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INTRA-INDUSTRY TRADE BETWEEN POLAND AND ITS SELECTED PARTNERS IN 2004-2022 – DOES THE SOURCE OF DATA MATTER?

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Abstract

Purpuse – The aim of this paper is to study changes in intensity of bilateral intra-industry trade (IIT) between Poland and its selected economic partners (Germany, Czechia, Slovakia, France, Lithuania, the United States, China, United Kingdom, Ukraine, Russia and Belarus) in the years 2004–2022. Furthermore, it examines whether these changes are sensitive to the data source used in the analysis by comparing figures derived from two recognised databases: UN COMTRADE database (via WITS) and EUROSTAT-COMEXT.
Methodology – We calculate Grubel-Lloyd (GL) indices using export and import values derived from WITS-COMTRADE database and EUROSTAT-COMEXT. We adopt 6-digit product groups, classified according to the HS nomenclature, as a proxy for an "industry."
Findings – The most significant finding of this research suggests that geographical proximity is less crucial for bilateral intra-industry trade (IIT) than deep economic integration within the EU framework, the substitutability of economies, and high consumer income levels, which drive demand for differentiated goods. The choice of database has a partial impact on the results, primarily due to differences in data availability. It is encouraging to observe a diminishing difference between both indices, which suggests an improvement in calculation methods and a greater accountability of national statistical agencies in reporting data to international organisations.
Keywords: bilateral intra-industry trade (IIT), Poland and its selected partners, source of data, UN COMTRADE database (via WITS), EUROSTAT-COMEXT.

JEL classification: F14.

Introduction

Intra-industry trade (IIT) refers to the simultaneous export and import of goods within the same industry in bilateral trade. IIT is particularly intensive among highly developed countries with expanded manufacturing sectors that produce differentiated goods-varieties often treated as imperfect substitutes. Citizens of these nations typically share high and similar wealth levels, as well as comparable preferences rooted in shared culture, tradition, religion, and habits. IIT is

also characteristic of regional integration groupings (and their legal frameworks, Regional Trade Agreements or RTAs), as the exchange of similar products is especially sensitive to trade barriers. Furthermore, IIT is bolstered by geographical proximity, which increases the likelihood of shared societal tastes and reduces transportation costs, particularly between countries with common land borders. Poland has diverse neighbours with varied characteristics, including both EU member states and non-EU countries. These countries differ in their trade potential, as well as their level of economic development. It is interesting to analyse the dynamics of changes in Poland's IIT with these partners to examine the extent to which theoretically acknowledged and empirically proven factors of trade intensification matter in this case. To further diversify our sample, we include Poland's significant but distant trade partners with substantial economic potential. Overall, the study covers following Poland's trading partners: Germany, Czechia, Slovakia, Lithuania (EU- members neighbours), Ukraine, Russia, Belarus (non-EU neighbours) as well as France, the United States, China and the United Kingdom. We analysed spanning the period from Poland's EU accession (2004-2022).

In addition to the long analysis period and the specific selection of trade partners, the added value of our research lies in the comparison of results obtained from two recognised databases: UN COMTRADE database (via WITS) and EUROSTAT-COMEXT. This approach allows us to verify whether the data source significantly impacts the results of such an analysis.

Literature review

In the literature there are plenty of studies on intra-industry trade (IIT), both theoretical (e.g. Afonso, Pinto and Vasconcelos, 2021; Dutta, 2022) and empirical concerning intra-industry trade for a selected industry (e.g. Hoang, 2019; Zapata, Arrazola and de Hevia; 2023) or all industries (e.g., Özçalık, Erkan and Bozduman, 2021; Souguir, 2024) or referring to total intra-industry trade (e.g. Agarwal and Betai, 2021; Brülhart, 2008; World Trade Organisation [WTO], 2013). The review of extensive literature on intra-industry trade is included in a work of Aggarwal (2023).

