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INTRA-INDUSTRY TRADE IN AGRI-FOOD PRODUCTS BETWEEN POLAND AND EUROPEAN UNION COUNTRIES

Key words: intra-industry trade, agri-food products, exported and imported products, quality, EU countries

ABSTRACT. The aim of this article is to elucidate intra-industry trade in agri-food products between Poland and other EU countries. This approach focuses on the analysis of Poland's intra-industry trade with the integrative group and selected EU countries, distinguishing between horizontal and vertical intra-industry trade. It also identifies the countries with which Poland exports higher-quality product groups than it imports, and those to which it exports lower-quality agri-food products compared to the ones it imports. The Grubel-Lloyd index (IIT – intra-industry trade) is applied to calculate intra-industry trade. To differentiate between vertical and horizontal intra-industry trade, unit values are utilized, assuming that relative prices reflect relative characteristics, where horizontally differentiated products are homogeneous (perfect substitutes) and possess the same quality, while vertically differentiated products have varying prices reflecting different qualities. A division was also made into high vertical intra-industry trade, characterized by higher-quality exported products, and low vertical intra-industry trade, characterized by higher-quality imported products. The research findings indicate that Poland's trade in agri-food products with EU countries predominantly exhibits characteristics of vertical intra-industry trade, with the quality of exported products generally surpassing that of imported ones.

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INTRODUCTION

Traditional theories of international trade assume constant economies of scale, homogeneous products, and perfect competition, aiming to explain the reasons for inter-industry trade based on comparative advantages. However, a significant portion of global trade since the 1960s has taken the form of intra-industry trade. In today's world, countries not only specialize in different products from various industries, but also offer various specialized product varieties within the same industry. The increasing importance of intra-industry trade in global commerce has been demonstrated by scholars such as Marius Brülhart [2009]. Rudolf Loertscher and Frank Wolter [1980], while investigating the reasons for the development of intra-industry trade, found that its intensity in bilateral relationships is greater when there are smaller differences in the level of economic development, market sizes, and distances between trading partners. Furthermore, the development of intra-industry trade is favored by the absolute size of the trading partners' markets and their membership in the same preferential trade zone [Pawlak, Poczta 2019]. Since the second half of the last century, such specialization has increasingly led to cross-border trade in diversified goods, both horizontally – goods differing in various characteristics but not in quality, and vertically – goods differing in various characteristics, including quality. Consequently, since the 1970s, more research has focused on these issues, providing theoretical foundations for intra-industry trade (IIT), i.e., the simultaneous export and import of products belonging to the same statistical product category. The theoretical foundations of intra-industry trade (IIT) were first identified by Herbert Gunter Grubel and Peter John Lloyd [1971]. Despite the growing significance of the topic, only a relatively small number of articles address intra-industry trade in the agri-food sector, and many studies do not differentiate between horizontal and vertical IIT [Falvey 1981, Greenaway, Hine 1991, Pawlak, Poczta 2019, Blanes, Carmela 2000]. This article aims to elucidate intra-industry trade in agri-food products between Poland and other EU countries, with a particular focus on vertical intra-industry trade. In the conducted analysis, a more detailed examination of Poland's vertical intra-industry trade with Germany, France, and the Visegrad Group countries was also conducted.

LITERATURE REVIEW

The literature on intra-industry trade began to emerge in the 1960s with publications by Petrus Johannes Verdoorn [1960] and Béla Balassa [1965, 1966]. These authors observed that some developed countries were both exporting and importing products within the same product categories. This phenomenon became more apparent in the years following the establishment of the European Economic Community (EEC). However,

it gained significant attention only after Herbert Gunter Grubel and Peter John Lloyd [1975] introduced an index for measuring intra-industry trade (IIT). Following extensive research, it became widely accepted that IIT is a more intense phenomenon among countries with similar income levels, and this similarity was strengthened by the process of economic integration.

Pioneering work on intra-industry models is credited to Paul Krugman [1979, 1980], Kelvin Lancaster [1980], Elhanan Helpman [1981], and Jonathan Eaton and Henryk Kierzkowski [1984]. Literature dedicated to intra-industry trade increasingly emphasizes the importance of distinguishing between horizontal and vertical intra-industry trade. Horizontal intra-industry trade (HIIT) is generally defined as the exchange of goods that differ in various attributes except quality, whereas vertical intra-industry trade (VIIT) involves the exchange of goods with different characteristics, including varying quality. Consequently, the presence of one or the other has different implications for trading partners. Horizontal intra-industry trade (HIIT) is more relevant for trade between highly developed countries with similar income levels, while (VIIT) is considered particularly significant for trade between uneven trading partners with differing income levels.

