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# Food Processing Industries in Visegrad Countries in Global Value Chains (1995–2018)

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## Abstract

The aim of the article is to evaluate the position in global value chains (GVCs) of food processing industries in the Visegrad countries (V4; Poland, Czechia, Hungary and Slovakia) between 1995 and 2018. To identify the intensity and forms of integration in GVC of these industries in each country and to compare it to the other V4 countries, we employed complex methods to measure the importance of foreign demand, (backward and forward) participation and position in GVCs, the territorial context of integration, and shifting patterns of the integration into GVCs using data from the TiVA database.

Our findings revealed variations in the integration of food processing industries in GVCs in the V4 countries. Common characteristics and trends were observed (e.g., increasing participation) until the Great Recession before stalling, increasing integration into European value chains, and absorption of foreign value added mostly from services industries. These trends are consistent with findings from previous studies.

A significant contribution of this study is that it reveals how food exports from the Czech Republic, Hungary and Slovakia are mostly linked to increased GVC participation. Notably, food processing industries in Hungary and Slovakia have continued to increase their participation in GVCs even after the Great Recession. Given the evidence of beneficial economic outcomes from increased participation in GVCs, this implies that the food processing industries in Hungary and Slovakia will become more competitive. Food industries in Poland and Hungary are positioning themselves relatively more downstream in the GVCs, while shifts in the Czech Republic and Slovakia are increasingly upstream. Given evidence of beneficial economic outcomes from increased participation in GVCs being more downstream in the GVCs, the V4 countries will need to evaluate how their trajectories may impact the future wellbeing of businesses and employees working in these industries.

Keywords: European Union, fragmentation of production, participation, value added, vertical specialization

JEL: F14, F15, F20



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## Introduction

In recent decades, one of the most important economic processes in the world economy is the increasing fragmentation in the production of goods and services, resulting in a deeper international division of labor and larger returns from specialization. World trade and production are increasingly structured around, and affected by, what is commonly referred to as global value chains (GVCs) (De Backer and Miroudot 2013; Gereffi 2014).

For countries in economic transition in Central Europe, foreign direct investments and trade within GVCs have been considered one of the most important vehicles of economic development and competitiveness (Kersan-Škaabić and Barisic 2023) since the introduction of the market economy and their liberalization in the early 1990s. In these transitional economies, integration within GVCs was promoted as a vehicle of technological development, with the potential to foster the growth of knowledge-based industries and further lead to their specialization in higher-value-added industries. This integration aims to enable their convergence with developed economies (Jurčić, Franc, and Barišić 2020).

It is understandable that these higher-value-added industries, such as automobiles, electronics, pharmaceuticals, and services, received significant attention and were intensively studied in literature in the Central and Eastern European (CEE) context (Kaminski and Ng 2005; Ženka and Pavlínek 2013; Cieślik, Biegańska, and Środa-Murawska 2016; 2019; Cieślik 2017; 2019; Antalóczy, Gáspár, and Sass 2019; Nacewska-Twardowska 2022; Venger, Romanovska, and Chyzhevska 2022). However, other industries in the region are becoming integrated into global value chains.

The agri-food sectors became increasingly organized within GVCs, led by food processors and retailers (De Backer and Miroudot 2013). Final food products consumed are increasingly organized across multiple countries and make use of inputs sourced from around the world. However, it is necessary to emphasize that the nature of products and processes in agri-food chains differ from those in other sectors. Transactions in agri-food chains are characterized by 1) frequency and time playing a critical role in production and logistics, 2) high uncertainty and high specificity of assets at various levels in the chain, and 3) factors such as the perishability of raw and intermediate processed products in the food supply chain (Trienekens 2011). Interactions among actors at different levels of the value chain thus become complicated, and more complex types of coordination relationships can be found. It is therefore relevant to argue that the integration of the agri-food sectors in the GVC will have a different character than for sectors that are traditionally associated with GVCs, such as engineering or electronics.

Additionally, as indicated by the OECD (2020), international trade in agriculture and food products plays a key role in providing consumers with greater choice and nutrition, lowering prices and production costs, and increasing supply. For producers, global markets send signals that drive efficient production decisions and generate substantial income and earning opportunities across the globe. In this context, GVCs link agriculture producers to consumers in different regions. The way the agri-food trade system is organized and the policies that influence it are thus of key interest and importance to policymakers.

It is also acknowledged that industries downstream in the GVC (e.g., food processing industries) play an increasing role in the systems of food production, including traceability and quality control systems, alternative marketing, and production contracts (Reardon and Timmer 2007). Thus, increased integration into GVCs increases the influence of this vertical governance system and creates a new set of factors in food systems. It is also important to keep in mind that the current aims of the European Union's (EU) agricultural policy highlight not only production/food security aspects but also social and environmental aspects. Integrating food processing industries into GVCs thus also becomes part of this complex "equation."

Research on firms' GVC integration in CEE countries has experienced a rapid rise in the last decade (Cieślik, Biegańska, and Środa-Murawska 2016; 2019; Cieślik 2017; 2019; Nacewska-Twardowska 2022; Kohut 2023; Kuzmenko and Cechura 2023). Despite the unique role and strategic position that food products play in our society when compared to other products of manufacturing industries, as well the attributes of agri-food chains that differ from those in other sectors, to the best of the authors' knowledge, no recent research has explored in detail the integration into GVCs of food processing industries in the CEE countries also known as the Visegrad countries (V4), specifically Poland, the Czech Republic, Hungary, and Slovakia. Given the specific developmental path of these countries since the 1990s, exploring the GVC integration in the food processing industries provides an interesting case for analysis.

To fill this gap and to provide a valuable contribution to government agri-food and industrial policies, this paper aims to evaluate the position in GVCs of food processing industries in the V4 between 1995 and 2018.

In this ex-post study, we use a globally consistent set of country and industry-level data on the integration of the goods processing sectors in GVCs to identify trends and comparisons to the overall economy in the V4 countries. The research covers an extended period from transformation and restructuring in the 1990s, the accession to the EU in 2004, the Great Recession (2008–2010), and post-recession recovery until just before the COVID-19 pandemic. This research provides important insights into the development pathways in CEE countries.

## Theoretical background

Global value chains can be defined as a range of activities dispersed across various countries that firms and workers engage in to bring a product from its conception to its end use (Gereffi and Fernandez-Stark 2018). Hummels, Ishii, and Yi (2001) defined GVCs as the series of stages of production of a commodity or service that encompass at least two international borders. The rise of GVCs has many policy implications in areas related to trade, investment, and industrial development. Dicken (2011) concludes that the growing integration of the sectors/regions in GVCs increases the influence of this vertical system and creates a new set of factors that influence the firm's and the sector/region's performance. There is also emerging evidence from Constantinescu, Mattoo, and Ruta (2019) and Ignatenko, Raei, and Mircheva (2019) that GVCs are even more beneficial for income growth and productivity than traditional trade. An OECD study (OECD 2016) highlights that a large share of employment in OECD countries (and their

key trading partner countries) relies on consumption taking place abroad, and this share has increased. A majority of these jobs originate in the service sector.

The rising fragmentation in production and the deeper international division of labor have been driven by the reduction of trade barriers, among other factors (Nenci et al. 2022). Accession to the EU was crucial to the emergence of conditions that were conducive to production fragmentation. Kaminski and Ng (2005) provided empirical support to the conclusion that Central Europe has become integrated into global, mostly EU-based networks of production and distribution.

