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Szkoła Główna Handlowa w Warszawie

Polish foreign trade: An analysis using value added statistics

The aim of the paper is to present changes in Polish foreign trade (in goods and services) in the period of 1995–2011 using trade statistics in value added terms, which will allow to estimate how much Polish value added embodied in final products is consumed in other countries and how much foreign value added originating in other countries is consumed in Poland. The calculations were made using the World Input-Output Database (WIOD), based on the input-output approach. The research results show that the balance (and thus the benefits) of Poland's foreign trade with its trading partners computed on the basis of traditional statistics in gross terms differed from trade balance calculated in value added terms. The difference resulted from different shares of intermediate goods in trade. At the sectoral level, trade balance in gross terms also differed from that in value added terms.

Keywords: value added trade, input–output tables, Poland

JEL classification: F14, F62

Handel zagraniczny Polski. Analiza z wykorzystaniem statystyk wartości dodanej

Celem referatu jest przedstawienie zmian w polskim handlu zagranicznym (towarami i usługami) w latach 1995–2011 z wykorzystaniem statystyk handlowych w kategoriach wartości dodanej. Pozwalają one na określenie, ile polskiej wartości dodanej zawartej w dobrach finalnych jest konsumowane bądź zużywane w innych krajach oraz ile zagranicznej wartości dodanej pochodzącej z poszczególnych krajów jest konsumowane bądź zużywane w Polsce. Obliczeń dokonano na podstawie danych z bazy World Input–Output Database (WIOD), korzystając z modelu przepływów międzygałęziowych. Z przeprowadzonego badania wynikało, że saldo (a tym samym ocena korzyści) wymiany handlowej Polski z poszczególnymi krajami obliczone na podstawie tradycyjnych statystyk w ujęciu brutto różniło się od salda obliczonego na podstawie statystyk w kategoriach wartości dodanej, co wynika z różnego udziału dóbr pośrednich w obrotach handlowych. Saldo obrotów obliczone według tych dwóch metod różniło się także w polskim handlu poszczególnymi grupami towarów i usług.

Słowa kluczowe: handel wartością dodaną, tablice przepływów międzygałęziowych, Polska

Klasyfikacja JEL: F14, F62

Introduction

The international fragmentation of production processes, i.e., the specialisation of countries in specific production stages and the globalisation of supply chains, has contributed to dynamic growth in trade in semi-finished products. The traditional computation of the value of international trade flows in gross terms (by measuring the value of goods crossing the borders of individual custom areas) has become less useful. The result is the development of world input–output tables, serving to generate trade statistics in value added terms which take account of the contribution of particular countries to the creation of value added and eliminate the multiple calculation in trade of components, first separately (as intermediate goods) and then as parts of final goods.

The aim of the paper is to present changes in Polish foreign trade (in goods and services) in 1995–2011 using trade statistics in value added terms. They allow to estimate how much Polish value added embodied in final products is consumed or absorbed in partner countries and how much foreign value added originating in specific countries is consumed or absorbed in Poland.

1. Trade in value added and value added in trade: Some theoretical aspects

The literature distinguishes between two main concepts connected with the flow of value added between countries [Stehrer, 2013; 2012; Nagengast, Stehrer, 2014]. One of them, 'trade in value added', allows to determine how much of the value added created in a country is absorbed or consumed in another country. Value added may flow to the destination country directly in the form of the final product or indirectly in the form of a semi-finished product through other countries. It means that the country concerned exports an intermediate product to a country in which it is used for the manufacture of the final product, subsequently exported to the country of destination where it is consumed or absorbed [Johnson, Noguera, 2012]. In addition to value added exports, there are also value added imports. Those allow to specify the origin of the value added consumed or absorbed in the importing country.

The concept related to value added flows between countries also enables the calculation of the value of trade balance in value added terms. Although with regard to the overall trade of a country the trade balances in gross terms and in value added terms are the same, they differ in bilateral trade. The differences arise from the exclusion from trade in value added of the parts of trade flows included in tra-

ditional statistics more than once [Koopman, Wang, Wei, 2014]. Therefore, trade in intermediate goods contributes to divergent statistics according to the two concepts. In the literature it is emphasised that trade flows in value added terms better reflect the benefits derived by particular countries from trade in respect of income and employment [Foster-McGregor, Stehrer, 2013; Timmer et al., 2013].

