

Intra-industry trade intensity between Poland and key economic partners: evidence from 2000–2022¹

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Abstract

The aim of this article is to examine how the intensity of bilateral intra-industry trade between Poland and its selected economic partners changed in 2000–2022. To analyse the changes in the intensity of intra-industry trade, we used Grubel-Lloyd indices, calculated on the basis of data including 6-digit product groups as classified in the HS nomenclature (UN COMTRADE database). The research results demonstrate that the most intensive intra-industry trade exists between Poland and Germany, Czechia, France, Hungary, Spain, Italy and the United States. For these seven trading partners, GL index values mostly exceeded 0.3 during the research period.

Keywords: Poland, Europe, intra-industry trade, Grubel-Lloyd index, economic partners

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Intensywność handlu wewnątrzgałęziowego Polski z kluczowymi partnerami gospodarczymi w latach 2000–2022

Streszczenie

Celem artykułu jest znalezienie odpowiedzi na pytanie, jak zmieniła się intensywność dwustronnego handlu wewnątrzgałęziowego Polski z wybranymi partnerami gospodarczymi w latach 2000–2022. Do badania zmian intensywności handlu wewnątrzgałęziowego wykorzystujemy wskaźniki Grubela-Lloyda obliczone na podstawie danych dla 6-cyfrowych grup produktowych z nomenklatury HS (baza danych UN COMTRADE). Wyniki badania wskazują, że najbardziej intensywny handel wewnątrzgałęziowy Polska prowadzi z Niemcami, Czechami, Francją, Węgrami, Hiszpanią, Włochami oraz USA. W przypadku tej siódemki partnerów przez większość okresu badania wartości wskaźników GL były wyższe niż 0,3.

Słowa kluczowe: Polska, Europa, handel wewnątrzgałęziowy, wskaźnik Grubela-Lloyda, partnerzy gospodarczy

The article's aim is to answer the question of how the intensity of Poland's bilateral intra-industry trade (IIT) with its selected economic partners changed between 2000 and 2022. The study covers Poland's trading partners, including EU Member States, non-EU European states (both developed and developing ones), non-European G7 states (Canada, Japan and the United States), and BRICS countries (Brazil, India, China and South Africa). Thus, we analysed Poland's intra-industry trade with 46 states of different characteristics over a 23-year period, which is an added value of this article. A further goal was to answer the question of how the intensity of Poland's intra-industry trade changed in comparison with similar trade changes observed in the European Union and worldwide.

To investigate the changes in the intensity of intra-industry trade, we used Grubel-Lloyd indices (GL indices), which were calculated using data on 6-digit product groups classified according to the Harmonised System (HS) nomenclature. The international trade statistics used in this research were obtained from the COMTRADE database (a United Nations database).

Literature review

There is a wealth of literature on Poland's intra-industry trade, with numerous publications focusing on specific industries. Examples include the automotive industry (e.g. Kawecka-Wyrzykowska 2010; Ambroziak 2012b; Dąbrowski 2017; Moczulski 2018), clothing industry (e.g. Łapińska et al. 2019a), agri-food industry (e.g. Szczepaniak 2011, 2013; Łapińska 2014), pharmaceutical industry (e.g. Łapińska et al. 2019b), machinery industry (e.g. Michalski 2018), and within various industries (e.g. Misala, Pluciński 2000; Molendowski 2006; Czarny, Śledziwska 2008, 2009a,b, 2010; Pluciński 2010; Talar 2012; Kawecka-Wyrzykowska 2017; Polan 2020; Wyrzykowska-Antkiewicz 2021). The discussion of Poland's intra-industry trade in all goods was conducted in the context of specific states (e.g. Misala, Pluciński 2000; Czarny, Śledziwska 2008, 2009a, 2010; Talar 2012;

Molendowski, Polan 2015; Kawecka-Wyrzykowska 2017; Michalski 2018; Wyrzykowska-Antkiewicz 2021), as well as groups of states, such as the EU-10 (e.g. Czarny, Śledziowska 2008; Kawecka-Wyrzykowska 2010, 2016a,b, 2017; Molendowski 2012, 2014; Molendowski, Polan 2013, 2015; Polan 2020), the EU-12 (e.g. Czarny, Śledziowska 2009a,b; Pluciński 2010; Toporowski 2017), the EU-15 (e.g. Misala, Pluciński 2000; Molendowski 2006, 2012, 2014; Czarny, Śledziowska 2008, 2009a,b; Kawecka-Wyrzykowska 2010, 2016a,b; Pluciński 2010; Toporowski 2010, 2013, 2017; Molendowski, Polan 2013, 2015; Kawecka-Wyrzykowska et al. 2017; Polan 2020), the EU-25 (Czarny, Śledziowska 2010; Kawecka-Wyrzykowska 2010), the EU-27 (Talar 2012), the Eurozone (Kawecka-Wyrzykowska 2016b, 2017), non-Eurozone Member States (Kawecka-Wyrzykowska 2016b, 2017), non-EU states (Kawecka-Wyrzykowska 2010, 2016a,b, 2017; Talar 2012), major non-EU trading partners (e.g. Toporowski 2017), developed countries, developing countries and transition countries (Czarny, Śledziowska 2012), CEFTA states (e.g. Misala, Pluciński 2000), and all countries in the world in total (e.g. Brühlhart 2009; Kawecka-Wyrzykowska 2016a,b, 2017; Czarny, Śledziowska 2012).

The general Grubel–Lloyd index for Poland's total trade (calculated on the basis of 4-digit HS codes) recorded a significant increase of 14 p.p. between the mid-1990s and the outbreak of the financial crisis in 2008. It then levelled off over the next six years, reaching approx. 32–33% (Kawecka-Wyrzykowska 2016a,b, 2017; Kawecka-Wyrzykowska et al. 2017). Similar findings were obtained by Ambroziak (2012a) for the years 1995–2008. Czarny and Śledziowska (2012) – when calculating the Grubel–Lloyd index based on 6-digit HS codes – obtained higher results for the index for 2000 and slightly lower ones for the years 2008–2010, due to the limitation of IIT with all countries around the globe during the financial and economic crisis. However, the transition from inter-industry trade to intra-industry trade was slow from 1993 to 1998 (Misala, Pluciński 2000). According to the Grubel–Lloyd index based on 5-digit SITC codes, the majority of Poland's trade with the world was already of an intra-industry nature in 2007 (Kawecka-Wyrzykowska 2010). Trade with developed countries was characterised by higher IIT indices than trade with the world in general, and an upward trend was witnessed in the years 2008–2010, while trade with developing countries remained predominantly of an inter-industry nature (Czarny, Śledziowska 2012).

