Integration of the Czech Republic' food industry in the global value chains

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Abstract: The food and beverages market has undergone dynamic development in recent decades. Among other fundamental changes, the current food system is characterized by changes which tend to put a growing concern on coordination (both horizontal and vertical), integration and competition. The long-term competitiveness and dynamic efficiency of food companies is affected by the way in which the company is embedded in food chains and networks, at present spread globally over multiple countries. Given that integration into global value chains (GVCs) provides opportunities for economic growth and development, the research on firm GVC participation and position has experienced a rapid rise in recent decade. This article investigates the effects of fragmentation of production on the food processing industry in the Czech Republic between 1995 and 2018 using data from Trade in Value Added database. The participation index and the position index are used to evaluate the form of integration of the food processing industry in the Czech Republic. The findings in this study can help inform industrial, agriculture and trade policy makers when assessing the nature of liberalization and structural transformation of agribusiness sectors in their countries as well as when assessing the potential benefits and risks.

Keywords: fragmentation, value added, global value chain, food processing
JEL Classification: F14, F15

1 Introduction

The business environment that has influenced the development and functioning of the food processing industry in the Czech Republic was different from the economic development in the Western world. Before 1989, the socialistic economy in the Czech Republic was governed by central planning emphasizing the growth of industrial production. However, as mentioned by Kopačka (2004), when using the growing amount of raw materials, energy and capital, there was not adequate growth in productivity or technological development. The centrally planned economy also did not allow companies to respond adequately to changes in the world economy and thus meant retraction in technological development and the inability to compete (Žídek, 2006). In the 1990s, as a result of the transformation process, changes and developments towards a market environment were triggered.

First, the structure of companies has started to change significantly (Blažková and Dvouletý, 2019). Before 1989, there were only 12 large food processing companies in the Czech Republic, which were divided into approximately 250 state-owned companies during the 1990s. These companies were included in the two-wave privatization process (i.e. in 1992 and 1994), which gave birth to more than 550 small and medium-sized enterprises (Ministry of Agriculture of the Czech Republic, 1998). Moreover, new food processing enterprises also began to emerge due to the boom of business activity in general and on the initiative of primary production – according to the Czech Statistical Office (Czech Statistical Office, 2021), there were 11,317 active enterprises in the Czech food and beverages industry in 2019. However, as mentioned by Blažková and Dvouletý (2019), the process of gradual concentration in all Czech food sectors has become more apparent again in the recent periods.

Second, there has been a significant increase in food prices, not only due to the removal of the negative turnover tax (i.e. state subsidies for consumer food prices), but also due to rising prices for other consumable goods and raw materials. This resulted in a reduction in food consumption leading to a gradual reduction in food production (Mezera and Dvořák, 1995), which was further exacerbated by the development of the volume of agricultural production in the Czech Republic

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(Bečvářová et al., 2009) and the foreign trade, i.e. by an increase in imports and, conversely, a decrease in exports (Homolka, 1995).

Another important milestone that significantly affected the food industry was the entry of retail food chains on the Czech market in the 1990s, whose aggressive centralized purchasing policy significantly damaged Czech agriculture and food producers due to their greater market power (Sexton, 2013). Therefore, the growing concentration in the Czech food industry was an inevitable reaction for food processors to succeed in a competitive market (Blažková and Dvouletý, 2019).

