

## Changes in the Slovak Plum Production and its Competitiveness on the Single Market

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### Abstract

The article identifies the importance and development of production and related competitiveness in the EU single market of plum production in the Slovak Republic in the time horizon from Slovakia's accession to the EU until 2020. The research results show an overall positive development in the area of plum orchards (18% increase), which is in contrast to the overall development of the area of orchards in the Slovak Republic (7.12% decrease). However, the changes in the area under cultivation are not reflected in the increase in production (decrease of 45.22%) during the period under study. This fact was also reflected in the volatility of the identified competitiveness of Slovak plum production on the EU Single Market during the period under review. The trade balance was positive only to a limited extent in 2008 and 2009. Nevertheless, the measured RCA values point to a more significant degree of competitiveness of Slovak plum production on the EU single market, with a positive trend between 2008 and 2015. However, there is a decline in competitiveness after 2015, when this negative trend could not be reversed until the end of the period under consideration. In order to reverse this negative trend, further targeted measures will be necessary in the future, both in terms of policies, modernisation processes and improved agrotechnical practices.

### Keywords

Fruit, plums, competitiveness, single market.

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### Introduction

Agriculture has often been in the focus of researchers when studying its role in the economy, society or nature (Mizik, 2021). Although agriculture no longer plays a significant role in the composition of GDP in developed countries, there are available research results that highlight the important position of this sector within the world and national economy (Johnston and Mellor, 1961; Johnson, 1993; Gollin, Parente and Rogerson, 2002). Developed countries, including EU countries, support this sector to maintain its basic function in rural development (Potter, 2006).

There has always been an obvious interest in investigating the situation within the EU territory when dealing with the current situation of agriculture. The situation of the agricultural

sector is a common object of research from an economic, social or political point of view. The agenda of agriculture is usually investigated as the situation of trade within the EU countries (Szabo and Grznár, 2015; Szabo and Grznar, 2016; Špirková, Stehlíková and Zúbková, 2017, Hošková and Zentková, 2024.) or third countries and EU countries (Murray and Zolin, 2012). We can highlight the interest of researchers in EU countries in the area of overall productivity (Chrastinová and Burianová, 2009) or, more recently, sustainability (Kalinowska et al., 2022). On the other hand, the research objective is more focused on trade barriers when studying trade between third countries and EU countries (Elijah et al., 2017).

The competitive dynamics of agricultural products involve a complex interplay of technological,

economic, social and environmental factors. To enhance global competitiveness, countries need to prioritise investments in research and development, infrastructure and sustainable practices. Addressing challenges such as climate change and market volatility requires joint initiatives at national and international levels. This review provides a basis for policy makers, researchers and stakeholders to understand and navigate the constantly evolving terrain of agricultural competitiveness.

Research on agricultural and food competitiveness has undergone a significant change in terms of breadth and depth (Ball et al., 2010; Gorton, Davidova and Ratering, 2000). It is now not only a tool to identify changes in agri-food production and its competitiveness in less developed countries (Bouet et al., 2020; Esterhuizen et al., 2006), but also a tool to identify a contemporary role of the agri-food industry within developed countries (Nowak and Kaminska, 2016; Nowak, Rozanska-Boczula and Krukowski, 2020).

A new research object emerged after the V4 countries (Czech Republic, Hungary, Poland and Slovakia) joined the EU. The accession of these countries was part of the largest enlargement of the EU in history. This enlargement brought a new interest of researchers when considering the impact on agriculture (Drożdż and Zemeckis, 2009; Mizik and Meyers, 2013). The results of the research showed that accession had a different impact on agriculture in the individual V4 countries (Jambor, 2010; Věžník and Konečný, 2011; Tóth, 2019; Kusz, Kusz and Hydzik, 2022, Zdráhal, 2024). Further research was followed by the study of international trade and competitiveness of agriculture in other European countries that transform their production within the industry when adapting to new market conditions (Dukič and Glavaš-Trbic, 2017).

Contemporary research oriented towards agricultural production in a regional and global scope emphasises individual commodities and their performance in international trade between countries (Smutka, Pokorná, Pulkrábek, 2012) or national demand (Kubicova et al., 2021).

With regard to the previous research conducted, the main aim of the article will be to provide focused research on a particular period of time starting from 2004 and lasting up to the year when the data started to be affected by the COVID-19 pandemics.

