AN ASSESSMENT OF SERBIAN INTERNATIONAL SUNFLOWER OIL TRADE

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ABSTRACT

The objective of this study is to assess Serbia's international market position in the sector of sunflower derivatives and edible fats from 2014 to 2023, with particular focus on competitiveness and stability as global trade partner. Using method Revealed Comparative Advantage (RCA) and calculating the Self-Sufficiency Ratio (SSR) the study evaluates Serbia competitiveness and its ability to meet domestic needs through domestic production. The analysis covers key products such as margarine, sunflower seeds, and sunflower oil (both crude and refined). Over the past decade Serbia has experienced significant growth in production and export of sunflower based products, particularly in category of refined oil. Sunflower industry stands out as a stable partner in the global market of sunflower products, following price dynamics and adapting to market challenges. The findings of this research provide a foundation for further discussion on measure to enhance Serbia's competitiveness, with an emphasis on adapting to global market changes and challenges.

Introduction

The sunflowers oil industry is one of the key sectors in global agricultural trade, particularly important for the countries like Serbia, which faces challenges in keeping competitiveness in international markets. Globally, more than 70 types of oils are used for human consumption, and sunflower oil ranks fourth. Beyond use in diet, sunflower oil and its derivatives are widely used in the production of margarine, vegetable fats, soap, cosmetics, biodiesel, pharmaceuticals, and even as a raw material for paints and varnishes (Đerčan et al., 2023).

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Sunflower seeds hold approximately 40-60% oil, 14-22% protein, 13-32% cellulose, 7-11% nitrogen-free extract, and 3% minerals making them highly valued in global market (Rabrenović, Vujasinović, 2021). Sunflower oil production is primarily concentrated in Ukraine, Russia, and Argentina, which are recognized as the world's leading producers and major players in international trade. These countries play a crucial role in ensuring supply stability in the global market, while Serbia contributes to overall production with a stable supply-demand balance due to its domestic sunflower production (Knežević, Popović, 2011). Innovations in production and processing technologies have been identified as key factors in supporting long-term competitiveness and resilience to market fluctuations (Rabrenović, Vujasinović, 2021). This study aims to analyse Serbia's international trade of sunflower derivatives and edible fats, with focus on competitiveness from 2014 to 2023. The methods employed in this research are based on the Revealed Comparative Advantage (RCA) method and the calculation of the Self-Sufficiency Ratio (SSR). These methods provide assessment of self-sufficiency level and competitiveness on foreign market. Prior studies on competitiveness have highlighted Serbia's significant potential for increasing sunflower oil exports while also emphasizing the need for a more efficient use of processing capacities and market diversification to enhance competitiveness (Matkovski et al., 2020). In the first part of this study were analysed global trends and research literature about sunflower oil production and trade. Then in the methodology section are presented the applied methods and data sources, establishing the analytical framework. The core of this study focuses on the interpretation of results, including trends in foreign trade, market structure, and an assessment of Serbia's sunflower oil competitiveness compared to global market. Finally, the conclusion summarizes the key findings and provides recommendations for improving Serbia's competitiveness and adapting to global market challenges.

Literature review

The sunflower oil industry stands for one of the key sectors in international trade of agricultural products. Sunflower is the third oilseed produced in the world, the fourth vegetable oil and third oilseed meal among protein feed sources. In recent decades competition has been intense in the highly dynamic markets of vegetable oils and oilseed meal, driven by palm oil and soybean meal (Pilorgé, 2020). Global market trends and the competitiveness of sunflower oil are often analysed with models, such as the Revealed Comparative Advantage (RCA) method, which assesses the ability of countries to compete effectively against leading global producers. Over the past decade, sunflower prices have been volatile, driven by a range of factors including supply and demand dynamics, climate variations, and geopolitical situation. Looking ahead, initiative-taking and strategic planning will be imperatives for maintaining the stability and prosperity of sunflower cultivation on a global level (Đerčan et al., 2023). Vegetable oil is an exchange commodity and Serbia taking part on international market. Although it was a founder of the World Trade Organization, Serbia isn't yet a member (Gulan, 2022). Knežević, Popović, (2011) explained that the growth of sunflower production is largely determined by the price and demand for oil. High profitability in sunflowers production primarily comes from revenue factors. The Republic of Serbia, as one of the