The food and beverages market has undergone dynamic development in recent decades. The market of deficit supply with a clear dominance of the supplier became a market with a predominance of demand and dominance of retail companies and a growing influence of the customer (de Backer and Miroudot, 2014). The food system is characterized by changes which tend to put a growing concern on coordination (both horizontal and vertical), integration and competition. As emphasized by Galizzi and Venturini, 2012), the long-term competitiveness and dynamic efficiency of food companies is affected by the way in which the company is embedded in chains and networks, at present spread globally over multiple countries. Given that integration into global value chains (GVCs) provides opportunities for economic growth and development, the research on firm GVC participation including its drivers and implications has experienced a rapid rise in the most recent decade (e.g. Gereffi, 2014; Fernandes et al., 2020; Reddy et al., 2021). Although the effects of global value chain (GVC) participation on the economic growth of agricultural and food sectors have already been examined in previous studies (i.g. Lim, 2021; Montalbano and Nenci, 2022; Giovannetti and Marvasi, 2016), the situation in Eastern and Central European countries has not received adequate attention. To fill this research gap, this study aims to investigate the effects of fragmentation of production on the food processing industry in the Czech Republic between 1995 and 2018 using data from Trade in Value Added data-base. The battery of methods is used to evaluate the intensity and the form of integration of the food processing industry in the Czech Republic into the global value chains.

2 Methods

Data comes from The Trade in Value Added (TiVA) database, 2021 edition (TiVa, 2022). TiVa is a collection of measures that can provide insights into global production networks and supply chains beyond what is possible with conventional trade statistics. The TiVA database contains a selection of principal indicators that track the origins of value added in exports, imports and final demand for the years 1995-2018. Indicators are available for 45 industries within a hierarchy based on ISIC Rev. 4. The indicators are derived from the 2018 version of OECD's Inter-Country Input-Output Database (Martins Guilhoto et al., 2022). Multiple methods were used to interrogate the integration of the Czech Republic' food industry in the global value chains.

First, the traditional trade openness index was used to analyze the degree to which the Czech Republic' food industry is open to international trade and it reports upon the level or grade of the internationalization of the sector. For the purpose of this study, the indicator is defined as follows (at current prices, current exchange rates):

$$trade\ openness\ index = \frac{export+impo}{production} \quad (1)$$

Where export, import and production embody food products, beverages and tobacco as defined in TiVa database.

Second, using data from the TiWA, shares of intermediate products in the structures of food imports and exports were analyzed. The indication of a sectoral/country integration into the global value chains is increasing proportion of trade with intermediate products. Increased internationalization and fragmentation of production might imply that an economy uses potential comparative advantages by specializing in one stage of the production process that it can focus on to maximize output or value added as opposed to producing a larger proportion of the value chain that include some stages of production that generate less value to the country. (Cieslik et al., 2016).

The use of the international input-output table by TiVA allows decomposing gross trade into value added components. The decomposition of gross exports provides information about domestic value added (DVA), foreign value added (FVA) content of exports and domestic value added sent to third economies (IV). Domestic value added embodied in gross exports (DVA; or EXGR_DVAc, I, p in TiVA) refers to the domestic value added content of exports, by industry i in country/region c to partner country/region p and represents the exported value added that has been generated anywhere in the domestic economy (i.e. not just by the exporting industry). Foreign value added embodied in gross exports (FVA; EXGR_FVAc,i) refers to the value of intermediate goods and services that are embodied in a domestic industry's exports. The value added can come from any foreign industry upstream in the production chain. Domestic value added sent to third economies (IV; EXGR_DVAFXSHc,i) represents the country c domestic value added content embodied in the gross exports of industry i in foreign countries. It is often considered as a measure of 'forward linkages' in analyses of GVCs.

The indication of a sectoral/country integrating into the global value chain is decreasing share of domestic value added in its gross exports, indicating a larger proportion of foreign value added in gross export and stronger linkages within global value chains (Cieślik et al., 2016).

Also, 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 of GVC participation (1) and GVC position (2).

$$GVC_{participation} = \frac{FVA+IV}{Export_{gross}} \quad (2)$$

The GVC participation index indicates the share of country's export that is part of multi-stage trade process. The higher the value of index the higher is the country's participation in GVC.