The other concept connected with value added flows between countries is 'value added in trade'. It allows to identify the origin of the value added contained in the total foreign trade of a country or in bilateral trade – between two countries. It enables the decomposition of exports of one country to another (or of the total exports of a country) by origin of the value added embodied in those exports. Koopman et al. [2010] distinguished between the following components of bilateral exports: (1) domestic value added content of exports in the form of final goods absorbed or consumed by the direct importer, (2) domestic value added content of exports of intermediates used by the direct importer to produce final goods for the domestic market, (3) domestic value added content of exports of intermediates used by the direct importer to produce goods for export – indirect value added exports, (4) domestic value added content of exports of intermediates used by the direct importer to produce goods returned to the country of origin of intermediate goods (reflected domestic value added), (5) foreign value added content of exports. At the same time, imports from one country to another can be decomposed into the following: (1) value added created in the country of the importer contained in both final and intermediate goods (direct value added imports), (2) re-imports – value added created in the importing country and exported to the country of the importer for its production needs, subsequently brought to the importing country, (3) value added content of the imports of a given country created in a country other than the country of the importer [Stehrer, Foster, Vries, 2012].

To sum up, the concept of value added in trade refers to trade flows in gross terms, enabling to decompose them by origin of value added. The notion of trade in value added is not directly related to trade flows in gross terms. Whereas traditional trade statistics include the value of specific products in circulation in the world economy, trade in value added is a somewhat 'abstract' concept. Statistics on trade in value added terms register the flow of value added across countries. This value is frequently not the same as that of products moved, as those comprise components manufactured in various countries.

2. Research method

This study was carried out with the use of data from the World Input–Output Database (WIOD), containing world input–output tables for the years 1995–2011. On the basis of the above-mentioned tables, using the system of equations in the

input–output (IO) model, appropriate calculations were made. The basic equation is as follows:

$$x = Ax + f = Lf \quad [1]$$

where:
x – denotes the vector of gross output,
A – denotes the matrix of technical input–output coefficients (costs),
f – denotes the vector of final output,
$L = (I - A)^{-1}$ – denotes the matrix of material-intensity (or additional demand) coefficients, also referred to as the Leontief inverse (and I is a unit matrix).

For the sake of a clear presentation of the essence of the calculations, the international input–output table only concerns 3 countries and one sector. The matrix notation of the equation $x = Ax + f = Lf$ is as follows:

$$\begin{pmatrix} x^1 \\ x^2 \\ x^3 \end{pmatrix} = \begin{pmatrix} A^{11} & A^{12} & A^{13} \\ A^{21} & A^{22} & A^{23} \\ A^{31} & A^{32} & A^{33} \end{pmatrix} \begin{pmatrix} x^1 \\ x^2 \\ x^3 \end{pmatrix} + \begin{pmatrix} f^1 \\ f^2 \\ f^3 \end{pmatrix} = \begin{pmatrix} L^{11} & L^{12} & L^{13} \\ L^{21} & L^{22} & L^{23} \\ L^{31} & L^{32} & L^{33} \end{pmatrix} \begin{pmatrix} f^{11} & f^{12} & f^{13} \\ f^{21} & f^{22} & f^{23} \\ f^{31} & f^{32} & f^{33} \end{pmatrix} \quad [2]$$

The value added exports of country 1 to the other countries were computed based on the following equation:

$$VAX^1 = vLf \quad [3]$$

where:
v – denotes the vector of value added coefficients,
transformations result in the following:

$$VAX^1 = \begin{pmatrix} v^1 & 0 & 0 \end{pmatrix} \begin{pmatrix} L^{11} & L^{12} & L^{13} \\ L^{21} & L^{22} & L^{23} \\ L^{31} & L^{32} & L^{33} \end{pmatrix} \begin{pmatrix} 0 & f^{12} & f^{13} \\ 0 & f^{22} & f^{23} \\ 0 & f^{32} & f^{33} \end{pmatrix} \quad [4]$$

and finally:

$$VAX^1 = v^1 L^{11} \left(f^{12} + f^{13} \right) + v^1 L^{12} \left(f^{22} + f^{23} \right) + v^1 L^{13} \left(f^{32} + f^{33} \right) \quad [5]$$

The first element of the above equation is the value added created in country 1 as a final good and exported to countries 2 and 3 to be absorbed or consumed. The second element denotes the value added created in country 1 in the form of an intermediate good. Next, it is exported to country 2 where it is used for the manufacture of a final good, to be eventually consumed or absorbed in country 2 or re-exported to country 3. The third element is interpreted in a similar way.