Many analyses of Poland's intra-industry trade are focused on its trade with the EU Member States. This is due to the fact that they are Poland's main trading partners, and IIT is typical for developed countries. One of the most important factors in the intensification of IIT is economic integration. Most authors point out that trade between Poland and EU Member States was characterised by a growing share of IIT in the 1990s and early 2000s (Misala, Pluciński 2000; Czarny 2002; Czarny, Śledziowska 2008, 2009a,b, 2010; Molendowski 2006, 2012, 2013; Molendowski, Polan 2013, 2015; Kawecka-Wyrzykowska 2016b, 2017). Some researchers claim that the outbreak of the financial crisis in 2008 slowed down or even stalled the upward trend in intra-industry trade. Subsequent years only observed an insignificant increase in its share (Kawecka-Wyrzykowska 2016b, 2017; Molendowski 2013; Molendowski, Polan 2013,

2015). The others (e.g. Toporowski 2013, 2015) argue that the crisis did not significantly influence intra-industry trade, and that the IIT index continued to increase until 2015. However, by the middle of the second decade of the 21st century, it was inter-industry trade that dominated between Poland and the EU. Only Wyrzykowska-Antkiewicz (2021) is of the surprising view that in 1992–2020 trade between Poland and the EU was mainly of an intra-industry nature (according to the Combined Nomenclature classification), with intra-industry trade accounting for 83% of trade within the EU in the last year of the analysed period.

The question of whether intra-industry trade is more typical for trade with the “old” EU Member States (EU-15) or the “new” EU Member States (EU-10 and EU-12) is a subject of dispute among researchers. Studies by Molendowski (2014), Molendowski and Polan (2015), Kawecka-Wyrzykowska (2016a,b), Kawecka-Wyrzykowska et al. (2017), Toporowski (2017) and Polan (2020) show that Poland achieves higher IIT results in trade with the EU-15 than with the EU-12 and the EU-10, while studies by Czarny and Śledziwska (2008, 2009a,b), Molendowski and Polan (2013), and Kawecka-Wyrzykowska (2010) demonstrate that trade with the EU-10 and EU-12 is of a more intra-industry nature than trade with the EU-15. This result is compatible with the IIT theory, which attributes this kind of exchange to the countries at a similar level of development. Higher IIT indices are typical of trade with the Eurozone rather than trade with the Member States from outside of the Eurozone and global trade (Kawecka-Wyrzykowska 2016b, 2017). The lowest IIT indices are recorded in Poland's trade with the rest of the world, understood as non-EU states (Czarny, Śledziwska 2010; Kawecka-Wyrzykowska 2016a,b, 2017; Kawecka-Wyrzykowska et al. 2017; Toporowski 2017).

Analysis of bilateral trade with EU Member States demonstrates that although the IIT index increased in the 1990s with regard to trade with the most EU-15 Member States, this trade remained predominantly inter-industry in nature (Misala, Pluciński 2000). In the 2000s and early 2010s the share of intra-industry trade was growing in Poland's trade with the most EU-15 Member States (Czarny, Śledziwska 2008, 2009a,b; Molendowski, Polan 2015), although in 2014 intra-industry trade prevailed exclusively in the exchange with Germany. Poland also achieved high IIT indices in trade with France, Czechia, Hungary, Malta, Italy and the Netherlands (Molendowski, Polan 2015; Kawecka-Wyrzykowska 2017).

Wyrzykowska-Antkiewicz (2021) suggests that IIT was predominating in Poland's trade with Germany already in 2003, and the same result was achieved in 2020 with respect to all EU Member States, except for Italy, Ireland and Slovenia. In 2020, the IIT index was highest in trade with Estonia, Croatia, Latvia, the Netherlands, and Lithuania.

In case of non-EU states, the years 2004–2008 saw an increase in the IIT index for Poland's trade with Switzerland and Ukraine, and a decrease in trade with Turkey (Czarny, Śledziwska 2010).

It is worth to mention that the biggest interest in Polish IIT was concentrated in the period following the transition, as well as during and after the adjustment processes that accompanied Poland's accession to the EU. In the third decade of the XXI century interest

in IIT has been superseded by new issues in economic analysis such as e-commerce, global value chains (GVCs), embargos and sanctions.

The literature review demonstrates that there has been no comprehensive analysis of Poland's IIT, particularly in recent years and during the period of Covid-19 pandemic. Moreover, while most studies have focused on intra-industry trade between Poland and the EU Member States, while there has been little research of the intensity of intra-industry trade with various non-EU states.

Methods and data

In our research, we calculated the Grubel-Lloyd (GL) indices based on values of exports and imports derived from the WITS-COMTRADE database. We assume that the industry equivalent is a product group understood as a 6-digit HS code level (the WITS-COMTRADE database does not include more disaggregated statistics). The values of GL range from 0 to 1 (0 – no intra-industry trade, 1 – all trade is intra-industry).

We calculated three types of GL indices, the first and the most important of which is a GL index for bilateral trade (for a selected country-pair):

$$GL_{ij} = 1 - \frac{\sum_{b=1}^k |X_{ijb} - M_{ijb}|}{\sum_{b=1}^k (X_{ijb} + M_{ijb})} \quad (1)$$

where:

i – reporter (reporting country),

j – partner (trading partner),

b – industry (6-digit HS code level),

k – number of industries in the total trade (trade in all products),

GL_{ij} – Grubel-Lloyd index in bilateral trade between country *i* and country *j*,

X_{ijb} – exports from country *i* to country *j* of products belonging to industry *b*,

M_{ijb} – imports to country *i* from country *j* of products belonging to industry *b*.

In our research, the reporting country is Poland. We calculated the value of the GL indices with respect to trade with a number of Poland's trading partners. We focused only on the general IIT shares, without calculating indices for vertical and horizontal intra-industry trade. This approach allowed us to avoid including excessive amounts of data in this article. Additionally, statistics on quantity of exports (imports) are unreliable, particularly those related to trade with developing countries. This means that the GL index values for horizontal and vertical intra-industry trade would be rather questionable.