The literature indicates some difficulties in measuring IIT. The first problem is called a geographical bias, because the value of IIT index depends on the level of aggregation of data on trading partners (Kawecka-Wyrzykowska, Ambroziak, Molendowski and Polan, 2017). The intensity of intra-industry trade is higher when the calculations are based on data aggregated for a group of countries (e.g. EU) than on the bilateral trade flows (e.g. Polish trade separately with all EU member states). The next difficulty with IIT indices proposed by Grubel and Lloyd (1975) is referred to trade imbalance. The trade imbalance of a country leads to undervalue of IIT indices. There are some adjustment methods for aggregate payments imbalance, but they are not universally accepted (Aggarwal, 2023; Kawecka-Wyrzykowska et al., 2017; Molendowski, 2006). The last major drawback is known as sectoral bias. It arises from the fact that IIT indices is sensitive to the level of product aggregation (Finger, 1975; Fontagné, Freudenberg, 1997; Lloyd, 2002; United Nations [UN] and World Trade Organisation [WTO], 2012). The GL index is higher when the data are more aggregated, because the different products such as canoes and container ships included in one product category are treated as substitutes, so intra-industry trade is positive. In such a case a high value of IIT constitutes only "statistical illusion" (Dutta, 2022; UN and WTO, 2012). However, some researchers (e.g. Dutta, 2022; Kawecka-Wyrzykowska et al., 2017; Talar, 2012) noticed that excessive disaggregation of data can lead to classification of close substitutes from consumers' point of view into different commodity groups and, as a result, consider their trade as inter-industry. To sum up, the choice of data classification and the level of data aggregation affect the results of IIT intensity, making it difficult to compare studies of different researchers.

There is a substantial body of literature regarding Poland's intra-industry trade. A number of publications concern specific industries (e.g. Dąbrowski, 2017; Kawecka-Wyrzykowska, 2010; Łapińska, 2014; Moczulski, 2018; Polan, 2020; Wyrzykowska-Antkiewicz, 2021). However, there are also many studies discussed Poland's IIT in trade with all goods with all countries in the world in total (e.g. Czarny, Śledziewska, 2012; Kawecka-Wyrzykowska, 2016, 2017), as well as with groups of countries (e.g. Czarny, Śledziewska, 2009; Molendowski, Polan, 2015; Śledziewska, 2015; Toporowski, 2017), and with individual states (e.g. Czarny, Śledziewska, 2008, 2009, 2010; Kawecka-Wyrzykowska, 2017; Molendowski, Polan, 2015; Talar, 2012; Wyrzykowska-Antkiewicz, 2021).

Usually the IIT index for Poland's trade with selected neighbouring is calculated for EU Member States or neighbouring countries, especially Germany. Czarny and Śledziewska (2008, 2009, 2010) claimed that although in the 2000s the IIT intensity in Poland's trade with Germany was growing, mutual trade remained inter-industry. However, Talar (2012) indicated in her study that the trade with Germany was mainly intra-industry already in 1999. Similar results to Talar for the beginning of 2000s were obtained by Pluciński (2011). The calculations of GL indices of Czarny and Śledziewska (2008, 2009, 2010) were based on Eurostat's data (goods at 8-digit level of CN) as well as those of Talar (2012) (goods at 2-digit of classification code SITC); Pluciński's results (2011) were based on OECD and Statistics Poland data (goods at 2-digit of classification code SITC). In the case of more recent analysis of Poland's intra-industry trade with selected partners the data came from COMTRADE database (Ambroziak, 2020; Kawecka-Wyrzykowska, 2017). In this context, it is reasonable to ask whether the differences in intensity of IIT with selected partners are due only to the level of product aggregation, or whether the origin of the data from different databases also matters.

Research method

We calculate Grubel-Lloyd (GL) indices using export and import values derived from WITS-COMTRADE database and EUROSTAT-COMEXT. We assume that a suitable proxy for an industry is a product group defined at the 6-digit HS code level. We calculate GL indices in bilateral trade for all selected country-pairs as in the formula (1).

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

where:
i – reporting country,
j – trading partner,
b – industry (6-digit HS code level),
k – number of industries in total trade of 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 from industry b,
M_{ijb}- imports to country i from country j of products from industry b.

Notably, data availability across the analyzed countries varies between the databases. This implies that the GL indices were calculated using a different number of industries for respective database. For instance, in the case of the USA, the discrepancy in the number of industries covered by both databases was negligible, averaging fewer than 10 industries between 2004 and 2022. In contrast, the difference for Slovakia was substantial; the Eurostat's database consistently included a larger number of industries than the COMTRADE database, with an average surplus of approximately 440 industries over the analysed period.

Research results

In Table 1, we present the average values of Poland's IIT indices in trade with the neighbour countries and with the other important trade partners included in this analysis. We have ordered the values of IIT indices in descending order according to calculation based on COMTRADE data.