The value added imports of country 1 from the other two countries can be expressed by the following equation:

$$VAM^1 = \begin{pmatrix} 0 & v^2 & v^3 \end{pmatrix} \begin{pmatrix} L^{11} & L^{12} & L^{13} \\ L^{21} & L^{22} & L^{23} \\ L^{31} & L^{32} & L^{33} \end{pmatrix} \begin{pmatrix} f^{11} & 0 & 0 \\ f^{21} & 0 & 0 \\ f^{31} & 0 & 0 \end{pmatrix} \quad [6]$$

and finally:

$$VAM^1 = \left(v^2 L^{21} + v^3 L^{31}\right) f^{11} + \left(v^2 L^{22} + v^3 L^{32}\right) f^{21} + \left(v^2 L^{23} + v^3 L^{33}\right) f^{31} \quad [7]$$

The first element of the above equation denotes the value added created in country 2 and country 3 in order to satisfy final demand in country 1. The second element is the value added created in country 2 and country 3 in order to satisfy final demand in country 1 through imports from country 2. The third element is interpreted in a similar way.

The value added exports of country 1 to country 2 are computed according to the following equation:

$$VAX^{12} = \begin{pmatrix} v^1 & 0 & 0 \end{pmatrix} \begin{pmatrix} L^{11} & L^{12} & L^{13} \\ L^{21} & L^{22} & L^{23} \\ L^{31} & L^{32} & L^{33} \end{pmatrix} \begin{pmatrix} f^{12} \\ f^{22} \\ f^{32} \end{pmatrix} = v^1 L^{11} f^{12} + v^1 L^{12} f^{22} + v^1 L^{13} f^{32} \quad [8]$$

The first element of the last equation denotes the value added created in country 1 and exported in the form of final goods to country 2. The second element refers to the value added created in country 1 and exported as intermediates to country 2, to be consumed or absorbed after further processing. The third element denotes the value added of country 1 exported as intermediates to country 3, to be shipped after processing as final goods to country 2.

In contrast to traditional trade statistics, trade data on flows of goods and services from the world input–output table are characterised by the lack of differences in mirror statistics[1]. For example, it means that imports of country 1 from country 2 equal to exports of country 2 to country 1.

The calculation of the value added imports of country 1 from country 2 is based on the equation allowing to estimate the value added exports of country 2 to country 1:

[1] In traditional statistics exports are expressed in FOB (free-on-board) prices on the border of the exporting country, whereas imports – in CIF (cost-insurance-freight) prices on the border of the importing country before import taxes (also customs duties). The CIF price is the FOB price plus transport costs and cargo insurance. Therefore, part of the price of goods might be already covered by the exporter, which may lead to the double counting of the same cost in statistics. Hence, the world input–output tables include adjustments of the value of imports to the value of exports to make them mirror images and international transport margins are contained in an additional row of the input–output table. It allows to maintain balance in the table [Timmer, 2012].

$$VAM^{21} = VAX^{21} = \begin{pmatrix} 0 & v^1 & 0 \end{pmatrix} \begin{pmatrix} L^{11} & L^{12} & L^{13} \\ L^{21} & L^{22} & L^{23} \\ L^{31} & L^{32} & L^{33} \end{pmatrix} \begin{pmatrix} f^{11} \\ f^{21} \\ f^{31} \end{pmatrix} = v^2 L^{21} f^{11} + v^1 L^{22} f^{21} + v^1 L^{23} f^{31} \quad [9]$$

The first element of the last equation is the value added created in country 2 and exported as intermediate goods to country 1 where it is absorbed or consumed after further processing. The second element denotes the value added created in country 2 and shipped as final goods to country 1. The third element is the value added created in country 2 and shipped in the form of intermediates to country 3 for its processing, subsequently sent as the final product to country 1.

