**ORIGINAL ARTICLE**

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# Changes in comparative advantages of the Polish food sector in world trade

**Abstract**
**Research background:** The period after Poland's accession to the European Union is a period of systematic development of Polish foreign trade in food products. Positive changes were visible already in the first year, but trade turnover and the balance of food exchange were even more dynamic in the subsequent years of Poland's membership in the EU.
**Purpose of the article:** One way to assess the competitiveness of Polish food sector is the analysis of comparative advantages (relative) in the trade of products of this sector. So the aim of the presented research is to assess the comparative ad-vantages of the Polish food sector (including its most important chapters).
**Methods:** The analysis of comparative advantages was based on relative trade advantage index (RTA) and the Lafay trade balance index (TBI). The analyses cover the years 2004–2017. The data source was the WITS-Comtrade trading database, in which trade flows are expressed in USD. The analysis was carried out at the HS chapter level.
**Findings & Value added:** The analysis of comparative advantages in the Polish trade in food products showed that during the membership in the European Union Poland had relative comparative advantages in the food trade on the world market. In the years 2004–2017 Polish export in agri-food products increased more than 4.5 times and the positive balance of trade in these products increased more than 9.0 times. Products in trade of which Poland had comparative advantages in 2017 accounted for 55.5% of trade of the Polish agri-food sector in the global market, i.e. by 12.8% more than in the year of accession of Poland to the EU. The dynamic development of trade in food products after Poland's accession to the EU, as well as significant comparative advantages in trade in these products, testify to the competitiveness and high importance of the Polish food sector for the national economy.

## Introduction

Foreign trade is one of the most important factors shaping international relations and determining the economic development of states. The value of global trade is growing much faster than global gross domestic product. As a result, the share of foreign trade in creating national income is steadily growing. The economic history knows many examples of the dynamic development of states and economic sectors, resulting from intensive trade with foreign countries. Trade is also conducive to improving the labour productivity and innovation, which translates into the increased level of employment, salaries and prosperity. It is, therefore, in the interest of individual states to build a strong competitive position in trade in commodities and services, as this contributes to increasing the value of trade and thus the level of openness of the economy. This international dimension of competition is the reason why entities participating in the market and competing for the benefits of participating in international trade are facing new challenges, and the conditions under which they operate are more and more difficult. This also applies to the food sector in Poland.

One way of assessing the competitiveness is to analyze comparative (relative) advantages in trade according to the approach by Balassa (in this approach, according to many economists, these are rather competitive advantages). The results of the comparative advantage account may be treated as an approximate assessment of the given sector's ability to compete in international trade and, at the same time, as a basis for assessing its international competitive position, because it is the ex post approach, referring to its measurement it in the past (Szczepaniak, 2017, p. 80).

The objective of the article is to assess the changes of comparative advantages in trade in Polish agri-food products in the global market (by most important product groups).

The article is composed of the introduction, four chapters, and a discussion and conclusion. The first chapter contains the literature review, highlighting and describing two main types of comparative advantages in international trade. The next chapter discussed the research method applied, i.e. the formula and interpretation of the relative trade advantage index (RTA) and the Lafay trade balance index (TBI). The third chapter shows the development of trade in agri-food products during the Polish membership in the European Union. The fourth chapter, in turn, contains the results of the analysis of Polish comparative advantages in trade in food product in the global market, carried out based on both above-mentioned indicators. The article is ended with a discussion and a conclusion, which contain the

most important findings stemming from the studies carried out and also suggestions for future analyses in this area.


## Literature review

Introduction into the theory of international trade, so-called the theory of comparative (relative) costs took place at the beginning of the 19th century. It is believed to have been done for the first time by Ricardo in his paper, published in 1817, entitled On the Principles of Political Economy and Taxation. According to Ricardo, the possibilities of favourable international specialisation exist in conditions of absolute differences between two countries as regards production costs expressed by labour inputs and also when one of these countries produces its commodities cheaper/more expensively than the other. A sufficient rationale for developing specialisation and international trade is the existence of relative differences in production costs measured by labour inputs. The point is that when country A has the absolute advantage over country B in the production of two commodities, it should specialize in the production and export of this commodity which it can produce relatively cheaper than country B, i.e. of this commodity, where its advantage over country B, as measured by labour inputs, is relatively the highest. At the same time, country B should specialize in the production and export of the commodity for which the unfavourable position of this country is revealed to the lowest extent possible (Misala, 2005, p. 34).

This traditionally recognised principle of relative costs may also be formulated in a slightly different way, i.e. differences in production costs, expressed by labour inputs, can be replaced by differences in the labour productivity. In this approach, the driving force of international trade is the diversification of labour productivity among individual countries. In other words, specialization in this field of production, where country A has the relative advantage in the labour productivity over country B is always favourable, while specialization in this field in which the given country does not have the relative advantage in the labour productivity over its business partner is unfavourable (Misala, 2005, p. 34).

