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Evaluation of the competitiveness of fresh tomato

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Summary: The existence of international trade and related trade theory are closely related to competitiveness. The following study focuses on the competitiveness of Hungary, which studies the development of comparative advantage in terms of tomato for fresh consumption among horticultural products. As a consequence, the main objective is whether Hungary has comparative advantage over EU-28 countries in case of fresh market tomato. Data in the study were provided by FAOSTAT database. The study period focuses on results from 2004 to 2019, breaking them down into 5-year (average) cycles. The method chosen was the RCA index group, the most widely recognized and applied index group for calculating comparative advantage. Although Hungary is not a significant vegetable-producing country in Europe, the fruit and vegetable sector accounts for 10-13% of the production value of agriculture. Regarding the results, it can be stated that Hungary does not have comparative advantage in case of tomato products. With respect to values of the tomato sector, the RCA index is in the range of $0<RCA\leq1$, therefore we have no comparative advantage. Spain and the Netherlands have stable competitive advantage. These countries show weak comparative advantage in each period studied, as the indicator values exceed 1 but do not reach 2.

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Key words: RCA, EU, vegetable, sales, comparative advantage

Introduction

In Hungary's agriculture, the fruit and vegetable sector is less dominant, representing a few percent in terms of its agricultural area, but it is not a negligible sector in terms of labour use.

Agriculture, forestry, and fishing accounted for 4.0% of the gross added value of the Hungarian economy. According to preliminary data of the Hungarian Central Statistical Office, the total gross output of agriculture increased by 4.1% (HUF 2,953 billion) in 2020. While there is a decrease in production volume (2.1%), prices increase by 6.3%. The volume of crop production decreased by 2.9%. It can be concluded that the yield of cereals decreased (11%), the yield of horticultural products decreased, as well, by 0.6% and all of the most important fruit species were affected by the decrease. 10-13% of the production value of agriculture comes from the fruit and vegetable sector, which is tantamount roughly to HUF 250-300 billion at the level of primary product output but may reach HUF 600 billion in commodity value. The foreign trade balance of the sector is positive, approximately HUF 50-60 billion (Fruitveb, 2021).

With respect to data on the foreign trading of goods in Hungary, it can be concluded that the value of imported products exceeded EUR 104 billion in 2019. Machinery and transport equipment accounted nearly for the half (48.5%), followed by processed products with 36.1%. Energy accounted for 8.0%, food, beverages, and tobacco for 5.3%, followed by raw materials for 2.1%. Horticultural products accounted for 0.8% (EUR 870 million) of the total domestic imports, while food products accounted for 15.7% of the beverages and tobacco group (KSH, 2019). Looking at previous years, the share of horticultural products increased steadily, by 63% (EUR 340 million) compared to the initial period. The export, i.e., export side, showed a similar trend. In 2019, the export value of the total domestic product turnover was EUR 109 billion. The largest volume of products was exported from the group of machinery and transport vehicles (57.4%), followed by the value of processed products (30.7%), followed by the food, beverages, and tobacco group with 6.9%. energy and raw materials ranked the last two places, with a rough share of 2%. The value of horticultural products was EUR 912 million, representing a share of 0.8% (KSH, 2019).

The main objective of this study is to determine whether Hungary has comparative advantage over EU-28 in case of fresh market tomato. The studies required to achieve this objective are based on the Balassa index and related index groups.

Materials and methods

Competitiveness is one of the key performance indicators of national economies. The definition of competitiveness may also depend on the level at which it is interpreted and examined. In a micro-level approach, the situation is simpler, as it is “the ability of firms to produce goods continuously and profitably that meet the requirements of an open market economy in terms of price and quality (Domazet, 2012)”, found in Jámbor’s (2019a) study on competitive advantage. The existence of international trade and related trade theory is closely related to competitiveness. Writings of Ricardo (1817) are about comparative advantages. The related theories and measurement possibilities were further elaborated by Jámbor in 2016.

To achieve this objective, it was necessary to delve into foreign trade data. During the study, relevant literature was reviewed to find out the measurement options and previously published results. The European Union and Hungarian statistical information related to the study, as well as the statistical background database were provided by the Food and Agriculture Organization of the United Nations (FAO), the Statistical Office of the European Communities (Eurostat) and the Central Statistical Office (KSH).