The measure of GVC participation can be used together with the GVC position index. That allows indication of location (vertical specialization) of the country in the production chain.

$$GVC_{position} = \log\left(1 + \frac{IV}{Export_{gross}}\right) - \log\left(1 + \frac{FVA}{Export_{gross}}\right) \quad (3)$$

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

3 Research results

The trade openness index was used to measure the importance of international trade in the food sector in the Czech Republic. It can give an indication of the degree to which the sector is open to international trade and it reports upon the level or grade of the internationalization of the sector. Table 1 presents levels and changes in the production, export, import and openness of the food processing industry in the Czech Republic. In the period between 1995 and 2018, the value of production increased 2.08 times; exports increased 4.92 times and imports increased 5.98 times. The increase in the values of the production and especially of exports and imports occurred after the Czech Republic joined the European Union in the 2004. The new Czech Republic food industry in the liberal environment of the Common market of the European union stimulated the trade exchange with other EU countries. Also, the inflow of foreign direct investments stimulated the sectoral integration into the structures of multinational companies. As a result of these changes, it can be seen that the openness of the Czech Republic' food industry increased from 25.4 % in 2003 to 68.7 % in 2018.

Table 1 The values of production, export, import and sectoral openness for the Czech Republic' food industry; selected years

	units	1995	2000	2003	2005	2010	2015	2018
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	(EX + IM)/ PROD. (%)	26.4	25.3	25.4	37.1	52.4	73.0	68.7

Source: own calculations, data from TiVA

The first indication of a sectoral/country integrating into the global value chain is increasing proportion of trade with intermediate products. Increased internationalization and fragmentation of production might imply that an economy which uses potential comparative advantages, due to sourcing from other countries, is having a comparative advantage in other stages of production or producing intermediate goods more cheaply than what domestically they might gain in competitiveness in other sectors, leading to better growth performance in terms of output or value added (Cieslik et al., 2016).

Figure 1 (a) shows the Czech Republic' food industry exports and imports in total and particularly with intermediates. It also shows the share of intermediate products in the structure of the food trade. The change in food exports and imports can be linked to the role of the accession of the Czech Republic into the European Union in 2004. Both food exports and imports increased intensely as well as the exports and imports of intermediate food products. However, imports of food

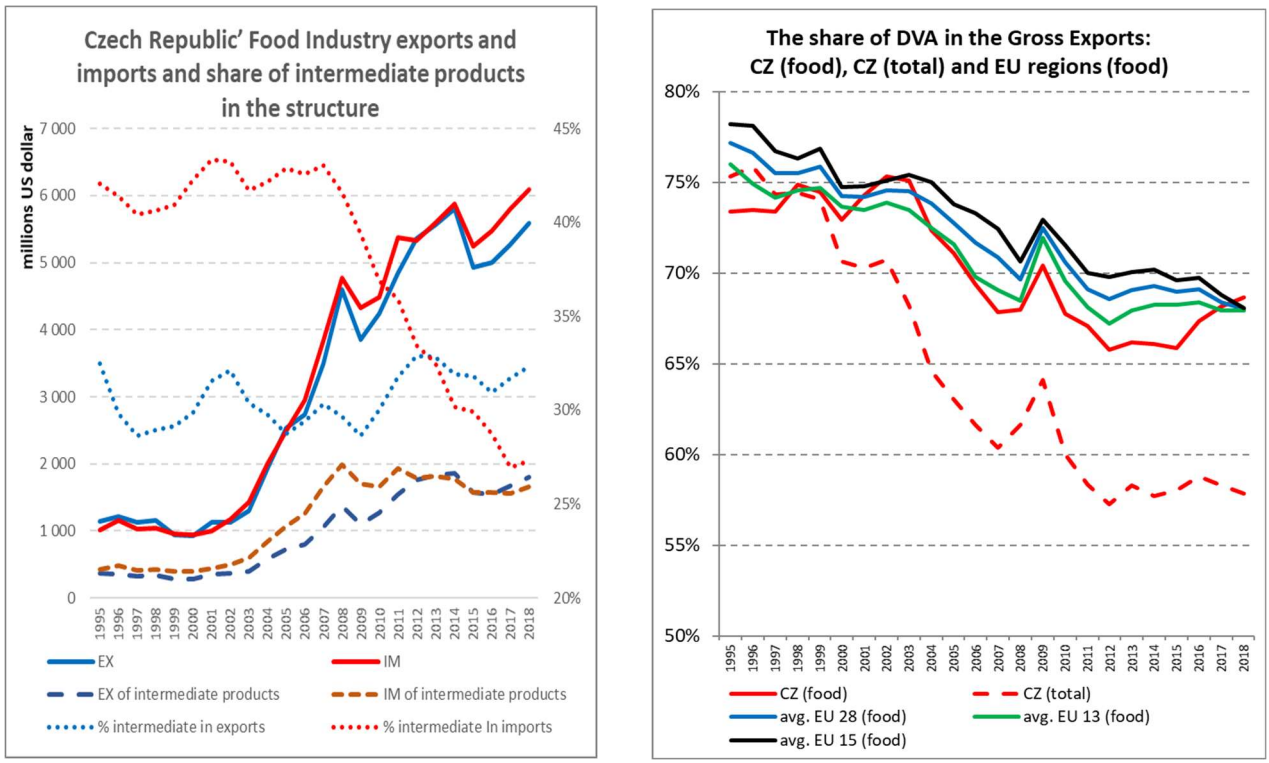
intermediate products reached its maximum in 2008 (in absolute terms) and exports of food intermediate products reached its maximum in 2014. Since then both trade flows remain on the same level.

