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Comparative Analysis of the Competitiveness of Agriculture and Agri-food Trade in Visegrad Group Countries under the European Union Frameworks*

Abstract: The study aimed to assess the competitiveness of agriculture and agri-food trade in the Visegrad Group (V4) countries during their European Union (EU) membership. Using data from Eurostat and the Agri-food Data Portal, labour productivity in agriculture and competitive position in agri-food trade within the EU internal market were analysed. In each V4 country, the labour productivity indicator was lower than the EU-27 average; however, Poland and Hungary had the least favourable scores. Of the four countries surveyed, Czechia recorded the highest productivity and Poland the lowest, influenced by the agrarian structure and level of employment in agriculture. However, it was positive that the dynamics of labour productivity change in all V4 countries were higher than the EU average. The research also showed that accession of Czechia, Hungary, Poland and Slovakia to the EU contributed to an increase in agri-food exports and imports in all analysed countries. Poland has a comparative advantage and is export-specialised in the food and live animals (SITC 0 commodity group) and beverages and tobacco products (SITC 1 commodity group), but not in the animal and vegetable oils, fats, and waxes (SITC 4 commodity group). In the SITC4 commodity group, Hungary performed best, having both a comparative advantage and export specialisation in this area. Slovakia is

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the worst performer compared to the other countries surveyed, having neither a comparative advantage nor export specialisation in any of the analysed commodity groups.

Keywords: Visegrad Group, agriculture, competitiveness, intra-community trade.

1. Introduction

The Visegrad Group (V4), comprising Poland, Czechia, Slovakia and Hungary, has been active since 1991. The V4 Group provides a platform for initiatives and activities in the fields of political and economic cooperation, security and defence teamwork, cultural and educational assistance, and regional and cross-border collaboration (Bednarzewska 2024; Jasiński 2020). Due to their parallel geopolitical conditions, economic transformations and socio-cultural similarities, as well as their experience as post-communist countries, the V4 Group seeks to represent the interests of Central and Eastern Europe within the European Union and on the international stage (Bednarzewska, Zinzuk 2024; Kluzek, Schmidt-Jessa 2022). After the Second World War, the countries that now make up the Visegrad Group had to organise their economies along Soviet lines. This resulted in chronic economic inefficiency and an inability to develop the country (Czyż 2014). Given that these countries have undergone systemic transformation and sought to build a modern, dynamically functioning market economy, they must therefore focus on raising their level of international competitiveness (Szczodrowski 2018). The accession of the V4 countries to the EU in 2004 was a watershed moment, requiring them to align with European policies while accessing funding from individual sectoral policies (Bolibok, Zinzuk, Matras-Bolibok 2025).

Agriculture plays an important role in the economies of the V4 countries. Despite their common historical and geographical features, they are characterised by different structural conditions, forms of land ownership and relations between production factors (Piwowar 2017). Accessing the EU has brought about a number of structural changes to these countries' economies, particularly in agriculture. This resulted in significant changes to the business environment in this sector, providing access to the large EU agri-food market and creating a need to compete in the agri-food sector with other EU member countries (Szabo, Grzmar, Zelina 2018). All V4 countries operate under the EU's Common Agricultural Policy (CAP), meaning they have similar conditions for agricultural development, market regulation, and access to the EU funds. Given this, it is particularly interesting to compare how institutional, structural, and technological differences affect the competitiveness of agriculture and the agri-food sector in these countries.

To the authors' knowledge, a large number of studies on the competitiveness of agriculture and the agri-food sector of the EU member states can be found in the literature. In contrast, there are relatively few studies analysing the agri-food sector in the Visegrad Group. The available studies either address the competitiveness of the economy (Falkowski 2023), specific aspects of agricultural sector development, including environmental performance (Sadowski et al. 2024; Szabo, Grznar, Zelina 2018; Svatoš, Smutka 2014), or evaluate the export potential of agri-food products (Bozduman 2023; Firlej, Kubala 2018). However, research on changes in the competitiveness of V4 agriculture and agri-food trade during the period of EU membership is lacking. This article aims to address this research gap. It assesses the competitiveness of Visegrad countries using two approaches: an analysis of labour productivity in agriculture and an analysis of the competitiveness of agri-food trade within the EU internal market. This will enable us to identify changes in the efficiency of labour utilisation in agriculture in the studied countries after they accede to the EU, as well as determine the extent to which their agri-food sector can compete effectively on the EU internal market by assessing results in agri-food trade. The aim of this study is also to assess selected features characterising the production potential of agriculture in the studied countries.

2. Literature Review

Competitiveness is a complex issue; consequently, there are many definitions of the concept in the literature, as well as a variety of approaches to its assessment (Nowak 2017; Zawalińska 2004). According to Porter (1992, 1990), the only significant concept of competitiveness at the national level is efficiency, with the main national goal being to create a high and constantly rising standard of living for the population. The Competitiveness Advisory Group of the European Commission (EC 1995) points out that competitiveness is an effective means to achieve rising living standards and increase social welfare. In the global context, by increasing productivity and efficiency in the context of international specialisation, competitiveness creates the basis for non-inflationary growth in income. Many authors (Woś 2001; Hatzichronoglou 1996; Freebairn 1987) define competitiveness as the ability to sell products profitably, that is, to deliver goods or services at the time, in the form, and to the place where buyers seek them, at prices that are as good as or better than those offered by other potential suppliers, while recovering at least the alternative costs of the resources involved. External competitiveness is defined as the ability to place domestic companies in foreign markets and develop effective exports. Standard trade theory identifies the fundamental determinants of competitiveness, such as divergences in technologies or relative factor endowments, returns to scale and price distortions.