The most common methodology for measuring comparative advantages related to competitiveness is the Balassa index, which, although widely criticized, is still the most widely used indicator (Fertő, 2006). The method used in the research is the RCA index group (Revealed Comparative Advantage). The indicator was first published by Balassa (1965) with the following formula:

$$B_{ij} \text{ or } RCA_{ij=} \left(\frac{X_{ij}}{X_{it}}\right) / \left(\frac{X_{nj}}{X_{nt}}\right)$$

Where X is export,
i, a particular country,
j, a particular product,
t, a particular product group,
n, a group of countries.

The value of the indicator varies from 1 to infinity, but if the value of the indicator is between 0 and 1, the country under study has no comparative advantage. According to Bowen (1983), the classical B-index itself is not suitable for measuring comparative advantage, as it does not consider trade distortions and economic policy measures. The Balassa index was supplemented by Vollrath (1991) with the creation of 3 new indexes for the import side. The indexes mentioned are as follows:

Revealed trade advantage (RTA) index: $RTA_{ij=} RXA_{ij} - RMA_{ij}$

where $RMA_{ij} = RCA_{ij}$ or B_{ij},

where $RMA_{ij}=\left(\frac{m_{ij}}{m_{it}}\right) / \left(\frac{m_{nj}}{m_{nt}}\right)$

where m=import value

This is the import side of the Balassa index. In case of a value above 0, the higher the value, the more competitive the area under study.

- Logarithm of the relative export advantage index (lnRXA)
- Relative comparative (RC) index:

$$RC_{ij}=\ln RXA_{ij} - \ln RMA_{ij}$$

The summary of Fertő (2006) is as follows. The measurement of comparative competitive advantage is completed by applying four indicators above. The indicators are based on the following values. A country has competitive advantage over a country or group of countries if conditions B (or RCA)>1 or RTA>0 and/or lnRXA>0 and/or RC>0 are met. Otherwise, it has comparative disadvantage.

This index has been used in several sectors to measure foreign trade performance. Jámbor (2019) examines competitiveness of the global grain trade, and the analysis of this field is a novelty at an international level, as well. His study found that Argentina, Ukraine, and Canada have the most significant competitive advantage. The competitiveness and comparative advantage of agriculture were measured by Fertő – Hubbard (2001), who examined 21 product groups, according to which the product group "vegetables and fruits" had comparative advantage in Hungary between 1992 and 1998 in the European Union. In 2004, Bozsik measured competitiveness in agricultural, as well. Fertő (2006) focused on comparative advantages in agriculture, but in this study at a more detailed product group level.

Basic data applied to calculate the RCA index were provided by the foreign trade collection of FAOSTAT international database. The export and import values of one of the most important vegetables competing for greenhouse surface (tomato) expressed in USD, were determined between 2004 and 2019. Adapted to the objective, the group of countries chosen is all the countries of the European Union and the product group is the category of vegetables. In addition, the most important producing, exporting, or importing countries in the European Union have been identified on the basis of the Eurostat and Faostat databases and are part of the analysis below.

Results and discussion

Statistics on vegetable production and trade – the European Union

The average vegetable production area of EU-28 exceeded 2 million hectares in 2015-2019. The harvest is an average of 60 million tons of vegetables over five years, according to Faostat. On average, the largest vegetable producer in 2015-2019 was Spain, which produces almost 22% of the EU's total vegetable quantity, but Italy, the Netherlands, Poland, and France are also significant, which together account for 66.5% of the total (40.1 million tons). Hungary ranks 12th, with a share of 2.9%, or 1.9 million tons of vegetables (Faostat, 2021).

Trade in vegetables between EU-28 Member States has developed as follows. In 2019, TOP5 countries accounted for 64.9% of the total import value (USD 37 billion). Hungary ranks 18th with a share of 0.9%, which means USD 314 million. Without exception, an increasing value of imports can be observed in countries studied. Germany has outstanding data in the category, producing significant import values in each of the periods observed, 37-55% and 65% higher than the United Kingdom. The United Kingdom and France imported almost the same quantity; the import side of their trade is considered stable. The Netherlands and Belgium are significantly lagging behind the top countries, but still imported USD 1.5-2.0 billion worth of vegetables.

Examining the export side of the vegetable trade in the same periodic breakdown, the list of largest countries has changed compared to imports. On the export side, EU-28 countries exported USD 36 billion worth of vegetables. TOP5 country still had a significant share in 2019. Nearly 80% of the total export value (USD 28 billion) is theirs. Hungary is not among the top 10 countries in this ranking either, lagging slightly behind in the year under study with a value of USD 580 million. Competition between Spain and the Netherlands is relatively balanced, with respect to averages from previous years. The Netherlands exported 7-5-6 % less of vegetables than Spain at the first place. The values of other countries (Italy, Belgium, and France) can be considered relatively stable based on the results, they have exported the same value in the last two periods (USD 4 billion, 3 billion and 2 billion).