Recent empirical studies, however, show that even among developed countries, vertical intra-industry trade is becoming dominant compared to horizontal trade [Greenway et al. 1994]. Distinguishing between horizontal and vertical intra-industry trade has potential implications for the analysis of the welfare effects of economic integration [Blanes, Martin 2000]. Intra-industry trade based on horizontally differentiated products is associated with low adjustment costs – the "smooth adjustment hypothesis" [Brülhart 2000]. However, these costs can be considerably higher for vertically differentiated products. Firstly, the use of production factors to produce traded goods can vary, similar to inter-industry trade [Greenaway, Hine 1991]. Secondly, when IIT leads to the displacement of lower-quality products with higher-quality ones, countries that produce the former should anticipate an increase in unemployment and a decline in prosperity if they do not offset this by offering their less competitive products to customers at lower prices [Shaked, Sutton 1984].

RESEARCH MATERIAL AND METHODOLOGY

The research utilized data sourced from the Eurostat database. The analysis covered 15 groups of agri-food products classified according to the Standard International Trade Classification (SITC), a standard classification developed by the United Nations and used for international trade statistics. The analysis did not include section 9 – "Commodities and transactions not elsewhere classified in SITC", focusing solely on agricultural and food products from the basic sections of SITC. In the analysis of Poland's foreign trade, the following were taken into account: the EU-27 countries as an integrative group,

the Visegrad Group countries, and the two largest countries in the European Union. The analysis was conducted for the year 2022.

In the context of trade in food products, a significant consideration is distinguishing between intra-industry and inter-industry trade. The importance of intra-industry trade can be assessed using the Grubel-Lloyd index (IIT – intra-industry trade) [Cieślik 2000]:

$$\text{IIT} = \frac{(X_{ij}+M_{ij}) - |X_{ij}-M_{ij}|}{X_{ij}+M_{ij}} \times 100\%$$

where:

X_{ij} – represents the export of product (sector) j from country i,
M_{ij} – represents the import of product (sector) j from country i.

The Grubel-Lloyd index takes on values ranging from 0 to 100. The higher its value, the greater the significance of intra-industry trade in a country's trade. High values of the indices, approaching 100, indicate the presence of intra-industry trade, where the export and import flows of goods from the same industry significantly overlap. These values reflect the exporting country's ability to satisfy the foreign recipient's demand preferences, which, in turn, speaks positively about the adaptive capabilities and competitiveness of the economy [Jagiełło 2003]. On the other hand, IIT indices that are close to zero suggest the existence of inter-industry trade. It is worth noting that thanks to intra-industry trade, the revelation of relative comparative advantages does not necessarily lead to the mass withdrawal of production factors from industries characterized by lower competitiveness or even its absence, and their engagement in more competitive activities. A country can specialize within the same sector but in different product groups [Czyżewski, Sapa 2003].

A significant limitation of the Grubel-Lloyd index is its inability to differentiate between horizontal and vertical intra-industry trade. Literature suggests several solutions to this problem, with one of the most widely adopted approaches being based on unit values developed by Kamal Abd-el Rahman [1991]. The fundamental assumption behind unit values is that relative prices reflect relative characteristics, where horizontally differentiated products are homogeneous (perfect substitutes) and possess the same quality, while vertically differentiated products have varying prices reflecting different qualities [Falvey 1981]. According to David Greenaway et al. [1995], a product is horizontally differentiated if, for each product category determined by a chosen statistical classification, the unit value of exports compared to the unit value of imports falls within a 15% range. If not, the products are considered vertically differentiated.

The bilateral trade balance with horizontally diversified products j occurs when the unit values of exports and imports for a specific dispersion coefficient α (e.g., 0.15) satisfy the condition [Brkić et al. 2021]:

$$1 - \propto \le \frac{UV_j^x}{UV_j^m} \le 1 + \propto$$

Similarly, bilateral trade in vertically differentiated products is defined as one in which:

$$\frac{UV_j^x}{UV_j^m} < 1 - \propto \qquad \text{or} \qquad \frac{UV_j^x}{UV_j^m} < 1 + \propto$$

Vertical Intra-Industry Trade (VIIT) represents specialization in varieties of different qualities that require different factor inputs. Jose Vicente Blanes and Carmela Martín [2000] categorize VIIT into two categories – high vertical intra-industry trade (VIITh) and low vertical intra-industry trade (VIITl), also utilizing the relative unit value. VIITh (α above 1.15) indicates trade in vertically differentiated products of higher quality (implying that the quality of exported products is higher than that of imported products), while VIITl (α below 0.85) denotes trade in vertically differentiated products of lower quality (implying that the quality of exported products is lower than that of imported products).