Table 1. Average values of the IIT index in Poland's trade with selected countries in 2004-2022

	DEU	CZE	FRA	USA	SVK	GBR	LTU	UKR	BLR	RUS	CHN
WITS-COMTRADE	0.45	0.39	0.35	0.34	0.31	0.26	0.25	0.11	0.09	0.09	0.07
EUROSTAT-COMEXT	0.50	0.41	0.40	0.35	0.43	0.30	0.26	0.10	0.08	0.08	0.10

Notes: Germany (DEU), Czechia (CZE), France (FRA), the United States (USA), Slovakia (SVK), the United Kingdom (GBR), Lithuania (LTU), Ukraine (UKR), Belarus (BLR), Russia (RUS), China (CHN).

Source: own calculation based on WITS-COMTRADE and EUROSTAT-COMEXT databases.

As expected, the highest intensity of IIT is observed in Poland's trade with its neighbouring EU member states: Germany and Czechia. Geographically more distant, but highly developed, France has average IIT shares almost as high as those of Czechia. The group of the "top five" partners is completed by Slovakia (another neighbouring EU member) and the USA (a distant partner with huge economic potential). The values of IIT indices for these partners constantly exceed 0.3. In the case of the Eurostat based calculations, this figure surpasses 0.4 (with the exception of the USA, whose IIT indices fell below this threshold). The average IIT value for Germany, Poland's leading partner, reached even values higher than 0.5 according to Eurostat's data, indicating that more than half of Polish trade with this country is intra-industrial.

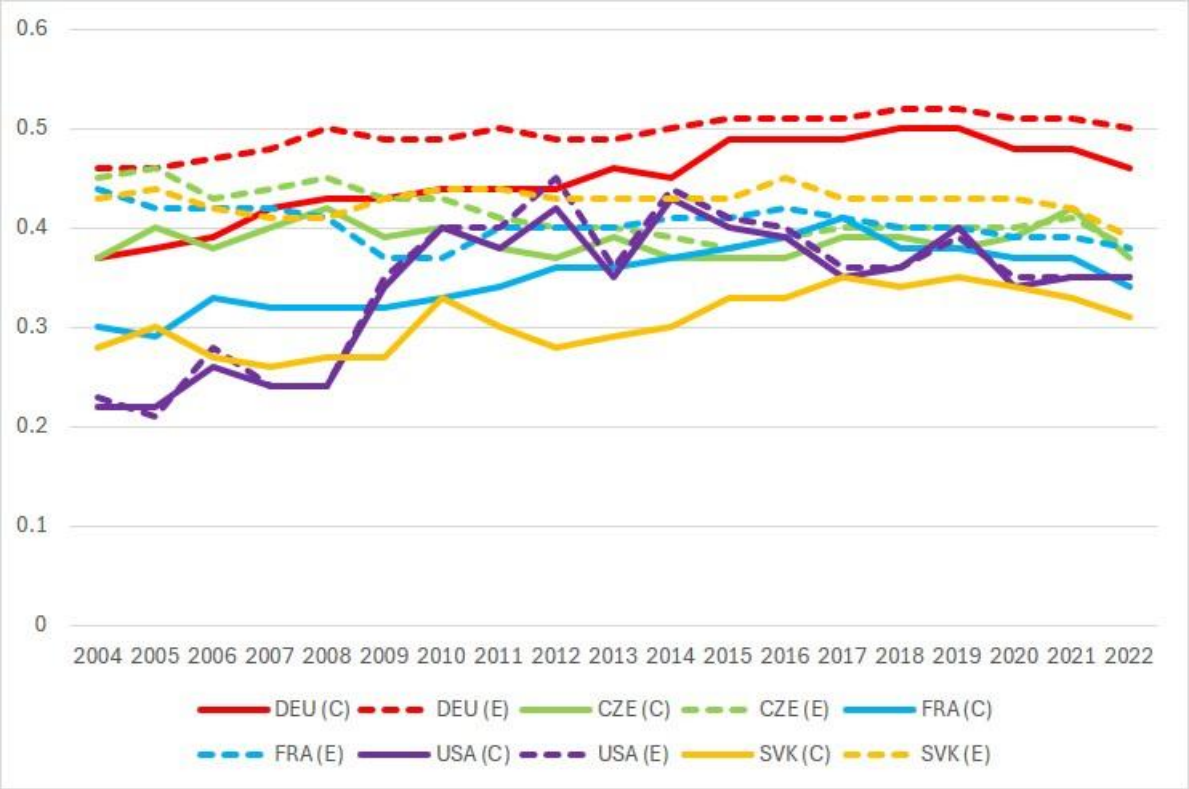

Figure 1. Poland's IIT index in trade with countries with the highest ratio

Notes: C – COMTRADE, E – EUROSTAT

Countries: Germany (DEU), Czechia (CZE), France (FRA), the Unites States (USA), Slovakia (SVK).