Another strand of economic literature addresses one of the sources of competitiveness: productivity differentials at the industry and firm levels, to analyse technical and allocative inefficiencies (Cockburn et al. 1999). With regard to agriculture, many studies have addressed the assessment of production potential competitiveness, i.e. the evaluation of factor resources and their interrelationships (Pawlak, Smutka, Kotyza 2021; Pawlak, Poczta 2020), as well as the outcome aspects of agriculture, including productivity (Rodzinka, Skica, Pomianek 2021). Research on agricultural productivity is fundamental because improving it is a condition for sustainable economic development (O'Donnell 2010). The study of production factor productivity can be conducted from two perspectives: a comprehensive analysis of the efficiency of utilising all production factors together, or partial productivity indicators that reflect the utilisation of individual production factors. Labour productivity, which is the ratio of production output to the number of employees, is widely considered to be one of the most important development parameters and an important indicator of competitiveness (Kołodziejczak 2015). Competitiveness in the agricultural sector is influenced by all factors, including labour, capital and, significantly, land, which is a very specific factor of production. The assessment of labour productivity in the agriculture of the V4 countries conducted in our study allows the identification of changes in the efficiency of the use of one of the key factors of production after accession to the EU, which directly relates to the ability to compete in the liberalised EU internal market. Labour productivity growth is indeed recognised as one of the primary sources of sustainable competitiveness in micro- and macroeconomic terms (EC 2009). Studies on this topic for EU member states have used both total productivity (Wimmer, Dakpo 2023; Smędzik-Ambroży, Sapa 2019) and partial factor productivity indicators (Zakrzewska, Nowak 2024). Surveys on V4 countries are less common. For instance, Szabo, Grznar and Zelina (2018) analysed the position of V4 countries in the European Union concerning agricultural productivity using selected indicators. Sadowski et al. (2024) assessed the environmental performance of agriculture in the V4 countries. Research on the regional eco-efficiency of the agricultural sector in V4 regions can also be found (Richterová, Richter, Sojtková 2021).

Many authors use trade-related measures to evaluate the competitiveness of the agricultural sector, or more broadly, the agri-food sector (Matkovski et al. 2022; Andrei et al. 2020; Jarosz-Angowska et al. 2020). It is also common to assess agriculture in terms of both its competitive potential and its achieved competitive position (Nowak 2017; Zawalińska 2004).

According to David Ricardo's theory of comparative advantage, countries should specialise in producing those goods for which they have a relative cost advantage. Due to their factor structure, agriculture in the V4 countries may have advantages in specific product groups, as reflected in the foreign trade balance. Michael Porter's theory

of competitive advantage (Porter 1990), on the other hand, suggests that economic sector competitiveness is not only due to resource factors, but also thanks to how efficiently they are used, and owing to innovation and adaptability to market conditions.

Using labour productivity and foreign trade indicators together in this study enables the external competitiveness of agriculture to be assessed, i.e. the ability of countries to achieve a trade surplus and specialise in exporting agri-food products with an advantage in the EU market. Thus, research undertaken from this perspective not only allows the state and changes in the competitiveness of V4 countries' agriculture to be measured, but also enables a deeper understanding of the mechanisms that determine their competitive position within the single European market to be gained. This approach aligns with the call for a holistic view of competitiveness that combines technical and allocative efficiency with market performance and structural adjustments.

3. Research Methods

In order to assess agricultural competitiveness, it is necessary to use appropriate research approaches that allow for a comprehensive analysis of both resource efficiency and the sector's ability to compete in international markets. This paper takes a two-pronged approach: the first focuses on analysing agricultural labour productivity as a key measure of efficiency and productive capacity, while the second centres on assessing trade competitiveness.

The first stage of the research involved providing a general characterisation of agriculture in the V4 countries, focusing on features that highlight the potential of the agricultural sector and its productive and economic performance. The second stage of the research process involved assessing the countries' competitiveness in terms of labour productivity. Productivity indicators were calculated as the ratio of the gross value added by agriculture to the number of people employed in the sector. Employment was expressed in AWUs (Annual Work Units), which represent full-time equivalent employment. In contrast, gross value added (GVA) was taken as the output of the production process. This measures the value of production minus the intermediate consumption of goods and services used in production, and is used to calculate labour productivity (Kołodziejczak 2025; Megyesiöva 2021; Gołaś 2019). GVA constitutes a basic income category that informs us about the ability to generate new value concerning the material costs incurred. It is also considered in the context of the quantity and quality of human capital, which is becoming an increasingly important factor in this ability (Wędzki 2006). For this reason, as emphasised by Gołaś (2010), GVA is one of the most objective categories for assessing enterprise efficiency and labour productivity.

As competitiveness should be considered relative, a comparison was made of labour productivity indicators between the V4 countries and the average calculated for the EU-27. Based on the obtained productivity index values, an analysis was also conducted of the dynamics of their changes over the study period. Due to the long research period, the rate of change was calculated by dividing the average of the last three years by the average of the first three years of the research period. Additionally, the average rate of change was calculated using the following formula (Pułaska-Turyna 2011):

$$\bar{T} = \sqrt[n-1]{\prod_{i=2}^n \frac{y_i}{y_{i-1}}} - 1, \quad (1)$$

where:

$\bar{T}$ – average rate of change of the phenomenon over time,

Π – means multiplication,

y – observed magnitude of the phenomenon,

y_i – i -th word of the time series,

$i = 1, 2, \dots, n$ – index with the base of the variable (the base is the previous year).

The next stage of the research involved assessing the competitive position of the V4 countries in agri-food trade on the EU internal market. This was based on the volume and dynamics of the V4 countries' agri-food exports and imports on the European Union's common market. This included the V4 countries' share of agri-food exports and imports on the EU internal market, the trade coverage ratio (TCR) for individual groups of agri-food commodities traded on the EU internal market, and the comparative advantage (RSCA) and export specialisation (TBI) indexes in agri-food trade on the EU internal market. Calculations were carried out for separate categories of agri-food products according to the Standard International Trade Classification (SITC): group SITC 0 (food and live animals); group SITC 1 (beverages and tobacco products); and group SITC 4 (oils, fats and waxes of plant and animal origin).

The trade coverage ratio (TCR) was calculated using the following formula:

$$\text{TCR} = \frac{X_{ij}}{M_{ij}} \times 100, \quad (2)$$

where:

i – the group of agri-food products analysed: SITC 0, SITC 1, SITC 4,

j – Visegrad Group countries analysed: Czechia, Hungary, Poland, Slovakia,

M – value of intra-EU imports,

X – value of intra-EU exports.