According to the Ricardian model, trade between two countries can be favorable for these countries if each of them exports commodities in the production of which it has comparative advantages. The country has the comparative advantage in the production of a commodity when the alternative production cost per other commodities is lower in that country than in other countries. International trade results in increasing the global produc-

tion because it allows countries to specialize in producing commodities in which they have comparative advantages (Krugman & Obstfeld, 2007, pp. 42–44). In these circumstances, each country participating in international trade achieves benefits, i.e. the production volumes in each of these countries are higher than if there was no trade between them.

According to this theory, the given country can reap the benefits of foreign trade even if it does not have the absolute advantage in the production of any commodity. It is enough for it to have the relative advantage in the production of the selected commodity, so that it can be its exporter. Therefore, this theory does not compare unit production costs of the same commodity in two countries, but it compares the ratio of unit production costs of two selected commodities in two countries.

Although the evolution of comparative advantages in international trade has already been dealt with by the classics of economics (in addition to Ricardo, also by Torrens, Mill, Marshall), empirical studies on this issue were only started in the middle of the 60s of the 20th century. This was due to Balassa, who proposed a method to measure revealed comparative advantages in the export (Balassa, 1965, pp. 99–123). The Balassa-type comparative advantage results from applying the export volume criterion when compared to other fields and, at the same time, to foreign countries (Guzek, 2004, p. 49). Neither costs nor benefits are comparative in this approach, but the advantage of the given country over foreign countries (or of foreign countries over the country) (Guzek, 2004, p. 49). According to Balassa, high advantages can not only be revealed at the high profitability of the production and export of a given product group of the analyzed country, but also at their low profitability (or lack thereof). The development of export will be, in fact, supported by the high level of export already achieved in the past.

The analysis of comparative advantages in the Balassa approach can be treated as approximating the country's ability to compete in international trade, and also as a basis for assessing the current competitive position of this country and its changes in the past. For this reason, comparative advantages in this approach are rather competitive advantages (Misala, 2011, p. 166). The constantly developed theory by Balassa and the methods he proposed to study comparative advantages are used today in international competitiveness studies in the field of foreign trade and more widely understood international trade. This is as understandable as possible. In fact, the specific system of cost-price comparative advantages of the given country over foreign countries or the absence of these advantages largely determines the development of foreign trade of each country and, hence, the development of foreign trade (Misala, 2010, p. 19). However, more and

more often there are opinions that the theory of comparative costs in conditions of free international trade is slowly becoming useless (Schumacher, 2013, pp. 98–99).

Certainly, despite unquestionable values of the theory of comparative costs, the complexity of processes occurring in the modern economy is a reason for which the directions and intensity of changes in trade flows cannot be presented only by this single theory of international trade. In an attempt to answer why one country is more successful in exporting and is more competitive than another, it is necessary to look for new variables explaining trade (Szczepaniak, 2018a, p. 290).

**Research methodology**

The following indicators have been used in the analysis of comparative advantages: relative trade advantage index (RTA) and Lafay trade balance index (TBI). The former points to comparative advantages of the analyzed country in trade in a given product group in the specific market, as it includes both export and import. The RTA index used in the study is a difference between the natural logarithm of the relative export advantage index (RXA) and the natural logarithm of the relative import advantage index (RMA). The following formulas have been used in the calculations (Szczepaniak, 2018b, pp. 20–21):

$$RTA_{ij} = \ln RXA_{ij} - \ln RMA_{ij} \tag{1}$$

$$RXA_{ij} = \frac{\frac{X_{ij}}{X_{ijw}}}{\frac{X_j}{X_{jw}}} \tag{2}$$

$$RMA_{ij} = \frac{\frac{M_{ij}}{M_{ijw}}}{\frac{M_j}{M_{jw}}} \tag{3}$$

where:
$RTA_{ij}$ – relative trade advantage index of a given country in a product group i in the market j,
$RXA_{ij}$ – relative export advantage index of a given country of a product group i to the market j,
$RMA_{ij}$ – relative import advantage index of a given country of a product group i from the market j,

$X_{ij}$– export of a product group i to the market j by a given country,
$X_{ijw}$ – global export of a product group i to the market j,
$X_j$ – export of all product groups to the market j by a given country,
$X_{jw}$– global export of all product groups to the market j,
$M_{ij}$ – import of a product group i from the market j by a given country,
$M_{ijw}$ – global import of a product group i from the market j,
$M_j$ – import of all product groups from the market j by a given country,
$M_{jw}$ – global import of all product groups from the market j.

The positive value of the RTA index (higher than 0) indicates the occurrence of the revealed comparative advantage in the Polish trade in a given product group in a given market and indicates the intensity of that advantage, while its negative value (lower than 0) indicates that this advantage does not occur and therefore there is an unfavorable competitive situation. This index, when compared to the RCA revealed comparative advantage index, is more comprehensive, as it takes into account both the export and import situation of a given country.