Therefore, trade balance between country 1 and country 2 in value added terms can be computed according to following formula:

$$NVAX^{12} = \left(v^1 L^{11} f^{12} + v^1 L^{12} f^{22} + v^1 L^{13} f^{32} \right) - \left(v^2 L^{21} f^{11} + v^2 L^{22} f^{21} + v^2 L^{23} f^{31} \right) \quad [10]$$

3. Research results

3.1. Geographical composition of Polish foreign trade

Germany accounted for the largest share in Polish exports of goods and services in 1995–2011. However, its importance markedly diminished in the period in question[2]. In value added terms, the share of Germany in Polish exports nearly dropped by half, to 16.6% in 2011 (Table 1). In comparison with traditional statistics, that proportion was as much as 7.1 p.p. lower. The difference is attributable to the strong position of Germany in the Polish value added chain, resulting from Germany's having located in Poland many investment projects in various sectors of the economy, particularly in manufacturing[3]. A number of Polish enterprises became sub-suppliers of parts and components to German factories, which meant an 'overstatement' of traditional statistics of exports to Germany on account of a large proportion of intermediates. Such goods, as components of German products, were sold to other recipients. In 2011 nearly 40% of Polish value added exported to Germany was then re-exported by that country [Ambroziak, 2015].

Strong commercial and investment linkages also characterised Poland's trade with the Czech Republic and Hungary. In 2011 the share of those countries in value added exports was by 2.3 p.p. and 0.9 p.p., respectively, lower than the pro-

[2] The tables show changes in trade over the period 1995–2011. Due to the limited volume of this article, the descriptive analysis is focused on the comparison of traditional trade statistics and statistics in value added terms.

[3] As at the end of 2014, the stock of foreign direct investment from Germany in Poland was US$ 30 billion, i.e., slightly more than 16% of the total stock of inward foreign direct investment in the Polish economy [NBP, 2015]

portion computed on the basis of gross exports. The opposite was the case for certain countries, mostly non-EU ones. Their shares in exports calculated on the basis of value added statistics were higher than those computed using traditional statistics. It concerned countries such as the United States, China and Russia (with their respective shares in value added terms 2.5 p.p., 1.8 p.p. and 0.5 p.p. higher). It meant that the countries in question consumed or absorbed relatively more Polish value added than traditional trade statistics suggested. Polish value added is brought to those markets indirectly through other countries such Germany. It is a major exporter to the Chinese market as well as to markets of other third countries.

Table 1. Poland's gross exports and value added exports by major recipient in 1995–2011

Exports partner	Gross exports			Value added exports			Difference between shares in gross exports and value added exports, in p.p.	
	share, in %		changes in 1995–2011, in p.p.	share, in %		changes in 1995–2011, in p.p.		
	1995	2011		1995	2011		1995	2011
Germany	37.4	23.7	-13.7	32.7	16.6	-16.1	-4.7	-7.1
UK	3.9	6.5	2.6	4.1	6.7	2.6	0.2	0.2
France	4.4	5.6	1.3	4.8	5.7	1.0	0.4	0.1
Russia	6.6	5.6	-1.0	6.9	6.1	-0.8	0.3	0.5
Italy	4.8	5.2	0.4	5.1	5.1	0.0	0.3	-0.1
Czech Rep.	2.9	4.9	2.0	2.2	2.6	0.4	-0.7	-2.3
US	3.8	3.2	-0.6	5.9	5.6	-0.3	2.1	2.5
Netherlands	3.6	2.6	-1.0	3.2	2.3	-0.9	-0.5	-0.3
Spain	1.2	2.6	1.3	1.6	2.6	1.0	0.3	0.0
Sweden	2.4	2.5	0.2	2.0	2.1	0.1	-0.4	-0.5
Hungary	1.5	2.2	0.7	1.2	1.3	0.1	-0.3	-0.9
Belgium	2.3	2.0	-0.3	1.8	1.6	-0.1	-0.6	-0.4
Turkey	0.3	2.0	1.7	0.5	2.2	1.8	0.2	0.2
Austria	2.3	1.8	-0.5	2.4	1.7	-0.7	0.0	-0.1
China	0.3	1.8	1.5	0.6	3.5	2.9	0.3	1.8
Denmark	3.0	1.5	-1.4	2.3	1.2	-1.2	-0.6	-0.4
Romania	0.3	1.2	1.0	0.3	1.2	0.9	0.0	0.0
Lithuania	0.5	1.2	0.7	0.4	0.9	0.5	-0.1	-0.3
Slovakia	1.0	1.2	0.2	0.7	0.9	0.2	-0.3	-0.3
Canada	0.6	1.0	0.4	0.7	1.1	0.4	0.1	0.1
Others	17.0	21.7	4.7	20.8	29.0	8.3	3.8	7.3