If the TCR index value exceeds 100, it means that a given country is a net exporter and has an export advantage over imports for the analysed group of products. A TCR below 100 indicates that the country in question is a net importer of the products in question and has a negative trade balance. The greater the value of the TCR indicator, the greater the advantage of exports over imports.

The trade balance index (TBI), indicating the level of export specialisation, was calculated by comparing net exports with total trade volume according to the following formula (Widodo 2009):

$$TBI_{ij} = (X_{ij} - M_{ij}) / (X_{ij} + M_{ij}), \quad (3)$$

where X_{ij} and M_{ij} represent, respectively, exports and imports of product group i by country j .

The TBI ratio reaches a value of -1 when a country only imports, and $+1$ when it only exports. A positive index value indicates that a country is a net exporter, while a negative value indicates that it is a net importer. A TBI value of zero indicates either no trade in a given product or a balance between exports and imports.

The following formula expresses the Symmetric Comparative Advantage Index (RSCA):

$$RSCA_{ij} = (RCA_{ij} - 1) / (RCA_{ij} + 1), \quad (4)$$

where RCA_{ij} is the original Balassa (1965) index, which can be calculated as follows:

$$RCA_{ij} = (X_{ij}/X_j) / (X_{iEU}/X_{EU}), \quad (5)$$

where:

X_{ij} – Member State j 's intra-EU exports in commodity group SITC 0, SITC 1, SITC 4,

X_j – intra-EU exports of member country j in all commodity groups,

X_{iEU} – total intra-EU exports of country j in SITC 0, SITC 1, SITC 4 commodity groups,

X_{EU} – total intra-EU exports (of all EU member states) in all SITC commodity groups.

The $RSCA_{ij}$ indicator takes values from -1 to $+1$ ($-1 \leq RSCA_{ij} \leq 1$). A positive value indicates that country j has a comparative advantage in a given commodity group. A negative value, on the other hand, indicates an absence of such an advantage in the product group under analysis.

Literature juxtaposes the RSCA (revealed symmetric comparative advantage) and TBI (trade balance index) indices, enabling an in-depth analysis of a country's competitive position in the foreign trade of a specific group of goods (Pitoňáková 2023; Astrini, Az zakiyyah 2018; Kąkol 2018). Although the two indicators measure different aspects, they are complementary and, together, allow products to be classified according to the type of trade advantage.

Source data were drawn from the EUROSTAT database and the Agri-food Data Portal, which contains national and European agricultural data and information on the CAP, provided by the European Commission's Directorate-General for Agriculture and Rural Development. The analysis period was 2003–2023, with 2003 (i.e. the year before the V4 countries joined the EU) also included. This was particularly important for assessing competitive position in trade and less so for assessing productivity.

4. Findings

4.1. Assessing the Competitiveness of Agriculture in the V4 Countries

To gain an overview of agriculture in the individual Visegrad countries, selected sector-specific indicators were analysed (Table 1). The research showed that, in structural, productive and economic terms, the agriculture of the V4

Table 1. Selected features of agriculture in the Visegrad Group countries in 2023

Tabela 1. Wybrane cechy rolnictwa krajów Grupy Wyszehradzkiej w 2023 r.

Specification	Employment in agriculture (thousand AWU*)	Percentage of people employed in agriculture	Share of agriculture in total GVA	Average economic size of a farm**	Share in the EU value of agricultural production	Land productivity
		%	%	EUR	%	EUR/ha
Czechia	95.17	2.01	1.89	191,487.7	1.34	1,347.6
Hungary	274.16	3.88	3.35	30,462.7	2.27	1,583.1
Poland	1,366.6	7.21	3.06	20,624.2	7.01	1,704.2
Slovakia	38.7	1.60	2.33	101,491.9	0.3	1,129.9
EU-27	7,605.38	3.09	1.77	39,701.4	100.0	2,951.7

* AWU (Annual Work Unit).

** Data for 2020.

Source: own study based on Agri-food Data Portal (2025).

Źródło: opracowanie własne na podstawie danych Agri-food Data Portal (2025).

countries is significantly differentiated as a result of natural, climatic, historical and legal conditions. Poland ranks first among the EU Member States in terms of the number of people employed in agriculture. Hungary, Czechia, and Slovakia rank 8th, 16th, and 23rd, respectively (Eurostat 2025). Poland held the largest share of the EU's agricultural production value among the V4 countries studied, producing just over 7% of the EU's agricultural output in 2023. The combined contribution of the other countries did not exceed 4%. Poland stands out for having both the highest percentage of people working in agriculture and relatively low land productivity, indicating the need for further modernisation. Czechia and Slovakia are characterised by a high concentration of production, evidenced by strong economic farms and a low employment rate in agriculture.