## Materials and methods

The data compared for the purposes of the article include fruit production on the one hand and plum production on the other. These data were collected within the Single market trade activities.

Data used for calculations we acquired from:

- Eurostat,
- Slovak Statistical Office.

Within the Eurostat databases the data was collected from the following datasets:

- Crop production in EU standard humidity (data code: apro\_cpsh1),
- EU trade since 1988 by HS2-4-6 and CN8 (data code: ds-045409\$defaultview).

The abovementioned datasets were used for plum production analysis and final calculation of the revealed comparative advantage of the Slovak plum production in the Single market.

Regarding the dataset of the Slovak Statistical office the following datasets were used:

- Hectare yields of selected agricultural crops (data code: pl3001rr),
- Gross vegetable production by commodities (data code: pl2018rs).

Datasets of the Slovak statistical Office were used for calculation of the overall fruit production in the Slovak Republic.

The decisive period for the observations in this study was between the years 2004 and 2020. The commodity investigated within international trade will be plum production.

With regard to the research activities carried out within the framework of this article, the main objective of the article is to identify the position of Slovak plum production and its competitiveness on the EU internal market.

The methods described below represent the pattern in order to fulfil the objective of the article. Basic descriptive statistics were used to compare the data observed during the period under study. Besides the direct comparison, the yield (Y) was estimated on the basis of the formula:

$$Y_c^v = \left( \frac{P_c^v}{A_c^v} \right) \quad (1)$$

The competitiveness of plum production in the Slovak Republic was estimated on the basis of the data observed during our research.

The trend of measuring the competitive advantage started at the end of the sixties. At that time, various authors such as Liesner (1958) or Balassa (1965) wrote their approach to the measurement of competitive advantage. As far as the authors mentioned above are concerned, the most common formula for the revealed competitive advantage is Balassa's index. The calculation formula can be expressed as follows:

$$RCA1_a^i = \left(\frac{X_a^i}{X_c^i}\right) / \left(\frac{X_m^i}{X_n^i}\right) \quad (2)$$

In the above formula for the revealed comparative advantage ( $RCA1_a^i$ ) we can identify the following variables:

$X$  - represents exports,

$i$  - subscript refers to particular observed country,

$c$  - subscript refers to all observed countries,

$m$  - subscript refers to combined exports.

Subsequent research has brought various modifications to the measurement of competitiveness. One of these modifications is the approach to measuring competitive advantage first introduced by Vollrath (1991). The formula for Vollrath's interpretation of competitiveness measurement can be defined as follows:

$$RXA_a^i = \left(\frac{X_a^i}{X_n^i}\right) / \left(\frac{X_a^r}{X_n^r}\right) \quad (3)$$

$$RMA_a^i = \left(\frac{M_a^i}{M_c^i}\right) / \left(\frac{M_m^i}{M_n^i}\right) \quad (4)$$

$$RCA2_a^i = \ln(RXA_a^i) - \ln(RMA_a^i) \quad (5)$$

The revealed competitive advantage ( $RCA2_a^i$ ) is measured as the difference between the relative export advantage ( $RXA_a^i$ ) and the relative import advantage ( $RMA_a^i$ ). Within these formulae, the following variables are identified:

$X$  - defines exports,

$M$  - defines imports,

$i$  - subscript refers to selected country,

$r$  - subscript refers to all observed countries,

$a$  - subscript refers to a specific product,

$n$  - subscript refers to all products.

The revealed competitive advantage ( $RCA2_a^i$ ) was used for the research purposes of this article when the calculated data were evaluated as:

$RCA2_a^i >$  country is competitive on the Single market,

$RCA2_a^i <$  country is not competitive on the Single market.

Data used for calculations we acquired from:

- Eurostat,
- Slovak Statistical Office.

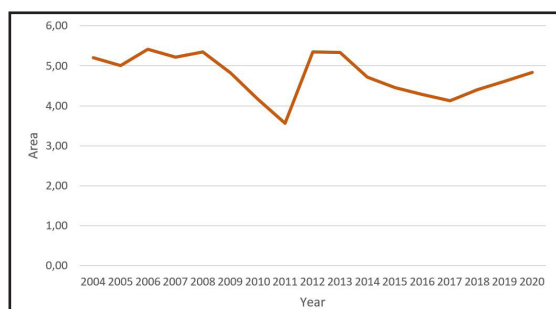
The time span of the research conducted within the study period was selected to be between 2004 and 2020. The beginning of the period of plum production in Slovakia is defined by the first year of the Slovak Republic's EU membership. Thus, the beginning of the reference period is still affected by a mixed effect before and after Slovakia's accession to the EU. The year 2020 has been chosen as the final period. After 2020, a number of economic and social changes have taken place which may have created additional factors in the competitiveness of plum production in Slovakia. Examples of such factors are the withdrawal of the United Kingdom from the EU and the resulting change in the size of the served market. On the other hand, there is a disruption in the market due to the COVID-19 pandemic measures. For the sake of consistency of the factors we have observed, the period under consideration has finally been terminated in 2020.