The TBI is based on export and import flows of an analyzed country, and, in particular, on the nature of the trade balance. The surplus in trade of a given group of commodities is identified with having competitive advantages in the export of commodities from that group, while the deficit — with the absence of such advantages. The Lafay index has been calculated according to the following formula (Lafay, 1992, pp. 209–236):

$$TBI_{ij} = 100 \left( \frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}} - \frac{\sum_{i=1}^{n}\left(X_{ij} - M_{ij}\right)}{\sum_{i=1}^{n}\left(X_{ij} + M_{ij}\right)} \right) \frac{X_{ij} + M_{ij}}{\sum_{i=1}^{n}\left(X_{ij} + M_{ij}\right)} \tag{4}$$

where:
$TBI_{ij}$ – Lafay index in trade of a given country in a product group i (here: HS chapters) with a group of countries j,
$X_{ij}$ – export of a product group i to a group of countries j by a given country,
$M_{ij}$ – import of a product group i from a group of countries j by a given country j,
$n$ – number of groups of agri-food products (here: HS chapters 01–24).

The index is interpreted as follows: when it takes values higher than zero, it means that an analyzed country has the competitive advantage in the export of products belonging to a given group; if the value of the index is

lower than zero, there is a reverse situation, namely an analyzed country has no competitive advantage over foreign countries in the export of this product group. In other words, positive values of the index show that Poland has competitive advantages in the export over foreign countries, identified with the surplus of trade in products from a given group, while negative values show the lack of such advantages, and thus the deficit.

The total presentation of the RTA relative trade advantage index with the TBI trade balance index can be used to construct a matrix that allows to synthetically assess the competitive position of individual countries in trade in specific products or product groups in selected markets[1]. Depending on the level of held comparative advantages (RTA) and the level of trade balance (TBI), this matrix allows to distinguish four variants of the competitive position of a given country (Figure 1). By applying this method, individual groups of agri-food products have been positioned during the research procedure. The methodical approach applied allowed to assess the capacity of the Polish agri-food sector to compete in world trade.

## Results

*Changes in the results of trade in agri-food products*

During the period of Polish membership in the European Union there has been a dynamic increase in foreign trade in agri-food products (Figure 2). The upward trend has already been revealed in the year of accession (2004), when Polish trade in agri-food products grew by almost 30% when compared to 2003. The value of trade, thanks to the persistent growth of both the export and import, was also growing in the following years. The exception was only 2009, when due to the economic slowdown caused by the global financial crisis, trade decreased by almost 11% when compared to the previous year[2]. In 2017, the total value of trade in Polish agri-food

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[1] The matrix of positioning products by level of comparative advantages and trade balance, as used in the study, has been partly modeled on the matrix built by Widodo (2009, pp. 57–81). However, in this study, the RSCA index (one of the RCA index modifications), used by Widodo to measure comparative advantages was replaced by the RTA index. It was considered to be more relevant in the case under consideration, as it applies both to the export and import situation of a given country. The second index used (TBI) remained the same. In this way, both competitiveness indicators are based on export and import flows.

[2] In the years 2015–2016, there was a decrease in trade, both of Poland in total and of the agri-food sector, expressed in USD, which resulted from the significant weakening of PLN and EUR in relation to USD. The data regarding Polish foreign trade, expressed in EUR and obtained from the Ministry of Finance, did not confirm that decrease.

products amounted to almost USD 49.6 billion, with the export reaching the level of USD 29.6 billion and the import — USD 20.0 billion. When compared to 2004, this means the increase in trade by more than 4 times, including the export — by 4.5 times, and the import — by more than 3.5 times. Since the accession of Poland to the EU, the positive balance of trade in agri-food products has also mostly increased (except 2008 and 2011). In 2017, the value of the trade balance exceeded USD 9.6 billion, which means that it was more than nine times higher than in 2004. In comparison, in the same period, the cumulative GDP growth rate, expressed at constant prices, amounted to approximately 163%[3]. The growth rate of the export and balance of foreign trade in agri-food products significantly exceeds the growth rate of GDP, thus confirming the export-oriented nature of the development of this sector of the economy in Poland.

In 2017, the most important product groups (HS chapters) in the agri-food export of Poland were: meat and offal, tobacco and tobacco products, dairy products, cereal products and pastry, various food preparations, meat and fish preparations, cocoa and cocoa preparations, fish and seafood, fruit and vegetable preparations and fruit and nuts. Those ten product groups accounted for 76.2% of the Polish agri-food export (Table 1). In the years 2004–2017, the export value of most agri-food product groups increased. In twelve HS chapters, there was an increase higher than the average, the highest in the case of: cereals, tobacco and tobacco products, fats and oils, coffee, tea and spices, meat and offal and cereal products and pastry. The degree of concentration of the Polish agri-food export to the global market increased, as in 2004 ten major commodity groups accounted for 74.6% of the export.