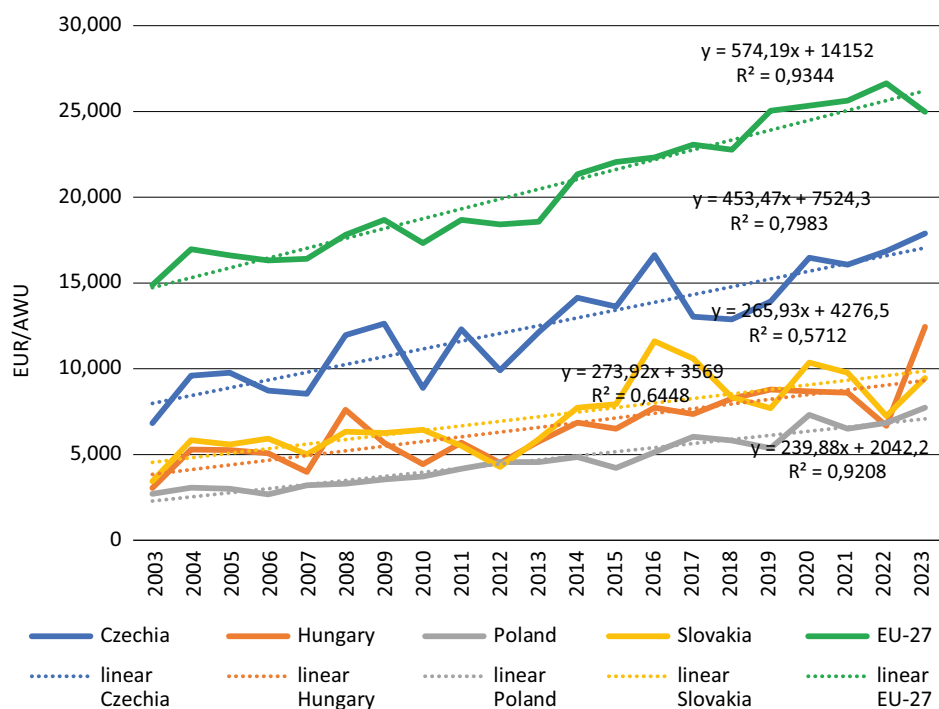


Figure 1. Labour productivity in agriculture in the Visegrad Group countries in 2003–2023 (EUR/AWU)

Rysunek 1. Produktivność pracy w rolnictwie krajów Grupy Wyszehradzkiej w latach 2003–2023 (EUR/AWU)

Source: own study based on Eurostat data.

Źródło: opracowanie własne na podstawie danych Eurostatu.

However, they also have low land productivity. Hungarian agriculture has a similar share of national GVA to Poland's, but with almost half the percentage of employment in this sector and an average farm size that is slightly higher. It should also be noted that none of the V4 countries achieved the average level of land productivity for the EU-27.

One factor that shapes the international competitiveness of a country's agriculture is labour productivity (Garrone et al. 2019; Jaroszevska, Pietrzykowski 2018). The European Commission considers productivity to be the most reliable long-term indicator of competitiveness (EC 2009). This indicator, which is calculated by dividing gross value added by the number of full-time employees in agriculture, varies between V4 countries (Figure 1).

Similar trends were generally observed in all the countries studied, despite different levels of labour productivity, although their pace varied. Between 2003 and 2023, average labour productivity ranged from over EUR 12.5 thousand / AWU in Czechia to EUR 4.7 thousand / AWU in Poland (Table 2). In each of the V4 countries, the level of the analysed indicator was lower than the EU-27 average, but Poland and Hungary fared the worst. Calculations based on Eurostat data (2025) show that labour productivity in Czechia was higher than the average achieved by the group of new member states (EU-13), but was more than 60% lower than in the old Member States. When analysing the dynamics of change in labour productivity, it can be seen that it was higher than the EU average in all V4 countries.

Table 2. Changes in labour productivity in agriculture in the Visegrad Group countries (2003–2023)

Tabela 2. Zmiany produktywności pracy w rolnictwie krajów Grupy Wyszehradzkiej (2003–2023)

Specification	Average labour productivity in 2003–2023	Dynamics (2003–2005 / 2021–2023)	Average annual rate of change ($\bar{\gamma}$)	Labour productivity index ratio to the EU-27	
	EUR/AWU			2003	2023
Czechia	12,512.4	205.1	4.937	0.46	0.72
Hungary	6,582.2	203.9	7.276	0.21	0.50
Poland	4,680.9	240.2	5.384	0.18	0.31
Slovakia	7,201.8	178.2	5.187	0.23	0.38
EU-27	20,468.2	159.4	2.620	1.00	1.00

Source: own study based on Eurostat data.

Źródło: opracowanie własne na podstawie danych Eurostatu.

4.2. Assessing the Competitive Position of V4 Countries in Agri-food trade

The next stage of the research involved taking measures to evaluate the competitive position of the V4 countries' agri-food trade within the EU's common market. Table 3 shows the volumes and trends in the export and import of food and live animals (SITC group 0), beverages and tobacco products (SITC group 1), and oils, fats and waxes of plant and animal origin (SITC group 4). The base period for calculating growth dynamics was 2003, as this was the year before accession to the EU common market, when trade restrictions were still in place between Hungary, Czechia, Slovakia, Poland, and the European Union. After the accession of V4 countries to the EU in 2004, trade restrictions were completely lifted, resulting in dynamic growth in all V4 countries in all analysed product groups in the EU internal market, both in terms of agri-food exports and imports. The most spectacular growth occurred in Polish exports of beverages and tobacco products (SITC 1: a 175-fold increase) and SITC 4 products (a 300-fold increase). Only Hungarian exports of SITC 4 products saw a more than 100-fold increase (Table 3).

Table 3. Volume and dynamics of agri-food exports and imports of V4 countries in the common market of EU in 2003 and 2023

Tabela 3. Wielkość oraz dynamika eksportu i importu rolno-spożywczego krajów V4 na wspólnym rynku UE w latach 2003 i 2023

Country	Commodity group	Exports (EUR million)		Imports (EUR million)		2023/2003	
		2003	2023	2003	2023	Export	Import
Czechia	SITC 0	419.9	8,400.2	945.0	10,275.0	2,000.0	1,000.9
	SITC 1	99.5	1,929.1	114.9	1,469.6	1,900.4	1,200.8
	SITC 4	11.1	567.0	87.8	389.1	5,100.1	400.4
Hungary	SITC 0	1,161.1	8,389.3	578.1	6,921.5	700.2	1,200.0
	SITC 1	60.1	688.3	68.5	765.1	1,100.4	1,100.2
	SITC 4	8.6	936.9	49.8	312.7	10,800.4	600.3
Poland	SITC 0	1,850.3	30,139.4	1,398.2	20,896.9	1,600.3	1,400.9
	SITC 1	31.0	5,457.3	107.8	2,256.3	17,500.9	2,000.9
	SITC 4	3.2	1,045.2	174.6	1,145.2	33,000.3	600.6
Slovakia	SITC 0	93.5	3,919.7	253.0	5,625.8	4,100.9	2,200.2
	SITC 1	15.7	259.0	27.7	833.9	1,600.5	3,000.1
	SITC 4	2.8	158.2	17.6	411.0	5,600.8	2,300.3

Source: own study based on Eurostat data.