Source: Own calculations based on WIOD data.

As in exports, the role of Germany in imports was lesser on the basis of statistics in value added terms than in gross terms (Table 2). In 2011 slightly more than 17% of the foreign value added absorbed or consumed in Poland came from Germany. That share was 4.4 p.p. lower than the figure computed based on traditional statistics. It indicates that Poland is not only a sub-supplier of parts and components to German factories, but it also imports German value added in the form of intermediate goods, to be exported to other countries after appropriate processing or assembly. In addition, parts and components accounted for a major proportion of Polish imports from the Czech Republic, Hungary, Slovakia and Italy. It resulted from lower shares of those countries in Polish imports according to value added statistics than those based on traditional statistics.

Table 2. Poland's gross imports and value added imports by major supplier in 1995–2011

Exports partner	Gross imports			Value added imports			Difference between shares in gross imports and value added imports, in p.p.	
	share, in %		changes in 1995–2011, in p.p.	share, in %		changes in 1995–2011, in p.p.		
	1995	2011		1995	2011		1995	2011
Germany	26.0	21.8	-4.2	24.7	17.4	-7.3	-1.4	-4.4
China	1.0	7.8	6.8	1.2	8.8	7.6	0.2	1.0
Russia	9.3	7.6	-1.7	7.8	7.4	-0.3	-1.5	-0.2
Italy	9.1	5.4	-3.7	8.7	4.9	-3.7	-0.4	-0.5
US	3.4	4.9	1.4	5.6	7.1	1.5	2.2	2.2
France	5.6	4.3	-1.3	6.3	4.4	-1.9	0.6	0.0
UK	5.2	3.7	-1.5	5.7	4.6	-1.1	0.6	0.9
Netherlands	5.3	3.5	-1.8	4.7	3.2	-1.5	-0.6	-0.3
Czech Rep.	2.7	3.4	0.7	2.0	2.2	0.2	-0.7	-1.2
Spain	1.6	2.6	1.0	1.8	2.8	1.0	0.2	0.2
Belgium	3.0	2.4	-0.7	2.7	1.9	-0.8	-0.3	-0.5
South Korea	0.8	2.1	1.3	0.9	1.9	1.0	0.2	-0.2
Sweden	3.1	1.9	-1.2	2.7	1.6	-1.1	-0.4	-0.3
Austria	2.4	1.8	-0.6	2/3	1.5	-0.8	-0.1	-0.3
Hungary	1.0	1.7	0.7	0.8	1.1	0.3	-0.2	-0.6
Turkey	0.3	1.6	1.3	0.3	1.6	1.3	0.1	0.1
Slovakia	1.2	1.6	0.3	0.9	1.0	0.1	-0.3	-0.6
Japan	1.4	1.4	-0.1	2.6	2.3	-0.3	1.2	0.9
Denmark	2.3	1.3	-1.0	2.0	1.2	-0.9	-0.3	-0.1
India	0.3	0.9	0.6	0.4	1.2	0.8	0.1	0.3
Others	14.9	18.4	3.4	15.9	21.8	6.0	1.0	3.5

Source: Own calculations based on WIOD data.

