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The role of foreign value added in creating Poland's comparative advantage in world merchandise exports

Rola zagranicznej wartości dodanej w tworzeniu przewagi komparatywnej Polski w światowym eksporcie towarowym

Keywords: Poland, exports, comparative advantage, foreign and domestic value added

Słowa kluczowe: Polska, eksport, przewaga komparatywna, zagraniczna i krajowa wartość dodana

Introduction

One of major trends in the world economy in the global era is international fragmentation of production, which means dividing previously integrated process into separate stages localized in various parts of the world. This allows to deepen specialization and achieve additional gains from trade especially in middle-income countries such as Poland.

There have been many theoretical papers on international fragmentation of production. The most significant are two that started two different approaches towards the issue. R. Jones and H. Kierzkowski [1990] view production process as fragments of production blocks that are located in different geographical locations linked with various services (administration, transportation, finance). Since diversification of labour productivity and factor cost is higher between countries rather than regions in a single country – fragmentation will be international. According to the standard approach, labour-intensive stages of production will be located in labour-abundant countries and capital-intensive activity – in capital-abundant countries. The second trend was initiated with a paper by D. Hummels, J. Ishii and K-M. Yi [2001]. They

introduce a concept of vertical specialization with production tasks localized in various countries. This leads to the creation of global value added chain. A country accepts parts and intermediate goods that are processed and then passed on in a more advanced form to the next link of the chain for further processing. Both approaches complement each other, but the latter emphasizes the problem of value added in various countries.

Development of offshoring significantly alters countries' trade specialization and in consequence their revealed comparative advantage. However, the inadequacy of statistical data that relies mainly on the gross exports was a barrier to carrying out meaningful analysis. A turning point in research on fragmentation was construction of an alternative method of measuring trade flows based on value added. The theoretical basis for the method was developed in 1930s by the Nobel Prize winner W. Leontief [1936]. Existing papers using trade data in value-added terms revealed important discrepancies in comparative advantage, trade balance and geographical structure of exports and imports. R.C. Johnson and G. Nougera [2012] proved that real value of bilateral trade (depending on a country) was 3–50% lower than calculated using traditional measures.

The main goal of the paper is to evaluate the impact of international fragmentation on Poland's comparative advantage. The analysis will focus on:

1) level of internationalization of production and share of foreign value added in Poland's gross exports,
2) Poland's comparative advantage in international trade based on RCA indexes calculated according to the traditional (gross exports) as well as alternative method based on the concept of country's value added.

The calculations were carried out using data from OECD–WTO *Trade in Value Added* (TIVA) database and the time frame of the analysis, determined by the availability of data, was limited to 1995–2009.

1. Research method

One of the fundamental methods to evaluate the internationalization level of country's production and its engagement in international production networks is measuring the share of foreign value added in gross exports. Basic assumption in value-added to gross exports analysis is a possibility to assess national share of final product's value. We simplify by skipping taxes and subsidies. Then, final product value (V^P) is a summation of all value-added (VA) in the process of production in subsequent countries. The formula is (1):

$$V^P = \sum_i VA_i^P \tag{1}$$

Net value added of country A (NVA) which constitutes its trade balance, is a difference between gross exports and imports as presented in formula (2). Gross exports is a summation of direct and indirect domestic value added (DVA) that country A is

exporting and foreign value added (FVA) which consists of previously imported foreign parts and components used in the production process. Imports consists of 3 elements: 1) bilateral value added (BVA), 2) reimported value added (RVA) and multilateral value added (MVA). BVA is imports to country A of products which value was added in 100% in country B. RVA means those imported products which final value was added in country B as well as components coming from A. MVA is that part of imports from B that has value added from country C.

$$NVA = (DVA + FVA) - (BVA+RVA+MVA) \tag{2}$$

Standard measure used to assess comparative advantage in world exports is Balassa index [Balassa, 1965]. The Balassa index is defined as the ratio of country's share in world exports of a given industry divided by its share in overall world trade. More specifically, BI^A_j is country *A*'s Balassa index for industry *j* defined as in formula (3). That is a ratio of share of industry j in country A exports (s^A_j) and share of industry j in reference country R exports (s^R_j). If $BI^A_j > 1$, country *A* is said to have a revealed comparative advantage (RCA) in industry *j*, since this industry is more important for country *A*'s exports than for the exports of the reference countries.

$$BI^A_j = \frac{s^A_j}{s^R_j} \tag{3}$$

Poland's comparative advantage in international trade based on RCA indexes can be calculated in a traditional way using value of gross exports or in an alternative way – using domestic value added. In the first approach RCA value is determined by country's integration with international production networks and foreign value added. The second one allows to view in a more objective way the real comparative advantage in world exports.