When comparing food exports and imports, the share of intermediate products in the structure of food exports and imports differ. The share of intermediate food products in the total value of food exports fluctuated around 30 % and started slightly increasing at the end of the period under review. The rest of the food exports are the finalized products. The share of intermediate food products in the total value of food imports was fluctuating and slightly increasing around 40 % of the total value of food imports. But since the end of the Great recession in 2008, the share of intermediate products in the total value of food imports started to decrease and was around 27 % in 2018. This suggest that the proportion of finalized products in the structure of food imports increased in the last decade. Also, this indicates an opposite process to the more intense integration into the global food value chains.

Another indication of a sector/country integrating into the global value chain is the decreasing share of domestic value added in its gross exports, indicating a larger proportion of foreign value added in gross export and stronger linkages within global value chains (Cieślik, 2017). Figure 1 (b) presents the levels and changes in the share of domestic value added in the gross export of the Czech Republic' food industry. Also, it is compared to the share of domestic value added in the gross export at the national level (all sectors; CZ total) and to average levels and changes in the share of domestic value added in the gross export of the food industries in the EU28 (average of EU countries), EU15 (old member states) and EU13 (new member states).

Figure 1 a and b The share of Domestic Value Added in the Gross Export (1995-2018)

(a) **(b)**



Source: own calculations, data from TiVA (http://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm).