Higher shares in imports than those suggested by statistics in gross terms were found in the case of the United States, China and Japan. Value added from the countries in question was not exported to Poland directly, in the form final goods, but indirectly through other countries. It meant that countries other than those mentioned above (such as the EU Member States) absorbed semi-finished products originating from the US, China and Japan in the manufacture of final goods to be exported to Poland. In the case of the three countries, as well as of the United Kingdom, their understated shares in Polish imports according to traditional statistics are also attributable to the relatively important role of services in imports from those countries.

At the level of total trade, the trade balances of Poland in value added terms and in gross terms were equal. However, significant differences could be seen in bilateral trade (Figure 1). In general, if Poland had trade deficit with certain countries in gross terms, it also recorded deficit in value added terms, but it was markedly lower. That was the case in trade with China, South Korea, Russia, the United States, Japan and the Netherlands. For instance, in 2011 the value of deficit in Polish trade in goods and services with China was nearly US$ 13.5 billion, whereas

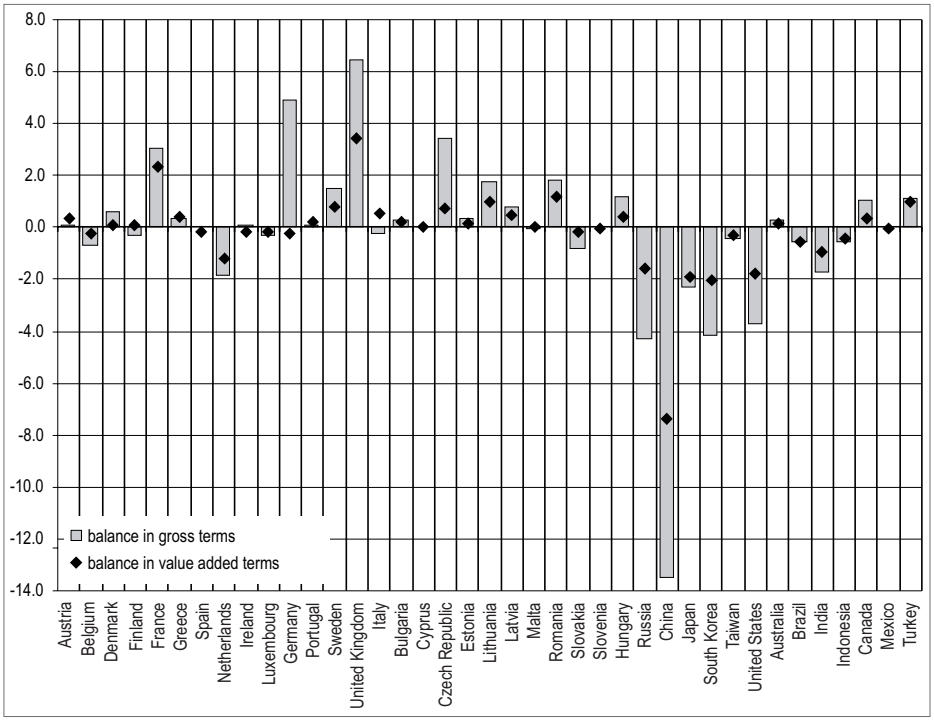

Figure 1. Balance in gross terms and in value added terms in Polish foreign trade with specific countries in 2011, in US$ billion

Source: Own calculations based on WIOD data.

deficit in value added terms was roughly half that figure, at only US$ 7.4 billion. One of the reasons was that indirect value added exports played a great role in Polish value added exports to China as well as to the other above-mentioned countries. Poland supplied other EU Member States, e.g. Germany, with parts and components absorbed in the production of final goods to be then exported to non-EU recipients, mostly China and the United States. As regards South Korea, the difference in deficit levels computed according to the two approaches was also influenced by a high share of intermediates in Polish imports from the country in question. Those were absorbed, for instance, in the production plants of Korean LG in the manufacture of television sets, subsequently exported to the EU.

