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GLOBAL COMPETITION IN WHEAT AND MESLIN, MAIZE AND RICE PRODUCTS: TÜRKİYE'S COMPETITIVENESS

Zeynep AKTAŞ ÇİMEN[1]*,

[1]*Akdeniz University, Social Sciences Vocational School, Department of Marketing and Advertising, Marketing Pr., 07030, Antalya, Türkiye*

Abstract: Global trade in agricultural products is critical for food security. As the volume of trade has increased and become more complex, it has become important to assess global competition in the trade of agricultural products. The objective of the study is to assess Türkiye's position and level of specialization in relation to the competitiveness of the top 20 countries in the global export market for three key agricultural products wheat and meslin, maize and rice over the period 2004-2023. These three products were chosen due to their significant role in the global economy. For the analysis, data were selected using the Harmonized System (HS) 4-digit product codes from Trade Map database. Specifically, wheat and meslin are coded as "1001", maize as "1005", and rice as "1006". 20 years of data on the exports and imports of countries were used and analyzed with the Indices of Revealed Comparative Advantage, Net Exports and Export-Import Ratio. According to the results of the RCA analysis, Ukraine has the highest competitive advantage in the global wheat and meslin export market, while Türkiye is the most competitively disadvantaged country. In the maize export market, Argentina holds the highest competitive advantage, whereas Türkiye is the most disadvantaged. In the rice export market, Guyana has the highest competitive advantage, with Türkiye being the most disadvantaged country after Austria.

Keywords: Exports, Revealed comparative advantage, Competitiveness, Türkiye

***Corresponding author:** Akdeniz University, Social Sciences Vocational School, Department of Marketing and Advertising, Marketing Pr., 07030, Antalya, Türkiye
E mail: zaktas@akdeniz.edu.tr (Z. AKTAŞ ÇİMEN)
Zeynep AKTAŞ ÇİMEN https://orcid.org/ 0000-0003-0959-5314

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1. Introduction

Agriculture has been the foundation of both nutrition and economic activities throughout human history, and agricultural products being the first products traded by societies. Although the mechanization of production processes during the industrial revolution somewhat overshadowed the importance of agriculture, it remains a critical sector for national economies (Aysu, 2018). Cereals, which are especially rich in carbohydrates and provide energy to the body, continue to be a basic food source for both human nutrition and animal husbandry (Can, 2023).

Cereals, which provide almost half of the nutrient and calorie needs in humans diets, include about a dozen varieties as food. Among of humans in their diets, are about a dozen as food. Of these, wheat, maize and rice are the most important food sources for human beings and will continue to be staple foodstuffs with the projected increase in the global population (Ranum et al., 2014; Erbaş Köse and Mut, 2018; Fukagawa and Ziska, 2019; Umair Riaz et al., 2020; Gutiérrez-Moya et al., 2021; Bin Rahman and Zhang, 2023). However, as an important and strategic sector in the global economy, agriculture is highly sensitive to weather and climate conditions. Indeed, the Paris Agreement (December 2015), which includes a global response to climate change, clearly recognizes that climate change will have negative impacts on countries' agricultural production (FAO, 2016). Agricultural products have a privileged role in meeting the food needs of societies, supplying raw materials to the industrial sector, creating employment and contributing to exports. However, in today's world, the global climate crisis, increasing world population, conflicts and wars between countries affect the production, trade and competition of agricultural products, which have an important place in human nutrition. The competitiveness of countries in agricultural products can vary at national, regional and global levels, and there are also differences in performance across countries (Jambor and Babu, 2017). Trade in agriculture and food has expanded since the 2000s with the liberalization of regional and multilateral trade (FAO, 2022). Wheat, rice and maize are the main agricultural commodities that have played a role in this expansion and are the cornerstones of food production and trade worldwide (Ji et al., 2024). During the period from 2004 to 2023, global exports of the three major cereal crops increased approximately fourfold, whereas Türkiye's exports surged nearly one hundredfold. Russia (19.15%), Australia (15.16%), and Canada (14.38%) collectively hold a 48.69% share in the global export rankings of wheat and meslin, with Türkiye contributing

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1.18%. In the global maize (corn) export market, the United States (25.60%), Brazil (25.47%), and Argentina (10.62%) together account for 61.69%, while Türkiye's share stands at 1.49%. Regarding global rice exports, India (29.99%), Thailand (14.66%), and Vietnam (12.54%) dominate with a combined share of 57.19%, whereas Türkiye's share is 0.51% (Trade Map, 2023). The competitiveness of agricultural products has therefore become an increasingly important issue in the global economy (Rodríguez et al., 2024) and one of the most important issues of the 21st century (Jambor and Babu, 2017). Understanding and improving agricultural competitiveness is therefore of paramount importance and is essential for a nation, sector or firm to be able to produce and export efficiently, sustainably and profitably in the face of evolving market demands (Thomé et al., 2023). Analyzing the competitiveness of agricultural products is crucial to provide policy recommendations and lessons on how to improve the competitiveness of agricultural products and food security in the long run (Jambor and Babu, 2017). Analysing trade dynamics such as competitiveness, export and import trends and global market access is crucial for understanding Türkiye's position in the global market for wheat and meslin, maize (corn) and rice. Recent studies have provided valuable insights into Türkiye's competitiveness in these products. These studies have analyzed the competitive situation of agricultural products in the global market from various dimensions (Şahin, 2016; Sarıçoban and Kösekahyaoğlu, 2016; Geetha and Srivastava, 2018; Govindasamy et al., 2023; Oktan, 2024).

This research paper sheds light on key aspects of trade dynamics and competitiveness of three agricultural commodities: wheat, rice and maize. The study aims to reveal the competitiveness of the top 20 leading countries in the global export market of wheat and meslin, maize (corn) and rice using data from the Trade Map (2023) database for the period 2004-2023. The top 20 export leaders of these three products were selected because they account for 95.53% of wheat and meslin exports, 95.62% of maize (corn) exports, and 95.28% of rice exports. Türkiye ranks 10th in maize (corn) exports, 17th in wheat and meslin exports, and 19th in rice exports among the 20 countries in the export ranking of these three products. This study will analyze. Türkiye's competitive position vis-à-vis the top twenty global exporters of these three agricultural products. Such research is crucial for adapting to the rapidly changing dynamics of the global economic environment and for focusing on a strategic restructuring of national agricultural and food systems.

The study consists of six chapters. Following the introductory section, which highlights the importance of the study, the second chapter examines the top 20 exporters of wheat, maize (corn), and rice in the global economy, as well as Türkiye's position in the global market. The third chapter reviews the current literature on the topic, while the fourth chapter outlines the study's methodology. The fifth chapter presents the research findings, and the sixth chapter concludes the study with a general evaluation of the researched topic.

1.1. Outlook for International Trade in Wheat and Meslin, Maize (Corn) and Rice

International trade plays a critical role in the growth of national economies and increases countries' access to foreign markets. In addition, international trade, creates new opportunities for local producers and provides product diversification, which plays an important role in stabilizing domestic markets and ensuring efficient use of resources (Sovcovici et al. 2024). According to Trade Map (2023), world exports of cereal crops consisting of wheat and meslin, maize (corn) and rice have increased approximately fourfold in the last 20 years, reaching 149881306 US Dollar thousand in 2023 (Figure 1).

Türkiye's exports of cereal crops, consisting of wheat and meslin, maize (corn) and rice, have increased nearly 100 times, reaching a staggering figure of 1697349 US Dollar thousand in 2023 (Figure 2). This rapid expansion is attributed to improvements in production and trade operations, which support the growth of the national agro-industrial sector and exports of agricultural and food products. In this context, assessing the competitiveness of agricultural exports is critical for improving the efficiency of production processes and developing effective marketing strategies.