Table 1. The Balassa index (RCA) of countries studied between 2004 and 2019.

Country	2004-2009 average	2010-2014 average	2015-2019 average	2004-2019 average
Hungary	0.03	0.07	0.08	0.06
Spain	1.32	1.19	1.04	1.19
The Netherlands	1.79	1.77	1.86	1.81
France	0.71	1.13	1.39	1.05
Greece	0.02	0.12	0.14	0.09
Belgium	0.76	0.67	0.80	0.75
Italy	0.49	0.46	0.35	0.44
Germany	0.32	0.24	0.21	0.26
United Kingdom	0.19	0.16	0.14	0.16
Poland	0.47	0.49	0.42	0.46

Source: FAO 2021 data, own edition

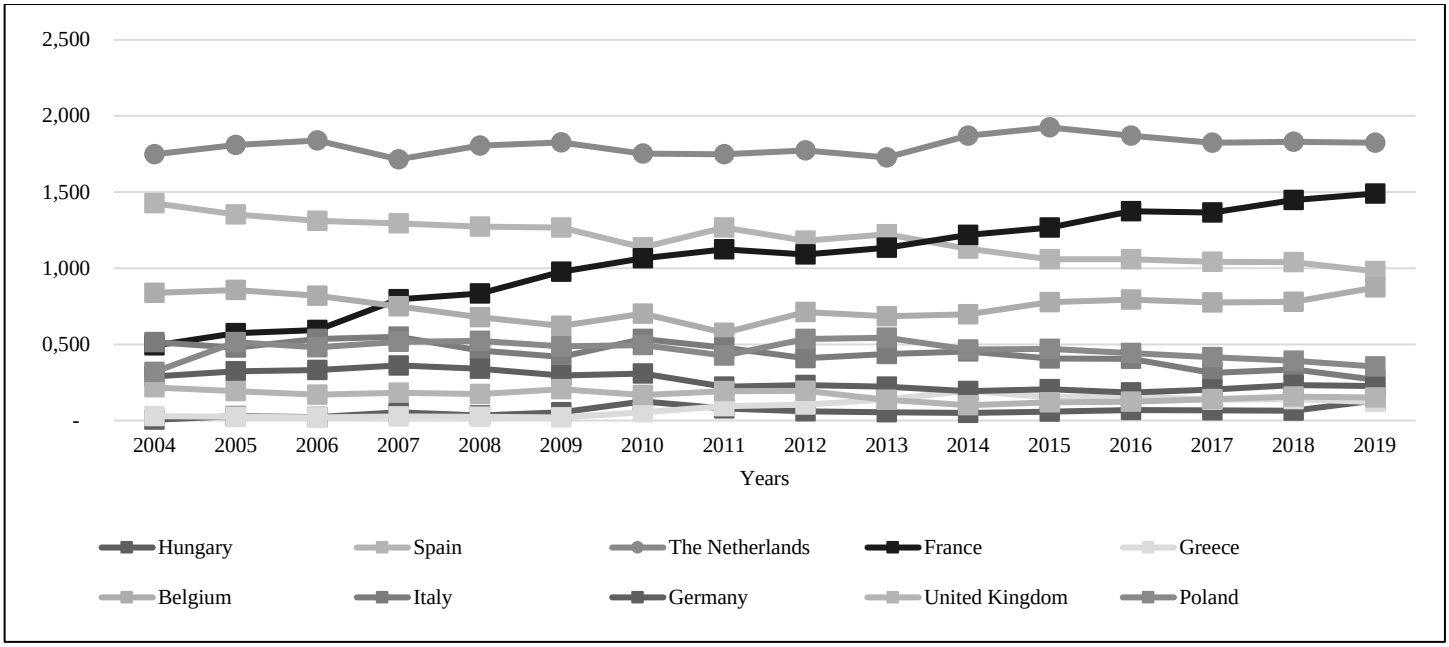

Figure 1. The Balassa index of countries studied between 2004 and 2019. Source: FAO 2021 data, own edition.

Table 2. Values of additional indicators for the period 2004-2019.