Source: own calculation based on WITS-COMTRADE and EUROSTAT-COMEXT databases.

As shown in Table 1, the ranking of Poland's major IIT partners is almost the same in both utilised databases. Within the "top five" group, the sole difference is that Slovakia ranks ahead of the USA in Eurostat classification. Interestingly, the values of average IIT indices derived from Eurostat's data are higher in case of trade with developed countries and China, but lower for Ukraine, Russia and Belarus. Probably relatively small turnover with the latter threepartners matters.

Figure 1 supplements the analysis by presenting IIT indices for "the top five" partners (Germany, Czechia, France, USA and Slovakia) in all analysed years. All these partners are highly developed, and all except the USA are members of the European Union. This presentation allows for the observation of not only the changes in IIT intensity, but also the differences between the IIT indices derived from both databases throughout the entire period. The biggest discrepancy is observed in the case of Slovakia with the constantly higher values of IIT index measured by Eurostat's data. This difference fluctuates between 0.08 in the years 2017, 2019 and 2022 and 0.16 in 2009. Conversely, the smallest differences are registered in trade with the USA and Czechia. We suspect that the total value of trade between these partners plays a role in these variations.

In the case of "the top five" partners, calculations based on Eurostat data generally yield not only higher but also more stable results than those derived from COMTRADE database. Interestingly, only the indices for Poland's IIT with the USA have similar values regardless of the source of data. The discrepancies resulting from the database choice are relatively small in the case of trade with Czechia (throughout the entire period) and Germany (since 2015). Furthermore, it is noteworthy that these data-driven discrepancies generally diminish over time. To sum up, while the choice of database introduces certain numerical variations in values of IIT indices for Poland's leading IIT partners (most notably in the case of Slovakia), the overall trends and partner rankings remain broadly similar.

The next step of our analysis involves a comparison of GL indices in Poland's trade with all its neighbours. In Figure 2 we present the GL indices for Poland's IIT with Germany, Czechia, Slovakia, Lithuania, Ukraine, Belarus, and Russia. The first four states are the EU members characterised by relatively high level of development, with which Poland enjoys free trade. Conversely, the remaining three are less developed, and trade with them faces greater constrains; this holds true even though Ukraine is recognised as a candidate for the EU membership, while Russia is subject to extensive sanctions due to its military aggression against Ukraine. The data discrepancies are the smallest in the case of Russia. Generally, the IIT intensity with Russia is the lowest among neighbouring countries because of complementarity of its economy with the Polish one, which constraints the scope for trade in substitutes. We expect that the war against Ukraine and economic sanctions imposed on Russia will cause further decrease in IIT intensity and Poland's overall trade volume with Russia.