leading regional producers of sunflower oil, facing challenge in keeping competitiveness at the global market. Serbia's market operates like interconnected vessels, influenced by external markets. The price trends of oilseeds and their products in Serbia closely follow those in the European market (Čurović, 2023). Beyond market conditions, environmental and climatic factors, including droughts and extreme weather conditions, significantly affect sunflower yield and quality. Sunflower, a spring-sown crop could be particularly sensitive to direct heat stress during flowering and drought conditions throughout the growing season. These factors lead to a significant reduction in yield, a decrease in oil content, and changes in fatty acid composition (Debaeke et al., 2017). The Republic Hydrometeorological Service of Serbia (RHMZ, 2024.), reported that during 2023/2024, precipitation levels were average for the region but poorly distributed, negatively affecting spring-sown crops. As a result, the yield of spring crops in 2023 was significantly lower than in previous years. Sunflower crops have adaptation potential to various climate and soil conditions. Its increasing prevalence in Serbia's fields is due to frequent hot temperatures and droughts, which this crop tolerates better than other spring crops (Krstić et al., 2023). Ecological and climatic challenges in sunflower production pose barriers to keep market competitiveness but also highlight the need for effective adaptation strategies. Research by Stričević et al. (2021) suggest that key adaptation measures in field crop production will include irrigation, adjusting sowing dates based on weather conditions, and selection suitable crops, varieties, and hybrids. Sunflower has managed to save its competitiveness in the oilseed market over the past decades, thanks to continuous innovations in genetics, production, and trade, as well as increasing market segmentation. Future opportunities for sunflower processors could emerge through the bio-refinery concept, enabling greater utilization of the entire plant and diversification of oil applications (for food, food industry, biofuels, biomaterials), proteins (for animal feed, including aquaculture, human nutrition, and potentially biomaterials), and even cellulose fractions (Pilorgé, 2020). In international trade analysis, research studies rely on methods to assess the competitiveness of countries and sectors. Ferto, Hubbard, (2003) used the RCA index to examine the competitiveness of Hungarian agricultural and food product in the European Union (EU) market from 1992 to 1998. They found that Hungary had a comparative advantage in several agricultural and food products, including livestock and meat. Rytko (2014) also applied the same method to define the competitive position of Polish and Slovak agricultural and food product in the European market and, for comparison, in third-country markets and across different product groups. From 1999 to 2012, the results shown that after joining the European Union, the significance of foreign trade in agri-food products increased for both countries within the EU, while only Poland experienced growth in third-county markets. The RCA index showed significant difference between these countries – Poland had a comparative advantage, while Slovakia didn't. Tawheed, Tushinder (2019) also used the RCA index to analyse the comparative advantages of the Indian agricultural sector compared to the top five agricultural exporting countries (SAD, UK, UAE, Singapore and China) from 1995. to 2017. The RCA and RSCA indicates revealed that India had a comparative advantage in products such as fruits and vegetables, fish and fish preparations, sugar and sugar preparations, various food products, and timber.

In analysis of Serbia's foreign trade position, significant contributions were made by Ignjatijević et al. (2012) who applied both Balassa's and adjusted revealed comparative advantage model. Their findings confirmed that Serbia has a strong comparative advantage in export of corn, soybean oil, sugar, and flour to the European market. Significant comparative advantages were also found for mineral and carbonated waters without sugar, sour cherries, malt beer, seed and hybrid corn, soft drinks, biscuits, crude sunflower oil, and cocoa products. Author's such as Matkovski et al. (2020) analysed competitiveness by examining export position Republic of Serbia on oilseed sector within the international market. Their study concluded that sunflower holds a higher level of comparative advantage in the global market compared to soybean and rapeseed. Another research confirmed the stability and growth of sunflower oil exports in recent years (Matkovski et al., 2020). Cvetković, Petrović-Ranđelović (2017) used RCA in research to find Serbia's comparative advantages in trade with Western Balkan countries. The results showed that Serbia has strong comparative advantages over Western Balkan countries (Bosnia and Herzegovina, North Macedonia, Albania, and Montenegro), except Croatia. Competitiveness analysis method, such as RCA and the SSR, allow an assessment of Serbia ability to meet domestic demand through domestic production. Based on earlier research, this paper will use proved theoretical framework to conduct a detailed analysis of Serbia s international trade in sunflower derivates and edible fats from 2014. to 2023.