2. Share of foreign value added in Poland's gross exports

Country's export potential is dependent not only on domestic enterprises export capability, but also on the activities of international corporations and nation's engagement in international production networks. Poland, in comparison to other economies of similar potential, is among most dependent on foreign components and intermediate goods. Furthermore, a significant increase in share of foreign value added in gross exports was noted in 1995–2008 – it grew from 15.42% to 30.59%. Due to global financial and economic crisis all the countries with the available data experienced a decrease in 2009. In Poland it fell to 27.89% (see Table 1). Share of foreign input into the gross exports is highly diversified among sectors of the economy. In 2009

the following sectors were characterized by the highest share of foreign value added: transport equipment (38.93%), electrical and optical equipment (34.07%), basic metals and fabricated metal products (32.67%), chemicals and non-metallic mineral products (32.50%). The sectors with the lowest share of imported parts and components were low technology industries, dependent on labor and raw materials, such as: mining and quarrying (15.85%), agriculture, hunting, forestry and fishing (16.64%) (see Table 1).

Table 1. Share of foreign value added in gross exports in 1995–2009 by industry (in %)

	1995	2000	2005	2008	2009
Total	15.42	23.33	30.67	30.59	27.89
Agriculture, hunting, forestry and fishing	12.18	11.27	11.27	17.64	16.64
Mining and quarrying	14.76	11.84	13.38	16.25	15.85
Food products, beverages and tobacco	13.84	15.60	20.63	19.85	19.20
Textiles, textile products, leather and footwear	14.78	29.48	32.76	31.13	29.81
Wood and paper	14.24	24.15	27.71	24.13	23.12
Chemicals and non-metallic mineral products	21.26	31.57	36.54	37.13	32.50
Basic metals and fabricated metal products	19.92	28.17	34.48	37.92	32.67
Machinery and equipment	17.25	24.14	30.80	31.63	29.38
Electrical and optical equipment	14.65	33.97	42.69	35.87	34.07
Transport equipment	19.72	32.83	45.82	40.51	38.93
Other manufacturing	13.79	25.14	30.15	28.16	26.09

Source: own compilation based on: OECD [2013].

Further analysis of foreign value added share in Poland's gross exports in various industries revealed the following trends. Share of foreign components and parts kept growing until 2005 in all sectors, except: 1) agriculture, hunting, forestry and fishing and 2) mining and quarrying. The highest growth occurred in industries with the most fragmented production processes. In 1995–2005 share of foreign value added in electrical and optical equipment increased by 28.04 percentage points, and in transport equipment – by 26.1 percentage points (see Table 1). In 2005–2008 share of imported parts in exports of the two aforementioned industries dropped. Similar tendencies characterized wood and paper, other manufacturing, textiles and footwear as well as food, beverages and tobacco. The remaining industries noted a steady growth until 2008.

Main sources of foreign components used to manufacture exported goods were countries of the European Union, mostly Germany. In 1995–2009 they accounted for 1/5 of the total foreign value added in Polish exports. Apart from Germany other countries with significant shares were: Italy, France, the United Kingdom and the

Netherlands. Outside the EU most components came from Russia, the United States, China, Japan and South Korea (see Table 2).