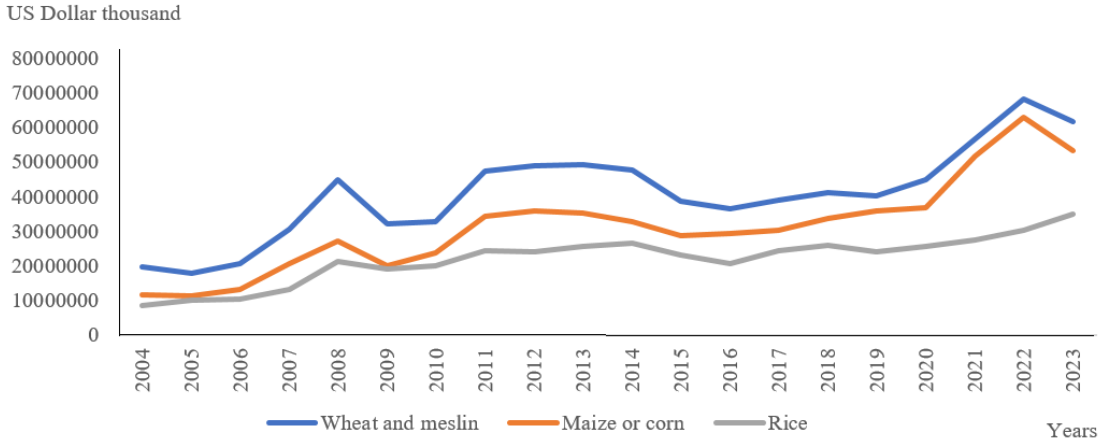

Figure 1. World wheat and meslin, maize (corn) and rice exports (2004-2023) (Trade Map, 2023).

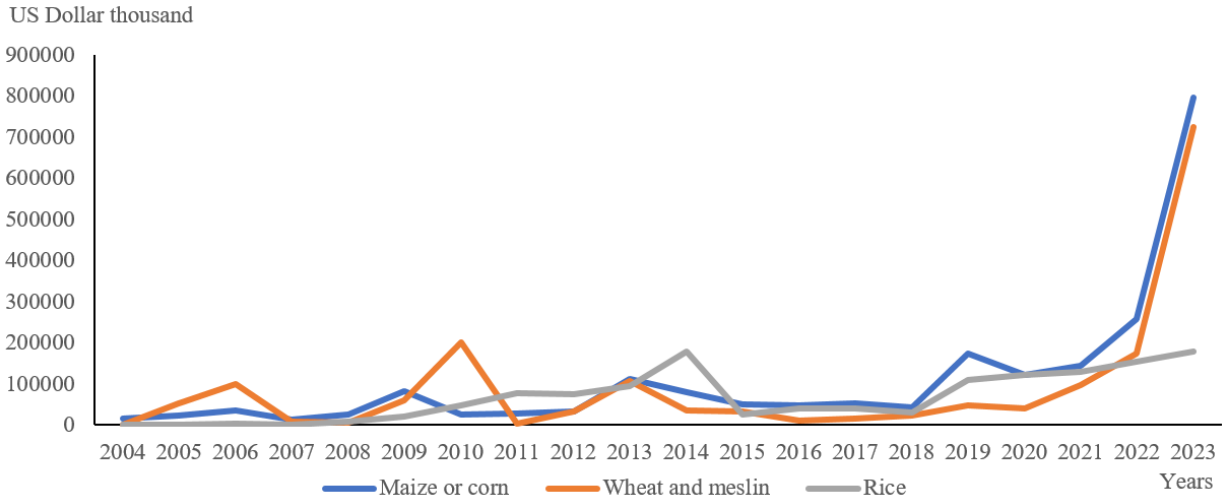

Figure 2. Türkiye's wheat and meslin, maize (corn) and rice exports (2004-2023) (Trade Map, 2023).

Table 1. Shares of top 20 countries in world total maize (corn), wheat and meslin, rice exports (2023) (Trade Map, 2023)

	Maize (Corn)		Wheat and Meslin		Rice	
Ranking	Country	%	Country	%	Country	%
1	USA*	25.60	Russia	19.15	India	29.99
2	Brazil	25.47	Australia	15.16	Thailand	14.66
3	Argentina	10.62	Canada	14.38	Viet Nam	12.54
4	Ukraine	9.29	USA	9.97	Pakistan	8.26
5	France	3.77	France	6.47	USA	5.78
6	Romania	3.14	Ukraine	4.78	Cambodia	5.39
7	Poland	2.42	Romania	3.62	China	2.82
8	South Africa	2.26	Poland	3.19	Italy	2.78
9	Russia	2.25	Germany	3.15	Myanmar	2.13
10	Türkiye	1.49	Kazakhstan	3.01	Brazil	1.78
11	Canada	1.43	Bulgaria	2.73	Uruguay	1.71
12	Paraguay	1.40	Lithuania	1.69	Belgium	1.34
13	Hungary	1.32	Argentina	1.42	Paraguay	1.19
14	India	1.32	Hungary	1.34	Netherlands	1.19
15	Myanmar	0.85	CR**	1.21	Australia	0.81
16	Bulgaria	0.71	Brazil	1.18	Djibouti	0.74
17	Pakistan	0.65	Türkiye	1.18	Guyana	0.69
18	Austria	0.65	Latvia	1.01	Spain	0.63
19	Serbia	0.52	Slovakia	0.75	Türkiye	0.51
20	Croatia	0.47	UK	0.56	Tanzania.	0.36
	Total	95.62	Total	95.93	Total	95.28

* United States of America ** Czech Republic *** United Kingdom.

Although the production of wheat, maize and rice, which are the most important food sources, shows regional differences, the USA ranks first with 25.60% share in maize (corn) exports, Russia with 19.15% share in wheat and meslin exports, and India with 29.99% share in rice exports (Table 1). The world export value of wheat is 61,543,142 thousand US Dollars (2023), with Türkiye accounting for 1.18% of world exports, amounting to 723,601 thousand US Dollars. For maize, world exports are valued at 53,447,386 thousand US Dollars (2023), with Türkiye accounting for 1.49% of world exports amounting to 795,323 thousand US Dollars. In rice, world exports are valued at 34,890,778 thousand US Dollars (2023), with and Türkiye accounting for 0.50% of world exports, amounting to 178,425 thousand US Dollars (Trade Map, 2023).

1.2. Literature Review

A better understanding of how competitive advantage relates to the real world is useful for determining the consequences of policy changes and clarifying economic welfare (Vollrath, 1991). Differences in relative agricultural productivity across countries reinforce the role of comparative advantage and, together with incentives to trade, increase the potential gains from trade (FAO, 2022). There are numerous studies in the literature on the measurement of OCA.

Şahin (2016) analyzed Türkiye's competitiveness in agri-food products with RCA, Explained Symmetric Comparative Advantage and Balance of Trade indices; Sarıçoban and Kösekahyaoğlu (2016), examined Türkiye's export competitiveness in agricultural product groups with RTA index; Geetha and Srivastava (2018) assessed India's corn export performance with RCA Index and Regression analysis; Pascucci (2018) utilized RCA, NEI, export market share and net export share indices to evaluate the competitive position of Italian roasting firms and the export competitiveness of the sector; Kutkowska and Szuk (2020) employed the Relative Trade Advantage (RTA), Export Market Share, Export Orientation, Relative Export Orientation, Hypothetical Exports and Trade Coverage indices to analyze trends in production, exports and imports, as well as the competitiveness of exporters in the global grain market; Nithyashree et al. (2020) investigated India's maize export performance with the RCA index; Maqbool et al. (2020) examined RCA, Vollrath index, Revealed Symmetric Comparative Advantage index (RSCA), Revealed Import Advantage (RMA) index, Revealed Trade Advantage (RTA) index and Net Export Index (NEI) for Pakistan's cereals trade competitiveness; Thomé and Paiva (2020) analyzed the international market structure and competitiveness of sparkling wine with RCA, NEI, Relative Position in the Market (RPM) and Hirschman-Herfindahl Index (HHI); Bashimov (2022) assessed Kazakhstan's comparative advantage in cereals exports using the RCA and RSCA indices; Thomé et al. (2023) evaluated the international market structure and export competitiveness of wine using the Revealed Symmetric Comparative Advantage (RSCA) Herfindahl-Hirschman Index and NEI; Govindasamy et al. (2023) analyzed the competitiveness of Pakistan's agricultural products (wheat, rice, maize, sugarcane and cotton) with using the RCA, Relative Export Advantage Index (RXA), RMA and Relative Import Advantage (RTA) indices; Oktan (2024) analyzed the competitiveness of Türkiye's cereals in comparison with G7 countries with RCA, RXA, RMA Revealed Competitiveness Index (RC), RTA, Export Specialization (ES), Net Trade (NT), Export Similiraty (ES) indices.