Materials and methods

This study uses data from the Statistical Office of the Serbia (SORS, 2025), UN Comtrade Data trade (UNCOMTRADE, 2025) for analyses Serbia international trade in sector of sunflower derivates and edible fats from 2014 to 2023, with the aim of assessing Serbia's international trade position and competitiveness. The methodology is based on analysis of secondary data collected from official sources such as statistical reports, trade flows reports and other relevant databases. The Revealed Comparative Advantage (RCA) method which will be use in this research, figure out whether there are comparative advantages for the four key category: margarine, sunflower seed, unrefined sunflower oil and refined sunflower oil based on collected data of export results.

For this research we applied a method based on The Revealed Comparative Advantage from Balassa (1965). This index enables researchers to calculate comparative advantage or disadvantage of a product or group of products compared to an industry or export market. Its goal is to illustrate the competitiveness and comparative advantage of a specific market player concerning certain products, based on historical trade date (Balogh, Menesi, 2019). The RCA compares the share of a specific product in a country's export with the share of specific product in global exports. It is proposed that the RCA be calculated as follows (Balogh, Menes, 2019):

$$RCAij = Bij = \left(\frac{X_{ij}}{X_{it}}\right) / \left(\frac{X_{nj}}{X_{nt}}\right)$$

Equation 1

Where x stands for export volume, i and j denote the selected country and product, respectively, while t and n represent a specific product group and group of countries, respectively (Balassa, 1965). In theory, index can range from 0 to infinity. According to the author, if the result is above 1, it suggests that the selected country has a comparative advantage for a particular product compared to competing suppliers, which should be reflected in a high market share in exports. On the other hand, result between 0 and 1, suggest a comparative disadvantage for the selected country compared to competing suppliers, suggesting a low market share in export (Balogh, Menesi, 2019).

Self-Sufficiency Ratio (SSR): this method is applied to analyse capabilities of Serbia to satisfy domestic demand for sunflower oil thought own production. This analysis je crucial for assessing stability of domestic agricultural production in relation to consumption and international trade. To calculate the SSR for refined sunflower oil in 2023 we use next formula (Slaboch, Kotyza, 2015):

$$SSR = \frac{Domestic\ production}{Domestic\ consuption} \times 100$$

Equation 2

*We used the Conversion factor to figure out the total amount of refined sunflower oil

Domestic production oil can be calculated according to next formula:

$$Domestic\ production = \sum sunflower\ seed\ production \times \%\ oil\ extraction\ from\ seed$$

Equation 3

Conversion factors: in production of the sunflower oil crucial factor is coefficient calculated between seed mass and oil output. Based on available data: 1 kg of commercial sunflower seed holds 38% to 42% oil – a characteristic declared by seed producer, without GMOs, with an average value of 40% (SRPS E.B4.410 1990 Sunflower seed for industrial processing). Crude sunflower oil (degummed) typically (based on technology, equipment, and processing efficiency) holds about 98% "pure oil" i.e. oil without impurities and moisture (Moslavac et al., 2010). By using this factor, we can definite the amount of refined oil obtained from sunflower seed. Based on the calculation 1 kg of sunflower seeds holds about 39% refined oil (0,40 * 0,98 = 0,39). This formula allows an estimation of the total oil output from the produced and traded sunflower seed. International trade plays a significant role in economic growth and development of a country taking part in trade (Vrdoljak, 2019). In an international trade sunflowers oil, analysis will rely on descriptive statistics, to show key parameters, as average values and trade flow trends.

