INTRA-INDUSTRY TRADE IN HIGH-TECH PRODUCTS IN SERBIA

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ABSTRACT:

Intra-industry trade (IIT) is the simultaneous export and import of similar products or services by one country. This model of trade is contrary to traditional theories of international trade and has occupied the attention of researchers since the 1960s. According to the Organization for Economic Co-operation and Development (OECD), high-tech products are defined as technical products whose production implies a high intensity of research and development. The paper will present data on the intensity of IIT between Serbia and its foreign trade partners from 2012 to 2020. The value of this index in the observed period ranged from 0.297 to 0.399. Also, the paper will present data on the exchange of high-tech products and the intensity of IIT between Serbia and the EU, CEFTA 2006, and Montenegro in the same period.

Keywords: *intra-industry trade, Grubel-Lloyd index, high-tech products*
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1. INTRODUCTION

Nowadays, a large part of international trade is intra-industry trade (IIT) which refers to the simultaneous export and import of products of the same sector by one national economy. The factors that most often affect the expansion in IIT are economies of scale, product differentiation, and availability of factors of production. The value of IIT trade between countries is higher if countries are more similar in terms of relative availability of labor and capital, technology, GDP per capita, and consumer preferences [1].

High-tech product trade refers to the export and import of products that are classified as high-tech according to the Standard International Trade Classification (SITC - Rev. 4). [2]. The groups of products involved are aerospace, computers and office machines, electronic telecommunications, pharmacy, scientific instruments, electrical machinery, chemistry, non-electrical machinery, and armament. Intense technological changes make the nature of high-tech products volatile. Therefore, products classified as high-tech today may not belong to this group in the future. The innovative process fosters high technology development, which stimulates the demand for high-tech products in the global market [3]. According to the OECD methodology cited in [4], industries in which the content of

sectoral research costs in shipped product costs exceeds 5% are classified as high-technology. The medium-high-technology sector includes industries with research and development costs content of 2.5 to 5%. Industries with a cost content of 1 to 2.5 % belong to the medium-low-technology sector, and if a cost content is less than 1% belong to the low-technology sector.

Empirical data show that economic integration affects the increasing scope of IIT, especially in small, open economies [5]. According to [6], technological differences can create comparative advantages that affect the pattern of trade toward increasing IIT. Milberg [7] indicates that maintaining a position and share in the global market requires a technological innovations advantage compared to foreign competitors. Innovation takes the form of product line enhancement through new, technologically sophisticated types of existing products. Consequently, R&D expenditure is a prerequisite for the survival of enterprises in the international market.

In Manrique's [8] paper, intra-industry trade may reflect a transitional phase in which developing countries begin to take over declining industries in developed countries, while developed countries tend to maintain their competitive advantage in the same activities through exports.

The article intends to analyze the IIT between Serbia and the EU, CEFTA 2006, and Montenegro with high-tech products from 2012 to 2020. Based on the obtained results, the authors will attempt to examine the changes that occurred during the observed period and indicate the volume and intensity of the observed products' exchange.

2. METHODOLOGY

The Grubel-Lloyd's Index (GLI) is most commonly used in the literature to measure the volume of intra-industry trade [9]. The index has a value of 0 when there are no products within the same class exchanged between the observed countries ($GL_i=0$; $X_i=0$ ili $M_i=0$), while the index has a value of 1 when the value of exported and imported products within the same class is equal ($GL_i=1$; $X_i=M_i$). GLI is calculated based on the following formula:

$$IIT_{i.AB} = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \tag{1}$$

Where Xi represents the export, and Mi represents the import of product i.