Table 2. Origin of foreign value added in Polish gross exports in 1995–2009 (in %)

	1995	2000	2005	2008	2009
Total	100.00	100.00	100.00	100.00	100.00
Domestic value added	84.58	76.67	69.33	69.41	72.11
Foreign value added	15.42	23.33	30.67	30.59	27.89
Germany	3.11	4.41	6.25	5.51	5.21
Russia	2.32	3.62	4.68	4.68	3.17
Italy	1.04	1.71	2.13	2.03	2.03
United States	1.33	1.64	1.44	1.59	1.71
France	0.76	1.32	1.76	1.42	1.35
China	0.10	0.25	0.66	1.30	1.30
United Kingdom	0.93	1.26	1.26	1.06	0.97
Japan	0.45	0.66	0.72	0.91	0.87
Netherlands	0.46	0.64	0.81	0.78	0.78
Czech Republic	0.32	0.52	0.81	0.79	0.75
South Korea	0.09	0.46	0.50	0.67	0.73
Spain	0.22	0.47	0.62	0.57	0.58
Belgium	0.31	0.45	0.55	0.49	0.54
Austria	0.42	0.48	0.55	0.55	0.52
Sweden	0.40	0.63	0.70	0.57	0.50
Rest of the world	3.16	4.81	7.23	7.67	6.88

Source: own compilation based on: OECD [2013].

New version of the OECD database, updated in May 2013, increased its utility allowing to calculate input of each country of origin into foreign value added by industry. The data confirms that in 2009 main contributor of foreign components in all industries except chemicals and non-metallic mineral products was Germany (see Table 3). The new data also revealed high concentration of foreign value added origin. In transport equipment Germany, the United States and Italy accounted for 16.18% of foreign value added, and Germany's share was 9%. In electrical and optical equipment share of Germany, the United States and China was 10.43%, and in basic metals and fabricated metal products Germany, Russia and Italy contributed 12.65% of foreign value added.

Table 3. Share of foreign value added in gross exports by industry and by source country in 2009 (in %)

	Total	Agriculture, hunting, forestry and fishing	Mining and quarrying	Food products, beverages and tobacco	Textiles, textile products, leather and footwear	Wood and paper	Chemicals and non-metallic mineral products	Basic metals and fabricated metal products	Machinery and equipment	Electrical and optical equipment	Transport equipment	Other manufacturing
Total	27.89	16.64	15.85	19.20	29.81	23.12	32.50	32.67	29.38	34.07	38.93	26.09
Germany	5.21	2.71	2.77	3.35	5.24	5.07	5.01	6.32	5.79	5.30	9.00	5.33
Russia	3.17	2.27	2.60	1.88	1.56	2.08	8.52	4.09	1.96	1.79	1.85	2.27
Italy	2.03	0.88	1.12	0.95	3.39	1.16	1.52	2.24	2.25	1.76	4.31	1.79
United States	1.71	0.96	0.94	1.14	1.40	1.45	1.74	1.52	1.74	2.14	2.87	1.35
France	1.35	0.80	0.74	0.92	1.48	1.13	1.57	1.62	1.50	1.55	1.97	1.34
China	1.30	0.55	0.65	0.65	2.16	0.70	0.92	1.34	1.66	2.99	1.71	1.20
United Kingdom	0.97	0.62	0.51	0.65	1.10	0.81	1.12	0.96	1.02	1.30	1.29	0.85
Japan	0.87	0.38	0.47	0.39	0.55	0.45	0.63	0.79	1.10	1.91	1.52	0.55
Netherlands	0.78	0.64	0.38	0.83	0.85	0.68	0.85	0.77	0.85	1.35	0.87	0.68
Czech Republic	0.75	0.48	0.40	0.62	0.68	0.65	0.78	1.06	0.79	0.71	1.15	0.81
South Korea	0.73	0.27	0.37	0.29	0.51	0.32	0.46	0.74	1.01	2.07	1.07	0.45
Spain	0.58	0.29	0.33	0.35	0.69	0.49	0.51	0.72	0.68	0.69	0.96	0.56
Belgium	0.54	0.35	0.28	0.39	0.70	0.45	0.71	0.67	0.58	0.66	0.65	0.54
Austria	0.52	0.25	0.29	0.33	0.46	0.70	0.48	0.73	0.60	0.50	0.79	0.58
Sweden	0.50	0.24	0.27	0.34	0.64	0.80	0.46	0.68	0.56	0.55	0.65	0.56
Rest of the world	6.88	4.95	3.73	6.12	8.40	6.18	7.22	8.42	7.29	8.80	8.27	7.23

Source: own compilation based on: OECD [2013].