## Results and discussion

### Development of fruit production in the Slovak Republic

Text Fruit production is highly dependent on climatic conditions throughout the year. Numerous studies (Martins et al., 2021; Salama et al., 2021; Trbic et al., 2021) have shown the negative impact of current climate changes on traditional fruit production around the world. Plum production is facing the same challenges both in European countries (Vodá, 2019) and in other countries of the world.

Within the scope of the research, the first area investigated was the overall state of fruit production in the Slovak Republic. The data revealed two main indicators of the current state of fruit production in the country. The first observed indicator was the fruit production area and its changes over time within seventeen consecutive years. The changes observed (see Figure 1) within selected years show rather a decrease in the total harvested area. According to the available data, 5.2 thousand hectares of orchards were harvested.

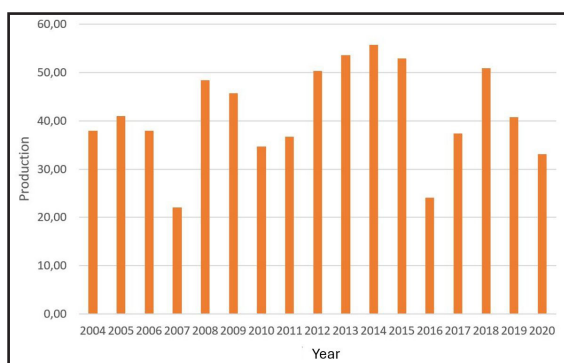


Source: Slovak Statistical Office, own calculations

Figure 1: Fruit production area in the Slovak Republic (1000 ha).

Despite the different changes observed in selected years, a relatively small decrease in the total harvested area was observed when comparing the year 2004 and 2020. The percentage change represents a decrease of 7.11% (or 370 ha). A significant decrease in the fruit production area was observed between the years 2008 and 2011, when the total fruit production area decreased by 33.46% (or 1.79 thousand hectares). A relatively steep increase in the production area was observed in 2012, which may be related to the high number of newly established orchards in the Slovak Republic. The relatively stable situation between the years 2012 and 2013 changed in the following years, when the decline of the fruit production area started again. Most of the decline was reversed in the last three observed years.

The second indicator examined was total fruit production over seventeen consecutive years. As shown in Figure 2, the volatility of production was higher than that of the production area.



Source: Slovak Statistical Office, own calculations

Figure 2: Total fruit production in the Slovak Republic (1000 tons).

This difference is a clear indication of the strong dependence of the fruit harvest on the overall climatic conditions throughout the year in each selected country. The relationship between fruit production and its dependence on weather

conditions is well supported by existing literature (Stöckle, 2009). The best harvest was achieved in 2014 (55.81 thousand tonnes of harvested fruit) and compared to the lowest observed value in 2007 (22.10 thousand tonnes of harvested fruit) we can see the volatility of fruit production in the Slovak Republic. In fact, fruit production in 2014 was 2.53 times higher than in 2007. We see a similar negative change between the years 2008 and 2011, as we found in the total fruit production area in the same period. More importantly, the last three years studied are in contradiction with the changes in the production area. We have observed a decrease of 34.98% (or 17.79 thousand tonnes) in the total fruit production between the years 2018 and 2020. The total fruit production during this period is in contradiction with the increase of the total fruit production area (+9.77% or 430 ha). This contradictory situation of the total fruit production compared to the increase of the total fruit production area could be caused by two main factors. The first could be the relatively high number of new, but not yet productive, orchards. The second cause may be the unfavourable weather situation within the mentioned years. Due to the significant changes in fruit production, we have examined the observed data within the framework of descriptive statistics.

If we look at the average production of 41.39 thousand tonnes of fruit (see Table 1).