There is a group of studies that have analyzed GVC participation of EU member states from different vantage points. Kersan-Škabić (2017) found a high level of participation of member states in GVCs with a predominance of backward linkages. They found that about 80% of value added in gross exports or final demand originates from other EU member countries. In another study, Kersan-Škabić and Barisic (2023) concludes that backward participation dominates, implying a high level of dependence of the production process in the EU on the import of intermediates (i.e., production inputs) from abroad. Vakhal (2023) suggests that EU membership has a positive impact on GVC embeddedness, whereas non-EU economies are still integrated into their own local downstream value chains.

Cieślik, Biegańska, and Środa-Murawska (2016) and Cieślik (2017) investigated the GVC integration of CEE countries between 2000 and 2009. They concluded that post-socialist countries differ in their levels of participation in GVCs, and countries that have stronger links with Western European countries, especially Germany, are more integrated. They also concluded that most CEE exporters are positioned in downstream segments of production rather than upstream markets. Furthermore, Cieślik (2019) analyzed the GVC connections of CEE countries in the electronics industry and found a dependence on industry exports of Chinese electronics. She concluded that in exports from the electronics industry, CEE countries have become more dependent on value added from China than from the EU. Nacewska-Twardowska (2022) concluded that the share of foreign value added in Polish exports was consistent with global trends, demonstrating Poland's deep commitment to global production chains.

Recently, Dellink, Dervisholli, and Nanci (2020) and Nenci et al. (2022) summarized evidence about the impact of GVC participation on agri-food sectors (although with significant variations across countries). Their summary concluded that while participation of these sectors in GVCs increased before the Great Recession, further integration stalled afterward. They also identified that the long-term increase in GVC participation came with an overall rise in gross exports in agriculture and food commodities, but roughly two-thirds of the export value was not part of a GVC. Further, they found that a boost to GVC participation in the food sector led to increased value-added creation in (mostly) foreign service sectors.

Lim (2021) found that modern agrarian economies were leapfrogging the manufacturing sector to directly develop their agriculture and services sectors through their participation in agri-food GVCs. Recent evidence showed that greater agri-food GVC participation was associated with an increase in agricultural employment growth and that positive job creation impact was mainly driven by the processed food industries downstream of GVCs rather than the raw commodity sector upstream (Lim and Kim 2022).

## Materials and methods

The data used in this paper come from the Trade in Value Added (TiVA) database (TiVA 2023). It contains a selection of principal indicators that track the origins of value added in exports, imports, and final demand. Indicators are available for 45 industries within a hierarchy based on ISIC Rev. 4 (Martins Guilhoto, Webb, and Yamano 2022). In this study, exports, imports, and production encompass food products, beverages, and tobacco as defined in the TiVA database, and they are in line with a hierarchy based on ISIC Rev. 4.

The analysis also compares food processing industries in the individual V4 countries and to the economies of V4 countries as a whole (where meaningful). This allows us to compare trends in the food processing industry and trends in the overall economy of these countries. The period covers 1995 to 2018 (before the COVID-19 pandemic).

Following recent empirical studies in global value chains (e.g., Hummels, Ishii, and Yi 2001; Koopman et al. 2010; Johnson and Noguera 2012; Cieślik, Biegańska, and Środa-Murawska 2016; Borin and Mancini 2020; Nacewska-Twardowska 2022), alternative empirical approaches are employed to investigate the effects of production fragmentation in the food processing industries in the V4 countries.

The Export Orientation index is used to analyze the share of country/industry value added that meets foreign final demand (FFDDVA). It reflects the measure of a country/industry's reliance on foreign final demand. It is defined as exported domestic value added (DVA) from the country/industry that meets foreign final demand as a percentage of the total value added produced by the country/industry (VALU).

$$\text{Export Orientation index} = \frac{\text{FFDDVA}}{\text{VALU}} \times 100. \tag{1}$$

Foreign value added (FVA) was historically the first indicator used in the literature by Hummels, Ishii, and Yi (2001) to measure a country's participation in GVCs, and it is known as the vertical specialization or backward participation index. It helps assess foreign suppliers' share in the total value of a country/sector's exports. It is considered a measure of backward linkages in the analysis of GVCs. It is defined as the FVA of a country/sector embodied in the country/sector's total gross exports. For the country analysis, the denominator is total exports, and for the industry analysis, the denominator is industry exports for a given country.

$$\text{Backward participation index} = \frac{\text{FVA}}{\text{EXGR}} \times 100. \tag{2}$$

The forward participation index uses the indicator of domestic value added sent to third economies (IV) and represents the country's domestic value added content embodied in the gross exports of industry in foreign countries. It is often considered a measure of forward linkages in analyses of GVCs.

$$\text{Forward participation index} = \frac{\text{IV}}{\text{EXGR}} \times 100. \tag{3}$$

Following Koopman et al. (2010), Johnson and Noguera (2012) and Borin and Mancini (2020), these metrics (DVA, FVA and IV) can be used to measure overall GVC participation and GVC position more precisely.

$$\text{GVC}_{\text{participation}} = \frac{\text{FVA} + \text{IV}}{\text{EXGR}}. \tag{4}$$

The GVC participation index indicates the share of a country's exports that is part of a multi-stage trade process. The higher the index, the greater the country's participation in a GVC. The measure of GVC participation can be used together with the GVC position index. The position index shows the location (vertical specialization) of the country in the production chain.

$$\text{GVC}_{\text{position}} = \ln\left(1 + \frac{\text{IV}}{\text{EXGR}}\right) - \ln\left(1 + \frac{\text{FVA}}{\text{EXGR}}\right). \tag{5}$$

A positive value (IV is higher than FVA) means the country lies upstream in the GVC. A negative value (IV is smaller than FVA) signals that it lies downstream. A country that exports raw materials or intermediate products lies upstream in the GVC; a country that uses a large portion of imported intermediate products to produce final goods for export lies downstream.

## Results and discussion

The food processing industries in the V4 show differences when compared according to the value of production, performance, and the level of integration into the international business environment (Table A1 in Appendix). Approximately two-thirds of the total production and export of food processing industries in the V4 countries comes from Poland. Slovakia has a smaller value of production and trade when compared to the other V4 countries. Poland and Hungary maintained their position as net exporters between 1995 and 2018. On the other hand, the Czech Republic and Slovakia were net importers during the same period. In the period under review, the value of production and trade increased in all V4 countries. Production and trade increased especially between 2005 and 2008, immediately after the V4 joined the EU in 2004.

Calculating industry openness reveals increases in the integration of V4 food processing industries into the international business environment. The inflow of foreign direct investments stimulated sectoral integration into the structures of the Common Single Market. As a result of these changes, the openness of food processing industries in all four V4 countries increased. The openness score of the food processing industry in Poland was lower when compared to the other V4 countries, although larger markets, such as the Polish market, typically have lower openness scores.

## Importance of foreign demand

The export orientation index was calculated to assess the extent to which food processing industries in the V4 countries rely on foreign markets to consume their production (Table 1).