Although there are studies on the competitiveness of agricultural products in the literature, there are no studies specifically addressing the global competitiveness of Türkiye's maize (corn), wheat and meslin and rice products. However, people worldwide obtain 51% of their calories from just these three crops: rice, wheat and corn (Sing, 2022). Developed countries, on the other hand, never give up agriculture. They are leaders, especially in the production of critical products. It is urgent for Türkiye to develop strategies in this regard. This study aims to contribute to closing the gap in the relevant literature.

2. Materials and Methods

2.1. Data Collection

This paper uses country trade data to calculate and assess the competitiveness of Türkiye's agricultural products for wheat, maize, and rice over the period 2004-2023. Although data sources such as UN COMTRADE, OECD Database, Trade Map (United Nations Commodity Trade Statistics Database) play an important role in providing worldwide trade data, export data, especially at the product level, are often reported two or three years late. Therefore, the final year for the analysis is 2023. The analysis focuses on the top 20 global exporters of wheat, maize and rice for the period 2004-2023. The survey data used in the study were obtained by selecting the "Total-All products" classification from the Trade Map (2023) database. Since some of the countries identified for the analysis had missing data for the period 2004-2023, index values could not be obtained for those years. Only one country's data for a single year was corrected to avoid affecting the analysis value.

There are a total of 238 member countries registered as product exporters in the Trade Map (2023) database. The study covers 20 years from 2004 to 2023. Ten years of trade data is considered sufficient to examine the trade competitiveness of a product (Jagadeesh et al., 2024). The top twenty countries exporting maize (corn), wheat and meslin and rice products in the Trade Map (2023) database were analyzed to obtain index values. The share of the top 20 maize (corn) exporters in world maize (corn) exports is 95.62%; the share of the top 20 wheat and meslin exporters in world wheat and meslin exports is 95.93%; and the share of the top 20 rice exporters in world rice exports is 95.28%. The countries with incomplete data on trade in these three cereal crops are Russia (missing data for 2022-2023), Myanmar (missing data for 2004-2009), Serbia (missing data for 2004-2005), Djibouti (only data for 2009-2021-2022-2023), Guayana, which has incomplete data for maize (corn) and wheat and meslin, but provides complete data for rice for the period 2004-2023. In this study, HS product codes are used to assess the competitiveness of Türkiye's wheat, maize and rice exports vis-à-vis the top 20 countries in the global market. Products and codes according to the Harmonized System (HS) in the Trade Map database;

"1001" coded wheat and meslin,

"1005" coded maize (corn) coded and

"1006" coded is rice. The use of HS product codes to analyze the export competitiveness of a product is a common practice, as shown in other studies examining various commodity exporting countries (Hasan and Das, 2024). HS is a product nomenclature system currently used by more than 200 countries (Trade Map, 2023) and is a versatile tool covering more than 98% of internationally traded goods (Cornejo et al., 2023).

2.2. Methods Measures

Foreign trade is a stochastic process that changes over time under the influence of economic, political and

environmental factors. Therefore, analyzing comparative advantages in foreign trade is important for developing specific strategies to improve foreign trade (Sovcovici et al., 2024). A country's competitive advantage, defined as its ability to produce in certain sectors (products) more efficiently, with higher quality, or more cost-effectively than other countries, is important for each country to analyze its comparative advantages and develop specific strategies to improve foreign trade (Balassa, 1965).

2.2.1. Balassa's revealed comparative advantage (RCA) index

The RCA index, based on the assumptions of the Ricardian trade model and also referred to as the Balassa (1965) index, is a quantitative method of analyzing the comparative advantage of exports. RCA is used to measure and evaluate a country's specialization in certain goods or services compared to other nations or regions (Balassa, 1965). The index value provides a general indication and overview of a country's export competitiveness and helps set foreign trade policy priorities. However, the RCA index does not take into account national practices that affect competitiveness such as tariffs, non-tariff measures, subsidies, etc. (United Nations Conference on Trade and Development, 2025). While the RCA index is widely used in the international trade literature, it is recommended to use it in combination with other indices to assess the sectoral effects of changes in trade barriers or to identify close competitors (French, 2017). The RCA index is calculated as the ratio of a country's exports in a sector to the share of world exports in that sector. If the index value indicates that a country's share of exports of a product exceeds its global share, the country is considered to have a declared comparative advantage in that product (Hasan and Das, 2024). Such analyses play an important role in shaping trade policies and accurately assessing international competition (Reed, 2024). The index was formulated by Balassa (1965) as equation 1:

$$RCA = \frac{X_{kt}^{j} / X_{t}^{j}}{X_{kt}^{w} / x_{t}^{w}} \quad (1)$$

In this context,

X^{j}_{kt} = j country's exports of product (sector) k in period t,

X^{j}_{t} = country j's total exports in period t.

X^{w}_{kt} = k product (sector) refers to total world exports in period t,

X^{w}_{t} = is the total value of world exports in period t (Sarıçoban et al., 2017).

If the RCA value is above "1", it indicates that the country has a significant comparative advantage (specialization) in the product in question. If the RCA value is less than 1, it indicates that the country does not have a significant comparative advantage (no specialization) in the product in question (Granabetter, 2016; Geetha and Srivastava, 2018; Hasan and Das, 2024). The larger the RCA value, the more important the comparative advantage becomes (Hasan and Das, 2024). In order to facilitate the interpretation of the RCA Index results, Hinloopen and Van Marrewijk (2001) have made the following quadruple classification:

Class 1: 0 < RCA ≤ 1 Disadvantage (no competitiveness)

Class 2: 1 < RCA ≤ 2 Weak competitiveness

Class 3: 2 < RCA ≤ 4 Medium competitiveness

Class 4: 4 < RCA Strong competitiveness

Here, Class 1 indicates a state of disadvantage, i.e. the country has no comparative advantage in the sector in question, while Class 2, Class 3 and Class 4 indicate situations where the country's comparative advantage in the relevant sector has shifted from weak to strong competitiveness.

2.2.2. Net export index (NEI)

NEI is another key index used of the main indices used to analyze export competitiveness at the level of a specific product group (sector). It is a variation of the RCA index developed by Balassa (1965) and includes both exports and imports in the model (Marković et al., 2019). The NEI serves as an indicator of a country's external competitiveness by incorporating international export and import flows related to a specific product group (sector) (Marković, 2019). The index shows whether a country is a net exporter or net importer of a particular product group (sector). If a country is a net exporter of a particular product group, it indicates that the country has a competitive advantage in the global market in that product group (sector). Conversely, a high NEI value may indicate that the product is in demand in the world market and that the production capacity or productivity of that country is high (Banterle and Carraresi, 2007; Pascucci, 2018; Thomé and Paiva, 2020). NEI is formulated as in equation 2 (Sarıçoban and Kösekahyaoğlu, 2017):

$$NEI = \frac{X_{kt}^{j} - M_{kt}^{j}}{X_{kt}^{j} + M_{kt}^{j}} \quad (2)$$

In this context;

X^{j}_{kt} = denotes the exports of country j of product (sector) k in period t,

M^{j}_{kt} = shows the imports of product (sector) k of country j in period t (Aktaş Çimen and Sarıçoban, 2024). The NEI value ranges from "-1" to "+1" (Balassa and Noland, 1989). "+1" indicates pure exports and the highest comparative advantage; '-1' indicates pure imports and the highest disadvantage; '0' indicates balanced trade or maximum intra-industry trade (Amighini, 2004). When the index value is between "-1" and "0", it indicates disadvantage; when it is between "0" and "+1", it indicates advantage; and when it is equal to "0", it indicates that exports and imports of a given product are balanced. In other words, NEI measures the degree of specialization of a country's exports of a particular good (Asciuto et al., 2008; Saboniene, 2009).