The second analysed index is a GL index for a selected country:

$$GL_i = 1 - \frac{\sum_{j=1}^n \sum_{b=1}^k |X_{ijb} - M_{ijb}|}{\sum_{j=1}^n \sum_{b=1}^k (X_{ijb} + M_{ijb})} \quad (2)$$

where:

i – reporter (trading country),

j – partner (trading partner),

n – number of trading partners,

b – industry (6-digit HS code level),

k – number of industries in the total trade (trade in all products),

GL_i – Grubel-Lloyd index for country i ,

X_{ijb} – exports from country i to country j of products belonging to industry b ,

M_{ijb} – imports to country i from country j of products belonging to industry b .

Due to limited access to statistical data, the number of Poland's trading partners used as a basis for calculating the GL indices is unstable. The number of trading partners increased from 70 in 2000–2003 to 140–150 in 2004–2010, and to 160 in 2011–2014, reaching a record high of 180 in 2015–2022. The number of trading partners influences the GL index: the lower the number, the more overstated is the index. It results from the fact that in the years with a relatively low number of partners the index does not cover trade with developing countries, for which data is missing and which usually bring relatively low contributions. An alternative approach is to calculate the index using only trade parameters, for which data is available for each year of the research period. However, in such comprehensive study as ours, many available statistical data would then have to be ignored, and the value of the GL index for Poland would be artificially overstated throughout the research period. For this reason, we decided to include a varying number of Poland's trading partners, fully aware of the limitations of this choice.

The third one is a GL index for the world:

$$GL_{world} = 1 - \frac{\sum_{i=1}^m \sum_{j=1}^n \sum_{b=1}^k |X_{ijb} - M_{ijb}|}{\sum_{i=1}^m \sum_{j=1}^n \sum_{b=1}^k (X_{ijb} + M_{ijb})} \quad (3)$$

where:

i – reporter (trading country),

m – number of reporters (trading countries),

j – partner (trading partner),

n – number of partners (trading partners),

b – industry (6-digit HS code level),

- k – number of industries in the total trade (trade in all products),
- GL_{world} – Grubel-Lloyd index for the world,
- X_{ijb} – exports from country i to country j of products belonging to industry b ,
- M_{ijb} – imports to country i from country j of products belonging to industry b .

Using a similar formula, we also calculated GL indices for the EU (the reporters are limited to EU Member States). The number of reporters (m) used for calculating GL_{world} is presented in *Table 1*.

Table 1: Number of reporters during 2000–2022.

Year	m	Year	m	Year	m	Year	m
2000	137	2006	158	2012	170	2018	171
2001	142	2007	165	2013	170	2019	166
2002	147	2008	164	2014	157	2020	163
2003	153	2009	168	2015	167	2021	162
2004	152	2010	170	2016	172	2022	143
2005	159	2011	167	2017	173		

Source: own authors' calculation based on WITS-COMTRADE database (15.05.2024).

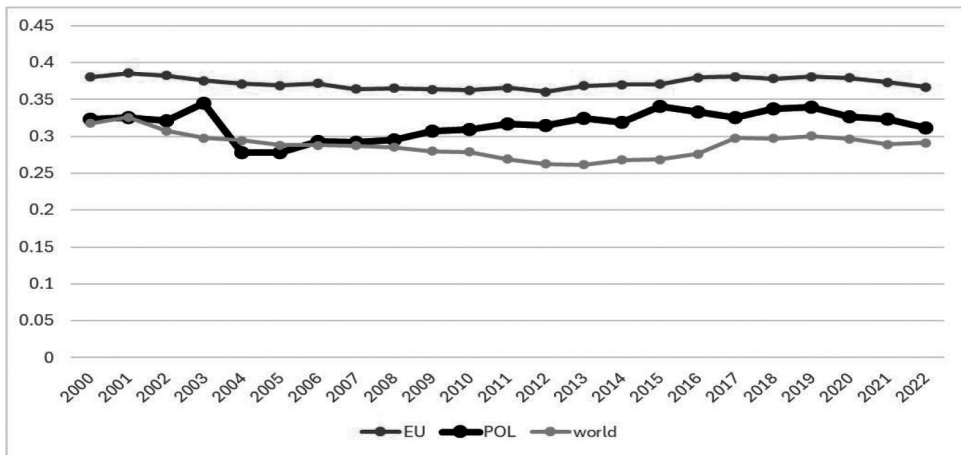
In case of the global GL index, both the number of reporting countries and the number of their trading partners vary over time. In the years, for which data is available for only a limited number of reporting countries, value of the GL index is most likely overstated in comparison to the respective values for the years with more available statistical data. We believe, however, that the scale of this inaccuracy is minor, since global values of the GL indices are shaped mainly by the indicators calculated for all developed countries and the largest developing countries, for which data is available for the entire research period. Therefore, the fact that the GL index for 2017 is based on data from 173 reporting countries, compared to 159 countries in 2005, does not significantly distort the results, because a difference of around a dozen countries between these two reference years corresponds to less than 1% in terms of global trade.

Results and discussion

The values of the GL index reflecting Poland's IIT in 2000–2022 are relatively stable, even if more fluctuating than IIT shares of the European Union and of the world (see: *Figure 1*). It is rather surprising, taking into account the fact that the analysed period was full of turbulence in the global economy, with intensive globalisation (so-called *hiper-globalisation*), global financial and economic crisis, post-crisis stagnation/economic

recovery (depending on the region of the world), globalisation slowdown (so-called *slowbalisation*), and the COVID-19 pandemic. It can be presumed that factors (both intensifying and weakening global, EU and Polish intra-industry trade) occurred concurrently during this period. The highest, and therefore the most stable, GL indices were recorded in the EU trade (with a variation of approximately 0.025), which is not surprising, considering that it involves highly developed states that primarily engage in exchange with partners from the EU. These partners are both culturally and geographically close, with free trade arrangements in place.

Figure 1: GL index values for Poland, the EU and the world in 2000–2022.



Source: own authors' calculation based on WITS-COMTRADE database (15.05.2024).

When looking at Poland's intra-industry trade, it is firstly worth noting that the GL index value dropped significantly in 2004 (approx. -0.07 compared to 2003), as a result of a significant change in the number of trading partners included in the calculations (an increase from 70 to 140 with the most newcomers distant and less developed. Secondly, from 2004 onward, the index values demonstrated a regular increase until 2015 (rising by a total of 0.06), even though the number of trading partners also grew. It means that we certainly faced an increasing intensity of Poland's intra-industry trade. After 2015, the index values fluctuated, although still remaining above the 2004 level.