Poland's share of value added in the food processing industry directed toward final foreign demand increased from 13.8% in 1995 to 40.5% in 2018. Similarly, the indices in the Czech Republic, Hungary and Slovakia reached 41.8%, 43.6%, and 40.9%, respectively, in 2018. This shows a significant increase in the orientation of V4 countries' food processing industries towards foreign markets, with approximately 40% of domestic value added embodied in foreign final demand. In the case of Slovakia, the results indicate an interesting situation: while there is an increasing orientation toward foreign markets, its trade deficit in food processing is widening.

Table 1. Export orientation Index for food processing industries and overall economies in Poland, Czechia, Hungary and Slovakia, selected years, %

| | | 1995 | 2000 | 2003 | 2005 | 2010 | 2015 | 2018 |
|---|---|---|---|---|---|---|---|---|
| Poland | F | 13.8 | 14.0 | 17.0 | 20.1 | 28.1 | 39.2 | 40.5 |
| | T | 19.8 | 21.4 | 24.6 | 25.7 | 27.9 | 33.5 | 36.4 |
| Czech Republic | F | 25.1 | 22.0 | 20.8 | 30.1 | 36.2 | 44.7 | 41.8 |
| | T | 31.4 | 35.3 | 31.7 | 37.2 | 37.6 | 43.2 | 42.5 |
| Hungary | F | 21.9 | 30.2 | 25.2 | 28.7 | 40.7 | 45.4 | 43.6 |
| | T | 29.3 | 38.6 | 34.3 | 36.1 | 42.8 | 47.7 | 46.1 |
| Slovakia | F | 21.3 | 16.6 | 19.6 | 32.8 | 35.7 | 38.7 | 40.9 |
| | T | 34.6 | 34.7 | 37.7 | 41.6 | 39.0 | 42.6 | 43.4 |

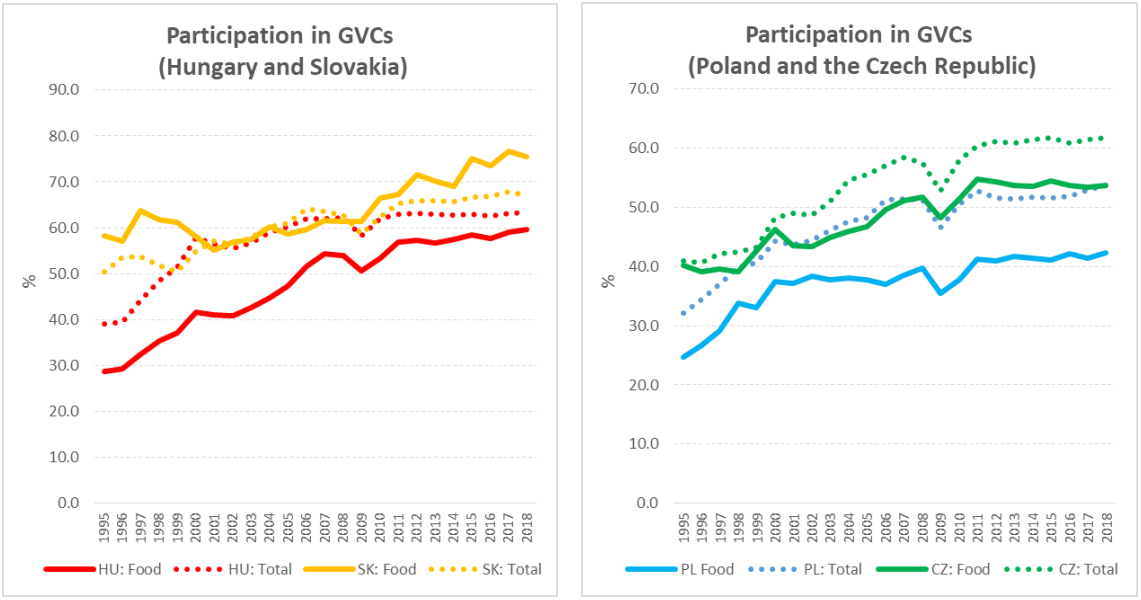
Note: F – Food processing industry; T – the overall economy.

Source: authors' elaboration, based on data retrieved from TiVA 2023.

When comparing these export orientation indices to the overall economies of V4 countries, the importance of foreign markets was smaller for food processing industries at the beginning of the period under review. However, food processing industries increased their dependence on foreign markets after the V4 acceded to the EU. At the end of the period, the food processing industry in Poland was even more reliant on foreign markets than was typical for the Polish economy.

## Participation in GVCs

The participation of V4 food processing industries in GVCs increased in the first half of the period under review until the Great Recession (Figure 1).




Note: Food – Food processing industry; Total – the overall economy.

Figure 1. Participation of V4 countries in GVCs for food processing industries and overall economies, selected years, %

Source: authors' elaboration, based on data retrieved from TiVA 2023.

In Poland and the Czech Republic, further integration essentially stalled in the subsequent period. This trend is in line with the results of existing studies (e.g., Nenci et al. 2022). On the other hand, the food processing industries in Hungary and Slovakia showed increasing GVC participation in the period after the Great Recession. The effects of the 2008 crisis are noticeable in all V4 countries. Food processing industries in V4 countries reveal lower participation in GVCs when compared to the overall economy, with the exception of Slovakia, which shows a slightly higher participation in GVC.

Long-term increases in GVC participation usually come with an overall rise in gross exports (Figure 2). The composition of gross exports is divided into backward-linked GVC exports, forward-linked GVC exports and non-GVC related exports. The backward-linked GVC exports are the sum of foreign value added across industries and countries, while the forward-linked exports are a part of domestic value added that will later be re-exported by the destination country. Non-GVC exports do not flow through GVCs; instead, they are absorbed in the destination country. In Poland, non-GVC-related exports still account for the dominant share (57.6%) of exports. By contrast, GVC-related exports make up 53.7% in the Czech Republic, 59.5% in Hungary, and 75.4% in Slovakia. The rapid rise in food exports of smaller V4 countries is thus linked to the increase in GVC participation (especially in Slovakia).