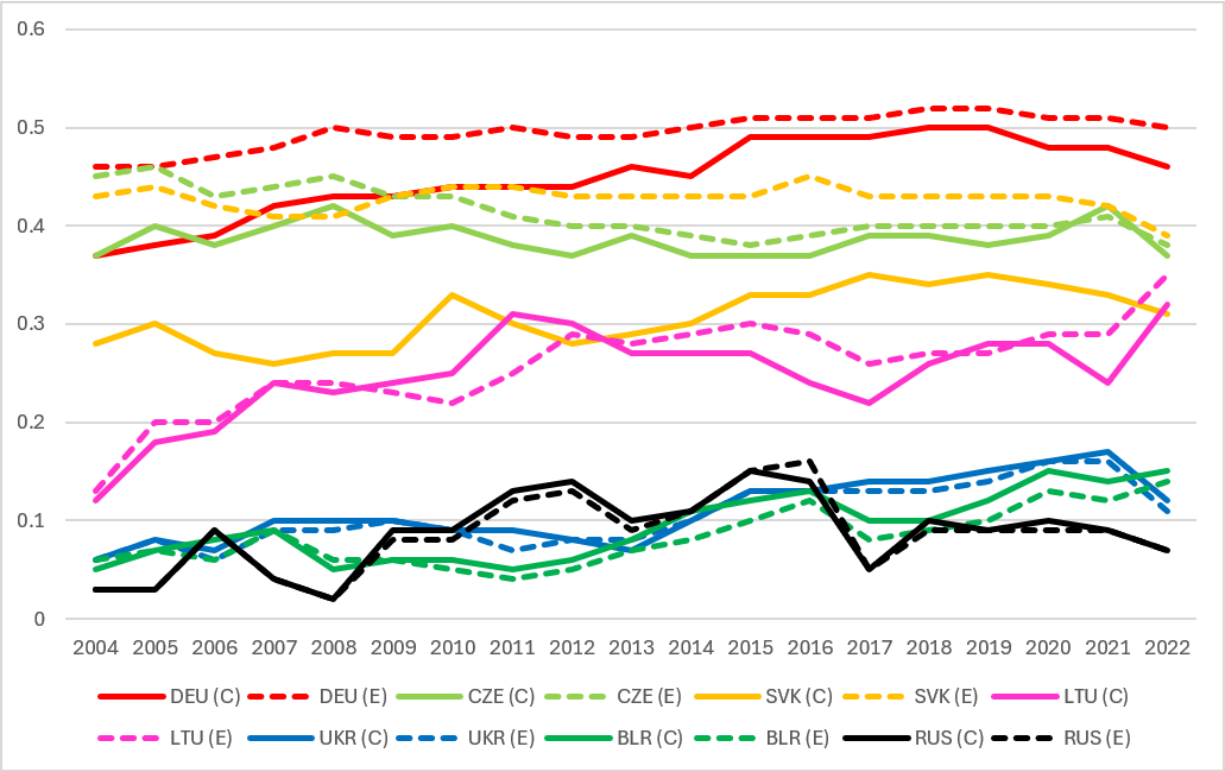

Figure 2. Poland's IIT index in trade with neighbouring countries

Notes: C – WITS-COMTRADE, E – EUROSTAT-COMEXT.

Countries: Germany (DEU), Czechia (CZE), Slovakia (SVK), Lithuania (LTU), Ukraine (UKR), Belarus (BLR), Russia (RUS).

Source: own calculation based on WITS-COMTRADE and EUROSTAT-COMEXT databases.

As expected, the GL indices for Poland's EU partners are considerably higher than those for the neighbours from outside the grouping. This is not surprising as three out of seven neighbours belong to "the top five" partners (Germany, Czechia and Slovakia). The values of GL indices for Lithuania – the latest neighbour with the EU membership – were initially much lower, but they recorded an upward trend. The value started at 0.13 in 2004 (Eurostat's data) and exceeded the level of 0.3 by the final year of analysis in both databases. It seems to confirm the importance of joint EU membership and common land border for IIT development, independent of even different trade potentials of both partners.

The values of GL indices in Poland's trade with Ukraine, Belarus and Russia never reached the level of 0.2. The highest value was observed for Ukraine in 2021 (0.17 measured using COMTRADE data), whereas the lowest values were recorded in trade with Russia in 2004 and 2005 (0.03). In the case of these partners, the source of data does not matter. Results are almost the same regardless of the database used. These low values of GL indices are understandable as Poland and these partners have different levels of development, which result in disparate economic structures, as well as different income levels and overall economic potentials. Their economies are complementary rather than substitutional for the Polish economy which hampers development of IIT. Moreover, in trade with these partners, not only are protectionist measures implemented, but economic sanctions are also applied, which further constraint bilateral turnover.

To conclude, the analysis of IIT indices in Poland's trade with all its partners suggests that deep integration is more important driver of intensified IIT than economic potential or

neighbourhood. The case of Lithuania supports this view, showing that bilateral IIT was developed in the post-accession period.