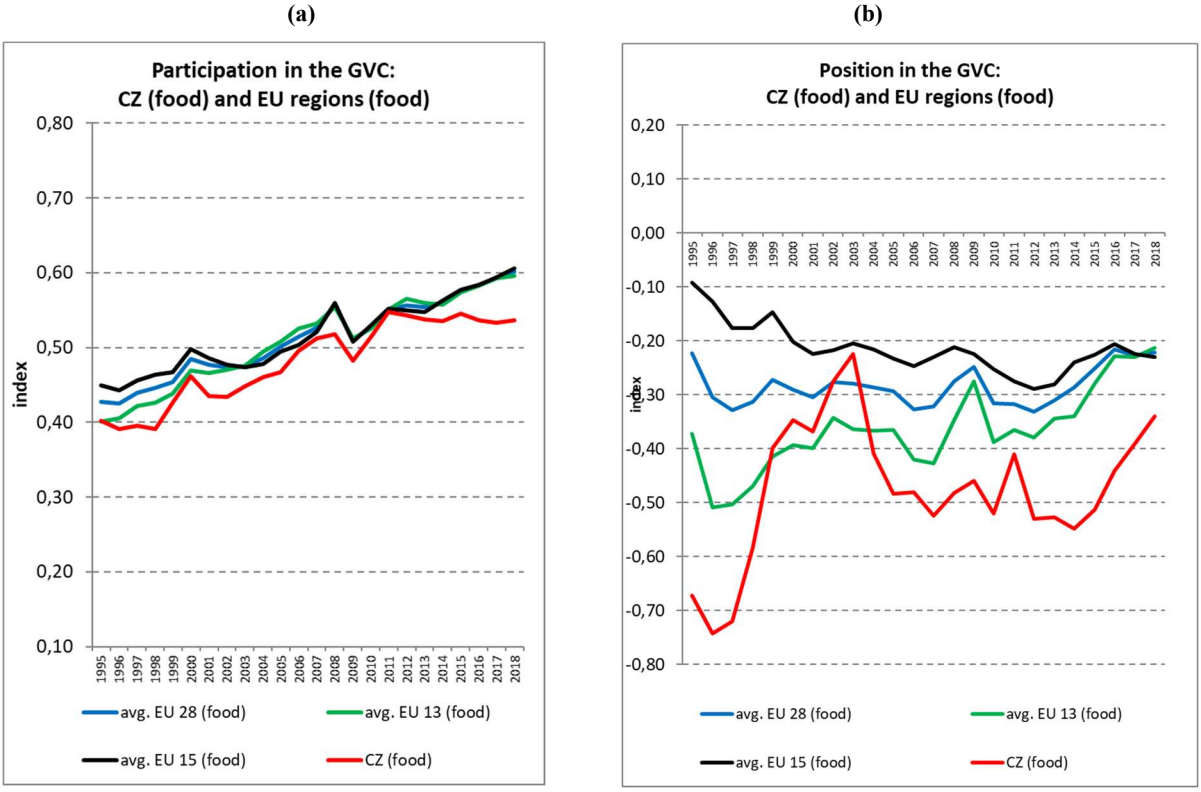
The figure 1 (b) shows that the share of domestic value added in the gross export of the Czech Republic' food industry is higher when compared to the Czech economy as a whole. This indicates lower intensity of integration of the Czech Republic' food industry in the global value chains comparing to the rest of the Czech economy. On the other hand, the level of integration is slightly higher when compared to the average for food processing industries in the EU28, EU15 and EU13 regions, but it general, it follows the pattern of EU regions. The share of domestic value added in the gross export of the Czech Republic' food industry was volatile through the period under review, but has slightly increased from 73.4% in 1995 to 75.1% in 2004. It indicates opposite process to integration into the global value chains as the sector used rather more of the domestic value instead of the foreign one. But after the 2004, the share of domestic value started to decrease rapidly till the end to the Great Recession. In the last decade, the share of domestic value added in the gross export of the Czech Republic' food industry started to stagnate around the value 67.0% and then started to increase again at the end of the period. This suggests that membership of the Czech Republic in the European union led to the

significantly higher integration into the global value chains. On the other hand, this process has stopped recently and reversed.

Besides the trade openness, the share of intermediates in the exports and imports and the share of DVA in the gross agrarian export already provides information about the level and change in integration into the GVC, the indicators of participation and position in GVC allow assessing the form of integration in more detail (Fig. 2).

Figure 2 (a) shows that between 1995 and 2018 the intensity of participation of food industries of the EU member states in the global food value chains have increased in the case of EU28 (on average), as well as in the case of old EU member states (EU15) and the new member states (EU13). Also, at the beginning on the period under review it is visible that the intensity of participation was slightly higher is the old member states when compared to the new member states. The level of participation of the Czech Republic' food industry in slightly lower when compared to the average levels of EU28, EU15 and EU13 through the period and in the post-crisis period of economic recovery, it seems that in the case of the Czech Republic' food industry the intensity of participation remains at the same level, contrary to the intensity of participation of EU regions that are increasing its participation also in the post-crisis period.

