Abstract
This article aims to determine the competitiveness of Slovak agri-food products. The article applied a comparative advantage (RCA) index and Lafay Index (LFI). The monitoring period was from 2011 to 2020. The Slovak Republic has long been competitive in trade in live animals, cereals, and oilseeds. Of food products, we are only competitive in sugar and confectionery, milk products and malt, as well as in milk and dairy products and cocoa products. Exports are dominated by lower value-added products, with higher value-added products predominating on the import side. This is ultimately reflected in the ever-deepening passive trade balance of the Slovak Republic in trade in agricultural and food products. Slovakia has a trade structure oriented on trade flows of old EU members. These interpretations provide policymakers with information on Agri-trade competitiveness.

Keywords: agri-trade, competitiveness, export, import, balance

JEL Classification: Q17, F19, F41

1. Introduction
Historically, the term competitiveness has been used primarily to link with the cost position of firms or countries. Reasons for losing competitiveness focus on wages as the main cost component, but they also extend to high energy prices and taxes. Later, competitiveness came to be seen as more than an accounting result comparing costs and revenues at one point in time. A wide interpretation of the term evaluates the sources of competitiveness of firms and countries as well as their outlook. Competitiveness was initially measured using trade or current account balances, with deficit countries judged to be uncompetitive wrote Aiginger, Bärenthaler - Sieber and Vogel (2013).

The agricultural sector's competitiveness, which in general is protected in developed countries, is monitored given the potential consequences if protection is reduced. Competitiveness can be defined as the ability to face competition and to be successful when facing competition. Competitiveness would then be the ability to sell products that meet demand requirements (price, quality, quantity) and, at the same time, ensure profits over time that enable the firm/sector to thrive. Trade theory suggests that a nation's competitiveness is based on the concept of comparative advantage. Conceptualized by Ricardo and the Heckscher-Ohlin model, comparative advantage postulates that trade flows result from differences in production costs among countries and that a country will specialize in the production of goods in which it has a cost advantage (Latruffe, 2010).

2. Data and Methods
There are several methods and indices available to assess competitiveness. To complete the analysis of the development of agri-food foreign trade of the Slovak Republic, the indicator of
comparative advantages- RCA, due to the availability of data and unambiguous interpretation of results with good explanatory power, the indicator of comparative advantages (Revealed Comparative Advantage) index was used. It is the most used easily interpretable indicator with a good telling ability. It is particularly suitable for assessing the competitiveness of agri-food trade (commodities, group of commodities) of one country vis-à-vis another.

\[
RCA = \ln \left( \frac{x}{m} / \frac{X}{M} \right) \quad (1)
\]

where: 
- \(x\) - export of the relevant commodity,
- \(m\) - import of the relevant commodity,
- \(X\) - total agri-food exports,
- \(M\) - total agri-food imports.

If the RCA value is greater than zero, the relevant commodity (sector) is at a comparative advantage; if the RCA value is less than zero, the relevant commodity is at a comparative disadvantage. If the RCA value is zero, this is neither a comparative advantage nor a disadvantage. If the Slovak Republic is a net importer of a certain commodity, in the table summaries it is marked with the symbol "D", net exports with the symbol "V" and if the given commodity was not traded, the symbol "…" is used for the designation (Serenčš & Gálik, 2012).

Identification of competitive commodities in foreign markets based on the Lafay index (LFI):

\[
LFI_j^i = \frac{X_j^i - M_j^i}{X_j^i + M_j^i} \times \frac{\sum_{j=1}^{N}(X_j^i + M_j^i)}{\sum_{j=1}^{N}(X_j^i + M_j^i)} \times 100 \quad (1)
\]

where:
- \(X_{ij}\) - export of country "i" in commodity group "j"
- \(M_{ij}\) - import of country "i" in commodity group "j"
- \(N\) - number of analysed commodity groups,
- whereas the sum of the LFI index for all analysed commodity groups is equal to zero,

\[
\sum_{j=1}^{N} LFI_j^i = 0. \quad (1)
\]

The Lafay index can be divided into three basic components (Burianová & Belová, 2012):

\[
LFI_1 = \frac{X_j^i - M_j^i}{X_j^i + M_j^i} \quad (1)
\]

\[
LFI_2 = \frac{\sum_{j=1}^{N}(X_j^i - M_j^i)}{\sum_{j=1}^{N}(X_j^i + M_j^i)} \quad (2)
\]

\[
LFI_3 = \frac{X_j^i + M_j^i}{\sum_{j=1}^{N}(X_j^i + M_j^i)} \quad (3)
\]

then:

\[
LFI = (LFI_1 - LFI_2) \times LFI_3 \times 100 \quad (4)
\]
• LFI1 - measures net exports for given commodities by the turnover of these commodities. This relationship is known as the Ballass RCA index.