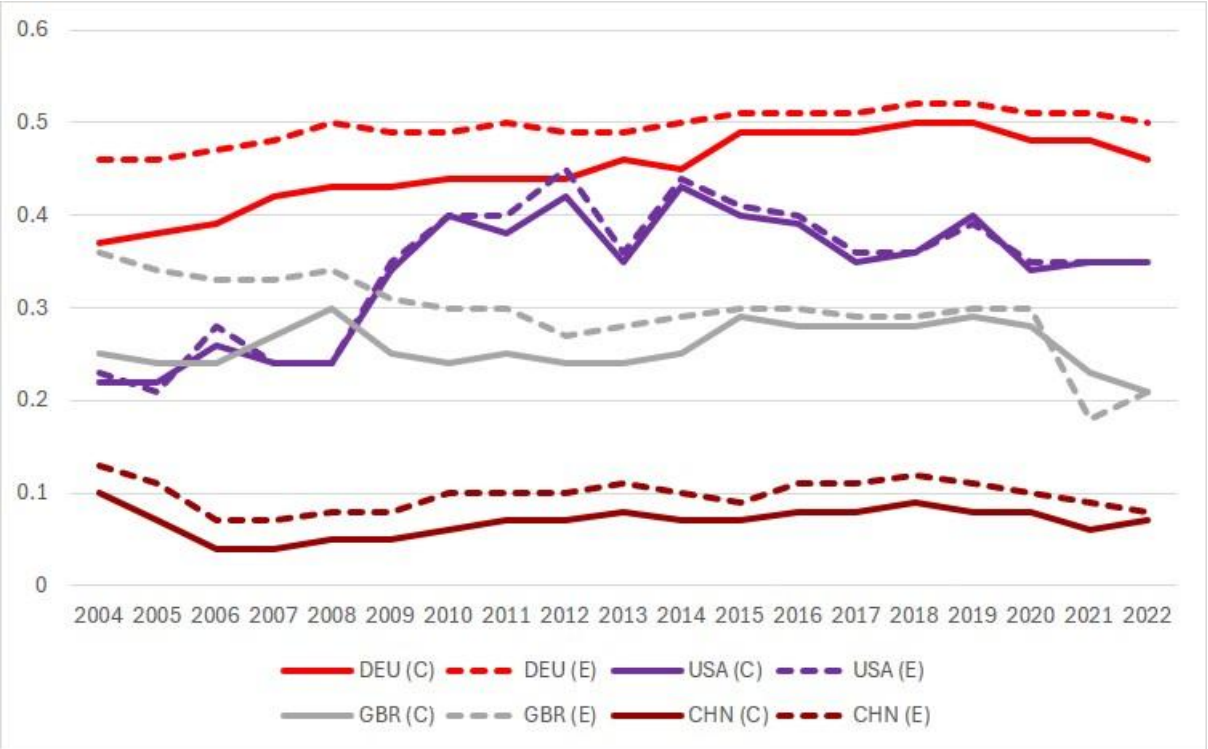

Figure 3. Poland's IIT index in trade with selected large economies

Notes: C – WITS-COMTRADE, E – EUROSTAT-COMEXT.

Countries: Germany (DEU), the United States (USA), the United Kingdom (GBR), China (CHN).

Source: own calculation based on WITS-COMTRADE and EUROSTAT-COMEXT databases.

Our next sample consists of Poland's important trade partners characterised by relatively substantial economic potentials: Germany, the USA, the United Kingdom and China. As illustrated in Figure 3, Germany remains the dominant partner, followed by the USA since 2009. The United Kingdom ranks third, recording even higher GL index values in many years before 2009. However, we can observe a sharp decline in the GL index in 2021 and later, most likely as a result of Brexit and the change of the trade rules with the EU. The case of the United Kingdom illustrates that economic disintegration may lead to a reduction of intra-industry trade flows. In contrast, Poland's IIT with China remains the lowest, with GL index barely exceeding 0.1. Despite China's immense market size, these low IIT indices reflect the constraints of geographical distance, the lack of economic integration and different production structures.

Germany records very stable values of GL indices, independent of the database used. Generally, for the countries whose GL values are presented in Figure 3, the results based on data derived from COMTRADE and Eurostat don't differ considerably, particularly after 2008. The most significant difference, amounting to 0.11, was recorded in trade with the United Kingdom in 2004.