After analysing the changes in the GL index for Poland's intra-industry trade in total, we move to analysis of Poland's bilateral IIT with selected trading partners. We start discussing trade with the EU Member States, because these are Poland's natural trading partners due to the country's presence in the most developed and integrated political bloc. In our empirical research we divide 26 EU Member States into several groups using a geographical criterion. The first group is composed of the Western European states: Germany (DEU), France (FRA), the Netherlands (NLD), Belgium (BEL), Luxembourg (LUX), Ireland (IRL) and Austria (AUT).

Table 2: GL index values for Poland's bilateral trade with Western European states in 2000–2022.

Year	POL-DEU	POL-FRA	POL-BEL	POL-NLD	POL-LUX	POL-IRL	POL-AUT
2000	0.347	0.346	0.248	0.248	0.253	0.187	0.352
2001	0.348	0.318	0.267	0.273	0.475	0.204	0.351
2002	0.375	0.295	0.219	0.259	0.310	0.268	0.303
2003	0.383	0.290	0.235	0.308	0.281	0.282	0.294
2004	0.367	0.297	0.196	0.248	0.249	0.075	0.243
2005	0.379	0.290	0.216	0.227	0.318	0.074	0.247
2006	0.389	0.327	0.247	0.251	0.203	0.091	0.261
2007	0.417	0.319	0.236	0.270	0.183	0.101	0.277
2008	0.425	0.322	0.249	0.270	0.124	0.267	0.265
2009	0.428	0.319	0.266	0.274	0.180	0.294	0.242
2010	0.435	0.327	0.264	0.269	0.186	0.121	0.245
2011	0.444	0.342	0.271	0.286	0.123	0.105	0.248
2012	0.444	0.358	0.256	0.266	0.140	0.114	0.246
2013	0.458	0.362	0.263	0.256	0.162	0.122	0.272
2014	0.453	0.367	0.264	0.282	0.188	0.115	0.272
2015	0.488	0.384	0.278	0.282	0.168	0.100	0.285
2016	0.488	0.390	0.274	0.272	0.211	0.142	0.282
2017	0.488	0.407	0.292	0.279	0.179	0.198	0.266
2018	0.500	0.377	0.292	0.300	0.153	0.194	0.278
2019	0.505	0.379	0.291	0.295	0.200	0.176	0.291
2020	0.484	0.369	0.293	0.299	0.178	0.196	0.304
2021	0.483	0.367	0.286	0.317	0.178	0.157	0.309
2022	0.462	0.339	0.299	0.289	0.160	0.177	0.301

Source: own authors' calculation based on WITS-COMTRADE database (15.05.2024).

Among the Western European countries, Poland's intra-industry trade was most intensive with Germany (see: *Table 2*), which should not be a surprise given that these are neighbouring countries sharing a long land border. Another factor intensified the bilateral IIT is the large economic potential of Germany and generally intensive Polish trade with this country. Worth mentioning is that values of the GL index for trade between Poland and Germany was increasing throughout almost the entire analysed period.

France ranks second in terms of intra-industry trade intensity (with the GL index also mostly increasing). The least intensive and largely unstable IIT was observed in trade with Ireland, which is not only an island state, but also the most distant among the Western European countries under analysis, what discourages IIT as trade with substitutes.

The second group of the Member States includes the Southern European countries: Italy (ITA), Spain (ESP), Portugal (PRT), Greece (GRC), Cyprus (CYP), Malta (MLT) and Croatia (HRV). They all are relatively distant from Poland and less developed than members of the previous group, therefore we expect its less intensive IIT with Poland.

Table 3: GL index values for Poland's bilateral trade with Southern European states in 2000–2022.

Year	POL-ITA	POL-ESP	POL-PRT	POL-GRC	POL-HRV	POL-CYP	POL-MLT
2000	0.326	0.460	0.058	0.399	0.135	0.009	n/a
2001	0.311	0.406	0.061	0.441	0.234	0.315	0.801
2002	0.290	0.359	0.062	0.429	0.183	0.892	0.852
2003	0.291	0.327	0.090	0.269	0.543	0.939	0.288
2004	0.235	0.278	0.259	0.123	0.310	0.833	0.808
2005	0.234	0.279	0.224	0.238	0.207	0.172	0.058
2006	0.265	0.297	0.185	0.128	0.327	0.180	0.118
2007	0.277	0.286	0.228	0.246	0.294	0.229	0.052
2008	0.281	0.341	0.230	0.168	0.371	0.228	0.060
2009	0.266	0.338	0.206	0.163	0.335	0.388	0.277
2010	0.278	0.346	0.180	0.237	0.215	0.439	0.207
2011	0.285	0.340	0.174	0.455	0.203	0.856	0.134
2012	0.304	0.324	0.165	0.282	0.262	0.747	0.173
2013	0.311	0.322	0.172	0.254	0.221	0.387	0.184
2014	0.304	0.334	0.246	0.301	0.250	0.536	0.667
2015	0.322	0.351	0.170	0.458	0.367	0.646	0.195
2016	0.336	0.367	0.194	0.379	0.376	0.584	0.183
2017	0.343	0.376	0.237	0.176	0.200	0.539	0.085
2018	0.355	0.389	0.273	0.171	0.219	0.735	0.106
2019	0.371	0.389	0.282	0.152	0.212	0.608	0.148