One of the industries highly engaged in international production networks was transport equipment. However, only 35.4% of foreign value added in gross exports in 2009 originated in the industry. Other components and intermediate goods were manufactured in basic metals (8.14%), chemicals (4.82%), mining and quarrying (3.12%), electrical and optical equipment industry (2.39%) [OECD, 2013]. Input of various services was much more significant, which is in accordance with theoreti-

cal assumptions made by H. Kierzkowski and R.W. Jones [1990]. In 2009 services accounted for 40.94% of foreign value added in exports of transport equipment, in particular: wholesale and retail trade – 17.9%, business services – 10.08%, transport, storage and telecommunication – 5.29%. In other industries share of services in foreign value added didn't surpass 40% and value added from the same industry amounted for a large share of foreign value added, especially in low technology and raw materials industries [OECD, 2013].

2. Poland's comparative advantage in world merchandise trade

In terms of traditional approach based on gross exports Poland had comparative advantage in exports of food products, beverages and tobacco, wood and paper, basic metals and fabricated metal products, other manufacturing and transport equipment (see Table 4). The largest gap characterized trade in electrical and optical equipment, machinery and equipment, chemicals and non-metallic mineral products, also after the year 2000 – textiles and footwear. Main trends in 1995–2009 were the following. In low and medium-low technology industries Poland's comparative advantage weakened. In contrast, there was a gain in comparative advantage in industries using advanced technologies. The highest growth of RCA indicator occurred in transport equipment (Balassa Index grew by 0.74), electrical and optical equipment (0.33) and machinery and equipment (0.30). These industries have the highest shares of foreign value added, over 30% of gross exports.

Table 4. Revealed comparative advantage indexes (RCA) of Poland calculated based on gross exports and domestic value added in 1995–2009

	Food products, beverages and tobacco	Textiles, textile products, leather and footwear	Wood and paper	Chemicals and non-metallic mineral products	Basic metals and fabricated metal products	Machinery and equipment	Electrical and optical equipment	Transport equipment	Other manufacturing
	Gross exports								
1995	1.7607	1.5541	1.3527	0.9966	1.8218	0.5080	0.2416	0.8069	2.1628
2000	1.3807	1.4998	1.5833	0.9017	1.5471	0.6492	0.4123	1.1313	2.2300
2005	1.5244	0.7708	1.4547	0.9216	1.2843	0.7713	0.5081	1.2334	1.9405
2008	1.3083	0.8697	1.1273	0.8041	1.1016	0.8318	0.6263	1.5583	1.7043
2009	1.4936	0.8597	1.2647	0.8212	1.0848	0.8114	0.5727	1.5469	1.6832

	Food products, beverages and tobacco	Textiles, textile products, leather and footwear	Wood and paper	Chemicals and non-metallic mineral products	Basic metals and fabricated metal products	Machinery and equipment	Electrical and optical equipment	Transport equipment	Other manufacturing
	Domestic value added								
1995	1.7406	1.6256	1.3220	0.9777	1.7805	0.4824	0.2583	0.7881	2.2199
2000	1.4778	1.4168	1.5383	0.9126	1.5311	0.6425	0.3922	1.0994	2.2622
2005	1.6392	0.7465	1.4449	0.9616	1.2836	0.7669	0.4911	1.0495	1.9842
2008	1.3747	0.8309	1.1357	0.8359	1.0361	0.8061	0.6629	1.4222	1.7225
2009	1.5311	0.8150	1.2392	0.8491	1.0528	0.7910	0.6026	1.3863	1.7142

Source: own compilation based on: OECD [2013].

Using the alternative method of calculating Balassa indexes based on domestic value added significantly alters Poland's comparative advantage in world trade. RCA indexes in the following industries are considerably lower: transport equipment, machinery and equipment, basic metals and fabricated metal products, wood and paper, textiles and footwear. All of the above were characterized by a high share of foreign value added, which proves its important role in creating comparative advantage and export potential.

However, an assumption that high share of foreign value added in gross exports contributes to gaining comparative advantage in international trade is too far-fetched. The influence may be positive as well as negative. In case of transport equipment foreign value added caused an increase in comparative advantage. But in other cases the results were opposite. In electrical and optical equipment foreign value added amounted to 34% of gross exports in 2009, but there was a high comparative gap. RCA indexes calculated in a traditional way were even slightly lower than those based on domestic value added.