• LFI2 - compares total net exports (sum of all analysed commodities) to their total turnover. The difference of the first two components acquires a positive value if LFI1> LFI2, which means that the RCA index of a given commodity is greater than the RCA index of the sum of all monitored commodities.

• LFI3 - adjusts the value in parentheses. It expresses the share of a given commodity in the total turnover.
- A positive LFI index indicates the existence of comparative advantage of a commodity or commodity aggregation.
- A negative value of the LFI index signals that specialization and therefore also a comparative advantage does not exist (Zaghini, 2005).

We obtained data for the sections and chapters of Agri-trade of the Common Customs Tariff from the Statistical Office of the Slovak Republic. The reference period is 2011 to 2020.

3. Results and Discussion
The basic motivation of all companies is the development of business activities. The research results show that the main reasons for the operation of Slovak agri-food companies on the foreign market are:
- the company's management is interested in territorial expansion,
- insufficient demand on the domestic market,
- foreign market demand,
- growth of competition on the domestic market,
- efforts to build a promising market position abroad,
- the existence of a branch or production plant abroad and the adoption of "internationalization" as a current trend in a globalizing world,
- the company’s involvement in the business network of internationally cooperating companies and ambition to establish itself in foreign markets (Horská et al., 2008).

Bojnec & Ferto (2009) found that higher and more stable comparative trade advantages are found for bulk primary raw agricultural commodities and less for consumer-ready foods, implying competitiveness shortcomings in food processing.

Bojnec & Ferto (2012) found that Central European countries experienced a more significant number of products with relative trade disadvantages and greater significance of one-way imports.
In the monitored period, Slovak Agri-trade is in deficit with a growing tendency. It can be seen from the graph that in 2012 higher exports are compared to other years. Based on Intrastat suspicions, export companies were investigated for fictitious exports of oils, oilseeds, sugar, and fats. After the investigation, the data in Chapters 12, 15 and 17 were even increased.

In the years 2015 to 2019, the import of Slovak agribusiness grew faster year-on-year than exports. In 2020, imports reached 4.77 billion Euros and exports 3.17 billion Euros. The value of imports represents the amount that Slovaks paid for agri-food produced abroad. This amount is far from being a commodity designed to diversify consumption. These are mainly foods that we can produce at home. The EU's carbon footprint is strong and contributes to environmental degradation. It might be appropriate to review the agricultural policy-making frameworks and
give stronger support to the local economy and local producers. This would help Slovakia to
develop this sector evenly, use the potential of production factors and gradually reduce the
value of imports. It would also have a strategic dimension.

Figure 3: Share of Agricultural and Food products in Agri-imports in %
Source: Statistical Office of the Slovak Republic + own calculation

Agri-import to the Slovak Republic is mainly represented by food (almost 80%), commodities
with higher added value processed abroad.

In 2011, sugar and confectionery (12.95%) accounted for Agri-exports; oil seeds and
oleaginous fruits, straw, fodder (11.72%); cereals (10.27%) and milk, eggs, honey, and
products (9.28%). In 2011, meat and edible meat offal accounted for the largest share in Agri-
imports (10.55%); milk, eggs, honey, and products (7.75%); beverages, spirits, and vinegar
(7.72%) and animal and vegetable fats (6.98%). In 2020, grain chapters accounted for Agri-
exports (12.8%); miscellaneous food preparations (10.49%); milk, eggs, honey, and products
(8.41%) and cocoa and cocoa preparations (7.96%). The following chapters of the tariff on
meat and edible meat offal contributed the most to Agri-imports in 2020 (11.41%); milk, eggs,
honey, and products (8.69%); beverages, spirits, and vinegar (8.37%) and miscellaneous food
preparations (7.98%).