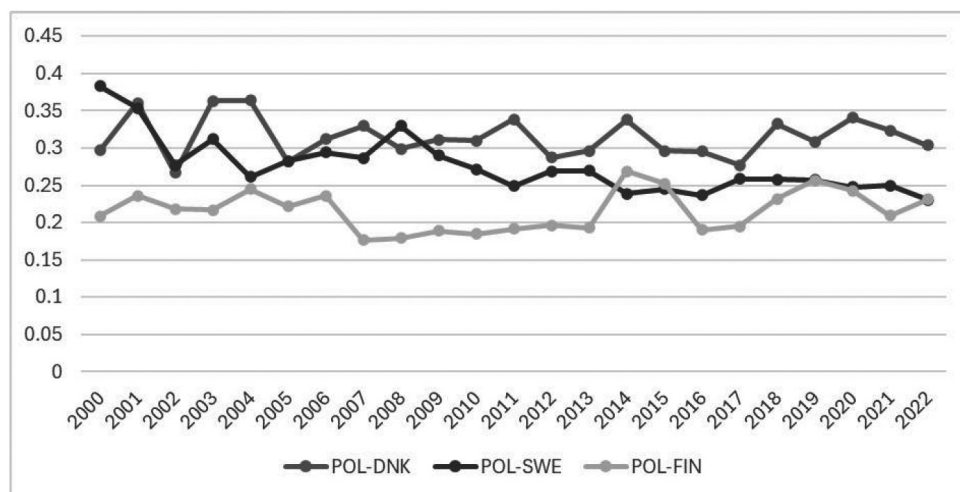
2020	0.391	0.350	0.279	0.200	0.227	0.771	0.206
2021	0.384	0.358	0.257	0.162	0.207	0.444	0.282
2022	0.371	0.339	0.246	0.183	0.215	0.212	0.107

Source: own authors' calculation based on WITS-COMTRADE database (15.05.2024).

In this group, Poland's intra-industry trade with Italy and Spain is the most stable in terms of intensity (see: *Table 3*). Cyprus and Malta are at the other end of the spectrum, with large fluctuations of GL index values. These variations are due to relatively small trade streams with these countries. As expected – in average – none of these IIT shares achieved level observed in Poland's trade with Germany.

The third group consists of the EU Nordic states: Denmark (DNK), Finland (FIN) and Sweden (SWE). Poland's intra-industry trade is the most intensive with Denmark, and least intensive with Finland (see: *Figure 2*).

Figure 2: GL index values for Poland's bilateral trade with Northern European states in 2000–2022.



Source: own authors' calculation based on WITS-COMTRADE database (15.05.2024).

The fourth group consists of the states of Central and Eastern Europe: Czechia (CZE), Slovakia (SVK), Hungary (HUN), Slovenia (SVN), Lithuania (LTU), Latvia (LVA), Estonia (EST), Bulgaria (BGR) and Romania (ROU), which joined the EU in 2004 and 2007. Intra-industry trade between Poland and Czechia is relatively the most stable and intensive, with GL indices of approx. 0.4 throughout the analysed period (see: *Table 4*). The development of this trade is supported by the facts that both countries are neighbours sharing a long land border, have a similar level of development, and share the same free trade arrangements.

Table 4: GL index values for Poland's bilateral trade with Central and Eastern European states in 2000–2022.

Year	POL- -CZE	POL- -SVK	POL- -HUN	POL- -SVN	POL- -LTU	POL- -LVA	POL- -EST	POL- -BGR	POL- -ROU
2000	0.420	0.277	0.347	0.391	0.271	0.412	0.673	0.568	0.174
2001	0.434	0.289	0.375	0.251	0.299	0.463	0.702	0.510	0.471
2002	0.419	0.314	0.356	0.205	0.235	0.471	0.461	0.517	0.518
2003	0.400	0.282	0.398	0.247	0.274	0.380	0.383	0.421	0.411
2004	0.371	0.278	0.279	0.163	0.120	0.109	0.171	0.229	0.250
2005	0.399	0.296	0.251	0.253	0.184	0.095	0.151	0.212	0.254
2006	0.380	0.271	0.310	0.270	0.188	0.165	0.162	0.208	0.217
2007	0.400	0.260	0.310	0.248	0.237	0.157	0.166	0.265	0.249
2008	0.421	0.267	0.323	0.280	0.233	0.185	0.207	0.199	0.235
2009	0.392	0.274	0.336	0.274	0.240	0.193	0.182	0.251	0.257
2010	0.399	0.333	0.325	0.268	0.251	0.209	0.152	0.224	0.241
2011	0.377	0.304	0.360	0.304	0.307	0.202	0.132	0.270	0.262
2012	0.372	0.279	0.394	0.321	0.300	0.227	0.155	0.255	0.294
2013	0.387	0.292	0.391	0.319	0.270	0.190	0.171	0.300	0.321
2014	0.368	0.299	0.357	0.360	0.266	0.156	0.118	0.274	0.322
2015	0.371	0.328	0.387	0.322	0.267	0.141	0.110	0.245	0.308
2016	0.366	0.327	0.351	0.325	0.241	0.174	0.161	0.218	0.308
2017	0.392	0.347	0.343	0.298	0.224	0.227	0.191	0.245	0.306
2018	0.390	0.339	0.348	0.321	0.257	0.190	0.175	0.261	0.315
2019	0.377	0.349	0.374	0.309	0.277	0.201	0.175	0.283	0.307
2020	0.385	0.342	0.376	0.280	0.281	0.193	0.169	0.286	0.318
2021	0.415	0.332	0.359	0.293	0.244	0.192	0.195	0.270	0.330
2022	0.370	0.313	0.359	0.310	0.322	0.184	0.181	0.222	0.293

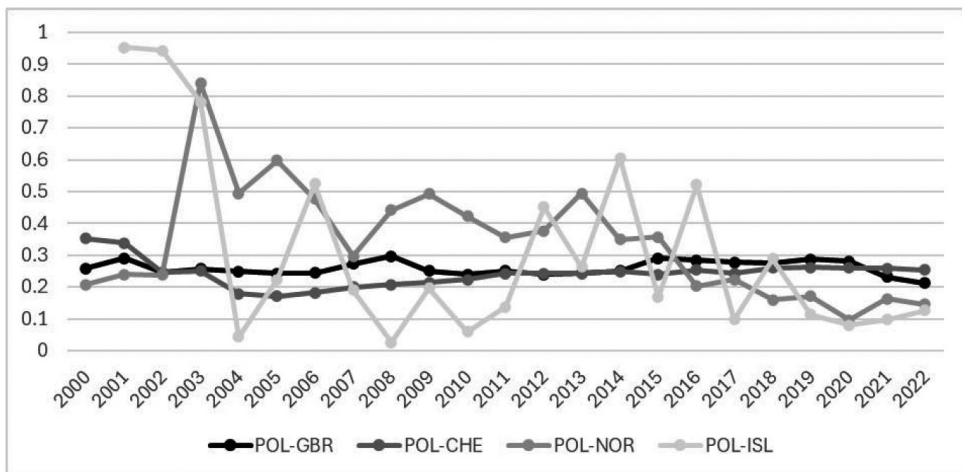
Source: own authors' calculation based on WITS-COMTRADE database (15.05.2024).