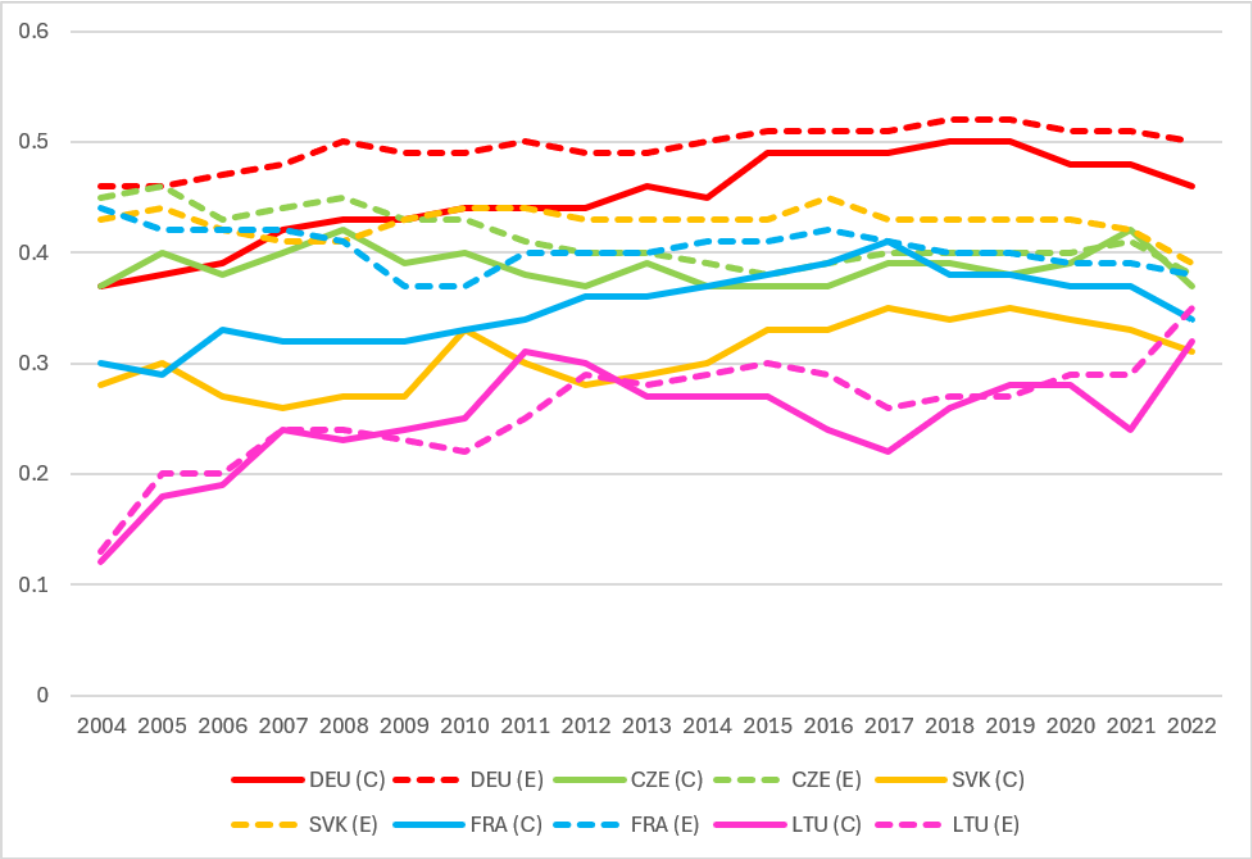

Figure 4. Poland's IIT index in trade with selected European Union member states

Notes: C – WITS-COMTRADE, E – EUROSTAT-COMEXT.

Countries: Germany (DEU), Czechia (CZE), Slovakia (SVK), France (FRA), Lithuania (LTU)

Source: own calculation based on WITS-COMTRADE and EUROSTAT-COMEXT databases.

The final sample consists of selected trade partners connected with the EU membership: Germany, Czechia, Slovakia, Lithuania and France. The first four partners have been extensively analysed in the proceding sections due to their status as Poland's neighbours. France was also previously mentioned as one of the partners with the highest IIT shares (see Table 1 and Figure 1). However, Figure 4 indicates that generally Poland's IIT with these countries remained relatively stable over the entire period (with sole exception of Lithuania). Additionally, in case of all partners except Slovakia, the differences between the GL indices are minor and diminishing, independent of the database used. However, the results based on Eurostat's data are more stable.

This study confirms further that the most intensive intra-industry trade exists between Poland and Germany, Czechia and France. For these three partners, GL index values permanently exceeded 0.3 across the research period, irrespective of database employed. In this case, mutual EU membership as well as high level of development and high income level within partner seem to be key factor deciding upon high IIT intensity.

CONCLUSIONS

The most significant finding of this research suggests that geographical proximity is less crucial for bilateral intra-industry trade (IIT) than deep economic integration within the EU framework, the substitutability of economies, and high consumer income levels, which drive demand for

differentiated goods. Poland's trade with non-EU countries remains predominantly inter-industry, even despite their geographical proximity. A notable exception is trade with the United States, where approximately 35% involves substitutes, notwithstanding the absence of a RTA and the significant geographical distance, which should be regarded as a success for Polish exporters. Ultimately, our analysis suggests that the integration effects are one of the main drivers of Poland's trade patterns.