Źródło: opracowanie własne na podstawie danych Eurostatu.

The strong creation effect of agri-food trade on the common EU market following the accession of the Visegrad Group countries to the EU is confirmed by observing changes in the share of exports and imports of the analysed groups of agri-food products in the total EU market for these groups of products. This is presented for selected years in Table 4. In all V4 countries, the share of exports and imports of all analysed groups of agri-food products increased in total EU agri-food exports and imports in 2023 compared to 2003, in most cases by a significant amount. The largest increases were recorded for Polish exports of beverages and tobacco products (SITC 1) and oils, fats and waxes of animal and vegetable origin (SITC 4). Analysing changes over five-year periods reveals that, in some cases, there were decreases in shares compared to the previous period despite an overall

Table 4. Share of V4 countries in agri-food exports (SX) and imports (SM) on the EU internal market in selected years of the period 2003–2023 (in %)

Tabela 4. Udział krajów V4 w eksporcie (SX) i imporcie (SM) rolno-spożywczym na rynku wewnętrznym UE w wybranych latach okresu 2003–2023 (w %)

Country	Year	SITC 0		SITC 1		SITC 4	
		SX	SM	SX	SM	SX	SM
Czechia	2003	0.32	0.75	0.41	0.49	0.19	1.45
	2008	1.39	1.93	1.80	1.39	0.89	1.44
	2013	1.57	2.08	2.07	1.87	2.41	1.74
	2018	1.58	2.14	2.63	2.34	2.14	1.49
	2023	2.17	2.70	3.84	2.93	2.29	1.52
Hungary	2003	0.89	0.46	0.25	0.29	0.14	0.82
	2008	1.80	1.37	0.67	1.10	1.43	1.23
	2013	1.98	1.27	1.05	0.88	3.66	1.38
	2018	1.81	1.44	1.18	1.09	3.27	1.30
	2023	2.17	1.82	1.37	1.52	3.78	1.22
Poland	2003	1.41	1.11	0.13	0.46	0.05	2.89
	2008	3.84	3.26	2.50	1.80	1.70	3.60
	2013	5.04	3.77	4.70	2.00	2.73	3.83
	2018	6.46	4.32	8.41	2.70	1.50	4.38
	2023	7.80	5.49	10.86	4.50	4.22	4.48
Slovakia	2003	0.07	0.20	0.06	0.12	0.05	0.29
	2008	0.72	1.07	0.22	0.91	0.35	1.20
	2013	0.88	1.18	0.27	1.09	1.61	1.97
	2018	0.73	1.15	0.26	1.30	0.53	0.93
	2023	1.01	1.48	0.52	1.66	0.64	1.61

Source: own study based on Eurostat data.

Źródło: opracowanie własne na podstawie danych Eurostatu.

increase in shares between 2003 and 2023. This was especially the case for SITC 4 products, where all V4 countries experienced a decrease in export and import shares in 2018 compared to 2013 (except Poland, which saw no decrease in imports). Slovakia experienced a decrease in export and import shares for all analysed product groups in 2018 compared to 2013, except for the import share of beverages and tobacco products. Generally, the largest increases in shares were recorded in the first five-year period, i.e. the four years after accession, compared to the year before EU accession. However, Czechia slightly decreased its share of EU imports in the SITC 4 product group in 2008 compared to 2003. Poland and Slovakia experienced a much more dynamic increase in the analysed values in the first study period compared to Czechia and Hungary. This may indicate that Poland and Slovakia were less connected to the EU market before their accession compared to Czechia and Hungary.

Based on the analysis of import-export coverage ratios calculated for individual groups of agri-food products (Figures 2, 3 and 4), it can be concluded that a positive trade balance (i.e. an advantage of exports over imports) was recorded for the two

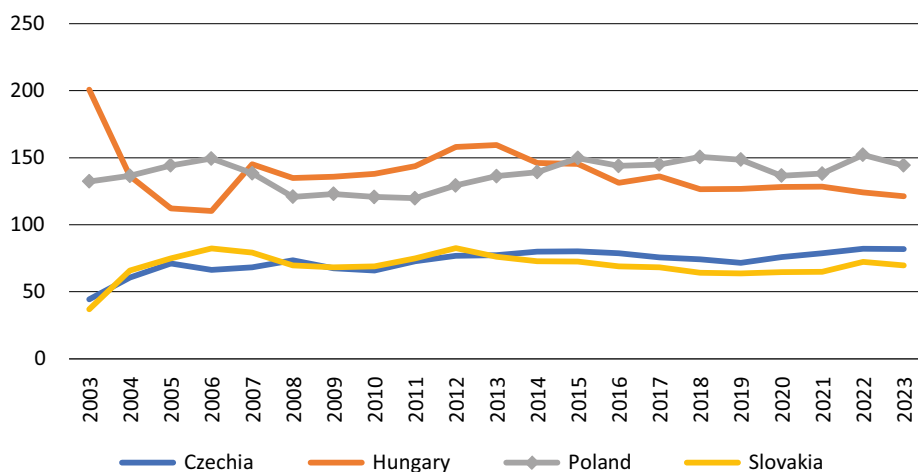


Figure 2. Import-to-export ratio (TCR) for V4 countries for the group of goods, food and live animals (SITC 0) in trade on the EU internal market (2003–2023)

Rysunek 2. Wskaźnik pokrycia importu eksportem (TCR) dla krajów V4 dla grupy towarów „żywność i zwierzęta żywe” (SITC 0) w handlu na rynku wewnętrznym UE (2003–2023)

Source: own study based on Eurostat data.

Źródło: opracowanie własne na podstawie danych Eurostatu.

