000 and 2014

		CEE6	**EU14**	**EU28rest**	**USA**	**China**	**Japan**	**Russia**	**ASIArest**	**REST**
		i	ii	iii	iv	v	vi	vii	viii	ix
	2000	15.4	41.6	3.1	8.8	1.1	1.8	3.2	1.7	23.3
CZE	2014	13.7	37.7	3.2	5.5	4.1	1.0	7.3	1.9	25.6
	2000	10.6	45.9	0.4	6.7	1.1	1.9	4.5	1.4	27.5
EST	2014	9.1	37.3	0.7	5.3	3.1	1.5	13.3	2.1	27.7
	2000	5.0	44.7	3.9	15.2	1.1	2.3	2.0	1.5	24.3
HUN	2014	9.1	35.0	7.3	9.5	5.3	1.6	3.5	1.9	26.7
	2000	11.8	41.5	0.4	7.7	0.8	1.6	7.6	1.5	27.1
LTU	2014	12.9	25.1	1.0	4.7	2.5	1.1	12.5	1.7	38.5
	2000	10.1	37.9	0.7	10.9	0.8	1.6	6.3	1.2	30.5
LVA	2014	19.3	24.0	0.9	4.0	2.5	1.1	12.1	1.6	34.5
	2000	7.7	48.7	2.1	8.0	1.0	1.3	4.0	1.4	25.9
POL	2014	9.5	41.2	3.0	5.0	3.3	1.1	6.1	1.8	29.1
	2000	16.1	49.7	2.9	4.7	0.5	3.8	2.6	1.4	18.2
SVK	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; REST = Australia, Brazil, Canada, Mexico, Norway, Switzerland, and Turkey; ROW = rest of world.
Source: Author calculation based on BM decomposition.

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 Appendix 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).

Table 7. The share of DVA in manufacturing and DVA in services for CEE and German exports in 2000 and 2014

		DVA from CEE countries exported to Germany			DVA from Germany exported to CEE countries		
		absorption	**reflection**	**redirection**	**absorption**	**reflection**	**redirection**
		i	ii	iii	iv	v	vi
CZE	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
EST	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
HUN	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
LTU	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
LVA	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
POL	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
SVK	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: Author calculation based on BM decomposition.

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 in manufacturing strongly exceeds trade in services. Looking at Germany and its DVA in exports to CEE countries (iv—vi), 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 redirected part of CEE 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 are next redirected to third countries, mostly in manufactured products.

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

Table 8. Redirection share of DVA in manufacturing and DVA in services for CEE and German exports in 2000 and 2014

		DVA from CEE countries exported to Germany								
		CEE6	EU14	EU28rest	US	China	Japan	Russia	ASIArest	REST
CZE	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
EST	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
HUN	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
LTU	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
LVA	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
POL	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
SVK	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
		DVA from Germany exported to CEE countries								
		CEE6	EU14	EU28rest	US	China	Japan	Russia	ASIArest	REST
CZE	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
EST	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
HUN	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
2LTU	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
LVA	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
POL	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
SVK	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: Author calculation based on BM decomposition.

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 for 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 as hub Germany for CEE exports, especially to China and Russia. CEE economies also mostly redirect and then absorb German value added (as with Hungary in 2014).

Additionally, we discovered a clear specialisation pattern among CEE trade in 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 export 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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	Manufacturing sector													
	CZE		EST		HUN		LTU		LVA		POL		SVK	
	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
	Service sector													
	CZE		EST		HUN		LTU		LVA		POL		SVK	
	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

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. *Source*: Author calculations based on BM decomposition.

	Manufacturing sector													
	CZE		EST		HUN		LTU		LVA		POL		SVK	
	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
	Service sector													
	CZE		EST		HUN		LTU		LVA		POL		SVK	
	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

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. *Source*: Author calculations based on BM decomposition

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