The most important commodity groups (HS chapters) in the agri-food import of Poland in 2017 were: fish and seafood, fruit and nuts, waste and animal feed, meat and offal, cocoa and cocoa preparations, various food preparations, dairy products, fats and oils, beverages, cereal products and pastry. The share of these ten product groups in the Polish agri-food import was 67.8% (Table 1). In the years 2004–2017, the import value of all agri-food product groups increased. In eleven HS chapters, the increase was higher than the average, being the highest in the following product groups: dairy products, other vegetable products, live animals, meat and offal, and cereal products and pastry. The degree of concentration of the Polish agri-food import remained at the similar level, as in 2004 ten major commodity groups accounted for 67.9% of imports.

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[3] CSO database: https://stat.gov.pl/wskazniki-makroekonomiczne/ (Access: 25.09.2018).

The balance of trade in agri-food products of Poland in total in 2017 was positive in the case of 13 HS chapters (in 2004 — 10 chapters), its highest value concerned trade in meat and offal, tobacco and tobacco products, cereal products and pastry, dairy products and meat and fish preparations. The largest deficit was generated by trade in fruit and nuts, waste and animal feed, fats and oils, fish and seafood.

The dynamic development of the agri-food industry during the period of Polish membership in the EU was therefore accompanied by a clear increase in the export commodity concentration and hence the export specialization. The observed changes in the export and import commodity structure also attest to the increasing commodity diversification of both trade flows, i.e. expansion of the product export offer and the import of new groups of commodities.

*Changes of comparative advantages in trade in agri-food products*

In 2017, the RTA relative trade advantage index in trade in agri-food products in Poland amounted to 0.32 in total, which means that Poland had relative comparative advantages in trade of those products in the global market and was therefore competitive in the market. However, the level of those advantages was slightly lower when compared to 2004 (0.36), which may point to a slight deterioration in the competitive position of Polish food producers in the global market (Table 2). From among 24 HS chapters covering agri-food products, RTA relative trade advantage indices higher than 0 occurred in 13 chapters, which accounted for a total of 66.9% of Polish trade in agri-food products. The highest RTA indices were recorded in product groups such as meat and fish preparations (1.95), tobacco and tobacco products (1.34), cereal products and pastry (0.90), meat and offal (0.89) and dairy products (0.79). From among five chapters with the highest share in Polish agri-food trade in total (meat and offal, tobacco and tobacco, dairy products, fish and seafood, cereal products and pastry), the RTA index below 0 occurred only in the case of fish and seafood (-0.30), which is related to the large role of import in supplying raw materials to this sector of the economy. In the years 2004–2017, changes in relative trade advantage indices in Polish agri-food trade in the global market were different. The RTA index increased in 12 of 24 HS chapters, most for cereals (by 2.17 points), followed by tobacco and tobacco products (by 1.16 points) and coffee, tea and spices (by 0.74 points). During the same period, this index significantly decreased in trade in other plant products (by 3.59 points), live animals (by 3.32 points) and dairy products (by 1.35 points).

From among the 24 most important groups of agri-food products, in 2017 TBI trade balance indices higher than 0 occurred in 9 chapters, which accounted for 55.5% of total Polish agri-food trade (Table 2). The highest TBIs were recorded in product groups such as meat and offal (4.07), tobacco and tobacco products (3.42), meat and fish preparations (1.97), cereal products and pastry (1.92) and dairy products (1.76). From among five chapters with the highest share in Polish agri-food trade in total, the TBI below 0 occurred only in trade in fish and seafood (-2.37), related to the large role of import in supplying raw materials to this sector. In the years 2004–2017, changes in trade balance indices in Polish agri-food trade in the global market were different. The TBI increased in 13 of 24 HS chapters, most for tobacco and tobacco products (by 3.76 points), cereals (by 2.28 points) and waste and animal feed (by 1.86 points). During the same period, this index significantly decreased in trade in live animals (by 2.93 points), dairy products (by 2.84 points) and vegetables (by 2.50 points).

Comparative advantages of Polish foreign trade in agri-food products (by HS chapters), measured jointly by the relative trade advantage index (RTA) and the trade balance index (TBI), show a very diversified situation in the cross-chapter of product groups (Figure 3 and 4). According to the assessment based on both of these indices, in 2017 the following product groups were competitive (RTA>0 and TBI>0): meat and offal, dairy products, cereals, meat and fish preparations, sugars and confectionery, cereal products and pastry, fruit and vegetable preparations, various food preparations and tobacco and tobacco products. However, Poland was not competitive (RTA<0 and TBI<0) in trade in: live animals, fish and seafood, live plants and cut flowers, fruit and nuts, coffee, tea and spices, seeds and oilseeds, vegetable extracts, other vegetable products, fats and oils, beverages and waste and animal feed. Trade in other product groups was only competitive when assessed based on one of the above indices, i.e. the RTA index (other animal products, vegetables, milling products, malt and starches, cocoa and cocoa preparations) and therefore no clear assessment of competitiveness was possible.