The GL index values are relatively more fluctuating and usually lower for other states of this region than those recorded for the trade between Poland and Czechia. Only IIT with Hungary was equal or even slightly more intensive in some years. The least in-

tensive trade in this group was observed between Poland and Estonia, even if in the first year of research Estonia was the leader in intensity of IIT with Poland. IIT between Poland and Latvia also was poor. Both last cases can be explained mainly with the difference in the size of trading economies.

As we have already discussed Poland's intra-industry trade with various groups of the EU Member States, now we move on to the analysis of trade with non-EU states. We begin with developed European states: Switzerland (CHE), Norway (NOR) and Iceland (ISL), which are linked with the EU by customs unions and other advanced formats of economic integration. We also analyse Poland's IIT with Great Britain (GBR), where a free trade area was established after Brexit.

Figure 3: GL index values for Poland's bilateral trade with Switzerland, Norway, Iceland and Great Britain in 2000–2022.



Source: own authors' calculation based on WITS-COMTRADE database (15.05.2024).

The GL index values for Poland's intra-industry trade with Switzerland and the Great Britain demonstrate only slight variations (see: *Figure 3*). A decrease in the index value for Poland's trade with the Great Britain was not significant, although it became clearly visible in 2022, i.e. after the UK's exit from the EU (annual decrease of the index by 0.02 was observed). As for Poland's trade with Norway and Iceland, index values are very diverse (the annual amplitude for Norway is almost 0.7, and for Iceland even as 0.9 p.p.). Similar situation was seen in trade with Cyprus and Malta, where even a single transaction matters, because the value of trade volumes is relatively small.

The GL index values for Poland's bilateral trade with European states other than the developed countries was also calculated in this research (see: *Table 5*). To this group belong the Eastern and Northern neighbours of Poland, namely Belarus (BLR), Russia (RUS) and Ukraine (UKR), as well as non-EU Balkan countries: Albania (ALB), Montenegro (MNE), North Macedonia (MKD), Serbia (SRB), Moldova (MDA) and Georgia (GEO) are also included in this research.

Table 5: GL index values for Poland's bilateral trade with European states other than developed countries in 2000–2022.

Year	POL- -UKR	POL- -BLR	POL- -RUS	POL- -SRB	POL- -MDA	POL- -ALB	POL- -MNE	POL- -MKD	POL- -GEO
2000	0.167	0.191	0.142	0.350	n/a	n/a	n/a	n/a	n/a
2001	0.166	0.136	0.176	0.873	n/a	n/a	n/a	0.576	n/a
2002	0.185	0.109	0.162	0.429	n/a	n/a	n/a	n/a	n/a
2003	0.200	0.108	0.242	0.417	n/a	n/a	n/a	n/a	n/a
2004	0.064	0.050	0.030	0.120	n/a	0.012	0.488	0.389	0.119
2005	0.082	0.070	0.035	0.259	n/a	0.401	0.140	0.279	0.108
2006	0.068	0.077	0.090	0.172	n/a	0.044	0.372	0.159	0.123
2007	0.098	0.085	0.037	0.148	n/a	0.047	0.009	0.153	0.066
2008	0.097	0.054	0.025	0.179	n/a	0.080	0.013	0.199	0.126
2009	0.102	0.059	0.089	0.190	n/a	0.045	0.004	0.068	0.153
2010	0.092	0.057	0.095	0.154	0.282	0.049	0.033	0.114	0.099
2011	0.087	0.052	0.128	0.230	n/a	0.094	0.007	0.120	0.048
2012	0.083	0.059	0.135	0.243	0.009	0.047	0.566	0.153	0.042
2013	0.070	0.081	0.102	0.146	n/a	0.071	0.006	0.117	0.050
2014	0.095	0.108	0.115	0.175	n/a	0.072	0.349	0.133	0.091
2015	0.128	0.120	0.150	0.159	0.279	0.047	0.119	0.131	0.082
2016	0.129	0.127	0.136	0.187	0.018	0.073	0.173	0.144	0.079
2017	0.135	0.098	0.052	0.226	0.405	0.071	0.270	0.200	0.130
2018	0.138	0.096	0.100	0.249	0.049	0.025	0.110	0.174	0.126
2019	0.146	0.119	0.093	0.251	0.364	0.037	0.070	0.161	0.105
2020	0.159	0.146	0.096	0.246	0.182	0.047	0.240	0.050	0.075
2021	0.170	0.136	0.094	0.246	0.215	0.146	0.201	0.057	0.097
2022	0.119	0.150	0.070	0.259	0.196	0.185	0.051	0.061	0.097

Source: own authors' calculation based on WITS-COMTRADE database (15.05.2024).

With a few exceptions, the GL index values do not exceed 0.3, and half of them are even below 0.2. Exceptional were years 2000–2003 in trade with Serbia, and GL indices reaching at most 0.87, as well as 2012 in trade with Montenegro, and GL indicator of 0.57. These values indicate low intensity of intra-industry trade, which is not surprising, taking into account the generally limited trade with these countries and differences in develop-

ment levels of the partners. Data on Poland's intra-industry trade with Albania, Georgia, North Macedonia, Moldova and Montenegro is not complete, making it impossible to calculate GL indices only for some years (especially for the first years of the analysed period).

The last group included in the analysis consists of non-European G7 states (Japan – JPN, Canada – CAN and the United States – USA) and BRICS countries (Brazil – BRA, China – CHN, India – IND, and South Africa – ZAF).

Table 6: GL index values for Poland's bilateral trade with selected non-European states in 2000–2022.