RESULTS OF RESEARCH

The results of the conducted research indicate that Poland›s foreign trade in agri-food products is predominantly characterized by intra-industry trade. The Grubel-Lloyd index for Poland' trade in these products, on average with all countries worldwide, stands at 78. An even higher value of this index is observed in Poland›s trade with the EU-27 countries. Among the analysed countries, France is the one with which Polan's trade in agri-food products exhibits the lowest degree of intra-industry trade intensity. The highest intra-industry trade intensity is observed in products from the SITC section "Food and live animals", while in the case of "Beverages and tobacco", it can be noted that there is inter-industry trade with Slovakia and Hungary (Table 1).

Considering the intensity of intra-industry trade at the two-digit SITC level, we can identify products characterized by almost complete intra-industry trade. For example, in the case of beverages in Poland's trade with all countries globally, the Grubel-Lloyd index is 99.5 (Table 1). There are also products where almost complete inter-industry trade occurs, such as Poland's trade with Slovakia in tobacco products (Table 1).

Table 1. Intensity of Polish intra-industry trade (Grubel-Lloyd indices) in agri-food products in 2022

SITC Code	Description	Poland- all countries	Poland- UE 27	Poland- Germany	Poland- France	Poland- Czechia	Poland- Slovakia	Poland- Hungary
	Agri-food products	78.0	79.0	74.7	57.3	59.9	63.8	63.9
	Section 0 – Food and live animals	76.6	79.4	75.7	58.1	53.7	67.4	62.4
00	Live animals other than animals of division 03	29.7	20.1	75.1	15.6	9.0	14.0	9.2
01	Meat and meat preparations	37.8	46.6	51.0	16.9	15.4	24.6	35.3
02	Dairy products and birds' eggs	58.6	69.3	74.6	76.8	42.0	29.6	27.2
03	Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates, and preparations thereof	95.1	90.0	39.2	56.4	15.7	2.2	9.3
04	Cereals and cereal preparations	53.8	51.9	31.9	83.8	81.8	66.6	59.7
05	Vegetables and fruit	98.7	96.2	88.1	69.4	30.6	19.2	68.3
06	Sugars, sugar preparations and honey	85.8	88.6	86.7	80.1	90.9	70.3	77.1
07	Coffee, tea, cocoa, spices, and manufactures thereof	94.1	94.6	67.8	77.4	49.6	67.9	45.0
08	Feeding stuff for animals (not including unmilled cereals)	90.3	85.8	92.8	80.8	98.2	48.1	86.8
09	Miscellaneous edible products and preparations	68.8	86.9	87.9	65.7	41.2	49.2	46.1
	Section 1 – Beverages and tobacco	63.0	62.1	51.7	51.1	55.7	29.6	22.0
11	Beverages	99.5	90.2	74.9	68.4	81.9	49.5	54.3
12	Tobacco and tobacco manufactures	44.7	41.1	32.2	1.5	24.5	0.1	2.8
	Section 4 – Animal and vegetable oils, fats and waxes	65.7	87.1	85.7	51.8	74.1	33.9	42.8
41	Oil-seeds and oleaginous fruits	76.1	81.0	87.4	68.3	19.6	96.6	42.5
42	Fixed vegetable fats and oils, crude, refined or fractionated	51.7	73.8	72.7	30.9	47.5	24.3	7.8
43	Animal or vegetable fats and oils, processed; waxes of animal or vegetable origin; inedible mixtures or preparations of animal or vegetable fats or oils, n.e.s.	90.1	73.4	64.5	49.7	47.2	9.7	71.8

Source: own calculation

In the context of all agricultural and food products, it can be observed that trade, on average, with all countries worldwide, with the EU-27, with Germany, the Czech Republic, and Hungary, exhibits characteristics of vertical intra-industry trade, and importantly, the products exported by Poland to these countries frequently demonstrate higher quality than the products imported from these countries. Only in the case of trade with France, do we observe low vertical intra-industry trade, meaning that agricultural and food products imported from France possess higher quality compared to the products exported. Trade with Slovakia displays horizontal intra-industry trade, signifying that the quality of exported and imported products is similar (Table 2).