Conclusion

Changes in the functioning of the world economy, cooperation and creation of international production networks requires a new approach to measuring trade and comparative advantage. It is necessary to assess share of the product's value that was added in the analyzed country to evaluate its position in international trade. The analysis carried out in this paper showed that foreign parts and components were an

important element of Polish manufacturing exports and their role increased considerably in 1995–2009. Foreign value added was particularly important in high technology industries such as transport equipment or electrical and optical equipment while its role in low technology industries was minor. Large part of foreign value added was contributed by European Union countries and in particular Germany. The data also confirmed the theory that services sector is a significant source of foreign value added.

There is still a considerable gap in Polish exports competitiveness compared to the old European Union countries [Mucha-Leszko, Kąkol, 2009] so naturally there is a valid question whether foreign value added can be used to close this gap. However, the relation between comparative advantage and foreign value added was not proved to be straightforward. The Balassa indexes calculated using two methods were different, but the role of foreign input was not always positive. In some industries it allowed Poland to be more competitive (e.g. transport equipment) while in others it weakened the advantage/enlarged the gap.

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The role of foreign value added in creating Poland's comparative advantage in world merchandise exports

The paper deals with changing approach to measuring trade an competitiveness due to the widely spread process of international fragmentation of production process which makes it much more difficult to assess origin of products in international trade. Therefore a method was developed to use foreign and domestic value added in order to evaluate country's role in world trade as well as its comparative advantage. Authors apply this methodology to Polish trade in goods in 1995–2009 and reveal that foreign components were an important part of its exports. Poland was highly dependent on foreign value added from European Union countries, especially Germany. Sectors with highest shares were: transport equipment, electrical and optical equipment, basic metals and fabricated metal products, chemicals and non-metallic mineral products. Foreign value added also affected Poland's comparative advantage – its

impact on various industries was adverse. In some cases it improved RCA indexes while in others using domestic value added for the calculations resulted in a larger comparative advantage.

Rola zagranicznej wartości dodanej w tworzeniu przewagi komparatywnej Polski w światowym eksporcie towarowym

Internacjonalizacja produkcji sprawiła, że tradycyjne metody mierzenia udziału kraju w światowym eksporcie oraz przewagi konkurencyjnej w mniejszym stopniu odzwierciedlają rzeczywistość. W związku z tym zaczęły rozwijać się alternatywne metody mierzenia strumieni handlu zagranicznego – na podstawie wartości dodanej. Celem opracowania jest ocena wpływu międzynarodowej fragmentaryzacji produkcji na kształtowanie się pozycji konkurencyjnej Polski. Szczegółowa analiza obejmuje udział zagranicznej wartości dodanej w eksporcie brutto Polski oraz kształtowanie się przewagi konkurencyjnej na bazie indeksu Balassy, obliczonego na podstawie metody tradycyjnej (eksport brutto), jak również alternatywnej (krajowa wartość dodana). Zastosowanie nowego podejścia do analizowania polskiego eksportu ujawniło duży wzrost znaczenia zagranicznej wartości dodanej w badanym okresie. Źródłem jej pochodzenia były w znacznym stopniu kraje Unii Europejskiej, zwłaszcza Niemcy, a sektory, w przypadku których FVA miała największe znaczenie, charakteryzowały się dużym stopniem wykorzystania technologii. Należały do nich środki transportu oraz maszyny i urządzenia. Inne wartości przyjmowały także indeksy ujawnionej przewagi konkurencyjnej obliczone przy uwzględnieniu zagranicznej wartości dodanej. Założenie jednak, że wysoki udział zagranicznej wartości dodanej w eksporcie brutto powoduje poprawę pozycji komparatywnej kraju w handlu międzynarodowym, jest zbyt daleko idącym uproszczeniem. Może mieć ona pozytywny wpływ, ale w niektórych sektorach okazał się on bardzo niewielki albo nawet wartości wskaźników były nieznacznie wyższe przy uwzględnieniu jedynie krajowej wartości dodanej.