Indicator	Value
Nbr. of observations	17.00
Minimum	22.10
Maximum	55.81
1 <sup>st</sup> Quartile	36.75
Median	40.78
3 <sup>rd</sup> Quartile	50.33
Mean	41.39
Variance (n-1)	98.38
Standard deviation (n-1)	9.92

Source: Slovak Statistical Office, own calculations

Table 1: Descriptive statistics of fruit production within years 2004 and 2020.

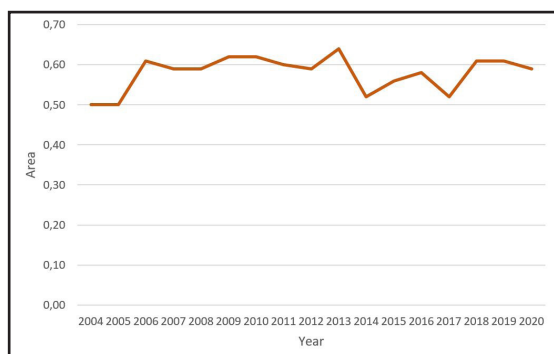
We can see that there is an almost even distribution between above average years (within 8 occasions) and below average years (also within 9 occasions). We have already highlighted in our study the significant volatility of fruit production within the observed period. This is supported by the measured standard deviation of 9.92 thousand tonnes of fruit. This value is relatively high compared to the mean of 41.39 thousand tonnes

of fruit. The measured value of the variance (see Table 1) supports our already mentioned assumption that the changes within the fruit production are relatively high compared to the average (median) production and the total production area itself.

### Plum production in the Slovak Republic

Having recognised the development and current position of total fruit production in the Slovak Republic, the next research was devoted to a detailed study of Slovak plum production and its competitiveness on the internal market. The following research was carried out according to the same scheme as the research of the total fruit production in the Slovak Republic.

The plum production area has been studied in detail for seventeen consecutive years. We observed significant differences between the total fruit production and the plum production area in the Slovak Republic between the years 2004 and 2020. The difference between the largest registered plum production area (see Figure 3) of 0.64 thousand hectares in 2013 and the smallest registered plum production area of 0.52 thousand hectares in 2014 and 2017 was only 18.75%.



Source: Eurostat, own calculations

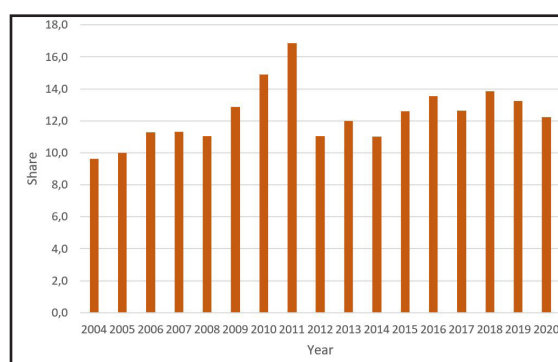
Figure 3: Plums production area (1000 hectares).

This observed value was lower compared to the same changes observed within the total fruit production area in the Slovak Republic, when the total fruit production area decreased by 33.46% (see Figure 1). This shows the difference in the volatility of the change in the total fruit production area and the plum production area in the Slovak Republic within seventeen consecutive years. In the case of plums, there was a positive change when comparing only the beginning and the end of the observed period. In 2004, the plum production area was 0.5 thousand hectares, while in 2020 it was 0.59 thousand hectares. This positive change observed in the study represents an 18% increase in the plum production

area. This result is contradictory to the changes in the total fruit production area in the Slovak Republic between 2004 and 2020, when we observed a decrease in the total fruit production area of 7.12%.

On the basis of the differences between the changes in the total fruit production area and the changes in the plum production area, the position and its development within the observed period have been carried out.

The share of the Slovak plum production showed heterogeneity (see Figure 4) when compared to the total Slovak fruit production within the years 2004 and 2020.

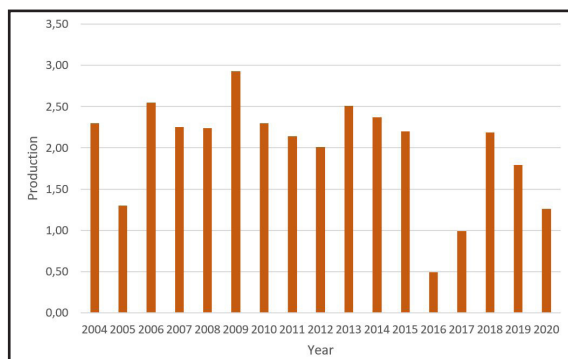


Source: Eurostat, own calculations

Figure 4: Plums production area share on the total orchard acreage (as percentage %).