2.2.3. Export-import ratio index (EIRI)

The EIRI is related to the concept of RCA and indicates the competitiveness of a country in a particular product group, specifically the level of specialization in the global

trade of that product group (Saboniene, 2009; Bashimov, 2018). The index shows the ratio of a country's export share to its import share in any product and the EIRI is formulated as in equation 3 (Balassa, 1977; Sarıçoban and Kösekahyaoğlu, 2017):

$$EIRI = \frac{X_{kt}^{j} / X_{t}^{j}}{M_{kt}^{j} / M_{t}^{j}} \quad (3)$$

In this context;

X^{j}_{kt} = 'j' country's exports of product group 'k' in period 't',

X^{j}_{t} = total exports of country 'j' in period 't',

M^{j}_{kt} = 'j' country's imports of 'k' product group in period 't',

M^{j}_{t} = Total imports of country 'j' in period 't'. An EIRI value greater than 1 indicates that the country specializes in the relevant product and has a competitive advantage, while a value less than 1 indicates that the country does not specialize and is competitively disadvantaged (Mikic, 2005).

3. Results and Discussion

In the analyses with RCA, NEI and EIRI for the top 20 countries including Türkiye in the global export market of wheat and meslin, maize (corn) and rice, the coefficients of revealed comparative advantage are calculated based on Trimmed Mean (TM: It refers to the removal of the highest and lowest values from a series and taking the arithmetic mean of the remaining values (Statistics How To, 2025) values. In addition, some abbreviations used in the tables are as follows:

- Between 2004-2013, the arithmetic average of the RCA coefficients for the 10 years,
- Between 2014-2023, the arithmetic average of the RCA coefficients for 10 years,
- Degree of Superiority: Indicates the degree of superiority (disadvantage, weak superiority, moderate superiority, and strong superiority) according to the appropriate average RCA values.
- Product Code (PC)
- Trimmed Mean (TM)
- Degree of Superiority (DS)
- Average (Av.)

The RCA coefficients calculated for the export of wheat and meslin, maize (corn), and rice for selected countries and Türkiye in world exports have been tabulated both periodically and in TM form.

Additionally, the TM RCA indices have been classified according to their superiority levels and displayed in the last column of the table.

3.1. Competitiveness of the Top 20 Countries in World Wheat and Meslin Exports

The TM values of the RCA coefficients, showing the competitive situation in the global market for the top 20 countries, including Türkiye, in the world wheat and meslin export ranking, are presented in Table 2.

According to the TM values, 15 out of 20 countries seem to have a competitive advantage in the wheat and meslin export market. However, among these 15 countries, 10 have a strong competitive advantage, 2 have a moderate competitive advantage and 3 have a weak competitive advantage. While 15 countries can compete in the global market for wheat and meslin exports, 5 countries (Poland, Germany, Brazil, United Kingdom and Türkiye) are at a competitive disadvantage.

Table 2. The RCA index values of the top 20 countries in world wheat and meslin exports

Ranking	Country	PC	2004-2013 Av.	2014-2023 Av.	TM	DS
1	Russia	'1001	2.82	6.26	4.45	Strong Superiority
2	Australia	'1001	9.73	7.67	8.53	Strong Superiority
3	Canada	'1001	4.95	5.67	5.34	Strong Superiority
4	USA	'1001	2.63	1.62	2.12	Moderate Superiority
5	France	'1001	3.65	3.36	3.41	Moderate Superiority
6	Ukraine	'1001	9.00	27.73	18.42	Strong Superiority
7	Romania	'1001	2.95	7.29	5.20	Strong Superiority
8	Poland	'1001	0.54	1.42	0.96	Disadvantage
9	Germany	'1001	0.58	0.54	0.56	Disadvantage
10	Kazakhstan	'1001	6.76	7.77	7.31	Strong Superiority
11	Bulgaria	'1001	7.29	11.43	9.56	Strong Superiority
12	Lithuania	'1001	4.88	8.65	6.78	Strong Superiority
13	Argentina	'1001	12.63	12.53	12.75	Strong Superiority
14	Hungary	'1001	1.88	1.96	1.92	Weak Superiority
15	CR*	'1001	0.88	1.13	1.03	Weak Superiority
16	Brazil	'1001	0.52	0.42	0.46	Disadvantage
17	Türkiye	'1001	0.25	0.20	0.19	Disadvantage
18	Latvia	'1001	7.28	13.45	10.53	Strong Superiority
19	Slovakia	'1001	0.75	1.23	1.01	Weak Superiority
20	UK**	'1001	0.48	0.22	0.34	Disadvantage

PC= product code, TM= trimmed mean, DS= degree of superiority, Av.= average, *CR: Czech Republic **UK: United Kingdom.

In the global market for wheat and meslin exports, the countries with strong dominance are Ukraine (18.42), Argentina (12.75), Latvia (10.53), Bulgaria (9.56), Australia (8.53), Kazakhstan (7.31), Lithuania (6.78), Canada (5.34), Romania (5.20), and Russia (4.45). The country with the highest competitive advantage in the global market is Ukraine. Additionally, Ukraine's increase in its RCA value from 9.00 in the 2004-2013 period to 27.73 in the 2014-2023 period indicates a significant competitive advantage in the global wheat and meslin export market. The top three countries that increased their competitive advantage in the second period compared to the first period are Ukraine (+9.42), Latvia (+3.25), and Bulgaria (+2.27). On the contrary, the first top three countries that lost competitive strength in the second period compared to the first period are. For Türkiye, whose population is increasing above the world average, this situation indicates that urgent intervention is necessary. Türkiye (During the 2004-2023 period, the area of agricultural land in Türkiye decreased faster than the world average (7.57%), while its population increased more than the world average (24.40%) (World Bank, 2024) is the most disadvantaged country in the global competition in the wheat and meslin export market according to the TM value. In the RCA analysis covering the period from 2004 to 2023, Türkiye's RCA value for the period from 2004 to 2013 decreased from 0.25 to 0.20 in the period from 2014 to 2023. This decline in Türkiye's RCA value indicates that Türkiye has been gradually losing its competitive edge in the global wheat and meslin export market during the 2004-2023 period.

The NEI results showing the commercial performance of the top 20 countries leading in wheat and meslin exports in the global market are presented in Table 3.