Data were obtained from the Republic office of Serbia's database, which allows do analyse volume and value export and import sunflower oil by product categories (e.g. crude and refined sunflowers oil, margarine, sunflower seed). This official data provides a reliable bases for evaluating Serbia's international trade. The data used in this research

include quantities and values of exports and imports for the following product category according to the National Statistical Textual category code (NSST):

0910100 - Margarine (excluding liquid margarine): this code refers to margarine, which has become a key product in the edible fats category. It does not include liquid margarine.

2224090 – Sunflowers seeds, other: This code covers types of sunflower seeds not used for sowing.

4215100 – Sunflowers or safflowers oil, crude: This code refers to crude sunflower or safflower oil that has not yet undergone refining.

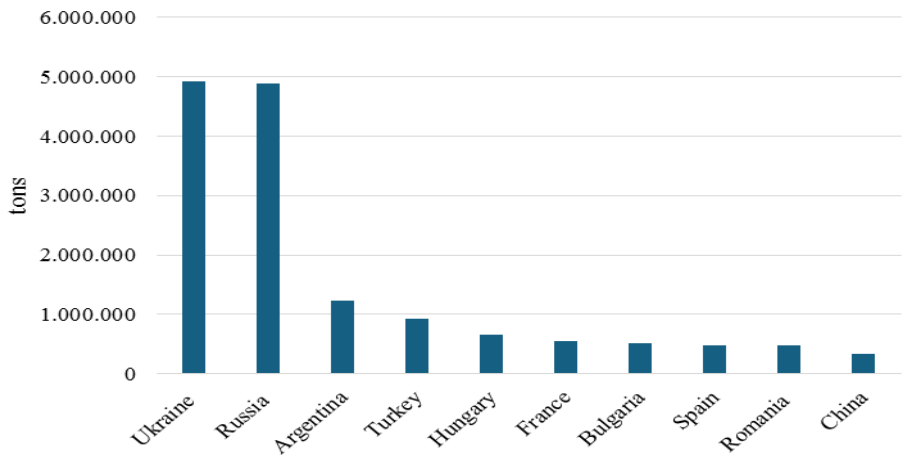
4215900 - Sunflowers or safflowers oil, refined: This code refers to refined sunflowers or safflower oil, which has undergone processing to achieve a higher quality and longer shelf life.

Additionally, international databases such as FAO and UN Comtrade Database were used for comparative analysis export on global level, which enabled a precise evaluation of Serbia's role in the global sunflower oil trade. The study is limited to available statistical data from official sources, also analysis is focusing on quantitative aspects export and import, as qualitative factors as political, economic, and social changes that could affects trade flows are not examined in this study.

Results

Today, the production and processing of sunflower seed is widespread across the world, with the most significant production regions in Europe, Asia, Nort and South America. Ukraine, Russia and Argentina are stand out as leading producers of sunflower-seed oil (crude), and they are playing key role on global production, as shown in Figure 1.

Figure 1. Top 10 countries in sunflower-seed oil (crude) production (in tons)



Source: FAOSTAT (2025)

Serbia is one of the leading counties in the Balkan region, both in production and in scientific-research development of sunflower hybrids in the Balkans (Kaya, 2014). The export of sunflower oil is a largely determined by the level of processing industry development. Export price must be competitive with global vegetable oil prices. These prices influence the formation of domestic prices of sunflower oil; otherwise, the oil will not be competitive (Čurović, 2018). From 2014. to 2023, the export prices of sunflower oil from Serbia show variations, but generally aligned with global price movements, as shown in Table 1.