Year	POL-USA	POL-CAN	POL-JPN	POL-CHN	POL-IND	POL-BRA	POL-ZAF
2000	0.261	0.137	0.145	0.072	0.325	0.178	0.888
2001	0.226	0.166	0.157	0.199	0.297	0.026	0.384
2002	0.300	0.185	0.188	0.113	0.335	0.390	0.680
2003	0.242	0.223	0.248	0.116	0.134	0.277	0.568
2004	0.225	0.119	0.103	0.101	0.126	0.146	0.110
2005	0.221	0.183	0.090	0.071	0.108	0.112	0.104
2006	0.259	0.131	0.094	0.045	0.105	0.117	0.109
2007	0.240	0.105	0.119	0.043	0.153	0.119	0.151
2008	0.242	0.113	0.109	0.048	0.175	0.108	0.197
2009	0.345	0.083	0.122	0.053	0.181	0.134	0.124
2010	0.397	0.483	0.119	0.059	0.215	0.140	0.154
2011	0.378	0.166	0.115	0.066	0.154	0.158	0.190
2012	0.424	0.188	0.107	0.067	0.149	0.163	0.177
2013	0.351	0.138	0.116	0.077	0.139	0.111	0.127
2014	0.427	0.136	0.127	0.071	0.120	0.096	0.098
2015	0.401	0.113	0.135	0.067	0.108	0.113	0.113
2016	0.392	0.139	0.151	0.079	0.116	0.094	0.175
2017	0.348	0.155	0.121	0.083	0.125	0.128	0.183
2018	0.356	0.153	0.138	0.085	0.155	0.120	0.208
2019	0.399	0.129	0.160	0.084	0.138	0.157	0.163
2020	0.343	0.164	0.142	0.075	0.135	0.145	0.205
2021	0.348	0.171	0.112	0.064	0.120	0.138	0.127
2022	0.352	0.186	0.110	0.067	0.109	0.191	0.135

Source: own authors' calculation based on WITS-COMTRADE database (15.05.2024).

The United States definitely stands out in this group, because the GL indicator values for Poland's intra-industry trade with the USA were around 0.4 after the year 2010. An increase in the GL index since 2008 means that the initial success achieved by Poland in this type of trade in the period of economic crisis brought a stable intensification of such exchange. This is more positive, because IIT, which is the exchange of substitutes, is very prone to larger distances between trading partners, differences in their economic potentials and trade barriers between them. These factors are indeed present in the exchange between Poland and the United States.

For the other non-European states covered by this analysis, GL index values usually did not exceed 0.2, although with some exceptions. For example, at the beginning of the research period Poland experienced a very intensive IIT with India (with an index of 0.34 in 2002) and in 2010 – with Canada (GL index 0.48). Even more intensive and dominating in this bilateral exchange was Poland's IIT with South Africa till 2003. In these last three cases the main reason are small trade streams with even marginal changes could influence the value of GL indices.

Conclusions

Apart from a few exceptions, in 2000–2022 the GL index values for Poland's bilateral intra-industry trade did not exceed 0.4, with the intra-industry trade between Poland and Germany being closest to such a high level of intensity: the index value of 0.4 was exceeded in 2007–2022, although a result of 0.5 was achieved only in 2019. As for Poland's IIT with Czechia, the GL index values were above 0.3 throughout the whole research period. The situation was similar in trade between Poland and France, with the exception of 2002–2005, when the respective values remained slightly below 0.3. In trade between Poland and Hungary, the GL index was slightly below 0.3 in 2004–2005, and in trade between Poland and Spain in 2004–2007 (in all other years its value was above 0.3). Trade between Poland and Italy is also of interest, with GL index values above 0.3, except in the years 2002–2011. All mentioned trade partners are with Poland in the EU – the most integrated bloc in the world consisting of highly developed countries. This fact demonstrates importance of trade freedom for IIT development.

The United States also deserve mentioning, with GL index values above 0.3 in 2009–2022. It is surprising, because the United States have a much bigger economic potential than Poland, they are geographically distant, and there is no free trade agreement between these countries. We therefore perceive the high IIT index for Poland's trade with the United States as a Polish trade success.

If we were to make a list of ten states, with which Poland's intra-industry trade is most intensive, the already mentioned seven states should be followed by Belgium, Netherlands, Slovakia and Denmark. Values of GL indices in trade with Belgium and Netherlands were slightly below 0.3 throughout the research period, while in the case of Slovakia and Denmark, for half of the research period the respective values were below 0.3, and for the remaining half – above 0.3. It means that 9 of 10 most important IIT partners of Poland are the EU members with 5 of them being European Economic Community founding

countries. Their intensive IIT with Poland proves that during analysed period Poland was able to keep up with these highly developed countries in trade with differentiated, usually manufactured, often technologically advanced products.

The described *status quo* of bilateral trade is reflected in the GL index values for Poland's intra-industry trade in total, which ranged from 0.28 to 0.34 (for the years 2000–2022). The respective index for the European Union was between 0.36 and 0.39.

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➔ References:

- AMBROZIAK Łukasz (2012a), *FDI and intra-industry trade: theory and empirical evidence from the Visegrad Countries*, "International Journal of Economics and Business Research", vol. 4, no. 1/2.
- AMBROZIAK Łukasz (2012b), *The intra-industry trade of the Visegrad Countries: the case of automotive industry*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", no. 1 (267).
- BRÜLHART Marius (2009), *An Account of Global Intra-Industry Trade, 1962–2006*, "The World Economy", 2009, vol.32, issue 3. DOI: 10.1111/j.1467-9701.2009.01164
- CZARNY Elżbieta (2002), *Teoria i praktyka handlu wewnątrzgałęziowego*, Warszawa.
- CZARNY Elżbieta, ŚLEDZIEWSKA Katarzyna (2008), *Polski handel wewnątrzgałęziowy z Unią Europejską na początku XXI w.*, in: Marzena Anna Weresa (ed.), *Polska. Raport o konkurencyjności 2008. Konkurencyjność sektora usług*, Warszawa.