Figure 2 Participation and position of the Czech Republic' food industry



Source: own calculations, data from TiVA (http://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm)

Figure 2 (b) shows that the relative position of the Czech Republic' food industry, as well as the positions (on average) of food industries in EU28, EU15 and EU13 countries in the global value chains are downstream. There is also different dynamic when comparing the tendencies between the old (EU15) and new (EU13) member states. The old member states were in a weaker downstream position in 1995, but are now moving more downstream. Contrary, the new member states were in strong downstream position in 1995, but moving upstream direction. During the period under inquiry the Czech Republic' food industry changed its tendency in relative positioning in the global value chains more than once. The Czech Republic' food industry started in downstream position (in even stronger downstream position than other new member states) in 1995 but was moving to more upstream position very quickly in the pre-accession period till 2003. Then the tendency changed and between 2003 and 2014 the Czech Republic' food industry started to position itself more downstream. After 2014 the tendency has changed again and the direction was more in upstream direction again. In other words, the relative position of the Czech Republic' food industry still takes a form of rather importing a large portion of intermediate products to produce final goods but it is reaching more towards the model of rather exporting of intermediate products that are finalized and exported by other countries in the global value chain.

4 Conclusions

This study aims to investigate the effects of fragmentation of production on the food processing industry in the Czech Republic between 1995 and 2018 using data from Trade in Value Added data-base. The battery of methods is used to evaluate the intensity and the form of integration of the food processing industry in the Czech Republic into the global value chains.

Results suggest that the degree to which the food processing industry in the Czech Republic is open to international trade has increased significantly during the period from 1995 and 2018 as well as the grade of the internationalization of the sector. Also, Czech Republic' food industry exports and imports (as well as the share in the structure of food export s and imports) with intermediate products increased, especially when the Czech Republic became the member state of the European union. The increasing proportion of trade with intermediate products is an indication of a sectoral integrating into the global value chain driven by increased internationalization and fragmentation of production. This conclusion is also supported by the decrease of domestic value added in the structure of gross food exports and is supported also by the change in scores of the index of participation. However, in the last decade the process of integration of the food industry in the Czech Republic into the global agri-food value chains has slowed down resp. reverse (slight decrease in openness, decrease in the share of imported intermediate products, stagnation of the share of domestic value add in the gross food exports, stagnation in the participation). The results also suggest that the relative position of the food processing industry in the Czech Republic in the global value chains is downstream, but changing towards upstream position (rather exporting of intermediate products that are finalized and exported by other countries in the global value chain). The findings in this study can help inform industrial, agriculture and trade policy makers when assessing the nature of liberalization and structural transformation of agribusiness sectors in the Czech Republic as well as when assessing the potential benefits and risks of such an integration.

The study shows that import of finalized food products is increasing. On the contrary, the share of intermediate products in the structure of food exports is increasing and the share of finalized food products is decreasing. The intermediate products made in the Czech Republic are being finalized in other countries. This has of course implication on value added and job creation in the Czech food industry. Such a state and tendency is also in contrast with goals set in the *Strategy of the Ministry of Agriculture of the Czech Republic with a view to 2030* (MZE, 2016). One of the goals in this strategy is to (goal C1) increasing export performance, especially of products with higher added value and searching for new markets outside the EU.

There are a few other next steps for this research. First, the historical interpretations of the changing integration of the food processing industry in the Czech Republic in the GVC relative to our findings lead to additional questions to inquiry. For example, according to the expectation, the change and the tendency of the share of DVA in gross exports should match the changes and opposite tendency in the shares of intermediate products in the structures of food exports and imports. But in the case of the food processing industry in the Czech Republic, the match is only partial. Further, there is also space for further research in this area to identify underlying factors influencing the participation and position and to assess the effects of participation and position in the GVC on structural transformation on the food processing industry in the Czech Republic.

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