Table 1. Dynamics of export prices of sunflower oil in relation to the price of sunflower seed and global sunflower oil prices USD/t

Year	Export prices of sunflower oil	Purchase prices of sunflower seed	Price of sunflower oil on global market
2014	1,068	240	1,204
2015	959	330	1,105
2016	948	275	1,083
2017	945	298	1,023
2018	909	268	1,014
2019	835	252	957
2020	992	291	1,084
2021	1,454	464	1,489
2022	1,770	519	1,860
2023	1,250	318	1,483

Source: SORS (2025); UNCOMTRADE (2025)

For example, in 2022, the purchase price of sunflower was reached 519 USD/t, showing an increase in production costs, but the export price of sunflower oil that year was much higher in relation to foregoing period (1,770 USD/t). Prices dropped in 2023, when the export price of sunflower oil was 1,250 USD/t, following sunflower seed price 317.5 USD/t. The price increase of sunflower oil begins with COVID-19 is noted both globally and domestically, starting with 10% in 2020, then continuing to 50% and by the end of 2022 reaching 80% increase on domestic market. The increase was stopped by the Decision on the price level and restrictions of basic foodstuff, which was returned to the level from November 15, 2021, and this regulation was valid until the end of March 2023. This regulation was triggered by the behavior of European countries that closed their markets, so the Republic of Serbia also implemented similar measures to protect standard of living by limiting basic food prices. Agriculture producers because these measures did not have consequences, because production of sunflower seed were subsidized with 7.8 RSD/kg up to 200 t/farm. However, oil factories because high purchase price of sunflower seed and the fixed price of oil being capped at 152-160 RSD/l, found themselves in a worse position as they only achieved “technical parity” (Čurović, 2023).

International trade of sunflower derivates and edible fats from 2014 to 2023 (in USD)

Detailed data of Serbian export and import of sunflower seed and its oils and fats, from 2014 to 2023 are shown in Table 2. Focus on research is on key product category which dominates in international trade. Through this approach the goal is to enable a comprehensive insight into the Serbian trade of sunflowers derivates and edible fats, to better understand the trends that occurred during the observed period, both on export and import side.

Table 2. Serbian export and import of sunflower derivates and edible fats from 2014 -2023 (in 000 USD)

Year	0910100 - Margarine (excluding liquid margarine)	2224090 – Sunflower seed, other	4215100 – Sunflower or safflower oil, crude	4215900 - Sunflower or safflower oil, refined
	Export			
2014	9,656	19,946	15,311	82,864
2015	7,556	32,978	26,579	64,367
2016	8,690	49,093	47,782	68,968
2017	8,494	36,269	51,257	65,308
2018	8,471	50,497	52,395	63,748
2019	8,155	43,537	86,102	67,342
2020	7,046	55,806	73,031	66,816
2021	9,634	50,076	98,058	86,035
2022	11,395	51,036	76,937	102,131
2023	14,327	33,900	66,191	103,389
	Import			
2014	3,322	6,580	2,290	3,779
2015	2,498	13,168	1	8,121
2016	3,039	1,321	1,312	11,614
2017	2,751	28,614	7,572	7,872
2018	3,129	12,025	5,795	3,261
2019	3,595	7,476	106	3,107
2020	3,119	7,895	10	12,870
2021	3,991	16,414	6,941	5,642
2022	4,435	15,268	725	5,179
2023	5,209	13,815	152	14,440

Source: SORS (2025)