When examining vertical intra-industry trade at the two-digit level of the SITC sections, it can be noted that in the case of "Fish, crustaceans, molluscs, and aquatic invertebrates and preparations thereof", their exports to all analysed countries are characterized by higher quality products compared to imports. Conversely, in the case of "Animal feed (excluding unmilled cereals)" imported products usually exhibit higher quality than those exported by Poland (Table 2).

The research findings indicating that Poland's foreign trade in agricultural and food products with EU countries is predominantly characterized by intra-industry trade differ from the results of studies on trade in the same product groups in other Central and Eastern European countries. For example, the exchange of agricultural and food products of Hungary [Jámbor 2010] and Bosnia and Herzegovina with EU countries suggests the dominance of intra-industry trade [Brkić et al. 2021]. However, when analyzing this trade over a longer period, we can observe an increase in the Grubel-Lloyd indices, indicating a gradual transition to intra-industry trade in these countries. On the other hand, Moldova's foreign trade in agricultural and food products with the EU is intra-industry in nature [Cimpoies 2017], but the intensity of this trade is lower than in Poland.

The development of both horizontal and vertical intra-industry trade is determined by various factors, including processes of internationalization, liberalization, and integration. The level of development in the agricultural and food sector also significantly influences changes in foreign trade. Therefore, further analysis is necessary to identify the most important determinants of changes in Polish and European trade in agricultural and food products and their impact on these changes

Table 2. Polish horizontal and vertical intra-industry trade in agri-food products in 2022

SITC Code	Description	Poland-all countries	Poland-UE-27	Poland-Germany	Poland-France	Poland-Czechia	Poland-Slovakia	Poland-Hungary
	Agri-food products	1.66 ↑	2.88 ↑	1.56 ↑	0.81 ↓	1.56 ↑	0.99 →	1.30 ↑
	Section 0 – Food and live animals	1.07 →	76.28 ↑	36.04 ↑	1.10 →	1.74 ↑	2.16 ↑	1.19 →
00	Live animals other than animals of division 03	1.58 ↑	1.24 →	1.01 →	6.64 ↑	2.59 ↑	1.04 →	3.58 ↑
01	Meat and meat preparations	1.34 ↑	1.50 ↑	1.48 ↑	1.73 ↑	1.42 ↑	0.85 →	0.06 ↓
02	Dairy products and birds' eggs	0.81 ↓	0.82 ↓	0.46 ↓	0.86 →	2.57 ↑	4.47 ↑	1.35 ↑
03	Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates, and preparations thereof	1.57 ↑	1.52 ↑	1.95 ↑	1.38 ↑	2.51 ↑	3.51 ↑	1.44 ↑
04	Cereals and cereal preparations	1.12 →	0.61 ↑	0.33 ↓	0.44 ↓	2.26 ↑	1.56 ↑	1.47 ↑
05	Vegetables and fruit	0.91 →	0.99 →	0.93 →	1.28 ↑	0.53 ↓	0.46 ↓	0.76 ↓
06	Sugars, sugar preparations and honey	0.73 ↓	0.91 →	0.70 ↓	3.56 ↑	0.98 →	1.17 →	0.82 ↓
07	Coffee, tea, cocoa, spices, and manufactures thereof	1.23 →	1.16 →	1.20 →	1.45 ↑	1.20 →	1.23 →	0.91 →
08	Feeding stuff for animals (not including unmilled cereals)	1.24 →	0.67 ↓	0.60 ↓	0.59 ↓	0.69 ↓	2.24 ↑	0.81 ↓
09	Miscellaneous edible products and preparations	1.07 →	0.98 →	1.04 →	0.75 ↓	1.63 ↓	0.78 ↓	0.27 ↓
	Section 1 – Beverages and tobacco	7.86 ↑	11.23 ↑	1.51 ↑	0.67 ↓	112.36 ↑	0.43 ↓	2.03 ↑
11	Beverages	4.05 ↑	4.74 ↑	0.31 ↓	0.48 ↓	65.43 ↑	0.23 ↓	0.71 ↓
12	Tobacco and tobacco manufactures	2.39 ↑	1.94 ↑	2.73 ↑	0.61 ↓	1.51 ↑	1.80 ↑	2.29 ↑
	Section 4 – Animal and vegetable oils, fats and waxes	0.97 →	0.87 ↓	0.95 →	0.71 ↓	0.84 ↑	1.02 →	1.06 →
41	Oil-seeds and oleaginous fruits	1.08 →	1.11 →	1.28 ↑	0.96 →	0.60 ↑	0.87 →	1.26 ↑
42	Fixed vegetable fats and oils, crude, refined or fractionated	1.06 →	0.95 →	0.99 →	0.61 ↓	0.98 →	0.97 →	1.30 ↑
43	Animal or vegetable fats and oils, processed; waxes of animal or vegetable origin; inedible mixtures or preparations of animal or vegetable fats or oils, n.e.s.	0.73 ↓	0.64 ↓	0.62 ↓	0.30 ↓	0.92 →	1.37 ↑	1.09 →