In 2017, the share of nine above-mentioned HS chapters, which, on a basis of both the RTA and the TBI, were considered to be competitive, in Polish agri-food trade amounted to 55.5%, while that of eleven uncompetitive departments — 33.1%. For comparison, in 2004, there were nine competitive and nine uncompetitive HS chapters and their share in trade of the Polish agri-food sector was 42.7% and 26.7%, respectively. From among nine competitive product groups in 2004, six maintained their position (meat and offal, dairy products, meat and fish preparations, sugars and confectionery, cereal products and pastry, fruit and vegetable preparations),

while three lost it (live animals, vegetables and other vegetable products). In the years 2004–2017, the competitive HS chapters were joined by cereals, various food preparations and tobacco and tobacco products.

Positive changes that have taken place during the analysed period in Polish agri-food trade consisted primarily in increasing the share in trade (up to 55.5%) of products in trade which there were comparative advantages in the global market (according to the assessment based on both above-mentioned indices). The number of chapters that could be considered competitive has remained unchanged, but the international competitive position of products belonging to those chapters has increased substantially. The second phenomenon which became visible in the years 2004–2017 was the clear polarisation of trade in product groups characterised by comparative advantages in global trade and those without such advantages.

## Discussion

The article assessed comparative advantages of the Polish agri-food sector in global trade. The analysis, which used the relative trade advantage index (RTA) and the trade balance index (TBI), shows that Poland has comparative advantages in trade in food in the global market. This study also reveals a very diversified situation by each product group. General conclusions are consistent with the results of other studies conducted in Poland (inter alia, Pawlak & Poczta, 2011, p. 145; Ambroziak, 2014, pp. 48–69; Szczepaniak & Tereszczuk, 2016, pp. 344–350). The studies on comparative advantages in the agri-food export of other EU countries contain the results of analyses using single comparative advantages indices (inter alia, Vacek & Smutka, 2017, pp. 432–438; Yurik, 2017, pp. 439–447) or, more rarely, standardized synthetic indices (e.g. Bojnec & Ferto, 2018, pp. 51–60). The methodical approach used in the presented study, i.e. the joint use of two indices based on export and import flows for positioning of individual agri-food product groups allowed to go beyond the framework of existing studies and more comprehensively assess the competitive position of the country (and its changes) in trade in certain product groups in the selected market. This approach is therefore an extension of the method for studying comparative advantages in sectoral terms (meso).

**Conclusions**

The analysis of comparative advantages in Polish agri-food trade has been carried out by means of positioning various food product groups according to the RTA relative trade advantage index and the TBI trade balance index, i.e. two ex post indices taking into account both the export and import situation of the country. The results of this analysis, supplemented by an analysis of basic flows of foreign trade, can be considered as an attempt to assess the sector's ability to compete in international trade, and, at the same time, as a basis for assessing its international competitive position.
The studies showed that, in the years 2004–2017, Polish trade in agri-food products increased more than four times, including the export — 4.5 times and import — more than 3.5 times. The positive balance of trade in food products increased more than 9.0 times in that period. Products in trade of which Poland had comparative advantages in 2017 accounted for 55.5% of trade of the Polish agri-food sector in the global market, i.e. by 12.8% more than in the year of accession of Poland to the EU.

The dynamic development of Polish trade in agri-food products and the increase in the indices measuring comparative advantages in foreign trade in the global market point to a clear improvement in the international competitiveness of Polish food producers. The Polish agri-food sector currently belongs to the most competitive sectors of the Polish economy. The improvement and strengthening of the competitiveness of Polish food producers were supported by appropriate transformations in the sector, which started in the early years of systemic transformation, became intensified during the preparations for the EU membership and then were stimulated by processes of the deepening economic and trade integration with the EU Member States. Threat to the development of the Polish agri-food trade can be further concentration of trade on the EU market, trade restrictions imposed by Russia, as well as the output of the UK from the EU without a contract (so-called hard Brexit). Studies on the international competitiveness of the Polish food sector, its measurement and its determinants will be continued.