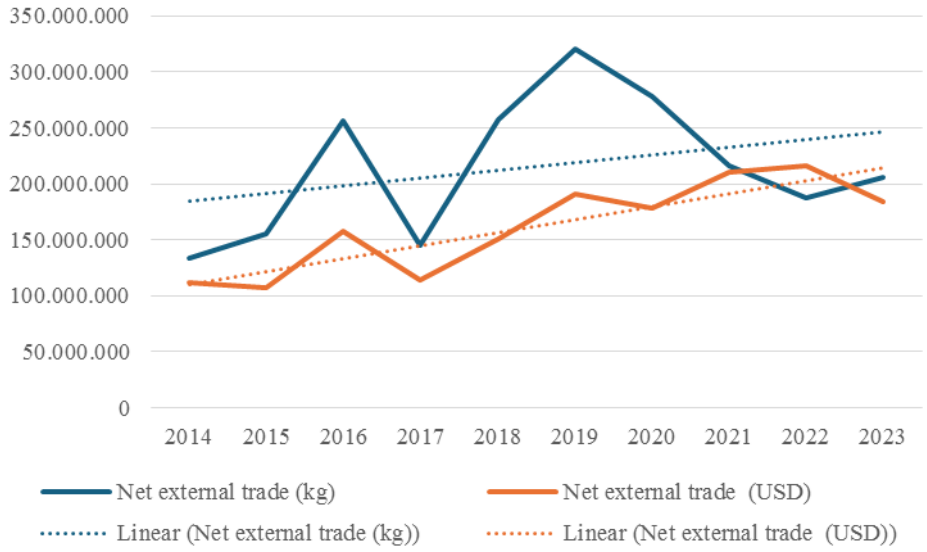
0910100 - Margarine (excluding liquid margarine) -The import of margarine is relative stable, with slightly increased quantities in the last two years. During the analysed period, the export of margarine shows stability with slight fluctuations. The growth in export value is particularly noticed since 2020, primarily as result of increase in prices, as the quantities have not changed significantly.

2224090 - Sunflowers seed, other – The export of sunflower seeds has fluctuated with a decline in last three years. An analogous situation is seen with the import of sunflower seeds, which shows a downward trend compared to 2021. This may show fluctuations in volume of domestic production.

4215100 - Sunflower or safflower oil, crude – The import of crude sunflower oil is symbolic, averaging only 4% compared to the average export value. On another hand, the export has shown a growing trend, with a record value in 2021, followed by a downward trend. However, it should be noted that this is a s semi-finished product, and such a situation is generally not a good indicator of the competitiveness of oil producers in the international market. This is influenced by the interest of foreign owners of oil factories in Serbia (e.g. Dijamant, Bimal) and the specific of market in the region.

4215900 - Sunflower or safflower oil, refined – The volume and value of import peaked in three years: 2016, 2020 and 2023, due to a drop in average sunflower yields on the domestic market. The export of refined oil during the analysed period has shown a stable with positive trend. Overall, the export of sunflower derivates and edible fats shows growth and fluctuations in quantities, but Serbia stays a net exporter of these products, showing its growing significance in global market in this category.

Figure 2. Dynamic and trend net external trade of sunflower derivates and edible fats



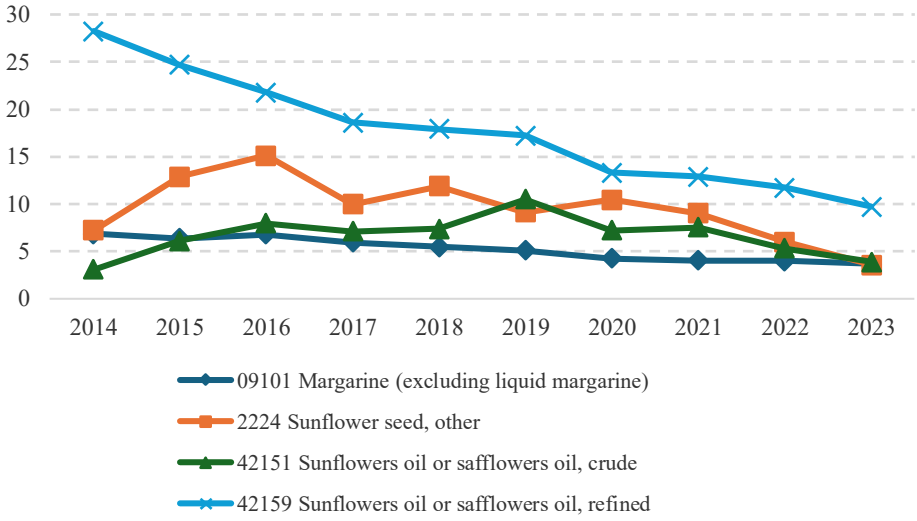
Source: SORS (2025)

The value of net trade has increased even when quantities were declining, which may indicate a rise in product prices (Figure 2). In bought indicator (volume and value) net trade generally grown during observed period, and it can be concluded that Serbia has a positive growing trade balance. However, there are certain variations that may be driven by climate or economic factors influencing trade.