With regard to countries with which Poland enjoyed trade surpluses in gross terms, surpluses tended to be recorded also in value added terms, but they were lower. It concerned trade with countries such as the United Kingdom, Germany, France, the Czech Republic, Lithuania, Romania, Hungary and Sweden. The greatest (relative) differences in trade balance calculated according to the two approaches characterised Polish trade with Germany and the Czech Republic. In 2011 Poland enjoyed the second largest trade surplus with Germany in gross terms (nearly US$ 5 billion), whereas it had a minor deficit in value added terms (slightly over US$ 200 million). In trade with the Czech Republic, the surplus calculated on the basis of value added statistics was around one-fifth of the figure in gross terms, at US$ 734 million (against US$ 3.4 billion in gross terms). The above differences stemmed from high shares of intermediate goods in Polish trade with the countries concerned.

3.2. Structure of Poland's foreign trade by type

Foreign statistics in value added terms also allow a decomposition of exports and imports by type of goods and services (Table 3). It primarily follows from the analysis of Polish exports that the share of goods in exports from sectors characterised by strong internationalisation of production (such as the manufacture of machinery and equipment, the manufacture of transport equipment) was – in value added terms – markedly lower than that suggested by traditional statistics. At the same time, the proportion of services, in particular non-commercial and business services, was higher. The reasons for it were twofold. First, the specific characteristics of the manufacture of goods allow to divide the process into a number of stages, frequently distributed across different countries. It creates flows of foreign trade in semi-finished products between the countries in which specific production stages are located. As a rule, such a situation is not possible in trade in services as the provision of a service cannot be divided into particular stages. Secondly, services contribute significantly to the process of the manufacture of goods, e.g. design, transport, distribution, etc. Traditional statistics recognise that part of

value added as exports of goods, which results in the understatement of the actual role of services in international trade. In 2011 the share of services in Polish exports of goods and services in gross terms was 18.8%, whereas that of services in Polish value added exports exceeded 50%. A similar situation was also noted with regard to imports. The share of services was markedly higher in Polish value added imports (44% in 2011) than in Polish gross imports (17%).

Table 3. Polish exports and imports in gross terms and in value added terms by type in 1995 and 2011, in %

Sector	Gross exports		Value added exports		Gross imports		Value added imports	
	1995	2011	1995	2011	1995	2011	1995	2011
Agriculture, hunting, forestry and fishing	3.8	1.5	6.6	3.7	3.6	2.6	5.0	4.3
Mining and quarrying	6.9	2.2	8.1	4.2	6.8	6.8	6.0	9.8
Food, beverages and tobacco	8.3	8.3	3.8	4.4	6.5	5.2	2.9	2.8
Textiles, textile products and footwear	10.2	4.1	7.0	2.6	3.6	4.6	1.7	2.5
Wood and paper	5.1	4.3	4.0	3.7	4.8	3.3	4.2	2.6
Coke and refined petroleum fuel	4.7	4.1	2.0	2.3	2.1	2.9	1.1	1.8
Chemicals and chemical products	7.9	6.1	4.7	3.4	13.2	11.7	7.6	6.4
Rubber and plastics	1.9	5.1	2.2	3.0	3.8	3.7	2.4	2.3
Basic metals and fabricated metal	11.8	10.2	7.9	6.3	6.9	10.2	6.5	6.5
Machinery, nec	4.5	5.4	3.9	3.3	10.8	7.4	6.5	4.8
Electrical and optical equipment	4.4	8.3	2.9	3.1	11.2	10.9	7.2	6.1
Transport equipment	7.4	15.2	3.5	4.9	5.6	10.6	2.7	4.2
Manufacturing, nec	5.9	6.4	4.2	4.5	3.7	2.6	2.6	2.0
Construction	4.8	2.9	4.1	3.8	0.2	1.2	0.9	1.2
Wholesale and retail sale trade; repair	1.4	2.8	12.3	18.3	2.5	2.2	10.1	9.8
Other market non-commercial services	1.2	1.2	4.8	4.5	0.2	1.0	4.0	4.9
Transport and telecommunications	5.8	7.2	7.6	9.2	7.7	5.9	9.7	8.2
Business services	3.5	3.9	7.3	10.7	6.4	6.4	15.7	16.4
Other services	0.4	0.8	3.3	4.2	0.4	0.7	3.3	3.5

Source: Own calculations based on WIOD data.