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# Annex

**Table 1.** Foreign trade in agri-food products of Poland in 2004 and 2017, by HS chapters

| HS chapters | Export | | | | Import | | | | Balance | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2017 | 2017 | change | 2004 | 2017 | 2017 | change | 2004 | 2017 |
| | share in % | share in % | in million USD | 2004 = 100 | share in % | share in % | in million USD | 2004 = 100 | in million USD | in million USD |
| 01. Live animals | 4.2 | 0.4 | 112.1 | 41.1 | 1.5 | 3.7 | 733.8 | 893.9 | 190.7 | -621.7 |
| 02. Meat and edible meat offal | 11.9 | 17.2 | 5,090.3 | 658.2 | 5.4 | 8.7 | 1,746.5 | 594.2 | 479.5 | 3,343.8 |
| 03. Fish and seafood | 5.0 | 5.1 | 1,518.9 | 472.7 | 7.9 | 10.1 | 2,008.4 | 466.9 | -108.9 | -489.5 |
| 04. Dairy products | 10.9 | 8.9 | 2,620.0 | 369.9 | 1.7 | 5.2 | 1,039.3 | 1,146.1 | 617.7 | 1,580.7 |
| 05. Other animal products | 1.7 | 1.0 | 308.9 | 280.8 | 3.3 | 1.2 | 235.2 | 128.9 | -72.4 | 73.7 |
| 06. Live plants and cut flowers | 1.2 | 0.5 | 141.2 | 175.8 | 2.6 | 1.5 | 300.9 | 213.5 | -60.6 | -159.7 |
| 07. Vegetables | 8.2 | 3.4 | 1,004.4 | 190.0 | 3.6 | 3.9 | 770.5 | 396.2 | 334.2 | 233.9 |
| 08. Fruit and nuts | 8.3 | 3.9 | 1,157.8 | 215.7 | 12.7 | 9.1 | 1,814.8 | 262.1 | -155.8 | -657.0 |
| 09. Coffee, tea and spices | 1.1 | 1.9 | 556.1 | 773.3 | 4.3 | 3.7 | 733.3 | 311.6 | -163.4 | -177.1 |
| 10. Cereals | 0.7 | 3.2 | 947.4 | 2,104.6 | 4.1 | 2.0 | 394.1 | 176.4 | -178.5 | 553.3 |
| 11. Milling products, malt and starches | 1.1 | 1.0 | 306.8 | 441.6 | 2.0 | 1.1 | 213.8 | 191.3 | -42.3 | 93.0 |
| 12. Oil seeds and oleaginous fruits | 2.1 | 1.3 | 390.1 | 283.9 | 2.7 | 3.3 | 664.6 | 451.3 | -9.8 | -274.5 |
| 13. Vegetable extracts | 0.1 | 0.1 | 20.7 | 332.6 | 0.9 | 0.5 | 99.1 | 207.0 | -41.6 | -78.4 |
| 14. Other vegetable products | 0.1 | 0.0 | 1.8 | 47.3 | 0.1 | 0.2 | 33.2 | 1,143.4 | 1.0 | -31.4 |
| 15. Animal or vegetable fats and oils | 0.8 | 1.5 | 449.4 | 898.0 | 5.8 | 5.1 | 1,018.2 | 319.3 | -268.8 | -568.8 |
| 16. Meat and fish preparations | 4.6 | 5.3 | 1,569.1 | 529.3 | 1.3 | 1.2 | 242.3 | 353.3 | 227.9 | 1,326.8 |
| 17. Sugars and confectionery | 5.2 | 2.8 | 843.1 | 250.6 | 2.2 | 2.1 | 411.2 | 347.7 | 218.2 | 431.9 |
| 18. Cocoa and cocoa products | 5.0 | 5.3 | 1,570.5 | 482.9 | 5.6 | 6.1 | 1,224.3 | 403.8 | 22.0 | 346.2 |
| 19. Preparations od cereals and parstrycooks' products | 5.9 | 8.5 | 2,510.1 | 656.5 | 3.3 | 4.5 | 897.8 | 495.5 | 201.1 | 1,612.3 |
| 20. Fruit and vegetable preparations | 8.4 | 4.5 | 1,319.5 | 241.4 | 3.9 | 3.8 | 761.0 | 361.2 | 335.8 | 558.5 |
| 21. Miscellaneous edible preparations | 5.8 | 6.2 | 1,825.0 | 485.3 | 7.2 | 5.6 | 1,120.2 | 283.6 | -18.9 | 704.8 |
| 22. Beverages and spirits | 2.9 | 2.9 | 868.0 | 457.9 | 3.9 | 4.6 | 917.4 | 436.2 | -20.8 | -49.5 |
| 23. Residues and prepared animal fodder | 2.4 | 3.8 | 1,111.2 | 712.1 | 11.0 | 8.8 | 1,748.8 | 291.4 | -444.2 | -637.7 |
| 24. Tobacco and tobacco products | 2.5 | 11.3 | 3,340.5 | 2,096.7 | 3.1 | 4.2 | 836.9 | 489.6 | -11.6 | 2,503.6 |
| Agri-food products | 100.0 | 100.0 | 29,583.1 | 456.3 | 100.0 | 100.0 | 19,965.8 | 366.1 | 1,030.5 | 9,617.3 |

Source: own calculations based on the WITS-Comtrade data.