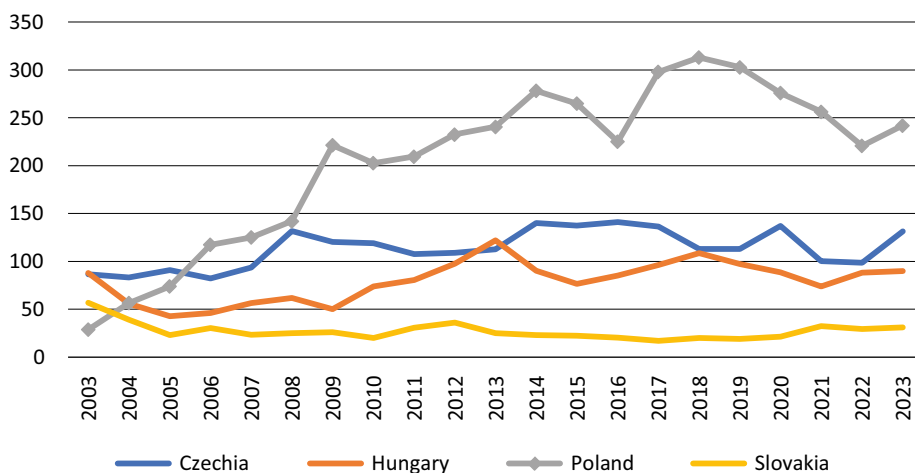


Figure 3. Import-to-export ratio (TCR) for V4 countries for the group of goods, beverages and tobacco products (SITC 1) in trade on the EU internal market (2003–2023)

Rysunek 3. Wskaźnik pokrycia importu eksportem (TCR) dla krajów V4 dla grupy towarów „napoje i wyroby tytoniowe” (SITC1) w handlu na rynku wewnętrznym UE (2003–2023)

Source: own study based on Eurostat data.

Źródło: opracowanie własne na podstawie danych Eurostatu.

groups of analysed products by Poland (SITC groups 0 and 1, Figures 2 and 3), Czechia (SITC groups 1 and 4, Figures 3 and 4) and Hungary (SITC groups 0 and 4, Figures 2 and 4). Slovakia did not have a positive trade balance for any of the analysed product groups. In terms of the analysed TCR indicator, Poland performs most favourably compared to the other Visegrad countries concerning beverages and tobacco (the highest indicator value since 2005), as well as with regard to the food and live animals commodity group since 2015. In most of the analysed years, Poland recorded the lowest values of the indicator for the SITC 4 group (Figure 4), as it is a significant importer of oils, fats and wax of plant and animal origin within the EU.

The final stage of the research involved identifying the trade advantages, or lack thereof, for individual groups of agri-food products in the V4 countries. Poland is the most advantageous in comparison with the other analysed countries, with a so-called strong export position ($RSCA > 0$, $TBI > 0$) recorded for food and live animals (SITC 0) and beverages and tobacco (SITC 1). Apart from Poland, the country with the most favourable type of advantage is Hungary, which has both a comparative

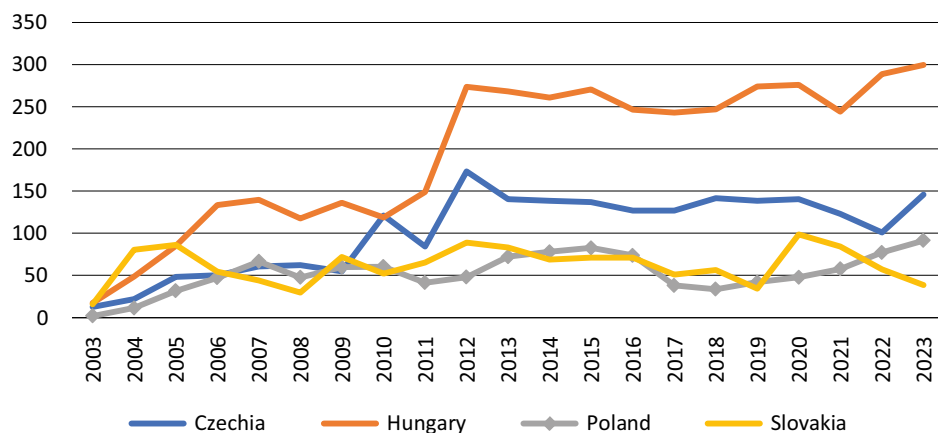


Figure 4 . Import-to-export ratio (TCR) for the V4 countries for the commodity group of oils, fats, animal and vegetable waxes (SITC4) in trade on the EU internal market (2003–2023)

Rysunek 4. Wskaźnik pokrycia importu eksportem (TCR) dla krajów V4 dla grupy towarów „oleje, tłuszcze, woski zwierzęce i roślinne” (SITC4) w handlu na rynku wewnętrznym UE (2003–2023)

Source: own study based on Eurostat data.

Źródło: opracowanie własne na podstawie danych Eurostatu.

advantage and export specialisation for the product group vegetable and animal oils, waxes and fats (SITC 4). The reverse situation occurs when a country has no comparative advantage and imports exceed exports over a given period ($RSCA < 0$, $TBI < 0$). Slovakia falls into this category, being uncompetitive in all analysed agri-food product groups and highly dependent on external supplies. A lack of comparative advantage and export specialisation was also found in the case of Czechia and Hungary for food and live animals (SITC 0), and in the case of Poland for vegetable and animal oils, waxes, and fats (SITC 4). The third situation, whereby a country exports despite lacking a comparative advantage ($RSCA < 0$, $TBI > 0$), is common for Czechia and Hungary. Czechia is a net exporter of beverages and tobacco (SITC 1) and oils and fats (SITC 4), despite having no comparative advantage in these product groups. A similar situation exists for Hungary with regard to food and live animals (SITC 0). Net exports in the absence of comparative advantage may indicate positive effects of export support policies, production relocation in the case of processed products, or low labour costs. None of the analysed countries fell into the fourth category of trade competitiveness for

Table 5. Comparative advantage (RSCA) and export specialisation (TBI) in agri-food trade on the EU internal market of the Visegrad Group countries in selected years of the period 2003–2023