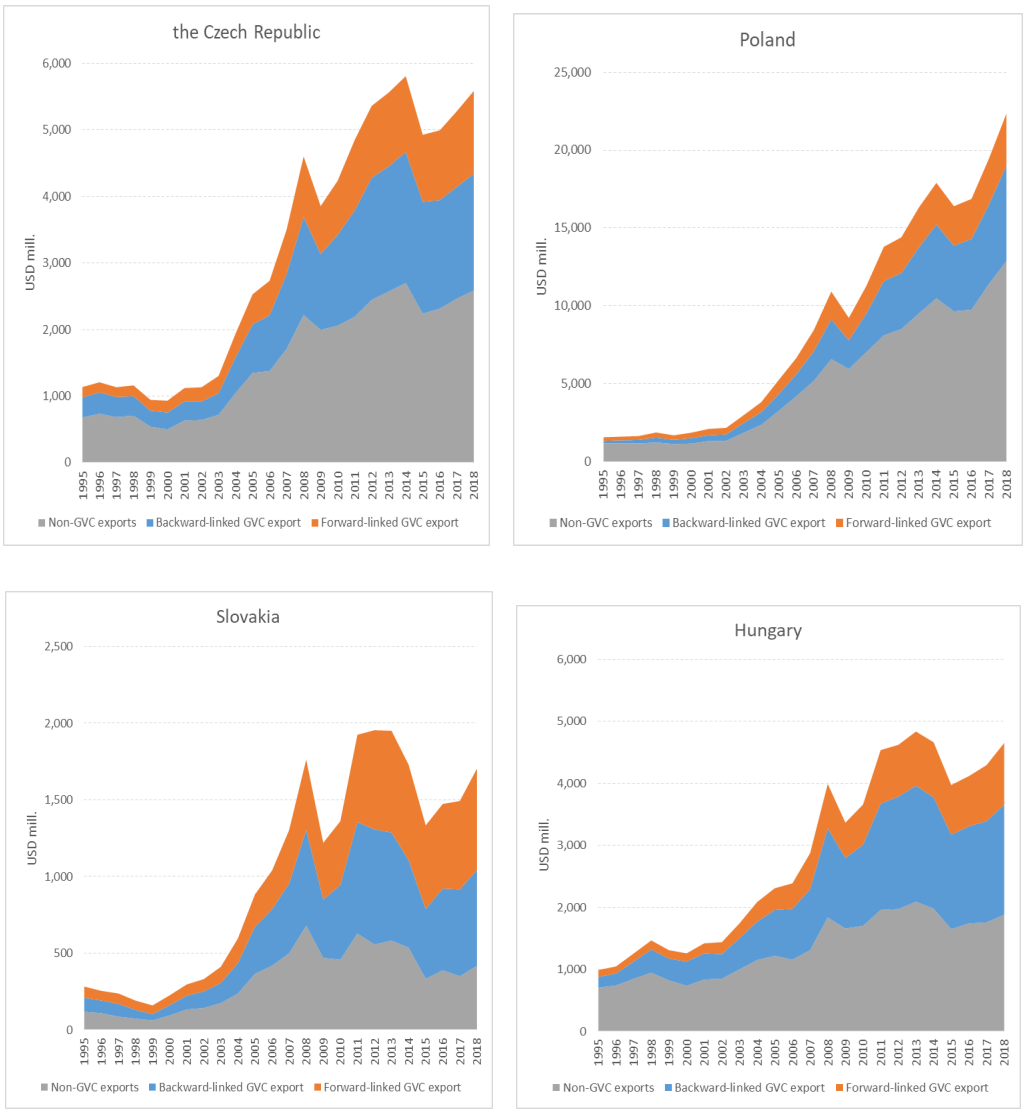



Figure 2. Exports and GVC participation of food processing industries in the V4 countries, 1995–2018, USD millions

Source: authors' elaboration based on data retrieved from TiVA 2023.

Another valuable way to further analyze and map the participation of V4 food processing industries in GVCs is to understand how they are positioned within GVCs. The domestic value added embedded in exports of a country's trading partners, along with the foreign value added used to create these exports, show whether a country is moving up or down a GVC.

## Backward participation in the GVC

Backward participation refers to foreign value added and expresses the buyer's perspective or sourcing side in the GVC, where an economy imports intermediate inputs to produce exports. Backward participation has increased in the food processing industries in all V4 countries. However, its level started to stagnate in the Czech Republic, Hungary and Slovakia following the Great Recession. In contrast, Poland's index value seems to have increased throughout the entire period under review. Additionally, when comparing smaller countries to the largest economies like Poland, some degree of caution is necessary because the latter is relatively self-sufficient. Hence,

the proportion of foreign value added in their exports is much lower than in smaller countries with less developed internal markets.

When comparing the food processing industries' backward participation in GVCs to the general situation in the whole economy of V4 countries, backward participation is generally less intensive. This again indicates that the food processing industries in these countries import fewer intermediate inputs to produce exports compared to the whole economy.

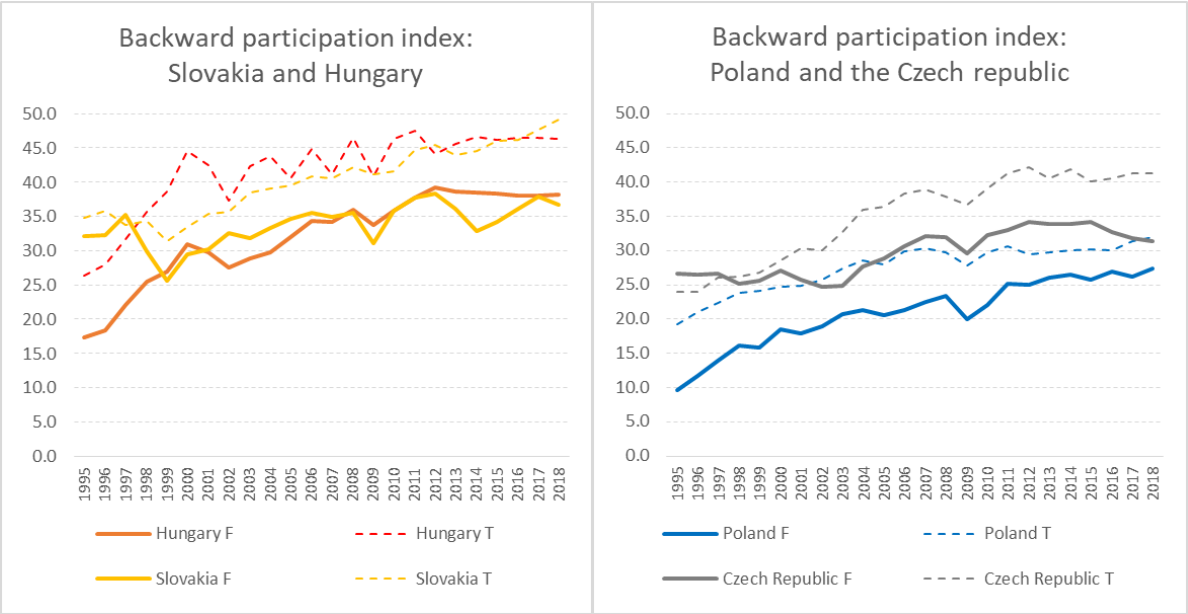



Figure 3. Backward participation indices of the food processing industry in Poland, the Czech Republic, Hungary, and Slovakia 1995–2018)

Source: authors' elaboration based on data retrieved from TiVA 2023.

The exports of food processing industries can stimulate value added creation in some other sectors. In the food processing industries, the largest share of imported sectoral foreign value added is provided by services (Table 2).