Table 1: RCA

| Code | Item name                              | 2011   | 2012   | 2013   | 2014   | 2015   | 2016   | 2017   | 2018   | 2019   | 2020   |
|------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 01   | live animals                           | 1.03   | 0.64   | 0.91   | 1.36   | 1.37   | 1.39   | 1.24   | 1.16   | 1.22   | 1.06   |
| 02   | meat and edible meat offal             | -0.86  | -0.76  | -0.81  | -0.72  | -0.83  | -0.97  | -1.38  | -0.97  | -0.94  | -1.36  |
| 03   | fish and shellfish                     | -0.92  | -2.12  | -1.17  | -0.91  | -1.98  | -1.96  | -1.85  | -1.69  | -1.65  | -1.73  |
| 04   | milk, eggs, honey, and products        | 0.18   | 0.07   | 0.13   | 0.24   | 0.21   | 0.14   | 0.11   | 0.18   | 0.12   | -0.03  |
| 05   | products of animal origin              | -0.46  | -0.80  | -0.74  | 0.17   | 0.25   | -0.27  | -0.11  | 0.14   | 0.08   | -0.03  |
| 06   | live plants and floricultural products | -1.39  | -1.57  | -1.28  | -0.98  | -1.05  | -1.15  | -1.11  | -1.05  | -1.09  | -1.09  |
| 07   | edible vegetables, roots, and tubers   | -1.57  | -1.32  | -1.68  | -1.49  | -1.44  | -1.49  | -1.46  | -1.38  | -1.21  | -1.32  |
| 08   | edible fruits and nuts                 | -1.05  | -1.16  | -0.91  | -1.00  | -1.04  | -1.05  | -0.97  | -0.88  | -0.88  | -1.01  |
| 09   | coffee, tea, and spices                | -0.05  | 0.08   | -0.13  | -0.13  | 0.07   | 0.23   | 0.36   | 0.29   | 0.48   | 0.43   |
| 10   | grain                                  | 0.91   | 0.93   | 1.19   | 1.51   | 1.57   | 1.89   | 1.78   | 1.51   | 1.43   | 1.88   |
| No. | Product Description                      | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|-----|-----------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 11  | Mill products, malt, starches            | 1.39| 1.33| 1.48| 1.55| 1.51| 1.51| 1.31| 1.33| 1.30| 1.34|    |    |    |    |
| 12  | Oil, seeds and fruits, straw, fodder     | 1.19| 1.25| 2.01| 1.06| 1.16| 1.09| 1.18| 1.38| 1.42| 1.20|    |    |    |    |
| 13  | Shellac, rubber, resin                   | -2.06| -2.16| -1.90| -2.42| -1.91| -2.68| -2.04| -1.18| -1.73| -1.74|    |    |    |    |
| 14  | Vegetable knitting materials             | -0.54| -0.33| -0.81| -2.00| -4.37| -4.58| -4.66| -1.25| -0.69| -0.92|    |    |    |    |
| 15  | Animal and vegetable fats                | -0.24| -0.02| -0.03| -0.12| -0.12| -0.08| -0.43| -0.24| -0.60| 0.30|    |    |    |    |
| 16  | Meat and fish preparations               | -0.83| -0.86| -0.81| -0.45| -0.37| -0.40| -0.35| -0.30| -0.32| -0.45|    |    |    |    |
| 17  | Sugar and confectionery                  | 0.74| 0.77| 0.92| 1.00| 1.23| 1.11| 1.26| 1.15| 1.22| 1.15|    |    |    |    |
| 18  | Cocoa and confectionery                  | 0.37| -0.04| -0.01| 0.15| 0.18| 0.18| 0.21| 0.24| 0.23| 0.29|    |    |    |    |
| 19  | Preparations of cereals, milk            | -0.66| -0.72| -0.55| -0.45| -0.52| -0.45| -0.30| -0.34| -0.26| -0.32|    |    |    |    |
| 20  | Preparations of vegetables, fruits, plants| -0.68| -0.89| -0.89| -0.91| -0.68| -0.58| -0.43| -0.50| -0.67| -0.89|    |    |    |    |
| 21  | Various food preparations                | -0.30| -0.51| -0.38| -0.28| -0.20| -0.10| -0.03| 0.05| 0.28| 0.27|    |    |    |    |
| 22  | Drinks, spirits, and vinegar             | -0.22| -0.18| -0.45| -0.41| -0.35| -0.41| -0.43| -0.43| -0.28| -0.30|    |    |    |    |
| 23  | Residues and waste, feed                 | -0.35| -0.42| -0.25| -0.21| -0.33| -0.26| -0.36| -0.21| -0.24| -0.33|    |    |    |    |
| 24  | Tobacco, substitutes                     | -2.08| -3.09| -2.55| -3.23| -3.77| -2.82| -2.81| -2.54| -3.03| -2.35|    |    |    |    |