These changes were mainly influenced by the volatility of the total fruit production area (see Figure 1) and not by the volatility of the plum production area (see Figure 3) within the studied years. This observation is supported by the comparison between the total fruit production area and the plum production area within each year. The lowest share of plum production in the total fruit production area was observed in 2004 and 2005 (8.5% of the total fruit production area in both years). The third and fourth highest values of the total fruit production area were recorded within the same years. On the other hand, the highest share of the plum production area was observed in 2011 (16.9% of the total fruit production area). The total fruit production area decreased rapidly and the lowest registered total fruit production area was also observed in this year. We also observed a high volatility in the share of plum production area in relation to the total fruit production area, if we compare the highest share observed in 2011 (16.9%) and the lowest share on the total fruit production area in 2004 and 2005 (8.5% for both years).

Similarly to the investigation procedure within the total Slovak fruit production, the investigation of the Slovak fruit production was carried out (see Figure 5).



Source: Eurostat, own calculations

Figure 5: Plums production (1000 tons).

The lowest quantity of harvested plums was observed in the year 2016 in the amount of 0.49 thousand tonnes. On the contrary, the highest quantity of harvested plums was reached in 2009. Plum production was 5.98 times higher in 2009 compared to 2016. This volatility of the production is higher compared to the volatility of the total fruit production, when the total fruit production was 2.53 times higher in the year 2014 compared to the year 2007. The changes observed in plum production may be caused by several factors. Two factors that may play a major role in plum production are the production area and the weather conditions. The influence of the production area can be weakened when examining the plum production in the Slovak Republic. This can be seen, for example, from the plum production in 2016 (0.49 thousand tonnes). Despite the lowest number of plums harvested in that year, the area under plum production was exactly the same as the seventeen-year average (0.58 thousand hectares). In relation to the simple average production (see Table 2) observed in the years under consideration, production should have been almost twice as high (real production 0.49 compared with average production 1.99). This can lead to the assumption that plum production is more vulnerable to climate change and is strongly influenced by weather conditions throughout the year. This assumption raises new questions that go beyond the research objectives of this article and the data available at the time of writing. Further research is needed in this area in the future.

The descriptive statistics was used to reveal more data related to the plum production and its changes within the observed years in the Slovak Republic.

This comparison was made in the same way as the descriptive statistics related to the total fruit production in the Slovak Republic. We observed 5 years when the plum production was below the mean value (see Table 2) related to seventeen observed years.

Indicator	Value
Nbr. of observations	17,00
Minimum	0,49
Maximum	2,93
1 <sup>st</sup> Quartile	1,79
Median	2,20
3 <sup>rd</sup> Quartile	2,30
Mean	1,99
Variance (n)	0,37
Standard deviation (n)	0,61

Source: Eurostat, own calculations

Table 2: Descriptive statistics of plum production within years 2004 and 2020.

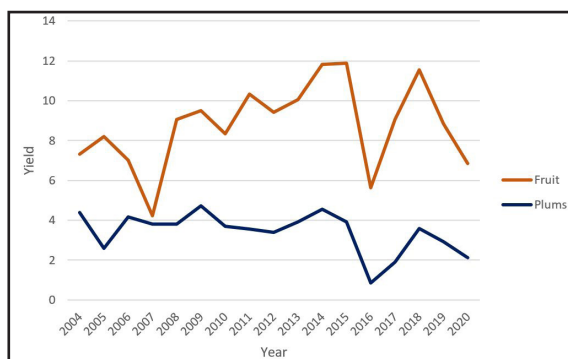
This value of underperforming years is lower compared to the total fruit production, when nine out of seventeen observed years showed underperforming values compared to the mean value. Based on this evidence, we concluded different paths for the total fruit production and the plum production between the years 2004 and 2020 in the Slovak Republic. The total fruit production shows lower volatility of production, but the number of years with lower production than the average is higher compared to the plum production.

The above-mentioned results concerning the differences in production development have raised the question of data availability both in terms of production area and production value. The most commonly used indicator is yield, which also meets the needs represented by the data studied.

The results of the yield comparisons between the years 2004 and 2020 represent differences in the total fruit yield per hectare compared to the harvested plum yield per hectare (see Figure 6).