**Table 2.** RTA and TBI indices in foreign trade in agri-food products of Poland in 2004 and 2017, by HS chapters

| HS chapters | RTA indices | | | TBI indices | | | Share of the chapter in agri-food trade in 2017 in % |
|---|---|---|---|---|---|---|---|
| | 2004 | 2017 | change in the years 2004–2017 in points | 2004 | 2017 | change in the years 2004–2017 in points | |
| 01. Live animals | 1.31 | -2.01 | -3.32 | 1.34 | -1.59 | -2.93 | 1.7 |
| 02. Meat and edible meat offal | 1.08 | 0.89 | -0.19 | 3.24 | 4.07 | 0.83 | 13.8 |
| 03. Fish and seafood | -0.01 | -0.30 | -0.29 | -1.46 | -2.37 | -0.91 | 7.1 |
| 04. Dairy products | 2.14 | 0.79 | -1.35 | 4.60 | 1.76 | -2.84 | 7.4 |
| 05. Other animal products | -0.31 | 0.11 | 0.42 | -0.82 | -0.06 | 0.76 | 1.1 |
| 06. Live plants and cut flowers | -0.40 | -0.87 | -0.47 | -0.67 | -0.50 | 0.17 | 0.9 |
| 07. Vegetables | 1.18 | 0.22 | -0.96 | 2.28 | -0.22 | -2.50 | 3.6 |
| 08. Fruit and nuts | 0.05 | -0.36 | -0.41 | -2.19 | -2.49 | -0.30 | 6.0 |
| 09. Coffee, tea and spices | -0.99 | -0.25 | 0.74 | -1.59 | -0.86 | 0.73 | 2.6 |
| 10. Cereals | -1.46 | 0.71 | 2.17 | -1.69 | 0.59 | 2.28 | 2.7 |
| 11. Milling products, malt and starches | -0.47 | 0.26 | 0.73 | -0.49 | -0.02 | 0.47 | 1.1 |
| 12. Oil seeds and oleaginous fruits | 0.20 | -0.59 | -0.79 | -0.29 | -0.97 | -0.68 | 2.1 |
| 13. Vegetable extracts | -1.80 | -1.61 | 0.19 | -0.39 | -0.21 | 0.18 | 0.2 |
| 14. Other vegetable products | 0.82 | -2.77 | -3.59 | 0.00 | -0.08 | -0.08 | 0.1 |
| 15. Animal or vegetable fats and oils | -1.57 | -0.93 | 0.64 | -2.52 | -1.72 | 0.80 | 3.0 |
| 16. Meat and fish preparations | 1.61 | 1.95 | 0.34 | 1.65 | 1.97 | 0.32 | 3.7 |
| 17. Sugars and confectionery | 1.19 | 0.66 | -0.53 | 1.50 | 0.38 | -1.12 | 2.5 |
| 18. Cocoa and cocoa products | 0.27 | 0.28 | 0.01 | -0.27 | -0.40 | -0.13 | 5.6 |
| 19. Preparations od cereals and parstrycooks' products | 0.85 | 0.90 | 0.05 | 1.28 | 1.92 | 0.64 | 6.9 |
| 20. Fruit and vegetable preparations | 1.10 | 0.47 | -0.63 | 2.27 | 0.31 | -1.96 | 4.2 |
| 21. Miscellaneous edible preparations | 0.10 | 0.39 | 0.29 | -0.72 | 0.27 | 0.99 | 5.9 |
| 22. Beverages and spirits | 0.04 | -0.12 | -0.16 | -0.46 | -0.80 | -0.34 | 3.6 |
| 23. Residues and prepared animal fodder | -1.16 | -0.55 | 0.61 | -4.27 | -2.41 | 1.86 | 5.8 |
| 24. Tobacco and tobacco products | 0.18 | 1.34 | 1.16 | -0.34 | 3.42 | 3.76 | 8.4 |
| Agri-food products | 0.36 | 0.32 | -0.04 | × | × | × | 100.0 |

Source: own calculations based on the WITS-Comtrade data.

**Figure 1.** Positioning of products by the level of comparative advantages and export-import relations

| | **Group B** Comparative advantages Net importer (RTA > 0 i TBI < 0) | **Group A** Comparative advantages Net exporter (RTA > 0 i TBI > 0) |
|---|---|---|
| RTA > 0 | | |
| RTA < 0 | **Group D** No comparative advantages Net importer (RTA < 0 i TBI < 0) | **Group C** No comparative advantages Net exporter (RTA < 0 i TBI > 0) |
| | TBI < 0 | TBI > 0 |

Source: own study based on Widodo (2009, p. 57–81).