The bilateral IIT index is calculated as the weighted average of the index (1) for all product classes i, with the weights of total trade with the product i relative to the total trade of all products. A detailed explanation of the methodology is given in the papers of the authors Ćuzović and Sokolov-Mladenović [10], Ćuzović and Sokolov-Mladenović [11]. The IIT index is calculated based on the following formula:

$$IIT_{i.AB} = \sum_i \left(\frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \right) * \left(\frac{(X_i + M_i)}{\sum_i (X_i + M_i)} \right) \tag{2}$$

The article uses secondary empirical data taken from the Statistical Office of the Republic of Serbia (RZS, 2022). The Statistical Office of the Republic of Serbia uses the Nomenclature of Foreign Trade Statistics (NFTS) to present data on exports and imports of products. The NFTS is based on the Standard International Trade Classification (SITC - Rev. 4). The classification is compiled according to the OECD definition and contains technical products whose production implies a high intensity of research and development (OECD).

3. RESULTS AND DISCUSSION

Table 1. Foreign trade of high-tech products of Serbia and selected partners (in millions of USD)

		2020	2019	2018	2017	2016	2015	2014	2013	2012
World	Export	736.3	538.6	487.5	421.2	425.0	405.9	464.3	455.8	473.2
	Import	2167.3	2232.0	1748.2	1455.1	1255.3	1191.1	1303.9	1455.1	1373.2
	Balance	-1431.0	-1693.4	-1260.7	-1033.9	-830.3	-785.2	-839.6	-999.3	-899.9
EU	Export	438.5	291.1	197.4	175.0	170.9	172.3	184.1	179.4	229.6
	Import	817.1	808.9	679.0	604.3	489.4	512.9	598.3	641.7	590.4
	Balance	-378.5	-517.9	-481.7	-429.3	-318.4	-340.6	-414.2	-462.3	-360.9
CEFTA 2006	Export	122.1	110.1	144.8	109.5	107.5	99.8	122.7	99.1	94.2
	Import	6.7	6.4	6.7	9.5	5.9	12.0	11.9	8.8	10.6
	Balance	115.4	103.7	138.1	100.0	101.6	87.8	110.7	90.2	83.7
MNE	Export	53.2	44.9	50.4	41.8	42.5	44.0	/	/	/
	Import	2.8	1.7	2.6	5.8	3.8	8.1	/	/	/
	Balance	50.4	43.19	47.76	35.97	38.75	35.85	/	/	/

Source: Author's calculations based on data from the Statistical Office of the Republic of Serbia

Table 1 shows the data on foreign trade of high-tech products of Serbia from 2012 to 2020. According to the presented data, Serbia has a permanent deficit in the total exchange with all foreign trade partners. The deficit ranged from 785.22 million in 2015 to 1.69 billion dollars in 2019. In addition to the growth of imports of high-tech products, the growth of exports was also recorded. Serbia has a constant deficit in foreign trade of high-tech products with the EU. The deficit in the observed period ranged from USD 318.41 million in 2016 to USD 517.86 million in 2019. The coverage of imports by exports was the highest in 2020, when it reached 53.67%, while the lowest value was recorded in 2013 when it amounted to 27.96%. According to the data presented, the Republic of Serbia's exports and imports of high-tech products increased during the observed period. Observing data on foreign trade of high-tech products between Serbia, CEFTA 2006 countries, and Montenegro, in the analyzed period, Serbia recorded a surplus. In the exchange with the member countries of the CEFTA 2006 organization, the surplus ranged

from USD 83.67 million in 2012 to USD 138.1 million in 2018. The trade surplus with Montenegro ranged from USD 35.85 million in 2015 to USD 50.4 million in 2020. In the foreign trade of high-tech products between Serbia and CEFTA 2006 countries and Montenegro in the observed period, there was an increase in exports of high-tech products of Serbia, while imports from this group of countries decreased.