Table 3. The NEI values of the top 20 countries in world wheat and meslin exports

Ranking	Country	PC	2004-2013 Av.	2014-2023 Av.	TM	DS
1	Russia	'1001	0.89	0.97	0.95	Specialization Exists
2	Australia	'1001	1.00	0.98	1.00	Specialization Exists
3	Canada	'1001	0.99	0.99	0.99	Specialization Exists
4	USA	'1001	0.85	0.81	0.83	Specialization Exists
5	France	'1001	0.95	0.94	0.95	Specialization Exists
6	Ukraine	'1001	0.94	1.00	1.00	Specialization Exists
7	Romania	'1001	0.31	0.72	0.58	Specialization Exists
8	Poland	'1001	0.06	0.70	0.40	Specialization Exists
9	Germany	'1001	0.40	0.29	0.35	Specialization Exists
10	Kazakhstan	'1001	0.99	0.88	0.95	Specialization Exists
11	Bulgaria	'1001	0.89	0.97	0.95	Specialization Exists
12	Lithuania	'1001	0.85	0.92	0.90	Specialization Exists
13	Argentina	'1001	1.00	1.00	1.00	Specialization Exists
14	Hungary	'1001	0.93	0.84	0.89	Specialization Exists
15	CR*	'1001	0.91	0.95	0.94	Specialization Exists
16	Brazil	'1001	-0.77	-0.71	-0.75	No Specialization
17	Türkiye	'1001	-0.65	-0.92	-0.84	No Specialization
18	Latvia	'1001	0.61	0.60	0.62	Specialization Exists
19	Slovakia	'1001	0.62	0.93	0.79	Specialization Exists
20	UK**	'1001	0.07	-0.36	-0.14	Specialization Exists

PC= product code, TM= trimmed mean, DS= degree of superiority, Av.= average, *CR: Czech Republic **UK: United Kingdom.

According to the analysis, 17 of the 20 countries have positive NEI values, while 3 countries have negative NEI values. The positive values in the analysis indicate that the relevant countries are net exporters in the wheat and meslin foreign trade, while the negative values show that they are net importers. Among the countries with negative values, Brazil, Türkiye, and the United Kingdom, Türkiye has the highest negative TM value. This means that the Kingdom is actually a net importer in the wheat and meslin foreign trade. Positive NEI values may indicate that the relevant countries contribute positively to the export of wheat and meslin and their trade balances.

The results of the EIRI analysis for the top 20 countries in the world wheat and meslin export ranking, which primarily measures intra-industry trade and provides information about the country's own trade performance, are shown in Table 4.

The EIRI analysis results indicate that Brazil and Türkiye are at a disadvantage in wheat and meslin exports. Additionally, the table shows that Argentina, Australia, and Ukraine have the highest advantages in wheat and meslin exports. The high EIRI values of Argentina, Australia, and Ukraine indicate that these countries have a higher export performance rather than importing wheat and meslin. However, the average RCA values of Argentina and Australia for 2014-2023 are lower than their average RCA values for 2004-2013. Ukraine's average RCA value for 2014-2023 is higher than its average RCA value for 2004-2013.

Table 4. The EIRI values of the top 20 countries in world wheat and meslin exports

Ranking	Country	PC	2004-2013 Av.	2014-2023 Av.	TM	DS
1	Russia	'1001	965.85	128.23	267.60	Competitive Advantage
2	Australia	'1001	102751.16	30171.80	50867.45	Competitive Advantage
3	Canada	'1001	791.33	300.00	521.03	Competitive Advantage
4	USA	'1001	23.86	14.33	18.06	Competitive Advantage
5	France	'1001	73.25	59.40	64.98	Competitive Advantage
6	Ukraine	'1001	1395.76	1786.00	1541.41	Competitive Advantage
7	Romania	'1001	5.93	9.30	7.54	Competitive Advantage
8	Poland	'1001	2.43	8.77	5.31	Competitive Advantage
9	Germany	'1001	3.84	2.60	3.16	Competitive Advantage
10	Kazakhstan	'1001	1220.81	132.39	560.46	Competitive Advantage
11	Bulgaria	'1001	103.06	99.71	100.12	Competitive Advantage
12	Lithuania	'1001	31.84	44.17	35.82	Competitive Advantage
13	Argentina	'1001	59742.29	51995.12	51581.09	Competitive Advantage
14	Hungary	'1001	65.26	17.93	36.17	Competitive Advantage
15	CR*	'1001	48.36	53.17	49.78	Competitive Advantage
16	Brazil	'1001	0.23	0.27	0.23	Competitive Disadvantage
17	Türkiye	'1001	0.73	0.06	0.25	Competitive Disadvantage
18	Latvia	'1001	9.16	5.94	7.19	Competitive Advantage
19	Slovakia	'1001	9.93	46.91	26.68	Competitive Advantage
20	UK**	'1001	2.15	0.77	1.42	Competitive Advantage

PC= product code, TM= trimmed mean, DS= degree of superiority, Av.= average, *CR: Czech Republic **UK: United Kingdom.

These findings regarding Argentina, Australia, and Ukraine indicate that Argentina and Australia's competitive advantages in the global wheat and meslin export market have diminished, while Ukraine's competitiveness has increased. Additionally, the table indicates that during the 2004-2023 period, 7 of the top 20 countries in the world wheat and meslin export market increased their competitive strength, while 13 of them saw a decrease in their competitiveness. The countries that have lost competitiveness are Russia, Australia, Canada, the USA, France, Germany, Kazakhstan, Bulgaria, Argentina, Hungary, Latvia, and the United Kingdom, while the countries that have increased their competitiveness are Ukraine, Romania, Poland, Lithuania, the Czech Republic, Brazil, and Slovakia.

3.2. Competitiveness of the Top 20 Countries in World Maize (Corn) Exports

The TM values of the RCA coefficients, which show the competitive situation in the global market for the top 20 countries in the world maize (corn) export ranking, where Türkiye ranks 10th, are shown in Table 5. According to TM values, 12 out of the 20 countries in the maize (corn) export market appear to have a competitive advantage. However, among the 12 countries with a competitive advantage, 8 have a strong, 3 have a moderate, and 1 has a weak competitive advantage. While 12 countries can compete in the global maize (corn) export market, 6 countries (Poland, Russia, Türkiye, Canada, Pakistan, and Austria) are at a competitive disadvantage. 2 countries (Myanmar and Serbia) could not have their RCA index value calculated due to missing data.

Argentina (34.45), Ukraine (28.78), Paraguay (24.57), Brazil (9.67), Romania (6.22), Hungary (4.52), Bulgaria (4.36), USA (4.32), respectively. The country with the highest competitive advantage in the global market is Argentina, which increased its RCA value from 28.66 in the period 2004-2013 to 40.41 in the period 2014-2023, indicating a further increase in its competitive advantage in the global maize (corn) export market. The top 3 countries that increased their competitive advantage in the second period compared to the first period are Ukraine (+32.92), Argentina (+11.75) and Brazil (+2.27). Conversely, Hungary (-1.78), USA (-1.42) and India (-1.05) are the top 3 countries that lost competitive advantage in the second period compared to the first period. These results indicate that while 3 countries (Ukraine, Argentina, Brazil) have become more competitive in the global maize (corn) export market, the other 3 countries (Hungary, USA, India) have lost competitiveness in the global market. Türkiye slightly increased its competitiveness in the maize (corn) export market slightly by increasing its RCA value (0.06) in the second period compared to the first period. However, according to the TM value, Türkiye remains the most disadvantaged country in global competition in the maize (corn) export market.

The NEI results showing the commercial performance of the top 20 countries leading in maize (corn) exports in the global market are presented in Table 6. According to the analysis, 16 out of the 20 countries have positive NEI values, while 2 countries have negative NEI values. The NEI index value could not be calculated for Myanmar and Serbia due to missing data positive values in the analysis indicate that the respective countries are net exporters in maize (corn) foreign trade, while the negative values indicate that they are net importers.