Table 2. Origin (industry) of foreign value added in V4 food processing industry exports; selected years, (%)

| Industry (ISIC Rev. 4) | 1995 | 2000 | 2003 | 2005 | 2010 | 2015 | 2018 |
|---|---|---|---|---|---|---|---|
| Poland | | | | | | | |
| Agriculture, hunting, forestry and fishing | 11.1 | 11.0 | 9.6 | 9.8 | 13.6 | 13.4 | 14.9 |
| Food products, beverages and tobacco | 3.5 | 3.3 | 3.4 | 4.3 | 5.6 | 7.0 | 6.5 |
| Manufacturing (excl. food., bev. and tob.) | 33.2 | 29.7 | 30.5 | 28.1 | 22.8 | 22.4 | 21.9 |
| Total Business Sector Services | 38.1 | 42.9 | 44.4 | 43.9 | 43.4 | 45.6 | 44.8 |
| Czech Republic | | | | | | | |
| Agriculture, hunting, forestry and fishing | 16.6 | 15.8 | 13.9 | 14.8 | 14.4 | 14.5 | 14.6 |
| Food products, beverages and tobacco | 5.0 | 4.9 | 5.7 | 7.1 | 6.9 | 6.6 | 5.8 |
| Manufacturing (excl. food., bev. and tob.) | 23.7 | 21.8 | 22.2 | 19.5 | 19.1 | 19.9 | 20.5 |
| Total Business Sector Services | 43.5 | 45.6 | 46.3 | 45.7 | 46.1 | 47.6 | 47.1 |

| Industry (ISIC Rev. 4) | 1995 | 2000 | 2003 | 2005 | 2010 | 2015 | 2018 |
|---|---|---|---|---|---|---|---|
| Hungary | | | | | | | |
| Agriculture, hunting, forestry and fishing | 8.5 | 7.1 | 6.8 | 6.8 | 8.1 | 8.8 | 9.4 |
| Food products, beverages and tobacco | 3.2 | 2.2 | 2.0 | 2.8 | 3.7 | 3.9 | 3.6 |
| Manufacturing (excl. food., bev. and tob.) | 31.8 | 33.7 | 31.3 | 28.0 | 24.4 | 24.4 | 24.7 |
| Total Business Sector Services | 43.6 | 43.8 | 47.5 | 47.3 | 47.8 | 48.6 | 47.6 |
| Slovakia | | | | | | | |
| Agriculture, hunting, forestry and fishing | 13.0 | 9.5 | 8.6 | 9.9 | 20.2 | 15.7 | 13.8 |
| Food products, beverages and tobacco | 4.9 | 4.3 | 4.4 | 6.6 | 7.2 | 4.9 | 6.0 |
| Manufacturing (excl. food., bev. and tob.) | 27.0 | 28.0 | 28.0 | 27.3 | 20.4 | 25.1 | 25.0 |
| Total Business Sector Services | 39.9 | 42.4 | 45.9 | 42.1 | 38.0 | 41.9 | 44.1 |

Source: authors' elaboration, based on data retrieved from TiVA 2023.

In all V4 countries, the share is similar, at around 45%, and the share of foreign services in imported value added increased during the period under review. This means that any boost to agri-food GVC participation in these countries contributes to increased value added creation (job creation) in certain foreign service sectors. Similarly, the boost to agri-food GVC participation in non-V4 countries leads to increased value added creation in services, agricultural, and other manufacturing sectors in the V4. The significant foreign value added inputs are (understandably) agricultural commodities and the share ranges between 9.4% in Hungary to 14.9% in Poland.

## Forward participation in GVCs

The forward participation of food processing industries has steadily increased in the Czech Republic and Hungary, with similar values of value for the overall economy of these countries. The situation in Poland and Slovakia differs, however. Forward participation in Poland increased at the beginning of the period under review. However, since joining the EU, forward participation of the food processing industry has decreased, contrary to the trend in the overall Polish economy.

After Slovakia joined the EU, the forward participation of the Slovakian economy stagnated. Conversely, forward participation in the Slovakian food processing industry has significantly increased. This change in forward linkages of the food processing industry contrasts with trends in the other V4 countries. The difference between the change of participation in the food processing industry and in the overall economy in Poland and Slovakia indicates the existence of sector-specific factors that shape how these countries' food industries integrate into GVCs.

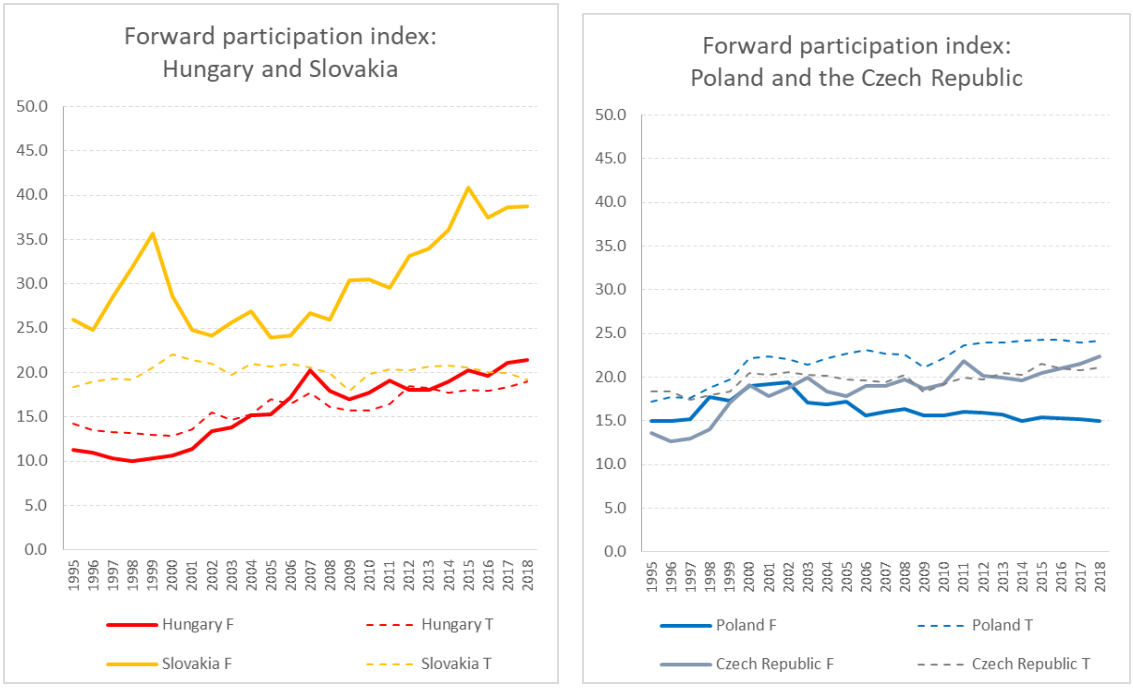



Figure 4. Forward participation indices of the food processing industry in Poland, the Czech Republic, Hungary, and Slovakia 1995–2018)

Source: authors' elaboration, based on data retrieved from TiVA 2023.

## Territorial context of the integration into the GVC

Increasing interest in Regional Value Chains (cf. Elia et al. 2021; Kersan-Škabić and Belullo 2021) has gained momentum due to the increasing protectionism that has resurfaced among several global powers as well as the need for redundant regional and domestic supply chains for critical supplies that were exposed by the COVID-19 pandemic. Understanding the relative participation of V4 countries in relation to the rest of Europe vs the Rest of the World will be important for future strategic positioning of food processing industries in these countries (Table 3).

The foreign value added in the exports of V4 food processing industries mostly comes from the EU (Table 3). In 2018, Poland's food processing industry sourced 58.4% of foreign value added from other EU countries, while the Czech Republic sourced 66.6%, Hungary 67.8%, and Slovakia 68.6%. Additionally, the majority of foreign value added was sourced from EU15 countries, especially Germany. The V4 countries also source inputs from each other.