Table 2. Foreign trade of individual groups of high-tech products of the Republic of Serbia and selected foreign trade partners (2020)

	World			EU			CEFTA 2006			Montenegro		
	Balance (mil. USD)	Share export (%)	Share import (%)	Balance (mil. USD)	Share export (%)	Share import (%)	Balance (mil. USD)	Share export (%)	Share import (%)	Balance (mil. USD)	Share export (%)	Share import (%)
1	-86.7	17.21	9.85	58.2	26.51	7.10	-0.2	0.02	3.87	8.2	0.02	0.00
2	-178.3	7.74	10.86	-25.7	5.05	5.85	18.4	15.07	0.41	10.8	20.42	0.66
3	-688.4	40.41	45.49	-84.0	48.23	36.17	44.7	37.29	13.08	23.5	44.28	1.30
4	-145.0	7.38	9.20	-142.8	2.06	18.58	13.8	14.48	57.80	5.7	15.46	92.89
5	-133.0	10.18	9.60	-71.6	8.15	13.14	15.3	13.28	12.96	6.0	11.31	1.54
6	-51.0	2.99	3.37	-5.0	3.21	2.34	2.8	2.43	2.30	1.0	2.10	3.62
7	-137.6	5.18	8.11	-66.4	3.75	10.14	16.6	13.70	1.32	2.9	5.36	0.00
8	-47.5	2.95	3.19	-40.5	1.85	5.95	3.6	3.20	5.20	0.3	0.52	0.00
9	36.6	5.97	0.34	-0.8	1.18	0.73	0.4	0.52	3.07	0.3	0.53	0.00

1-Aerospace, 2-Computers and office mechines, 3-Electronic-telecommunications, 4-Pharmacy, 5-Scientific instruments, 6-Electrical machinery, 7-Chemistry, 8-Non-electrical machinery, 9-Armament;
Source: Author's calculations based on data from the Statistical Office of the Republic of Serbia

Table 2 shows the data on foreign trade of individual groups of high-tech products of the Republic of Serbia and selected foreign trade partners in 2020. The deficit has been recorded in Serbia's total exchange in all product groups except armament. The highest deficit was recorded in the group of electronic-telecommunications products, USD 688.4 million, while the surplus in armament amounted to USD 36.6 million. Electronic-telecommunications products had the largest share in exports and imports of 40.41% and 45.49%, respectively. Armament participated in the total foreign trade of high-tech products with 5.97% in exports and only 0.34% in imports during 2020. Except for the aerospace group, which had a surplus in foreign trade with the EU, all other product groups had a deficit. Products from the group of electronic-telecommunication products accounted for 48.23% of Serbia's exports, while aerospace products accounted for 26.51%. Electronic and telecommunications products accounted for 36.17% of imports. Serbia's exchange with CEFTA 2006 countries indicated a deficit in the aerospace group, while

Serbian exports were surplus in all other groups. Products from the group of electronic-telecommunications accounted for the largest share of Serbia's exports, accounting for 37.29%, while the pharmacy group of products accounted for the largest share of imports, accounting for 57.8% of total imports. In an exchange with Montenegro, Serbia achieved a surplus in all product groups in 2020. Products from the groups aerospace, chemistry, non-electrical machinery, and armament are not registered in the import of Serbia from Montenegro. Most of the imports were a pharmacy group of products, with a 92.89% share in the total import of high-tech products from Montenegro.

Table 3. The Grubel-Lloyd's Index

Godina	Ukupno	EU	CEFTA 2006	Crna Gora
2020	0.341	0.287	0.091	0.099
2019	0.297	0.312	0.084	0.074
2018	0.318	0.312	0.063	0.089
2017	0.335	0.322	0.154	0.088
2016	0.383	0.376	0.098	0.067
2015	0.376	0.318	0.143	0.085
2014	0.389	0.376	0.125	/
2013	0.356	0.334	0.110	/
2012	0.399	0.330	0.100	/

Source: Author's calculations based on data from the Statistical Office of the Republic of Serbia

The results of the Grubel-Lloyd IIT index for high-tech products from 2012 to 2020 are shown in Table 3. Data were calculated at the NSFT product level, and GLI values decreased during the observed period. The index's value was 0.297 in 2019 and 0.399 in 2012. The value of the index in an exchange with the EU ranged from 0.376 in 2014 and 2016 to 0.287 in 2020. The GLI values in high-tech product exchanges between Serbia and CEFTA 2006 countries ranged from 0.154 in 2017 to 0.063 in 2018. During the period under consideration, the value of GLI in the exchange of high-tech products with Montenegro was less than 0.1.