The yield per hectare was higher within the group of species defined as the total fruit category compared to the plum harvest alone in each year observed. This comparison already suggests that the yield per hectare is not our performance within the total fruit category. The difference in yield per hectare between the total fruit category and the plum category was not stable. The percentage change in yield

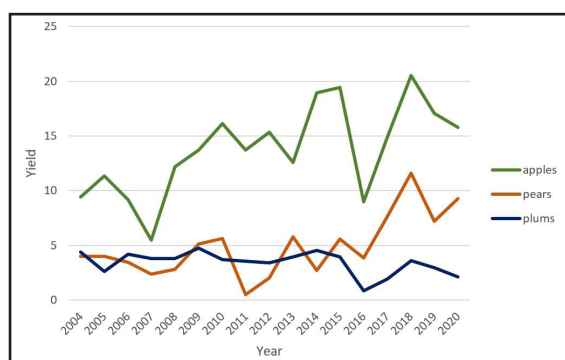
per hectare also did not follow the same path within the years observed.



Source: Eurostat, own calculations

Figure 6: Plums yield per hectare compared to average fruit yield per hectare in the Slovak Republic (tons per hectare).

We observed similar changes in yield, but also completely opposite developments in some observed years. For example, there were completely different changes between 2004 and 2005. The yield of harvested plums decreased significantly by 40.64%, but the yield of the total fruit harvest in the Slovak Republic increased by 12.18% between 2004 and 2005. On the other hand, there was a similar development between 2015 and 2016. The total fruit production decreased by 52.57%, but the change within the category of plum yield per hectare was even more significant at 78.50%. The average yield per hectare was 8.77 tonnes per hectare in the overall fruit category and 3.41 tonnes per hectare in the plum category. According to our measurements, there were six below average years within the total fruit category. This means that in the majority of occurrences (11 years) the current yield per hectare was higher than the average value measured between the years 2004 and 2020. The same situation was observed within the category of plum production. The current yield was lower than the average within six individual years (Figure 7).



Source: Eurostat, own calculations

Figure 7: Plums average yield per hectare compared to other mostly grown fruits in the Slovak Republic.

### Slovak foreign trade in plums and its competitiveness on the internal market

In the context of foreign trade in the type of product under study, the research activity focused on its position in terms of absolute values of exports and imports. At the same time, the data were also evaluated in terms of the competitiveness of plum production in the Slovak Republic in the context of the wider EU single market.

When comparing exports and imports, the values of the foreign trade balance of plum production were taken into account (see Table 3).

Year	Fruit	Plums
2004	-1488735,00	-9813,00
2005	-1734500,00	-6541,00
2006	-1591324,00	-6730,00
2007	-2242888,00	-9852,00
2008	-2031706,00	18894,00
2009	-1923892,00	615,00
2010	-2050819,00	-2409,00
2011	-2192308,00	-7043,00
2012	-1912857,00	-4471,00
2013	-1954909,00	-2261,00
2014	-2019684,00	-10885,00
2015	-2187271,00	-11240,00
2016	-2469387,00	-19725,00
2017	-2390436,00	-18188,00
2018	-2254832,00	-18803,00
2019	-2537694,00	-24233,00
2020	-2871345,00	-28395,00

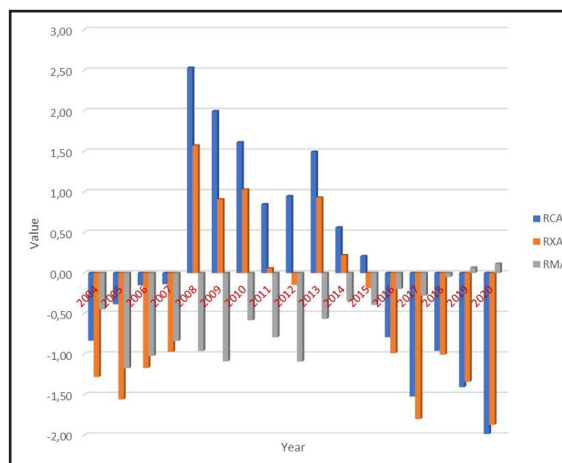
Source: Eurostat, own calculations

Table 3: Foreign trade balance with fruit and plums.