Table 3. Origin (region) of foreign value added in exports and the destination of domestic value added in V4 food processing industry exports; selected years, %

| | | 1995 | 2000 | 2003 | 2005 | 2010 | 2015 | 2018 |
|---|---|---|---|---|---|---|---|---|
| Origin (region) of foreign value added in exports of food processing industry | | | | | | | | |
| PL | EU28 | 60.7 | 59.9 | 64.9 | 61.0 | 55.7 | 58.1 | 58.4 |
| | EU15 | 54.3 | 53.9 | 58.8 | 54.2 | 48.3 | 50.7 | 50.4 |
| CZ | EU28 | 66.6 | 61.3 | 65.7 | 65.8 | 64.2 | 66.4 | 66.6 |
| | EU15 | 51.9 | 49.3 | 52.4 | 49.7 | 48.1 | 48.2 | 48.8 |

| | | 1995 | 2000 | 2003 | 2005 | 2010 | 2015 | 2018 |
|---|---|---|---|---|---|---|---|---|
| HU | EU28 | 61.4 | 60.6 | 63.7 | 66.0 | 65.9 | 68.5 | 67.8 |
| | EU15 | 53.7 | 52.4 | 54.9 | 54.0 | 48.9 | 48.9 | 48.3 |
| SK | EU28 | 65.8 | 63.7 | 70.3 | 62.7 | 40.1 | 59.7 | 68.6 |
| | EU15 | 37.8 | 43.7 | 46.4 | 37.9 | 23.1 | 35.1 | 41.4 |
| Destination of domestic value added in exports of food processing industry | | | | | | | | |
| PL | EU28 | 63.3 | 59.7 | 63.8 | 70.9 | 76.9 | 74.8 | 79.2 |
| | EU15 | 58.4 | 46.7 | 49.4 | 50.9 | 57.5 | 54.9 | 61.2 |
| CZ | EU28 | 66.1 | 77.0 | 78.3 | 80.2 | 82.5 | 80.5 | 82.1 |
| | EU15 | 38.4 | 41.9 | 42.5 | 39.8 | 50.2 | 42.5 | 43.3 |
| HU | EU28 | 74.6 | 69.1 | 70.4 | 69.6 | 76.2 | 75.3 | 77.5 |
| | EU15 | 57.7 | 49.8 | 51.7 | 48.3 | 41.8 | 45.1 | 46.4 |
| SK | EU28 | 78.7 | 81.3 | 81.4 | 85.6 | 90.3 | 89.2 | 89.4 |
| | EU15 | 23.3 | 25.2 | 19.1 | 28.4 | 25.7 | 28.5 | 30.0 |

Source: authors' elaboration, based on data retrieved from TiVA 2023.

Table 3 also presents the domestic value added that is part of the exports of food processing industries in the V4 countries. The products from which the DVA is embedded may be used as intermediate products and re-exported, or they may be used as final products for consumption.

The share of DVA directed toward EU countries increased between 1995 and 2018, reaching 79.2% in Poland, 82.1% in the Czech Republic, 77.5% in Hungary, and 89.4% in Slovakia. The EU15 countries are important destinations for exports of DVA from food processing industry products, especially from Poland (61.2%). However, the new member states (EU13; not shown in the table) became important destinations of this DVA, especially after the EU's enlargement. Between 1995 and 2018, the share of EU13 countries as destinations for domestic value added increased from 4.9% to 18.0% in Poland, from 27.7% to 38.8% in the Czech Republic, from 16.9% to 31.1% in Hungary, and from 55.4% to 59.4% in Slovakia. In other words, a large proportion of imports and exports (and value added) are integrated within EU value chains; however, the exact territorial linkages and magnitude probably differ when comparing the V4 countries to each other.

## The Shifting patterns of GVC integration

Although the participation index and indices of backward and forward participation provide information about the intensity and form of integration of food processing industries in GVCs, the combination of indicators of participation and position allows for a more comprehensive assessment of the trajectory of integration in additional contexts (Figure 5).

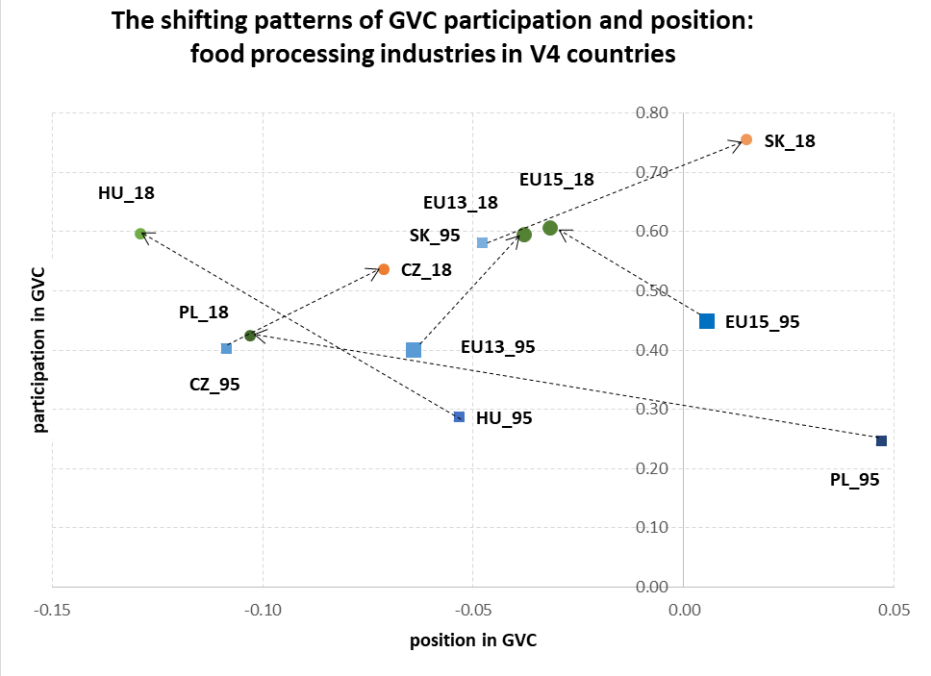



Figure 5. The shifting patterns of GVC participation and position of the food processing industries in V4 countries, 1995 and 2018

Note: EU 15: old EU Member States; EU13: new EU Member States (joined the EU in 2004, 2007, and 2013)

Source: authors' elaboration based on data retrieved from TiVA 2023.

The overall participation of the V4 economies in GVCs increased during the period under review, with these economies situated relatively downstream in the GVCs. Throughout this period, the V4 economies shifted more downstream (not presented here).

Food processing industries in the V4 countries increased their participation when comparing the beginning and end of the period under scrutiny. At the same time, Poland and Hungary are shifting their relative positions more downstream (this pattern is also typical for the EU15 member states). By contrast, the Czech Republic and Slovakia are moving their relative positions more upstream (the year-on-year changes are presented in Figure A1 in the Appendix).

## Conclusion

The aim of the article was to evaluate the position of food processing industries in Visegrad countries in global value chains (GVCs) between 1995 and 2018.

During this period, these industries increased their integration into GVCs until the Great Recession, which aligns with the general trend of many countries observed globally (Nenci et al. 2022). However, further integration subsequently stalled for Poland and the Czech Republic. In contrast, the food processing industries in Hungary and Slovakia increased their participation, even after the Great Recession, mostly because of the increase in forward linkages. Based on existing studies (Constantinescu, Mattoo, and Ruta 2019; Ignatenko, Raei, and Mircheva 2019), we recognize that increasing participation in GVCs is generally more

beneficial for productivity and income growth than traditional trade. This suggests that the food industry in Hungary and Slovakia will become more competitive.