Table 4. Products with the highest GLI value during 2020 (in thousands of USD)

		Export	Import	GLI
8745510 - Thermometers and pyrometers	Scientific instruments	3683.0	3690.8	0.999
8749000 - Parts and accessories for machines and appliances,n.e.s.	Scientific instruments	915.3	898.7	0.991

8743190 - Instruments for measuring or checking the flow or level of liquids,other	Scientific instruments	1396.5	1362.0	0.987
7929100 - Propellers and rotors and parts thereof	Aerospace	287.9	296.8	0.985
8747800 - Other instruments for measing or checking electrical quantities	Scientific instruments	1449.8	1361.9	0.969
5311100 - Disperse dyes and preparations based thereon	Chemistry	589.6	549.0	0.964
8984400 - Optical media for the recording of sound or of other phenomena	Electronic-telecommunications	14488.5	13379.4	0.960
7527000 - Storage units	Computersoffice mechines	17333.2	18885.4	0.957
8745200 - Instruments,apparatus and models for demonstrational purposes	Scientific instruments	773.7	892.1	0.929
7642500 - Audio-frequency electric amplifiers	Electronic-telecommunications	629.2	770.4	0.899

Source: Author's calculations based on data from the Statistical Office of the Republic of Serbia

Table 4 shows which high-tech products had the highest GLI value in 2020. The index for thermometers and pyrometers had the highest value of 0.999. Five of the top ten products with the highest GLI value are scientific instruments, two are electronic-telecommunications products, and one is from aerospace, chemistry, computers and office machines. The list excludes items from the following categories: pharmacy products, electrical machinery, non-electrical machinery, and armament.

4. CONCLUSION

High-tech products in recent years have seen a significant increase in participation in the production structure of international trade. According to the World Bank, the share of high-tech products in the world's merchandise exports in 2011 was 18.57%, while in 2020, it reached 22.21%. The share of high-tech products in the exports of different groups of countries by level of economic development shows significant differences between middle and high-income countries, on the one hand, and low-income countries, on the other hand. In low-income countries, the share of high-tech products in total merchandise exports during 2020 was 5.38%. In 2020, middle-income countries recorded a share of high-tech products in total exports of 23.45%, while high-income countries recorded 21.7%. Although developed countries have the most patents registered and the most funds allocated for research and development (R&D), the slightly higher share of high-tech

products in total exports of middle-income countries can be explained by deindustrialization and the growing share of these products in the export of Asian countries such as China and Malaysia.

Intensive investment in R&D and production of high-tech products boosts a country's exports and competitiveness in the global market. Exports of high-tech products have a significant impact on the economic prosperity of exporting countries [13]. Accordingly, policymakers should stimulate the production and export of these products.

Exports and imports of high-tech products of the Republic of Serbia increased during the observed period. However, the growth of imports was faster than the growth of exports, so in the period from 2012 to 2020, there was an increase in the total deficit in foreign trade of high-tech products. Furthermore, a deficit was noted in the exchange of high-tech products with the EU. On the other hand, the Republic of Serbia recorded a surplus in trade with CEFTA 2006 countries and Montenegro. Exports and imports of high-tech products are concentrated in the group of electronic-telecommunications products. These products accounted for 40.41% of exports and 45.49% of imports of high-tech products.

During the observed period from 2012 to 2020, the value of GLI decreased. The result indicates that there was a decrease in the value of IIT. Based on the results of GLI, it can be concluded that in the exchange of high-tech products of Serbia with the countries of CEFTA 2006 and Montenegro, a small share of IIT is characteristic.

The paper is the starting point for the analysis of IIT high-tech products in Serbia. For further research, it is significant to analyze horizontal and vertical IITs, in order to observe the differences in the quality of products that Serbia imports and export in the product groups that are characterized by IIT.

5. LITERATURE

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