Furthermore, our research reveals that for partners with relatively low GL index values and small trade turnover (Ukraine, Belarus, Russia) the choice of data source is insignificantOn the contrary, the most significant differences resulting from the data source are found in the IIT indices for Poland's trade with Slovakia. These discrepancies are much larger than those observed in trade with Germany and Czechia, although a tendency to close this gap has been noted in the final years of the study.

Overall, a general trend of decreasing differences between the GL values derived from COMTRADE and Eurostat is observed over time. This tendency can be attributed to several factors, including improved reporting by national statistical agencies and more accurate data aggregation methods. An important reason for different results obtained from the separate databases may lie in the differences in the number of industries taken into account of each database. To investigate this, we selected two countries for a detailed comparative analysis: the USA (recording highly similar indices calculated based on both databases) and Slovakia (showing substantial differences). We examined the numbers of industries recorded in both cases thoroughout the whole period covered by our analysis (2004-2022). Our initial hypothesis was confirmed. In the case of the USA the difference in number of industries in both databases was small, with a 2004-2022 average of fewer than 10 (e.g. 11 industries in 2020). This implies that base for calculations was similar in Eurostat and COMTRADE, therby yielding similar results in calculations. Conversely, the opposite holds true for Slovakia, where the average difference of ca. 440 industries was observed - with Eurostat consistently reporting a higher number each year. In the year 2020, this gap widened to even almost 700 industries, resulting in huge difference in values of both indices (with the Eurostat one much higher than the COMTRADE). We suppose that a similar tendency applies to all other countries. Consequently, this may partially explain the discrepancies in IIT indices reported by various researchers regarding Poland's trade with different partners.

This implies that the choice of database is partially significant, primarily due to variations in data availability. It is encouraging to observe a diminishing difference between both indices, which suggests an improvement in calculation methods and a greater accountability of national statistical agencies in reporting data to international organisations.

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HANDEL WEWNĄTRZGAŁĘZIOWY MIĘDZY POLSKĄ A WYBRANYMI PARTNERAMI W LATACH 2004-2022 – CZY ŹRÓDŁO DANYCH MA ZNACZENIE?

Streszczenie

Cel – Celem artykułu jest zbadanie zmian intensywności dwustronnego handlu wewnątrzgałęziowego (IIT) między Polską a wybranymi partnerami gospodarczymi (Niemcami, Czechami, Słowacją, Francją, Litwą, Stanami Zjednoczonymi, Chinami, Wielką Brytanią, Ukrainą, Rosją i Białorusią) w latach 2004–2022 oraz ustalenie, czy zmiany te są wrażliwe na źródło danych wykorzystanych w analizie. Porównujemy dane pochodzące z dwóch uznanych baz danych: bazy danych UN COMTRADE (za pośrednictwem WITS) oraz EUROSTAT-COMEXT.

Metoda – Obliczamy wskaźniki Grubela-Lloyda (GL) na podstawie wartości eksportu i importu pochodzących z bazy danych WITS-COMTRADE oraz EUROSTAT-COMEXT. Jako przybliżenie branży (przemysłu) traktujemy 6-cyfrowe grupy produktów sklasyfikowane w nomenklaturze HS.

Wyniki – Najbardziej istotnym rezultatem jest wniosek, że sąsiedztwo geograficzne wydaje się mniej istotne dla rozwoju handlu wewnątrzgałęziowego niż czynniki takie jak: wolny handel i głęboka integracja gospodarcza w ramach UE, substytucyjność gospodarek partnerów oraz stosunkowo wysokie dochody ludności, skutkujące intensywniejszym zakupem zróżnicowanych produktów. Wybór bazy danych ma częściowo znaczenie, a powodem tego jest głównie dostępność danych. Optymistyczne jest zmniejszanie się róż-

nicy w obu wskaźnikach, co sugeruje poprawę metod obliczeniowych i większą odpowiedzialność krajowych agencji statystycznych za przekazywanie danych organizacjom międzynarodowym.

Słowa kluczowe: handel wewnatrzgałęziowy, Polska i wybrani partnerzy, źródło danych, baza danych WITS-COMTRADE baza danych EUROSTAT-COMEXT.

Klasyfikacja JEL: F14.

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