Table 5. The RCA index values of the top 20 countries in world maize (corn) exports

Ranking	Country	PC	2004-2013 Av.	2014-2023 Av.	TM	DS
1	USA	'1005	5.03	3.61	4.32	Strong Superiority
2	Brazil	'1005	6.53	12.75	9.67	Strong Superiority
3	Argentina	'1005	28.66	40.41	34.45	Strong Superiority
4	Ukraine	'1005	12.60	45.52	28.78	Strong Superiority
5	France	'1005	2.52	1.69	2.08	Moderate Superiority
6	Romania	'1005	4.20	8.14	6.22	Strong Superiority
7	Poland	'1005	0.30	0.76	0.50	Disadvantage
8	South Africa	'1005	3.43	2.96	3.25	Moderate Superiority
9	Russia	'1005	0.14	0.94	0.51	Disadvantage
10	Türkiye	'1005	0.23	0.39	0.26	Disadvantage
11	Canada	'1005	0.30	0.42	0.36	Disadvantage
12	Paraguay	'1005	25.65	23.64	24.57	Strong Superiority
13	Hungary	'1005	5.45	3.67	4.52	Strong Superiority
14	India	'1005	1.71	0.66	1.14	Weak Superiority
15	Myanmar	'1005	0.00	0.00	0.00	2004-2010 missing data
16	Bulgaria	'1005	3.76	5.10	4.36	Strong Superiority
17	Pakistan	'1005	0.71	1.20	0.77	Disadvantage
18	Austria	'1005	0.66	0.67	0.67	Disadvantage
19	Serbia	'1005	0.00	0.00	0.00	2004-2005 missing data
20	Croatia	'1005	1.94	4.43	3.16	Moderate Superiority

PC= product code, TM= trimmed mean, DS= degree of superiority, Av.= average.

Table 6. The NEI values of the top 20 countries in world maize (corn) exports

Ranking	Country	PC	2004-2013 Av.	2014-2023 Av.	TM	DS
1	USA	'1005	0.89	0.92	0.92	Specialization Exists
2	Brazil	'1005	0.80	0.90	0.87	Specialization Exists
3	Argentina	'1005	0.99	0.99	0.99	Specialization Exists
4	Ukraine	'1005	0.78	0.93	0.87	Specialization Exists
5	France	'1005	0.76	0.70	0.73	Specialization Exists
6	Romania	'1005	0.36	0.66	0.54	Specialization Exists
7	Poland	'1005	-0.34	0.26	-0.02	No Specialization
8	South Africa	'1005	0.59	0.62	0.66	Specialization Exists
9	Russia	'1005	-0.29	0.63	0.21	Specialization Exists
10	Türkiye	'1005	-0.55	-0.58	-0.60	No Specialization
11	Canada	'1005	-0.34	-0.18	-0.27	No Specialization
12	Paraguay	'1005	0.70	0.75	0.74	Specialization Exists
13	Hungary	'1005	0.86	0.63	0.76	Specialization Exists
14	India	'1005	0.98	0.79	0.91	Specialization Exists
15	Myanmar	'1005	-	0.85	-	2004-2009 missing data
16	Bulgaria	'1005	0.38	0.67	0.55	Specialization Exists
17	Pakistan	'1005	-0.47	-0.35	-0.44	No Specialization
18	Austria	'1005	0.14	-0.07	0.03	Specialization Exists
19	Serbia	'1005	-	0.87	-	2004-2005 missing data
20	Croatia	'1005	0.27	0.58	0.46	Specialization Exists

PC= product code, TM= trimmed mean, DS= degree of superiority, Av.= average.

Among the countries with negative values, Poland, Türkiye, Canada, and Pakistan, Türkiye has the highest negative TM value. These results mean that Türkiye, Poland, Canada, and Pakistan are actually net importer countries in maize (corn) foreign trade. Positive NEI values may mean that the relevant countries' maize (corn) exports positively contribute to their foreign trade balances. The negative situation in the NEI values of Poland, Türkiye, Canada, and Pakistan regarding maize (corn) trade may mean a negative contribution to global export competitiveness.

The analysis results conducted with EIRI for the top 20 countries in the world maize (corn) export ranking, which measures intra-industry trade and provides information about the country's own trade performance, are shown in Table 7. The EIRI analysis results show that Türkiye and Canada are at a disadvantage in maize (corn) exports. Additionally, the table shows that Argentina,

India, and the USA have the highest advantages in maize (corn) exports. The high EIRI values of Argentina, India, and the USA indicate that these countries have a higher export performance in maize (corn) rather than import.

Argentina's average RCA value for 2014-2023 is greater than its average RCA value for 2004-2013. This increase in the RCA value means that Argentina's competitiveness in global maize (corn) exports has further increased. In the maize (corn) export market, India's average RCA value decreased from 349.55 in the 2004-2013 period to 60.70 in the 2014-2023 period, while the USA's RCA value declined from 44.50 to 40.09 during the same period. These findings regarding India and the USA indicate that the competitive advantage of India and the USA in the global maize (corn) export market has diminished. India has significantly reduced its competitiveness in the global maize (corn) market during the 2014-2023 period. Additionally, the table indicates that 12 of the top 20 countries in global maize (corn) exports from 2004-2023 have increased their competitiveness, while 8 have seen a decline in their competitiveness. Countries losing competitiveness include the USA, France, South Africa, Türkiye, Paraguay, Hungary, India, and Austria, while countries gaining competitiveness are Brazil, Argentina, Ukraine, Romania, Poland, Russia, Canada, Myanmar, Bulgaria, Pakistan, Serbia, and Croatia.

Table 7. The EIRI values of the top 20 countries in world maize (corn) exports

Ranking	Country	PC	2004-2013 Av.	2014-2023 Av.	TM	DS
1	USA	'1005	44.50	40.09	42.35	Competitive Advantage
2	Brazil	'1005	26.66	47.40	32.00	Competitive Advantage
3	Argentina	'1005	312.63	362.36	327.97	Competitive Advantage
4	Ukraine	'1005	16.04	58.42	33.89	Competitive Advantage
5	France	'1005	12.27	7.92	10.04	Competitive Advantage
6	Romania	'1005	5.06	6.97	6.09	Competitive Advantage
7	Poland	'1005	1.07	2.59	1.73	Competitive Advantage
8	South Africa	'1005	32.83	24.39	25.99	Competitive Advantage
9	Russia	'1005	2.01	6.42	3.72	Competitive Advantage
10	Türkiye	'1005	0.78	0.44	0.42	Competitive Disadvantage
11	Canada	'1005	1.00	1.01	0.93	Competitive Disadvantage
12	Paraguay	'1005	10.99	10.40	10.53	Competitive Advantage
13	Hungary	'1005	23.87	7.64	14.66	Competitive Advantage
14	India	'1005	349.55	60.70	172.77	Competitive Advantage
15	Myanmar	'1005	-	20.76	-	Missing Data
16	Bulgaria	'1005	6.58	8.03	7.19	Competitive Advantage
17	Pakistan	'1005	1.06	1.47	1.03	Competitive Advantage
18	Austria	'1005	2.25	1.20	1.68	Competitive Advantage
19	Serbia	'1005	-	28.46	-	Missing Data
20	Croatia	'1005	4.43	5.42	4.94	Competitive Advantage

PC= product code, TM= trimmed mean, DS= degree of superiority, Av.= average.

3.3. Competitiveness of the Top 20 Countries in Global Rice Exports

In the ranking of the top 20 countries exporting rice in the world, Türkiye ranks 19th. The TM values of the RCA coefficients, which show the competitive situation in the global market for the top 20 rice-exporting countries, are presented in Table 8. According to TM values, 12 out of 20 countries in the rice export market appear to have a competitive advantage. However, among the 12 countries with a competitive advantage, 9 have a strong competitive advantage, while 3 have a weak competitive advantage. In the global market for rice exports, 12 countries are competitive, while 6 countries (China, Belgium, Netherlands, Austria, Spain, Türkiye) are at a disadvantage in the competition. The RCA index value could not be calculated for 2 countries (Myanmar and Djibouti) due to missing data. Countries with a strong dominance in the global rice export market are as follows: Guyana (86.87), Pakistan (63.87), Uruguay (46.68), Vietnam (19.75), Thailand (17.47), India (15.79), Paraguay (12.74), and Tanzania (4.26). The country with the highest competitive advantage in the global market is Guyana. However, the decrease in its RCA value from 104.66 in the 2004-2013 period to 68.18 in the 2014-2023 period indicates that it is gradually losing its competitive advantage in the global rice export market. The top three countries that increased their competitive advantage in the second period compared to the first period are Cambodia (17.92), Paraguay (12.78), and Tanzania (8.61). Conversely the top three countries that lost competitiveness in the second period compared to the first period are Guyana (-36.43), Vietnam (-22.92), and Uruguay (-14.25). These results show that while the competitiveness of three countries (Cambodia, Paraguay, Tanzania) in the global rice export market has increased, the other three countries (Guyana, Vietnam, Tanzania) have lost competitiveness in the global market. Türkiye, on the other hand, slightly enhanced its competitiveness

in the rice export market by increasing its RCA value by 0.20 in the second period compared to the first period. However, according to the TM value, Türkiye is the second most disadvantaged country in the global rice export market after Austria.