→ Intra-industry trade levels

↓ Vertical intra-industry trade when the quality of exported products is lower than the imported products

↑ Vertical Intra-industry trade when the quality of products is higher than the imported products

Source: own calculation

SUMMARY

In summary of the conducted research, it can be affirmed that there is a need to distinguish between horizontal and vertical intra-industry trade, especially in identifying low and high vertical intra-industry trade. This differentiation allows for the determination of the quality of exported and imported products. When a country exports products of higher quality than it imports within the same product groups, that country becomes more competitive and can expand its exports even to countries with similar product specialization. The agricultural and food trade of Poland with European Union countries, for the most part, takes the form of high vertical intra-industry trade. Therefore, it can be concluded that Polish agricultural and food products exported from this sector exhibit higher quality compared to similar products from other European Union countries intended for our market. However, this does not apply to all product groups. For instance, animal feed exported by Poland to European Union countries is of lower quality compared to imported feed. Research results also indicate that the competitiveness of French agricultural and food products is higher than that of Polish products due to their superior quality, and trade in this product group is characterized by high vertical intra-industry trade. The research results suggest that Poland's trade in agricultural and food products with European Union countries can grow despite specialization in the same product groups. The determining factor for this development may be the differing quality of individual product groups in different EU countries. Poland potentially has a significant opportunity to gain greater benefits from trading these products than most EU countries due to the higher quality of products offered by our country.

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HANDEL WEWNĄTRZGAŁĘZIOWY PRODUKTAMI ROLNO-SPOŻYWCZYMI MIĘDZY POLSKĄ I KRAJAMI UNII EUROPEJSKIEJ

Słowa kluczowe: handel wewnątrzgałęziowy, produkty rolno-spożywcze, produkty eksportowane i importowane, jakość. kraje UE

ABSTRAKT. Celem artykułu jest ukazanie wewnątrzgałęziowego handlu produktami rolno--spożywczymi między Polską a innymi krajami UE. Skoncentrowano się na analizie wewnątrzgałęziowego handlu Polski z ugrupowaniem integracyjnym i z wybranymi krajami UE, a także na rozróżnieniu poziomego i pionowego handlu wewnątrzgałęziowego oraz wskazaniu, w handlu z którymi z analizowanych krajów jakość poszczególnych grup produktów eksportowanych przez Polskę jest wyższa od importowanych, a do których krajów eksportuje się produkty rolno-spożywcze niższej jakości niż i nich importuje. Do obliczenia handlu wewnątrzgałęziowego zastosowano wskaźnik Grubela-Lloyda (IIT – intra-industry trade), natomiast, aby dokonać rozróżnienia handlu wewnątrzgałęziowego na handel wertykalny i horyzontalny wykorzystano wartości jednostkowe. Przyjęto założenie, że ceny względne odzwierciedlają względne cechy, gdzie produkty zróżnicowane poziomo są jednorodne (doskonałe substytuty) i charakteryzują się taką samą jakością, podczas gdy produkty zróżnicowane pionowo mają różne ceny odzwierciedlające różną jakość. Dokonano również podziału na wysoki wewnątrzgałęziowy handel pionowy, charakteryzujący się wyższą jakością produktów eksportowanych, i niski wewnątrzgałęziowy handel pionowy, charakteryzujący się wyższą jakością produktów importowanych. Wyniki badań wskazują, że handel Polski produktami rolo-spożywczymi z krajami UE ma w przeważającym stopniu charakter handlu wewnątrzgałęziowego pionowego i jakość produktów eksportowanych w większości jest wyższa od jakości produktów importowanych.

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