RCA analysis for the period 2014-2023

For the period 2014-2023, Serbia's comparative advantage in the export of four key product categories: margarine, sunflower seed, sunflower oil (crude and refined), are analysed using the RCA index. The aim of this analysis is to assess the market value of each of these products and their competitiveness in the global market.

Figure 3. Dynamic and trends of RCA index



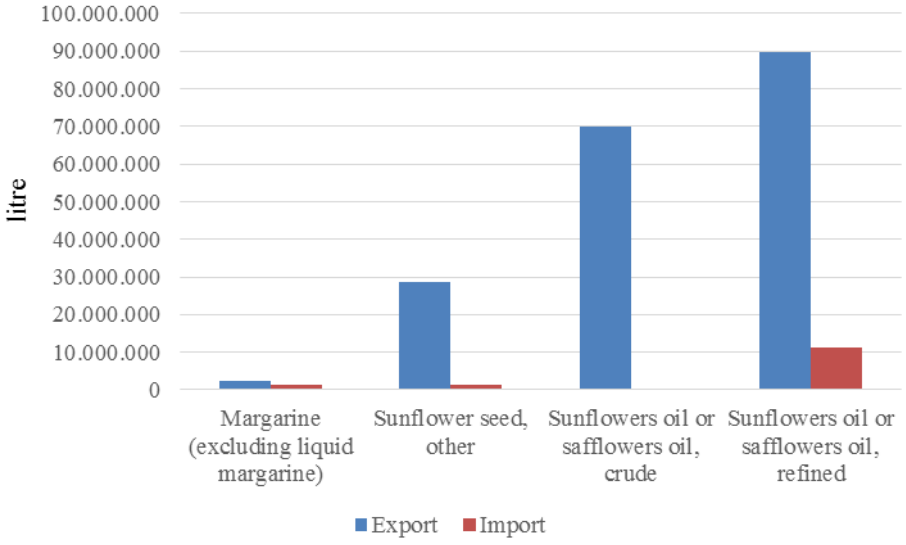
Source: SORS (2025); UNCOMTRADE (2025)

The values of the RCA index presented in Figure 3 were above 1, saying that Serbia had a comparative advantage in the export of all analysed products during the observed period. However, a declining trend in RCA index values for all observed categories from 2014-2023 is noticeable, suggesting that Serbia's competitiveness in global trade is decreasing. The highest RCA index level is for refined oil. Margarine has the lowest RCA index level but generally remained stable throughout the analysed period. The RCA index values for sunflower seed show fluctuations, but after 2020, they follow a declining trend. It can also be observed that the RCA values for crude oil decreased after 2019 and nearly aligned with the values from 2014 by 2023, but they are still above 1, meaning Serbia maintained competitiveness in this segment. Although edible fats, the decrease in RCA values may signal a reduction in competitiveness, possibly due to a decrease in demand and the global market or increase competition from other large producers. It is essential to enter non-traditional markets and improve positions in existing market segments.

The Self-Sufficiency analysis Serbia market of sunflower oil in 2023

The self-sufficiency of the Republic of Serbia's market in the sunflower oil sector was calculated based on the conversion factor of sunflower derivative product and edible fats into refined sunflower oil. The SSR indicates positive trends in this segment (Figure 4).