The NEI results showing the commercial performance of the top 20 countries leading in rice exports in the global market are presented in Table 9.

Table 8. The RCA index values of the top 20 countries in world rice exports

Ranking	Country	PC	2004-2013 Av.	2014-2023 Av.	TM	DS
1	India	‘1006	13.58	17.6	15.79	Strong Superiority
2	Thailand	‘1006	21.57	13.84	17.47	Strong Superiority
3	Viet Nam	‘1006	31.81	8.89	19.75	Strong Superiority
4	Pakistan	‘1006	59.28	63.68	63.87	Strong Superiority
5	USA	‘1006	1.27	0.83	1.05	Weak Superiority
6	Cambodia	‘1006	6.71	24.63	14.41	Strong Superiority
7	China	‘1006	0.27	0.2	0.23	Disadvantage
8	Italy	‘1006	1.1	0.93	1.01	Weak Superiority
9	Myanmar	‘1006	-	-	-	2004-2010 missing data
10	Brazil	‘1006	0.92	1.27	1.11	Weak Superiority
11	Uruguay	'1006	53.99	39.74	46.68	Strong Superiority
12	Belgium	'1006	0.46	0.52	0.48	Disadvantage
13	Paraguay	'1006	6.34	19.12	12.74	Strong Superiority
14	Netherland	'1006	0.23	0.33	0.28	Disadvantage
15	Austria	'1006	0.02	0.03	0.03	Disadvantage
16	Djibouti*	'1006	-	-	-	-
17	Guayana	'1006	104.61	68.18	86.87	Strong Superiority
18	Spain	'1006	0.58	0.43	0.49	Disadvantage
19	Türkiye	'1006	0.18	0.38	0.27	Disadvantage
20	Tanzania	'1006	1.44	10.05	4.26	Strong Superiority

PC= product code, TM= trimmed mean, DS= degree of superiority, Av.= average, * the data obtained is from the years of 2009-2021-2022 and 2023 only.

Table 9. The NEI values of the top 20 countries in world rice exports

Ranking	Country	PC	2004-2013 Av.	2014-2023 Av.	TM	DS
1	India	'1006	1.00	1.00	1.00	Specialization Exists
2	Thailand	'1006	1.00	0.99	1.00	Specialization Exists
3	Wiet Nam	'1006	0.97	0.86	0.93	Specialization Exists
4	Pakistan	'1006	0.98	0.97	0.98	Specialization Exists
5	USA	'1006	0.55	0.30	0.43	Specialization Exists
6	Cambodia	'1006	0.23	0.96	0.64	Specialization Exists
7	China	'1006	0.07	-0.39	-0.17	No Specialization
8	Italy	'1006	0.74	0.57	0.66	Specialization Exists
9	Myanmar	'1006	-	1.00	-	2004-2009 missing data
10	Brazil	'1006	-0.23	0.14	-0.01	No Specialization
11	Uruguay	'1006	1.00	0.99	0.99	Specialization Exists
12	Belgium	'1006	-0.01	-0.06	-0.04	No Specialization
13	Paraguay	'1006	0.94	0.99	0.98	Specialization Exists
14	Netherland	'1006	-0.14	-0.04	-0.08	No Specialization
15	Australia	'1006	-0.08	-0.01	-0.03	No Specialization
16	Djibouti*	'1006	-	-	-	-
17	Guayana	'1006	1.00	1.00	1.00	Specialization Exists
18	Spain	'1006	0.37	0.18	0.29	Specialization Exists
19	Türkiye	'1006	-0.72	-0.46	-0.59	No Specialization
20	Tanzania	'1006	-0.42	0.48	0.03	No Specialization

PC= product code, TM= trimmed mean, DS= degree of superiority, Av.= average, * the data obtained is from the years of 2009-2021-2022 and 2023 only.

According to the analysis, the NEI values of 12 out of the 20 countries appear positive, while the NEI values of 6 countries are negative. The NEI index value could not be calculated for Myanmar and Djibouti due to missing data positive values in the analysis indicate that the respective countries are net exporters in rice foreign trade, while the negative values indicate that they are net importers. The countries with negative values are China, Brazil, Belgium, the Netherlands, Australia, and Türkiye. Among these countries, the one with the highest negative TM value is Türkiye. These results mean that China, Brazil, Belgium, the Netherlands, Australia, and Türkiye are net importing countries in rice foreign trade. Positive NEI values may indicate that the relevant countries contribute positively to rice exports and trade balances. Conversely the negative NEI values of China, Brazil, Belgium, the Netherlands, Australia, and Türkiye in rice trade may indicate a negative contribution to global export competitiveness.

The analysis results of the top 20 countries in the world rice export ranking, which measures more intra-industry trade and provides information about the country's own trade performance, using EIRI, are shown in Table 10. According to the EIRI TM values, the analysis results show that Australia and Türkiye are at a disadvantage in rice exports. Additionally, it is understood that India, Thailand, and Uruguay have the highest advantage in rice exports according to the TM values in the table. The high EIRI values of India, Thailand, and Uruguay indicate that these countries have a strong performance in rice exports. However, India's average RCA value decreased from 163369.94 in the 2004-2013 period to 4399.32 in the 2014-2023 period, and Thailand's RCA value decreased from 2426.54 to 572.31 in the same period. These findings regarding India and Thailand indicate that their competitive advantage in the global rice export market has significantly decreased during the 2004-2023 period. Additionally, the table indicates that during the 2004-2023 period, 9 of the top 20 countries in global rice exports have increased their competitive strength, while 10 have seen a decrease in their competitiveness. The EIRI value for the country of Djibouti could not be calculated due to missing data. Countries that have increased their competitiveness are Cambodia, Myanmar, Brazil, Paraguay, Netherlands, Australia, Guyana, Türkiye, and Tanzania, while countries that have lost competitiveness are India, Thailand, Vietnam.

The index results for the top 20 leading exporters of wheat and meslin, maize (corn) and rice products in the global market are evaluated together with the results of similar studies previously conducted for India, Pakistan and Kazakhstan.

Geetha and Srivastava (2018), using the RCA Index and Regression Analysis, found that the quantity and value of India’s maize exports recorded significant growth in the post-WTO period (1996-2016), but exhibited an unstable Outlook.