Country	Values of additional indicators for the period 2004-2019				
	RMA	**RTA**	**ln RXA**	**ln RMA**	**RC**
Hungary	0.78	-0.72	-1.30	-0.12	-1.19
Spain	0.48	0.71	0.07	-0.34	0.41
The Netherlands	0.82	0.98	0.26	-0.09	0.35
France	0.98	0.07	0.00	-0.01	0.01
Greece	0.56	-0.47	-1.17	-0.27	-0.90
Belgium	0.51	0.24	-0.13	-0.30	0.17
Italy	0.53	-0.10	-0.37	-0.28	-0.09
Germany	1.30	-1.04	-0.59	0.11	-0.71
United Kingdom	1.03	-0.87	-0.79	0.01	-0.81
Poland	1.50	-1.04	-0.34	0.17	-0.52

Source: FAO 2021 data, own edition

The study of relative comparative advantage for tomato

In case of literature, it can be stated that relatively few publications and analyses are available on the structure of the vegetable market. However, it is also significant that, although few studies on competitiveness have been carried out specifically for this sector, several researchers in the agricultural sector found that some countries have comparative advantage over vegetables.

Although Hungary is not considered a country of great importance for vegetable production in the European Union, it is still of great importance for agriculture. The fruit and vegetable sector accounts for 10-13% of the production value of agriculture. The aim of the study is to examine the competitiveness of the tomato sector in EU-28, looking for the answer whether Hungary has comparative advantage in case of these vegetables and how competitiveness of the most significant countries has developed. To achieve this, I calculated the Balassa index, which are presented below. The study period was from 2004 to 2019, which I divided into three periods. It can be seen from ***Table 1*** that Hungary does not have comparative advantage in case of tomato.

The RCA index is in the range of 0 <RCA≤1, therefore Hungary has no comparative advantage. Spain and the Netherlands have stable competitive advantage. These countries show weak comparative advantage in each period studied, as the indicator values exceed 1 but do not reach 2. With regard to France, the country had comparative advantage over EU-28 on average in 2015-2019 and 2010-2014, but still had a comparative disadvantage in 2004-2009. ***Figure 1*** shows the evolution of the Balassa index between 2004 and 2019, which indicates that most of the countries studied have comparative disadvantage in terms of tomato.

In case of Belgium, however, we can see that the value of the indicator has been steadily rising since 2015, and in this trend, they can generate comparative advantage from the previous disadvantage this year. Additional indexes were added during the study of competitive advantage, which are additions to the Balassa index. The RTA, i.e., the relative trade advantage index, supports comparative disadvantage in of Hungary in the periods studied and in comparison, with EU-28 countries. It recorded a negative value in each period. Thus, the result of the Balassa index is also backed by the value of the RTA index. The logarithm of the ln RXA, or relative export benefit index, supports the trade disadvantage recognized so far with a negative value. Furthermore, the RC index (relative competitiveness index) showed a negative value of around 1 (***Table 2***).

The Balassa index, supplemented by these three indexes, was found to be proper for studying the competitiveness of a given country. All in all, in case of tomato products, considering all four studied indicators, Hungary has comparative disadvantage compared to the EU countries, which is largely due to low exports and imports. As a result, we are not competitive enough in the international market. The indicators above have also been developed for other countries studied, which support the findings concluded so far with regard to possible competitive advantages and disadvantages. However, as a result of the study, it can be concluded that Hungary, France, and Greece increased significantly, while the Netherlands increased at a slower pace in terms of the competitiveness indicator. Spain's B-index values, which otherwise has competitive advantage, showed a decline, but still maintained its comparative advantage. A decrease can be observed for Italy, Germany, and the United Kingdom. Indicators for Belgium and Poland are stagnant in the periods under study. In addition, standard deviations were found for each country and each year (including periods), which were significantly low for each country. The low value shows the stability of foreign trade, consequently, no significant fluctuations can be observed between years.

Conclusions

The results showed that Hungary did not have comparative competitive advantage in the tomato sector compared to EU-28. The values of the Balassa index were significantly lower than the expected value above 1, which represents a comparative competitive advantage. Other indicators in the index group support the conclusion reached by the B-index. The development of the RTA and RMA indexes was also below the expected value. Between 2004 and 2019, the result of the RMA index in Hungary was 0.78, while the result of the RTA was -0.72. Overall, we had comparative competitive disadvantage in case of the most significant forced vegetable species in the period 2004-2019 compared to the group of countries studied. The study showed stability in foreign trade over the years, as standard deviations were low. In the tomato sector, only Spain and the Netherlands had a lasting comparative advantage, with a B-index value above 1 in each year of the period under review. Additional indices also confirmed the comparative advantage. France had a comparative competitive advantage in only two investigation periods (2015-2019; 2010-2014).

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