Source: Statistical Office of the Slovak Republic + own calculation

Its unfavourable commodity structure has been deepening in the agri-food foreign trade of the Slovak Republic for a long time. It is reflected in the high share of agricultural raw materials on the export side and processed food products dominate on the import side. During the period under review, agricultural raw materials accounted for an average of up to 32.8% of the total value of agri-food exports. On the other hand, food products accounted for an average of up to 78.2% of the value of total agricultural imports. The unfavourable commodity structure was also reflected in the assessment of the competitiveness of Slovak agri-food commodities (Table 1). The Slovak Republic has long been competitive in trade in live animals, cereals, and oilseeds. Of food products, we are only competitive in sugar and confectionery, milk products and malt, as well as in milk and dairy products and cocoa products. As a result of the growth in the consumption of cheese and butter, which was rehabilitated by their increased imports, the Slovak Republic lost a competitive advantage within the entire chapter of milk, eggs, honey, and their products. On the contrary, we record a positive development in the chapter coffee, tea, and spices. Although these are mostly commodities of an irreplaceable nature, the increase in production and thus in the export of coffee is constantly increasing the comparative advantage of the entire commodity group.

The unfavourable commodity structure of the agri-food foreign trade of the Slovak Republic can be assessed more clearly based on the RCA indicator in individual product verticals. Within the meat vertical, we are only competitive with live livestock. It is a basic raw material for the meat industry with low added value. At the same time, we have long achieved a comparative disadvantage with meat products (Ch 16) and especially meat (Ch 02). In terms of the trade balance, the deteriorating situation in the meat trade is striking.
We record the highest values of the RCA index for grain. Even in mill products, thanks to significant malt exports, we are competitive in foreign markets. However, for final products with higher added value, such as cereal products (Ch 19) as well as feed (Ch 23), the situation is the opposite with a significant negative impact on our trade balance. We also achieve a comparative advantage in another commodity group of agricultural raw materials, which is oilseeds. Even in this product vertical, we are not able to transform it into final food products (Ch 15).

The worst situation is within the vertical of fruits and vegetables. The Slovak Republic is not competitive not only in processed fruit and vegetable products (Ch 20) but also in fresh vegetables and fruit (Ch 07 and 08). However, with fresh vegetables and fruits, the unfavourable situation is also due to the number of their species, which cannot be produced in our natural conditions. At the same time, in the off-season, it is economically more advantageous to import them from countries with more suitable climatic conditions. In terms of trade balance developments, the deepening comparative disadvantage in processed fruit and vegetable food products is striking.
We also verified the achieved results by means of the Lafay index (Table 2). The Lafay index is a more comprehensive indicator of competitiveness assessment and has fully confirmed and highlighted the unfavourable developments identified by the RCA. In terms of comparative advantages in individual product verticals, he further highlighted the differences in the competitiveness of agricultural raw materials and food products. The results of the Lafay index reveal unfavourable and worrying trends in the development of comparative advantages in the agri-food foreign trade of the Slovak Republic. We have identified only 7 commodity groups within which the Slovak Republic has a comparative advantage. It is evident from the results that in up to 4 commodity groups (live animals, milk and dairy products, oilseeds, sugar, and confectionery) the Slovak Republic is gradually losing comparative advantages on world markets. On the other hand, only in cereals and, more recently, in coffee and spices, the Slovak Republic is strengthening its position in foreign markets. This development, combined with deepening comparative disadvantages within up to ten chapters of the HS, does not provide a precondition for reducing the value of the deficit balance of agri-food foreign trade.

4. Conclusion

The analysis of the agri-food foreign trade of the Slovak Republic through the indicators of comparative advantages confirms the long-term unfavourable commodity structure of our trade. Exports are dominated by lower value-added products, with higher value-added products predominating on the import side. This is ultimately reflected in the ever-deepening passive trade balance of the Slovak Republic in trade in agricultural and food products. It is evident that if the efficiency and effectiveness of the food industry do not increase, the improvement of this situation cannot be solved by a massive increase in agricultural exports, as it will lead to further escalation of high value-added food imports based on raw materials exported from Slovakia.

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