- CZARNY Elżbieta, ŚLEDZIEWSKA Katarzyna (2009a), *Polski handel wewnątrzgałęziowy z Unią Europejską w latach 2000-2007*, in: Marzenna Anna Weresa (ed.), *Polska. Raport o konkurencyjności 2009. Zasoby ludzkie a przewagi konkurencyjne*, Warszawa.
- CZARNY Elżbieta, ŚLEDZIEWSKA Katarzyna (2009b), *Polska w handlu światowym*, Warszawa.
- CZARNY Elżbieta, ŚLEDZIEWSKA Katarzyna (2010), *Recent developments in Poland's intra-industry trade*, in: Marzenna Anna Weresa (ed.), *Poland. Competitiveness Report 2010. Focus on Clusters*, Warsaw.
- CZARNY Elżbieta, ŚLEDZIEWSKA Katarzyna (2012), *Międzynarodowa współpraca gospodarcza w warunkach kryzysu*, Warszawa.
- DĄBROWSKI Wojciech (2017), *Analiza wymiany handlowej Polski z krajami Unii Europejskiej w branży motoryzacyjnej*, "Ekonomia międzynarodowa wobec współczesnych wyzwań", vol. 3, no. 2.
- KAWECKA-WYRZYKOWSKA Elżbieta (2010), *Evolving pattern of intra-industry trade specialization of the new member states of the EU: the case of the automotive industry*, in: Filip Keereman, Istvan Szekely (eds), *Five Years of an Enlarged EU*, Berlin-Heidelberg.
- KAWECKA-WYRZYKOWSKA Elżbieta (2016a), *Changes in types of Poland's intra-industry trade in the period 1995-2014 in comparison with the other Central and Eastern European countries - EU members: Conclusions for changes in the competitiveness of Polish foreign trade*, "International Business and Global Economy", no. 35/1.
- KAWECKA-WYRZYKOWSKA Elżbieta (2016b), *Intensity of intra-industry trade and Poland's susceptibility to asymmetric shocks*, "Unia Europejska.pl", no. 4 (239).
- KAWECKA-WYRZYKOWSKA Elżbieta (2017), *Is Intra-Industry Trade Specialization a Precondition to Business Cycle Synchronization When Joining the Euro Area? The Case of Poland*, "International Journal of Management and Economics", vol. 53, no. 4.
- KAWECKA-WYRZYKOWSKA Elżbieta, AMBROZIAK Łukasz, MOLENDOWSKI Edward, POLAN Wojciech (2017), *Intra-industry trade of the New EU Member States. Theory and empirical evidence*, Warsaw.
- ŁAPIŃSKA Justyna (2014), *Determinants of intra-industry trade in agricultural and food products between Poland and EU countries*, "DANUBE: Law and Economics Review", vol. 5 (3). DOI: 10.2478/danb-2014-0009
- ŁAPIŃSKA Justyna, KADZIELAWSKI Grzegorz, DZIUBA Radostaw (2019), *Country-Specific Determinants of Intra-Industry Trade in Clothing and Footwear between Poland and European Union Countries*, "Fibres & Textiles in Eastern Europe", vol. 27, no. 4 (136).
- ŁAPIŃSKA Justyna, MELUZÍNOVÁ Jana, UHMAN Jiří (2019), *Country-specific determinants of intra-industry trade in pharmaceuticals: the case of Poland and its European Union partners*, "E+M. Ekonomie a Management", vol. 22, no. 1. DOI: 10.15240/tul/001/2019-2-013
- MICHALSKI Bartosz (2018), *EU-Korea FTA and its impact on V4 economies. A comparative analysis of trade sophistication and intra-industry trade*, "Comparative Economic Research. Central and Eastern Europe", vol. 21, no. 1. DOI: 10.2478/cer-2018-0001
- MISALA Józef, PLUCIŃSKI Eugeniusz Maciej (2000), *Handel wewnątrzgałęziowy między Polską a Unią Europejską. Teoria i praktyka*, Warszawa.
- MOCZULSKI Michał (2018), *Handel wewnątrzgałęziowy pomiędzy Polską a Niemcami w przemyśle motoryzacyjnym*, "Studia i prace WNEIZ US", no. 53/2. DOI: 10.18276/sip.2018.53/2-19

- MOLENDOWSKI Edward (2006), *Handel wewnątrzgałęziowy krajów CEFTA z państwami Unii Europejskiej*, "Gospodarka Narodowa", no. 5–6.
- MOLENDOWSKI Edward (2012), *Major changes in the foreign trade of Poland resulting from its accession to the EU*, Conference: "Contemporary Issues in Business, Management and Education'2012". DOI: 10.3846/cibme.2012.22
- MOLENDOWSKI Edward (2014), *The Visegrad Group Countries – changes in intra-industry competitiveness of their economies during the world financial and economic crisis*, "Procedia – Social and Behavioral Sciences", vol. 110. DOI: 10.1016/j.sbspro.2013.12.947
- MOLENDOWSKI Edward, POLAN Wojciech (2013), *Changes in intra-industry competitiveness of the New Member States (EU-10) economies during the crisis, the years 2009–2011*, "Comparative Economic Research. Central and Eastern Europe", vol. 16, issue 3. DOI: 10.2478/cer-2013-0019
- MOLENDOWSKI Edward, POLAN Wojciech (2015), *Zmiany pozycji konkurencyjnej Polski w handlu wewnątrzgałęziowym z krajami UE-15 przed akcesją i po niej*, in: Ewa Matuszyńska, Grzegorz Mazur, Ida Musiałkowska (ed.), *Polska. 10 lat członkostwa w Unii Europejskiej*, Poznań.
- PLUCIŃSKI Eugeniusz (2010), *Handel globalny i regionalny a innowacyjne wyzwania dla Polski*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", no. 150.
- POLAN Wojciech (2020), *Intra-industry trade and competitiveness of the new EU member states*, Warsaw.
- SZCZEPANIAK Iwona (2011), *Rola wymiany wewnątrzgałęziowej w polskim handlu zagranicznym produktami rolno-spożywczymi*, "Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu", vol. 13, no. 2.
- SZCZEPANIAK Iwona (2013), *Development of intra-industry trade as a measure of competitiveness of the Polish food sector*, "Oeconomia Copernicana", no. 2.
- TALAR Sylwia (2012), *Wewnątrzgałęziowa wymiana handlowa Polski w warunkach integracji*, "Studia Ekonomiczne / Uniwersytet Ekonomiczny w Katowicach", no. 123.
- TOPOROWSKI Patryk (2010), *The post-accession patterns of intra-industry trade between New Member States and EU-15: why so different?*, Conference ETSG 2010, Lausanne, <https://www.etsg.org/ETSG2010/papers/Toporowski.pdf> (09.09.2010).
- TOPOROWSKI Patryk (2013), *The steps of Visegrad countries towards better integration within the EU: a case of intra-industry trade*, Conference ETSG 2013, Birmingham, <https://www.etsg.org/ETSG2013/Papers/379.pdf> (13.09.2013).
- TOPOROWSKI Patryk (2017), *Did the economic crisis change V4 trade patterns? The case of intra-industry trade*, "Eastern Journal of European Studies", vol. 8 (2).
- WITS-COMTRADE database (WWW), <https://wits.worldbank.org/> (15.05.2024).
- WYRZYKOWSKA-ANTKIEWICZ Monika (2021), *Wewnątrzgałęziowa wymiana handlowa Polski z Unią Europejską. Stan i uwarunkowania rozwoju*, Warszawa.