When comparing exports and imports, the values of the foreign trade balance of plum production were taken into account (see Table 3). Comparing the years 2004 and 2020, the same trend was observed in the form of an increase in the negative foreign trade balance for plum production and total fruit production in the Slovak Republic. In the case of total fruit production in the Slovak Republic, there is an increase of 92.87% in the negative external balance between 2004 and 2020. However, an even more significant negative trend was observed in the case of plum production and the external balance of this commodity. In this case, there is a 189.36% increase in the negative external balance between 2004 and 2020. A significantly different trend was also observed when comparing total fruit production and plum production within the different years studied in the research activity.

As in the case of production values, the year-on-year changes in the external trade balance for plums are more volatile than those for total fruit. The most significant negative change in the external balance was observed between 2006 and 2007. During this period, the negative external balance of fruit production decreased by 40.95%. In comparison, the most significant year-on-year change in the foreign trade balance for plum production occurred between 2013 and 2014. Within these years, there was a strong negative growth of 381.42% in the foreign trade balance within plum production. In the opposite spectrum of the observed data, the most significant reduction in the negative foreign trade balance within fruit production occurred in 2011 and 2012. The negative external trade balance was reduced by 12.75% in the years under review. From the above data it can be seen that the negative change in the foreign trade balance for fruit recorded higher values in the years under review compared to the positive changes, which resulted in a reduction of the negative value of the foreign trade balance for fruit production in the Slovak Republic compared to fruit production in the EU internal market. The most significant reduction in the negative value of the foreign trade balance for plum production occurred in 2007 and 2008. There was even a positive shift in this period, when the foreign trade balance of plum production recorded a positive value of 18 894 tonnes, compared with a negative foreign trade balance of 9 852 tonnes in 2007. In 2009, the foreign trade balance of plum production was also positive and, together with the positive value in 2008, represented the only two years in which the foreign trade balance of plum production of the Slovak Republic recorded positive values. This is a positive phenomenon compared to the development of the balance of foreign trade in total fruit production of the Slovak Republic, as in previous measurements no year was recorded with a positive value of the balance of foreign trade in fruit production. In the overall assessment, however, it should also be noted that the external balance of plum production also showed positive changes only in six years of the period under review. This value is therefore identical to that of the external trade balance of fruit production.

In connection with the competitiveness of plum production, we focused on the RXA, RTA and RCA indices in the last state of research. The measurement results show that plum production in the Slovak Republic reached both positive and negative values of the RCA index during the period under study (Figure 8).



Source: Eurostat, own calculations

Figure 8: Revealed comparative advantage in fresh plums within V4 countries between years 2004 and 2020.

The comparative advantage (RCA index) of plum production in the Slovak Republic was achieved between 2008 and 2015. In principle, this development is also directly related to the positive development of the RCA index over the period considered. The only exceptions are the years 2012 and 2015. The highest comparative advantage in plum production in the Slovak Republic was achieved in 2008. At the same time, the highest positive value of the RXA index was measured in the same year, which documents the increase in export competitiveness in that year. At the same time, the above export value is also in line with the increase in plum production in 2008, when the Slovak Republic achieved the highest level of positive foreign trade balance for this commodity. On the other hand, the worst measured value of the RCA index (-1.98) was recorded in 2020. In this year, the worst values of the RXA index and the best values of the RMA index were reached at the same time. The aforementioned facts measured for partial indices resulted in the most significant decrease in the competitiveness of Slovak plum production on the EU internal market in 2020.

## Conclusion

The global agricultural sector is undergoing rapid change, with the competitiveness of agricultural products playing a crucial role in shaping the economic prosperity of nations. This study aims to provide a comprehensive analysis of the factors affecting the competitiveness of agricultural products, taking into account both domestic and international perspectives. The main research focused on changes in plum production in the Slovak Republic between 2004 and 2020.