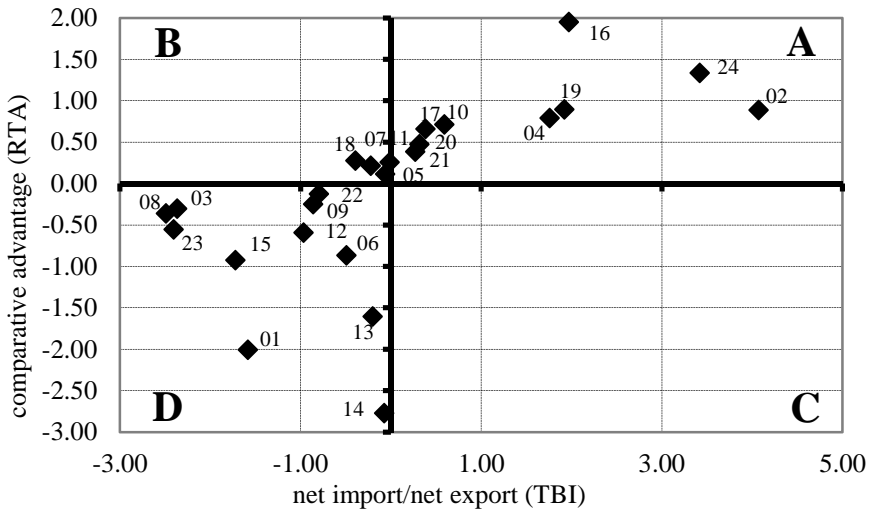**Figure 2.** Foreign trade in agri-food products of Poland in the years 2004–2017, in million USD
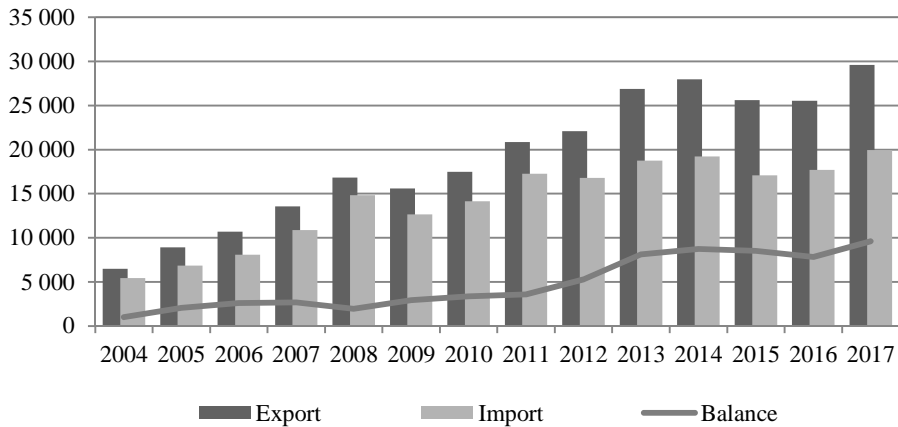


Source: own calculations based on the WITS-Comtrade data.

**Figure 3.** Positioning of agri-food products by the level of comparative advantages and export-import relations in 2004, by HS chapters
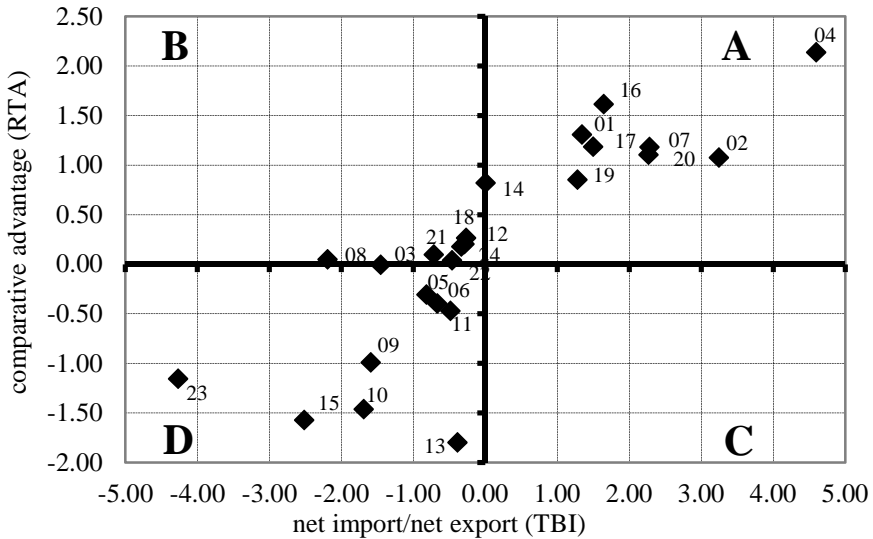
**Figure 4.** Positioning of agri-food products by the level of comparative advantages and export-import relations in 2017, by HS chapters