Figure 4. The Self-Sufficiency analysis of sunflower oil on Serbian market in 2023 (in l)



Source: Authors' calculations based on SORS (2025)

Data presented in Figure 4 revealed the Serbian self-sufficiency position for 2023. The quantities of all products were converted into litres of refined oil, considering the average oil density (0,9235), as cited by Oštrić Matijašević, Turkulov (1980) who note that the specific density at 20°C 0,920-0,927. The analysis by categories include:

- Margarine: Exports exceed imports, suggesting Serbia has a positive trade balance in produce of margarine.
- Sunflower seed: Exports (28,676,912litres) significantly exceed imports (1,364,253 litres), confirming Serbia's role as an exporter of sunflower seed.
- Sunflower crude oil: Exports (70,049,572 litres) is much higher than import (103.996 litres), indicating a significant export of crude sunflowers oil compared to imports, However, it also suggests that Serbia is losing potential profit selling crude oil to foreign refineries, which process and sell the oil at higher prices. A greater focus on domestic processing capacities, could mean more jobs in the sector and higher added value.
- Sunflower refined oil: Exports of refined oil (89,576,611 litres) far exceed import (11,286,410litres), proving that Serbia has a strong export capacity in this category.

The self-sufficiency rate for sunflower oil in 2023 was 254%, meaning domestic production was 1,54 times greater than domestic consumption. In other words, Serbia not only meets its domestic needs but also produces a significant surplus. The average per capita consumption of sunflower oil, including oil used in margarine production, was 17,3 litres in 2023. The data indicates that Serbia is a significant exporter of sunflower derivates and edible fats, while import remain relatively low compared to exports, pointing to a self-sufficient production system. The Balkan market is dominant in exports, with Bosnia and Herzegovina, Montenegro, and North Macedonia as key destinations, while the largest import share comes from Russia.

Discussion

The results of this analysis align with findings from other authors approve similar conclusions about the competitiveness of Serbia on international market of sunflower oil. For example, Matkovski et al. (2020) confirm Serbia's comparative advantage in sunflower oil exports but also stress the need for technological innovation and market diversification to hold competitiveness. The study by Ignjatijević et al. (2012) highlighted Serbia's comparative advantage in various agricultural products, including refined sunflower oil. Similarly, Knežević and Popović (2011) emphasized that the grown of sunflower production is largely driven by oil prices and demand, with price trends matching those in the European market, as also noted by Čurović (2023). In early 2024, Serbia imposes restrictions on the export of crude sunflower oil. Therefore, the period up to 2024 is more proper for assessing the actual situation in foreign trade relations involving sunflower oil and its derivates. The research findings show that Serbia largest exports share go to the Balkan region, while imports primarily comes from Russia. This market concentration could pose a challenge in the future, particularly in the context of changing international political and economic relations.

Conclusions

The research has shown that Serbia holds a significant position in the global market for sunflower derivates and edible fats, particularly in the refined oil sector. The use of econometric methods, such as RCA and SSR, has enabled a deeper understanding of Serbia's competitiveness in this sector. Our results showed that the RCA values were always above 1 during the observation period, proving that Serbia has a comparative advantage in the export of all analysed products. However, a downward trend in the RCA index values over time was also observed, suggesting that Serbia's competitiveness in global trade is declining. The degree of self-sufficiency for refined sunflower oil in 2023 was 254% meaning that domestic production is 154% higher that domestic consumption. In other words, Serbia not only meets domestic needs but is also a significant exporter of sunflower oil. These data show a stable international trade position, although challenges exist in term of dependence on a several key markets, primarily the Balkans and Russia, which could create vulnerability in case of global political and economic disturbances. Several limitations were discovered in this research. First, the analysis did

not cover the trade of mayonnaise, which hold 70% of edible sunflower oil, a factor that could offer added insight into the fats sector. Furthermore, when finding comparative advantages, data on total global exports for the analysed product categories are missing. Although the quantitative data is detailed, the lack of qualitative information, such as changes in consumer preferences and the impact of innovation, points to space for future research. In addition, sunflower oil is the dominant type of oil on the Serbia and surrounding markets, but taking in account other types of oil will provide a more comprehensive understanding of the competitiveness of edible oils and derivatives on the international market. The conclusion of this paper is that Serbia has comparative advantages in sunflower oil market, but further market diversification is necessary to keep competitiveness and increase resilience to global changes.

Conflict of interests

The authors declare no conflict of interest.

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