In this area, the overall fruit production in the Slovak Republic was also measured. Based on a relative comparison of the two main indicators (orchard area and annual production), significant differences were found. The total area of plum orchards is relatively stable, with 500 ha of plum orchards recorded in 2004 and 590 ha in 2020. Over the period considered, the highest value of the area of registered plum orchards was recorded in 2013 (640 ha). On the other hand, the opposite trend was observed for the total area of orchards in the Slovak Republic, with a decrease of 7.12% over the period (compared to an increase of 18% in the area of plum orchards). Among these changes in the area of orchards and plum orchards, the share of plum orchards in the total area of orchards increased by 2.6% between 2004 and 2020. However, this positive trend was more dependent on the decrease in the total area of orchards (-370 ha) than on the increase in plum orchards (90 ha). Overall, however, the above-mentioned measurements clearly document a higher level of stability in the area of plum orchards compared to the total area of orchards in the Slovak Republic. The measurements focused on fruit and plum production in the Slovak Republic showed opposite results compared to the data measured in the case of the total area of orchards. In this case, the decrease in the production of plum orchards was more pronounced (-45.22%) compared to fruit orchards (-12.97%) in the years 2004 and 2020. There were also significant differences within the extreme values measured over the study period. The difference between the lowest and the highest plum production was 5.98. On the other hand, the difference in production within orchards was significantly lower at 2.53. The observed yields per hectare showed that plum production in the Slovak Republic is below the total fruit production yield. These results were caused by the interaction of two main indicators analysed in the paper. These indicators were fruit production area and total fruit production. This fact also contributed to the food insufficiency in this area when the trade balance recorded a negative value in fifteen out of seventeen observed years. Based on the results of the descriptive statistics and the international trade balance of the plum sector in the Slovak Republic, the revealed comparative advantage was determined. The competitiveness of the Slovak plum production has followed a different path in terms of measurements revealed by the RCA indicator. A positive value of this indicator was measured between the years 2008 and 2015, mainly supported by the growth of the relative export advantage

of the Slovak plum production. From the year 2016, there is an obvious decline in the revealed comparative advantage of the Slovak plum production. This decline was again mainly supported by the negative value of the relative export advantage within this commodity.

Slovak plum production has undergone significant changes during the period under review. On the basis of the measurements carried out within the framework of the research, an opinion was formed about a general decline. Stagnation of the production area, plum production, yield per hectare are all factors contributing to a negative competitiveness of this agricultural sector in the Slovak Republic. There are many factors that have contributed to this situation. Some of them are systematic problems of investment debt in this sector or slow adoption of new measures by farmers. Other factors, however, are global factors such as climate change or soil erosion. This factor has been already well documented by various authors (Zea et al., 2022; Nugroho et al., 2023) and could be applied for the territory of the Slovak Republic, while impacting its competitiveness within the broader EU territory. Among other possible drivers of Slovak plum competitiveness, we can find government policy instruments that play a role in shaping the national and international position of agricultural commodity competitiveness. These factors are documented by recent research results (Urbancová and Vrabčová, 2021; Kozelský et al., 2024) but are subject to further future research as an optional determinant of Slovak plum production competitiveness.

Among other factors that may play a role in the change in the competitiveness of the Slovak plum production there is the role of the market integration and trade policies within the EU. The integration of Slovak plum production into the EU single market has increased competition between plum producers in the Member States. This increased competition may have a significant impact on local producers as they face challenges from more competitive markets within the EU (Jarosz-Angowska, A., et al., 2022). Furthermore, the role of structural challenges and investment niveau may significantly contribute to the position of the Slovak plum production competitiveness. The competitiveness of the agricultural sector is influenced by structural factors such as farm size, specialisation and investment in modernisation. Larger farms and those with higher levels of investment are better able to adapt to market and policy changes. Evaluating these structural

aspects within Slovak plum production could shed light on production trends (European Parliament, 2024).

A more detailed study of these factors influencing plum production in the Slovak Republic is beyond the original scope of this article and represents an opinion for further scientific discussion and research.

The results of the research will have significant economic and social implications in the near future. A reduction in domestic supply will only increase dependence on imports. In the later stages, this may even affect market opportunities for local plum producers in the Slovak Republic. The observed situation within the Slovak plum production is in line with the increasing trade deficit, with Slovakia recording a trade deficit of EUR 700.60 million in December 2024 (Trading Economics, 2024).

The apparent decline in productivity growth figures indicates a possible lack of modernisation and investment in the sector (Cosmulescu et al., 2010). Necessary measures include the introduction of modern, advanced farming techniques, supported by targeted subsidies and other financial support mechanisms for replanting with high-yielding and climate-resilient varieties. Well-known studies also point to climate variability as a significant factor affecting fruit production. The implementation of climate adaptation strategies, such as the selection of frost-tolerant genotypes, will be essential to ensure the long-term stability of plum production.

The above challenges will require long-term action at regional, national and EU levels. Strategic investments, policy reforms and the adoption of modern agricultural practices are crucial to revitalise Slovak plum production and increase its competitiveness on the European Union's internal market.

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