Tabela 5. Przewaga komparatywna (RSCA) i specjalizacja eksportu (TBI) w handlu rolno-spożywczym na rynku wewnętrznym UE krajów Grupy Wyszehradzkiej w wybranych latach okresu 2003–2023

Country	Year	SITC 0		SITC 1		SITC 4	
		RSCA	TBI	RSCA	TBI	RSCA	TBI
Czechia	2003	-0.71	-0.38	-0.64	-0.07	-0.82	-0.78
	2008	-0.38	-0.15	-0.27	0.14	-0.5	-0.23
	2013	-0.38	-0.13	-0.26	0.06	-0.18	0.17
	2018	-0.44	-0.15	-0.22	0.06	-0.31	0.17
	2023	-0.36	-0.10	-0.10	0.14	-0.34	0.19
Hungary	2003	-0.33	0.34	-0.75	-0.06	-0.85	-0.70
	2008	-0.08	0.15	-0.52	-0.24	-0.19	0.08
	2013	-0.05	0.23	-0.36	0.10	0.25	0.46
	2018	-0.15	0.12	-0.35	0.04	0.14	0.42
	2023	-0.13	0.10	-0.35	-0.05	0.14	0.50
Poland	2003	-0.18	0.14	-0.88	-0.55	-0.95	-0.96
	2008	0.07	0.09	-0.14	0.17	-0.32	-0.36
	2013	0.11	0.15	0.07	0.41	-0.20	-0.16
	2018	0.12	0.20	0.25	0.52	-0.55	-0.50
	2023	0.10	0.18	0.26	0.41	-0.20	-0.05
Slovakia	2003	-0.82	-0.46	-0.84	-0.28	-0.88	-0.73
	2008	-0.35	-0.18	-0.74	-0.60	-0.62	-0.54
	2013	-0.36	-0.14	-0.75	-0.60	-0.08	-0.09
	2018	-0.45	-0.22	-0.76	-0.67	-0.57	-0.28
	2023	-0.33	-0.18	-0.60	-0.53	-0.52	-0.44

Source: own study based on Eurostat data.

Źródło: opracowanie własne na podstawie danych Eurostatu.

any of the analysed groups of products, which is defined as having exports based on comparative advantage, but with imports exceeding exports at any given time ($RSCA > 0$, $TBI < 0$). This should be viewed positively, as such a situation would indicate possible existing demand barriers and untapped potential.

In summary, the analysis of trade performance indicates that the Polish agri-food sector should specialise in product groups in which it has a comparative advantage. Poland already has a strong position in the food and beverage sector, while Hungary and Czechia have a strong position in the production of fats and

oils. Strengthening competitiveness will require developing these segments and bringing them in line with EU standards. At the same time, it is advisable to avoid competing in areas where there is no comparative advantage.

5. Discussion

The Visegrad Group is an interesting subject for analysis, given its shared transformational history and similar accession timings to the EU. Despite these similarities, however, the V4 countries have followed different development paths in the agricultural sector, which has affected their competitive position in the single European market. In Poland, for example, individual farming was already dominant before the economic transformation (Bański 2017). Consequently, after 1989, farms in Poland were highly fragmented and independent, perpetuating numerous smaller family farms. By contrast, the socialist system in Czechia, Slovakia and parts of Hungary was based on large state-owned cooperatives. After privatisation, these were often transformed into large, integrated agricultural enterprises (Bański 2017). Poland stands out for its high level of agricultural employment (approx. 9.1 workers per 100 ha), which reduces labour productivity. Conversely, Slovakia has only 2.5 employees per 100 ha (Szabo, Grznar, Zelina 2018) and very little capital per hectare (the lowest rate in the EU). This means that Slovakian farms are much smaller and less well-equipped than others, resulting in lower productivity and greater import dependency. Research has shown that agriculture in V4 countries differs in terms of production potential and the importance of this sector to the economy (Table 1). This applies to labour resources, the economic size of farms, and agriculture's share in GVA.

Research into the competitiveness of agriculture in these countries enables the identification of barriers and development potential, providing a basis for formulating effective strategies to support productivity growth. The literature indicates that natural and cultural conditions, the countries' different political histories, levels of economic development, relationships between land and labour, levels of fertilisation, mechanisation, innovation and structural change, as well as institutional factors and human capital are reasons for differences in labour productivity (Kołodziejczak 2025; Kijek, Kijek, Nowak 2020; Baer-Nawrocka, Markiewicz 2013). The research presented in this paper shows that labour productivity in agriculture is relatively low in the V4 countries, but labour productivity growth is higher than the EU average (Table 2). In the case of Poland and Slovakia, labour productivity indicators are still more than 60% lower than the EU-27 average. However, reducing development differences between EU member states and regions within individual countries is one of the most important goals

of European integration (Adamowicz, Szepeluk 2018). In the context of existing differences in labour productivity levels, Kołodziejczak (2025) emphasises that the modernisation and structural transformation processes in agriculture in countries with low labour productivity levels should be further supported. This is particularly relevant for countries with unfavourable agrarian structures. The author's recommendations include measures to support the modernisation of production technologies and the implementation of innovations, including digitalisation and artificial intelligence solutions. Other recommendations include land concentration and measures to support the merging of farmers into production cooperatives and producer groups. Such measures appear to be particularly relevant for agriculture in Poland and Hungary. In contrast, Czechia and Slovakia have a different farm structure, resulting in a higher concentration of production. Therefore, it is particularly reasonable to support the implementation of innovative technologies and precision agriculture in these countries.

In addition to productivity, the study analysed the competitive position of the Visegrad countries in the EU's internal agri-food trade market. Few authors have studied the agri-food trade of the Visegrad countries. Svatoš and Smutka (2014) demonstrated that the majority of the V4 countries' agri-food trade, in terms of both exports and imports, was with EU countries, and that the V4 countries were also significant trading partners with one another. Based on an analysis of V4 countries' mutual trade, they found that the main trading entities active in the V4 market were Czechia and Slovakia, while the most competitive entities were Poland and Hungary. This strong position of Poland and Hungary was also confirmed by earlier research, conducted in 2012 by Bielik, Smutka and Horská (2012), which examined the reciprocal trade of the V4 countries. Our research shows that this advantage has been maintained by the V4 countries in subsequent years of EU membership. However, there is a lack of studies focusing solely on agri-food trade within the V4 countries. In contrast, there are more studies analysing agricultural trade and the position of individual EU member countries (Nowak et al. 2023; Kasztelan et al. 2021; Jarosz-Angowska et al. 2020). This study focuses on agri-food trade within the V4 countries, filling the research gap created after 2014 and providing comprehensive comparisons of their competitive positions throughout their EU membership.