Our results further revealed that a dominant share of food export value from Poland still consists of non-GVC-related food exports. In contrast, GVC-related food exports were more significant in the Czech Republic, Slovakia and Hungary. The rapid rise of food exports of the smaller V4 countries is mostly linked to the increase in GVC participation, especially in Slovakia.

The territorial decomposition of imported and exported value added suggests that food industries in the V4 countries are increasingly integrated within the EU's Regional Value Chains. This is consistent with the results of Cieślik, Biegańska, and Środa-Murawska (2016). In these industries, the largest share of imported sectoral foreign value added was provided by service sectors, implying that exports of V4 food processing industries can stimulate value added creation in sectors in other EU countries. Consequently, any boost to agri-food GVC participation in V4 countries likely increases value added creation (and possibly job creation) in (mostly) service sectors in EU countries. This shows the high complexity of economic integration of the V4 in the EU, which goes beyond traditional trade assessments.

The combination of results of participation and position indices revealed shifting patterns of integration into the GVC of V4 food processing industries. Poland and Hungary are moving their relative position in GVCs more downstream, while the Czech Republic and Slovakia are moving upstream. When linking our results to recent evidence (Lim and Kim 2022), the relatively more downstream position of food industries in Poland and Hungary should be associated with positive job creation and agricultural employment impacts. However, the upstream shifts in the Czech Republic and Slovakia should have policymakers in these countries paying closer attention to this value chain evolution.

There are limitations in this research that should be considered. First, some of the V4 countries experienced a slowdown in their participation in GVCs after the Great Recession. However, since the indicators applied cannot draw causal inference, it is difficult to explain if most of the slowdown was due to the Great Recession or if some of it resulted from earlier gains from regional and GVC participation before the Great Recession that had already been extracted prior to EU accession.

Similarly, it is difficult to fully understand why some of the changes in position occur. For example, EU accession also resulted in an increasing number of value-added manufacturing establishments in the food industry in these countries being purchased by companies from outside the V4 (particularly from other EU member states). The changing participation and position of V4 countries in GVCs may be driven by how these non-V4 corporations are aligning/restructuring these establishments within their own supply chains.

Companies may be repositioning their food industry establishments in countries downstream because they want food industry products with weight-gaining processes (e.g., bottling of food and beverages) or products with high perishability geographically closer to high population centers to reduce transportation and shrinkage costs (Shaffer, Deller, and Marcouiller 2004). This may partly explain Poland's move downstream in GVCs.

Second, while much has been said about the value added gains from GVC trade, this research does not identify who owns that value added. It remains unclear if the value added gains from GVC participation in a country accrue to business owners and employees residing in that country or if ownership lies with multinational companies, resulting in the value added leaking outside the countries' borders. This raises questions about how value added is distributed upstream or downstream to owners of labor and capital. Many assumptions about the benefits of repositioning downstream come from research in non-food value chains. The idea that increasing valued added will correspond with higher employment and wages as a result of repositioning downstream may not hold for food value chains. For example, if there are potentially higher-paying jobs at earlier stages of food processing and lower-paying jobs downstream (particularly if downstream includes wholesaling and retailing portions of the value chain), then assuming that moving downstream may be a more desirable development strategy may need to be reevaluated.

GVCs will create an additional vertical system of governance and a new set of factors that influence the agri-food systems in V4 countries and their ability to deliver food production, as well as social and environmental goods and services. Given the current emphasis on environmental footprints, it opens up avenues for further research into how GVCs affect changes in the positioning of CEE countries within GVCs. The findings in this study can help inform industrial, agricultural, and trade policymakers when assessing liberalization trends and structural transformations within agribusiness sectors in their countries, as well as when assessing the potential benefits and risks.

Further research is also needed to study the COVID-19 pandemic and its aftermath to understand how COVID-19 disrupted the agri-food GVCs in the V4 countries or to what extent GVCs revealed robustness and resilience. Additionally, as noted by Nenci et al. (2022), recent slowdowns and reductions in global production fragmentation have raised new questions related to reshoring, diversification along GVCs, and regionalization as a consequence of reduced chain lengths.

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## Branże przetwórstwa spożywczego krajów Grupy Wyszehradzkiej w globalnych łańcuchach wartości (1995–2018)

Celem artykułu było zbadanie pozycji w globalnych łańcuchach wartości (GVC) branż przetwórstwa spożywczego w krajach Grupy Wyszehradzkiej (w Polsce, Czechach, na Węgrzech i Słowacji) w latach 1995–2018. Aby zidentyfikować intensywność i formy integracji tych branż w GVC w każdym kraju oraz porównać je z innymi krajami V4, zastosowano złożone metody służące do pomiaru znaczenia popytu zagranicznego, dotychczasowej i przyszłej partycypacji i pozycji w GVC, terytorialnego kontekstu integracji oraz zmieniających się wzorców integracji w GVC przy użyciu danych z bazy danych TiVA.

Analiza ujawniła różnice w obszarze integracji branż przemysłu przetwórstwa spożywczego w GVC między krajami V4. Zaobserwowano wspólne cechy i tendencje (np. wzrost partycypacji aż do wielkiej recesji, a następnie wyhamowanie, rosnącą integrację w europejskich łańcuchach wartości i absorpcję zagranicznej wartości dodanej głównie z sektorów usługowych). Tendencje te są zgodne z wynikami poprzednich badań.

Istotnym wkładem tego badania jest to, że ujawnia ono, w jaki sposób eksport żywności z Czech, Węgier i Słowacji jest powiązany głównie ze zwiększoną partycypacją w GVC. Warto zauważyć, że przemysł przetwórstwa spożywczego na Węgrzech i Słowacji zwiększał swój poziom partycypacji w GVC, nawet po wielkiej recesji. Biorąc pod uwagę korzystne wyniki gospodarcze wynikające ze zwiększonego udziału w GVC, oznacza to, że przemysł przetwórstwa spożywczego na Węgrzech i Słowacji stanie się bardziej konkurencyjny. Przemysł spożywczy w Polsce i na Węgrzech pozycjonuje się coraz niżej w łańcuchach wartości, podczas gdy zmiany w Czechach i na Słowacji mają tendencję wzrostową. Biorąc pod uwagę dowody na korzystne wyniki gospodarcze wynikające ze zmniejszonego udziału w globalnych łańcuchach wartości, kraje V4 będą musiały ocenić, w jaki sposób kierunki ich działania mogą wpłynąć na przyszły dobrobyt przedsiębiorstw i pracowników z tych branż.