There are significant differences in the assessment of the benefits of international trade at the sectoral level on the basis of traditional statistics and statistics in value added terms (Figure 2). As in bilateral trade, deficit or surplus on trade in

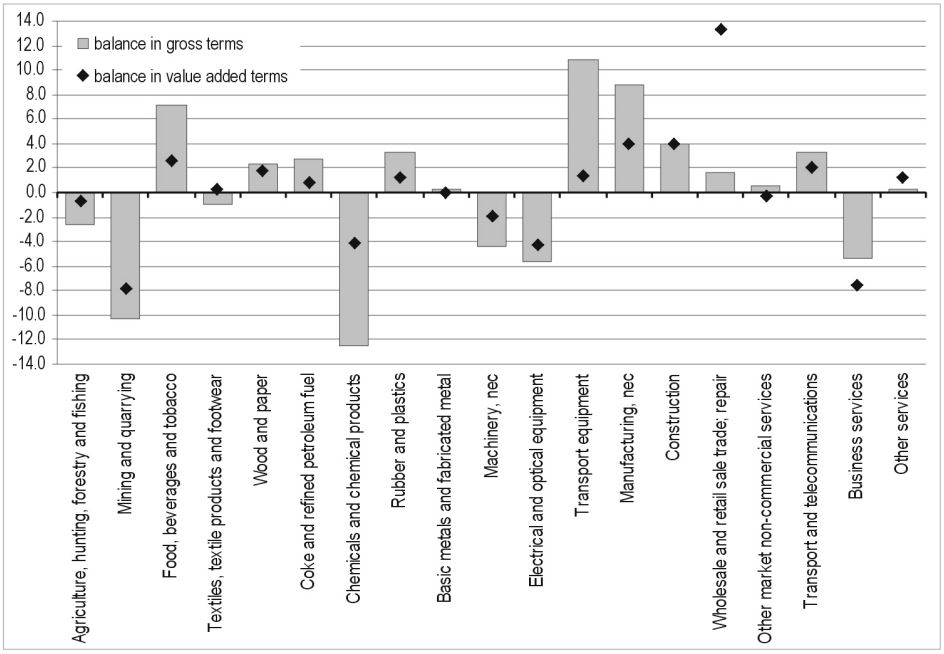

Figure 2. Balance in gross terms and in value added terms in Polish foreign trade by sector in 2011, in US$ billion

Source: Own calculations based on WIOD data.

specific groups of goods and services computed on the basis of value added statistics was lower than the respective value based on statistics in gross terms. According to traditional statistics, in 2011 Poland enjoyed the greatest surplus in trade in transport equipment, at US$ 10.8 billion. In value added terms, the surplus was several times lower, at US$ 1.4 billion. The gap stemmed from a high foreign value added content of Polish exports of transport equipment and from the relatively important role of services in the manufacture of such goods. Value added in the form of various services in the production of vehicles was registered in traditional trade statistics as the value of goods. It also concerned other industries, e.g. the manufacture of machinery and equipment. Hence, in value added terms Poland had the highest surplus in trade in services such as wholesale and retail trade and the repair of vehicles. In 2011 its value was US$ 13.3 billion, against a surplus of merely US$ 1.6 billion in gross terms.

Conclusions

The making available in 2012–2013 of databases containing world input–output tables (e.g. WIOD) was a significant advancement in research on international trade. It allowed to compile statistics of value added flows between countries. Those statistics take account of the contribution of particular countries to the creation of value added and eliminate the multiple calculation of such goods in trade – first as components (intermediate goods) and then as parts of final goods. Therefore, the assessment of the benefits of Poland's trade with individual countries or in specific groups of goods and services tends to differ depending on whether it is made on the basis of value added statistics or traditional statistics. Such differences mostly stem from the scale of trade in intermediates which is not included in value added statistics.

Although they have many merits, the world input–output tables also involve a number of shortcomings. First, despite the ongoing work on updating the database, the most recent data available are those for 2011. Secondly, it covers 35 economic sectors, including 14 manufacturing industries. It limits the level of detail in trade analyses conducted. Thirdly, the construction of a world input–output table required the adoption of a number of assumptions and the application of many additional estimates, e.g. of differences between the values of exports expressed in FOB prices and those of imports at CIF prices.

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