Research has shown that V4 countries vary in terms of their agricultural production potential, labour productivity levels, and competitive position in agri-food trade. Therefore, further research is needed to identify the factors that influence the potential for improving agricultural competitiveness in individual countries. It would also be worthwhile to distinguish and compare the competitiveness of agricultural and food products in international trade, as well as to compare these indicators to labour productivity separately for both sectors. Szajner and

Szczepaniak (2020) indicate that the structure of the Polish foreign agri-food trade is dominated by food industry products. The share of food industry products in total agri-food exports is particularly high, ranging from 80 to 90%. Furthermore, these authors demonstrated that the growth rate of food product exports after the EU accession was significantly higher than that of agricultural products. The literature also includes studies on labour productivity in the food industry. Juchniewicz (2022) found that all V4 countries were among the countries with low labour productivity in this sector. At the same time, these differences in relation to countries with high labour productivity were not as significant as in agriculture. Therefore, in-depth research is required to determine the extent to which food products have contributed to improved competitiveness in the agri-food trade.

6. Conclusion

The competitiveness of the agricultural sector is one of the key issues in the context of the European Union's single market and global trade conditions. This issue is particularly important for the Visegrad Group countries, which faced the challenge of adapting their agricultural structures to the requirements of CAP and competing with more developed Member States after they acceded to the EU. Despite sharing similar historical circumstances and undergoing similar transformation processes at the same time, the V4 countries exhibit varying levels of agricultural development, as reflected in both productivity levels and foreign trade results in agricultural products. In all V4 countries, labour productivity was lower than the EU-27 average after accession to the European Union. Of the four countries studied, Czechia recorded the highest productivity and Poland the lowest, influenced by agrarian structure and the level of employment in agriculture. The dynamics of change in productivity were higher in the V4 countries than in the EU-27 on average, improving the ratio of the labour productivity index of the countries under study to the EU average.

The study showed that accession to the EU by Czechia, Hungary, Poland and Slovakia contributed to an increase in exports and imports of all agricultural product groups in all analysed countries. Poland has a comparative advantage and is specialised in exporting the commodity groups of food and live animals (SITC 0) and beverages and tobacco products (SITC 1), but not oils, fats and waxes of vegetable and animal origin (SITC 4). Within the oils, fats and waxes of vegetable and animal origin group (SITC 4), Hungary performed best with a comparative advantage and export specialisation.

The agriculture of the Visegrad countries should prioritise increasing the efficiency and added value of production. However, the direction in which CAP is developing may limit progress due to its focus on pro-environmental measures.

In this situation, it seems reasonable to continue with development paths based on the sustainable intensification of production. For countries such as Poland and Hungary, it is important to stimulate structural changes that would improve the productivity of production factors, particularly labour.

This study has some limitations. The study did not analyse the efficiency of all production factors, focusing instead on labour. Further research should consider a less extensive data aggregation than that used in this study. It is also worth considering the impact of recent US policy developments on changes in the V4 group. Another limitation is that the labour productivity analysis was limited to the agricultural sector, whereas the product groups analysed also included those related to food processing. Further research should consider this aspect, as the development of food processing has led to a dynamic increase in trade in V4 countries, especially Poland, and improved competitiveness in trade.

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Analiza porównawcza konkurencyjności rolnictwa i handlu rolno-spożywczego w krajach Grupy Wyszehradzkiej w ramach struktur Unii Europejskiej

Streszczenie: Celem opracowania była ocena konkurencyjności rolnictwa i handlu rolno-spożywczego krajów Grupy Wyszehradzkiej (V4) w okresie członkostwa w Unii Europejskiej (UE). Na podstawie danych Eurostatu oraz Agri-food Data Portal dokonano analizy produktywności pracy w rolnictwie oraz pozycji konkurencyjnej w handlu produktami rolno-spożywczymi na wewnętrznym rynku UE. W każdym z krajów grupy V4 poziom wskaźnika produktywności pracy był niższy od przeciętnego poziomu w UE-27, jednak w Polsce i na Węgrzech relacja ta była najmniej korzystna. Spośród czterech badanych krajów najwyższą produktywność odnotowano w Czechach, a najniższą w Polsce, na co wpływała struktura agrarna i poziom zatrudnienia w rolnictwie. Pozytywnym zjawiskiem było jednak to, że dynamika zmian produktywności pracy we wszystkich krajach grupy V4 była wyższa niż średnia w UE. Badania wykazały również, że akcesja Czech, Węgier, Polski i Słowacji do UE przyczyniła się do wzrostu zarówno eksportu, jak i importu produktów rolno-spożywczych we wszystkich analizowanych krajach. Polska wykazuje przewagę komparatywną i specjalizację eksportową dla grupy towarów „żywność i zwierzęta żywe” (SITC 0) i dla grupy towarów „napoje i wyroby tytoniowe” (SITC 1) oraz brak przewagi komparatywnej i specjalizacji eksportowej dla grupy towarów „oleje, tłuszcze, woski zwierzęce i roślinne”. W ostatniej z analizowanych grup SITC 4 najlepiej wypadają Czechy mające przewagi komparatywne i specjalizację eksportową w tym zakresie. Najgorzej na tle badanych krajów wypada Słowacja, która nie uzyskała przewagi komparatywnej ani specjalizacji eksportowej w żadnej z analizowanych grup towarów.

Słowa kluczowe: Grupa Wyszehradzka, rolnictwo, konkurencyjność, handel wewnątrz-wspólnotowy.