Słowa kluczowe: Unia Europejska, fragmentacja produkcji, partycypacja, wartość dodana, specjalizacja pionowa

## Appendix

Table A1. The values of production, export, import and sectoral openness for the food processing industry in Poland, the Czech Republic, Hungary and Slovakia; selected years

| | Units | 1995 | 2000 | 2003 | 2005 | 2010 | 2015 | 2018 |
|---|---|---|---|---|---|---|---|---|
| **Poland** | | | | | | | | |
| Production | US Dollar, Millions | 20,488.0 | 22,761.2 | 27,906.6 | 40,084.6 | 57,045.1 | 59,035.2 | 73,890.6 |
| Export | US Dollar, Millions | 1,568.5 | 1,863.6 | 2,992.4 | 5,247.7 | 11,285.3 | 16,407.6 | 22,361.6 |
| Import | US Dollar, Millions | 911.7 | 1,720.1 | 2,310.0 | 3,822.7 | 8,513.8 | 9,789.1 | 12,876.1 |
| Openness$^{F}$ | (EX + IM) / PROD. (%) | 12.1 | 15.7 | 19.0 | 22.6 | 34.7 | 44.4 | 47.7 |
| Openness$^{T}$ | | 24.2 | 31.5 | 35.0 | 35.2 | 39.4 | 44.2 | 47.9 |
| **The Czech Republic** | | | | | | | | |
| Production | US Dollar, Millions | 8,165.3 | 7,401.6 | 10,774.3 | 13,528.2 | 16,646.6 | 13,928.9 | 16,996.9 |
| Export | US Dollar, Millions | 1,135.9 | 931.6 | 1,302.9 | 2,530.0 | 4,235.3 | 4,926.5 | 5,584.5 |
| Import | US Dollar, Millions | 1,017.8 | 940.5 | 1,433.4 | 2,489.4 | 4,484.9 | 5,246.1 | 6,085.5 |
| Openness$^{F}$ | (EX + IM) / PROD. (%) | 26.4 | 25.3 | 25.4 | 37.1 | 52.4 | 73.0 | 68.7 |
| Openness$^{T}$ | | 38.4 | 44.2 | 40.7 | 48.7 | 49.6 | 59.1 | 57.1 |
| **Hungary** | | | | | | | | |
| Production | US Dollar, Millions | 7,778.0 | 6,246.3 | 9,909.7 | 11,130.9 | 11,569.7 | 11,203.8 | 13,117.6 |
| Export | US Dollar, Millions | 989.4 | 1,258.8 | 1,743.0 | 2,309.1 | 3,657.5 | 3,973.5 | 4,651.0 |
| Import | US Dollar, Millions | 462.6 | 596.0 | 977.1 | 1,765.8 | 3,054.9 | 2,991.2 | 3,787.2 |
| Openness$^{F}$ | (EX + IM) / PROD. (%) | 18.7 | 29.7 | 27.4 | 36.6 | 58.0 | 62.2 | 64.3 |
| Openness$^{T}$ | | 37.0 | 62.0 | 57.2 | 53.9 | 68.6 | 76.7 | 75.3 |
| **Slovakia** | | | | | | | | |
| Production | US Dollar, Millions | 2,395.5 | 2,145.3 | 2,976.9 | 3,484.4 | 4,437.6 | 3,997.7 | 4,673.5 |
| Export | US Dollar, Millions | 282.6 | 225.3 | 411.3 | 882.9 | 1,360.7 | 1,333.2 | 1,703.0 |
| Import | US Dollar, Millions | 430.4 | 435.6 | 623.1 | 1,533.7 | 3,012.6 | 2,762.6 | 3,694.8 |
| Openness$^{F}$ | (EX + IM) / PROD. (%) | 29.8 | 30.8 | 34.7 | 69.4 | 98.6 | 102.5 | 115.5 |
| Openness$^{T}$ | | 45.9 | 45.2 | 52.3 | 62.1 | 59.7 | 65.8 | 66.7 |

Note: The openness is calculated as: (export + import) / production; Openness$^{F}$ – gross trade openness of food processing industry; Openness$^{T}$ – overall gross trade openness of the economy.

Source: own calculations, data from TiVA 2023.

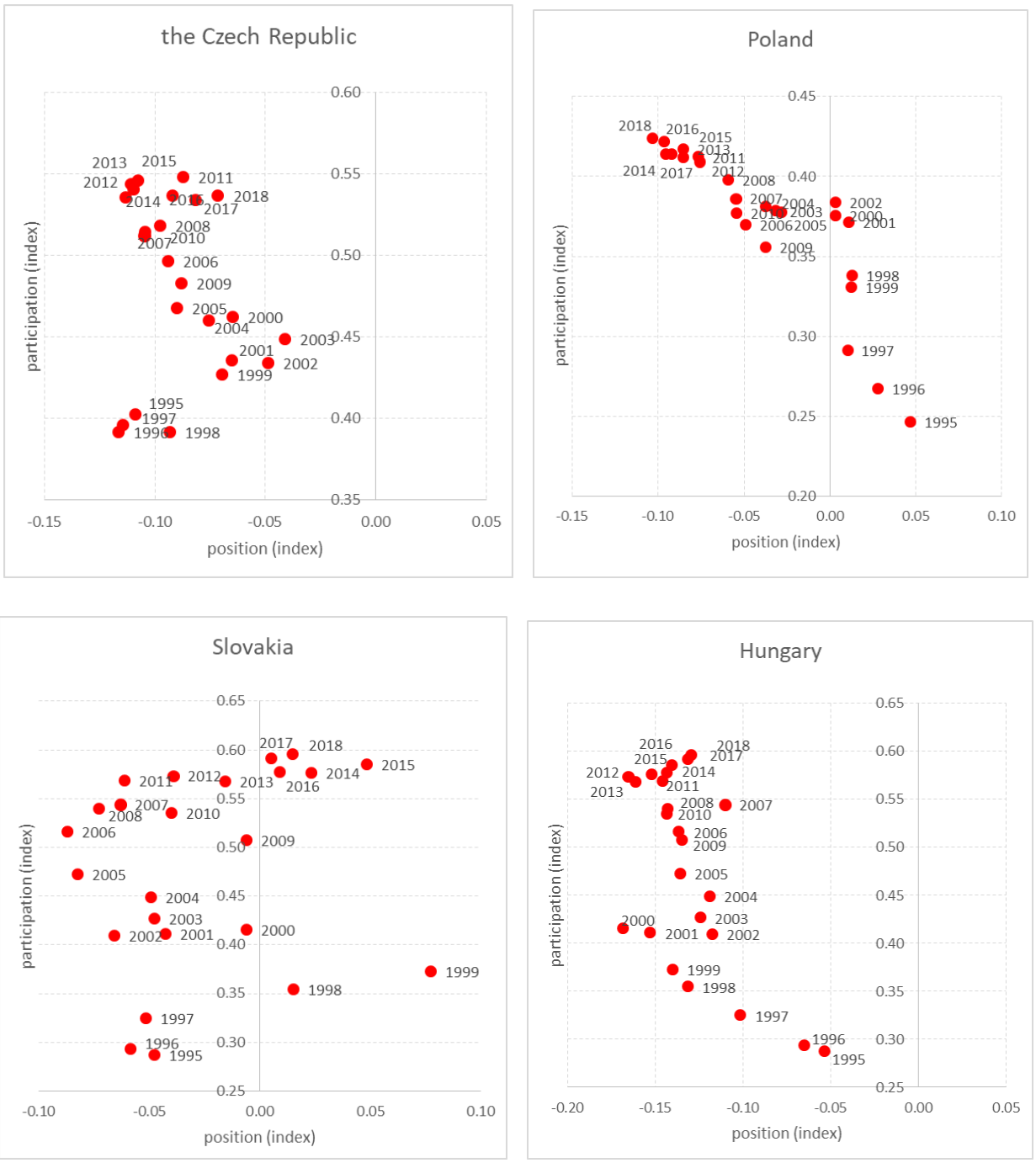


Figure A1. Shift in participation and position of food processing industries in Poland, the Czech Republic, Hungary and Slovakia, 1995–2018, index

Source: own calculations, based on data from TiVA 2023.