Table 10. The EIRI values of the top 20 countries in world rice exports

Ranking	Country	PC	2004-2013 Av.	2014-2023 Av.	UO	DS
1	India	'1006	163369.94	4399.32	20922.97	Competitive Advantage
2	Thailand	'1006	2426.54	572.31	1220.98	Competitive Advantage
3	Viet Nam	'1006	91.14	58.43	76.63	Competitive Advantage
4	Pakistan	'1006	1169.49	92.91	507.70	Competitive Advantage
5	USA	'1006	5.58	2.65	4.04	Competitive Advantage
6	Cambodia	'1006	16.00	112.03	50.59	Competitive Advantage
7	China	'1006	2.23	0.62	1.34	Competitive Advantage
8	Italy	'1006	10.69	5.07	7.83	Competitive Advantage
9	Myanmar	'1006		1669.60		2004-2009 missing data
10	Brazil	'1006	1.32	1.95	1.61	Competitive Advantage
11	Uruguay	'1006	1656.21	468.76	905.04	Competitive Advantage
12	Belgium	'1006	1.57	1.21	1.38	Competitive Advantage
13	Paraguay	'1006	119.70	443.47	260.81	Competitive Advantage
14	Netherlands	'1006	1.21	1.27	1.26	Competitive Advantage
15	Australia	'1006	0.16	0.17	0.16	Competitive Disadvantage
16	Djibouti*	'1006	-	-	-	-
17	Guyana**	'1006	33037249.86	2285.69	488.46	Competitive Advantage
18	Spain	'1006	3.65	2.12	2.88	Competitive Advantage
19	Türkiye	'1006	0.33	0.51	0.41	Competitive Disadvantage
20	Tanzania	'1006	5.43	2020.10	451.46	Competitive Advantage

PC= product code, TM= trimmed mean, DS= degree of superiority, Av.= average, * Missing data (there is data from 2009-2021-2022-2023). ** The import value for 2008-2009 is "0". To calculate the index value, the values for the years 2008 and 2009 have been entered as "0.001".

They stated that increases in domestic maize (corn) production increases led to the development of maize exports. Nithyashree et al. (2020), on the other hand, pointed out that the decline in India's maize exports and the increase in maize imports have negatively affected the balance of trade over time and predicted an increase in India's imports, especially for cereals, in the future. The results of the analyses in this study covering the period 2004-2023 seem to confirm the findings of Geetha and Srivastava (2018) and Nithyashree et al. (2020). According to the NEI and EIRI analysis results, India has a high export performance in maize foreign trade and is a net exporter. However, the RCA analysis indicates that India has lost significant strength in global competition in maize exports during the period 2014-2023 compared to 2004-2013, suggesting a weak competitive advantage in the global maize export market.

Govindasamy et al. (2023) examined the competitiveness of wheat, maize (corn), rice, sugar cane and cotton, which are important agricultural products grown in Pakistan. They stated that Pakistan has a share in the world production of sugar cane and cotton, with rice being added to these products in recent years. However, they stated that Pakistan uses these products domestically rather than foreign trade and is very sensitive in terms of imports of these 5 agricultural products, showing a relative import advantage (RMA) in some years from 2001 to 2021. In this study, which analyses the competitiveness of the top 20 leading exporters of wheat and meslin, maize (corn) and rice in the global market, Pakistan was excluded from the analysis since it is not among the top 20 countries in wheat and meslin exports. However, ranking 17th in the maize (corn) export market and 4th in rice exports, Pakistan is among the leading countries in the global rice export market. Pakistan uses wheat and meslin and maize (corn) primarily to meet domestic demand and according to the RCA index results, Pakistan is disadvantaged in global competition in the maize (corn) export market. However, Pakistan has gained significant strength in global competition in maize exports in the 2014-2023 period compared to the 2004-2013 period. According to the results of NEI analysis, Pakistan is a net importer country in maize (corn) foreign trade contributing negatively to the foreign trade balance. According to the results of EIRI analysis, it is understood that Pakistan has increased its competitiveness in the global maize (corn) export market. According to the results of RCA index, Pakistan has a competitive advantage in rice exports in the global market NEI and EIRI analyses show that Pakistan has a high export performance in rice foreign trade and is a net exporter. In this study covering the period 2004-2023, the results of maize (corn) and rice analyses of Pakistan seem to confirm the findings of Govindasamy et al. (2023).

Bashimov (2022) determined that Kazakhstan has a comparative and competitive advantage especially in wheat and barley exports. In this study, which analyses the competitiveness of the top 20 leading exporters of wheat and meslin, maize (corn) and rice in the global market, Kazakhstan ranks 10th in global exports of wheat and meslin. According to the results of the RCA index, Kazakhstan has an advantageous position in the global market competition in wheat and meslin exports. According to the results of NEI analysis, Kazakhstan is a net exporter in wheat and meslin foreign trade and contributing positively to the foreign trade balance. According to the results of EIRI analysis, Kazakhstan has a competitive advantage in the global wheat and meslin export market, although it has slightly lost competitive power during the period 2014-2023 compared to the 2004-2013. In this study covering the period 2004-2023, the wheat and meslin analysis results of Kazakhstan confirm the findings of Bashimov (2022).

4. Conclusion

The importance of trade in the global economy has been continuously increasing from the past to the present. However, as agricultural areas shrink, the increasing world population, decreasing agricultural land areas, and the climate crisis have made the trade of agricultural products such as wheat and meslin, maize (corn), and rice, which meet more than half of the daily energy needs of the world's population, even more important. Countries that can effectively adapt to the changing global trade environment are achieving greater success in the global economy and increasing the intensity of competition in the trade of these products. In today's world economy, the conditions of fierce competition necessitate that trade be shaped solely based on advantages. This approach can help countries achieve their economic growth and development goals by utilizing their competitive advantages.

The study was conducted to reveal the competitiveness of the top 20 countries in the global wheat and meslin, maize (corn), and rice export market during the 2004-2023 period. Data for the period 2004-2023 concerning the 20 countries were obtained from the Trade Map database, and analyses were conducted using RCA, NEI, and EIRI. The top twenty exporters account for 95.53% of global wheat and meslin exports, 95.62% of maize (corn) exports, and 95.28% of rice exports. Ukraine, the country with the highest RCA index value in the global wheat and meslin export market, is a net exporting country according to the NEI value. While Australia and Argentina, the leaders of the global market from 2004 to 2023, have lost their competitive edge, Ukraine has become the country that has increased its competitive advantage the most. Ranking 17th in the global wheat and meslin export market, Türkiye is the most disadvantaged country in the global competition of the wheat and meslin export market according to the RCA index value. According to the NEI value, Türkiye is in the position of a net importer of wheat and meslin. Türkiye, which reduced its EIRI value from the 2004-2013 period to the 2024-2023 period, is the most disadvantaged

country in global competition. Argentina, the country with the highest RCA index value in the global maize (corn) export market, is a net exporter according to the NEI value. During the period from 2004 to 2023, while India and the USA, the leaders of the global market, lost competitive strength (especially India), Argentina became the country that increased its competitive advantage the most. Türkiye, ranked 10th in the global maize (corn) export market, is the most disadvantaged country in the global competition of the maize (corn) export market according to the RCA index value. According to the NEI value, Türkiye is a net maize (corn) importing country. Türkiye, which reduced its EIRI value in the 2024-2023 period compared to the 2004-2013 period, is the most disadvantaged country in global competition. The country with the highest RCA index value in the global rice export market, Guyana, is a net exporter according to the NEI value, and according to the EIRI value, Guyana was the leader in the global market from 2004 to 2023. Meanwhile, India and Thailand have lost their competitive power, while Tanzania has increased its competitive advantage the most. Ranking 19th in the global rice export market, Türkiye is the second most disadvantaged country after Austria in the global competition of the rice export market according to the RCA index value. According to the NEI value, Türkiye is a net rice importer. Türkiye, although it has increased its EIRI value in the 2024-2023 period compared to the 2004-2013 period, is a country at a disadvantage in global competition.

As a country known for its agriculture, Türkiye appears to be at a disadvantage in the global export market for wheat and meslin, maize (corn), and rice. With a population growing above the world average, rapidly decreasing agricultural land, and the global climate crisis considered the most significant issue of the century, Türkiye's dependence on imports for these three agricultural products seems to impose a financial burden on the economy, potentially causing serious economic loss for the country. The government has a great responsibility to find solutions to the problems encountered in the production of these products, which hold an important place in human nutrition. Otherwise, the foreign trade balance of these three products will be negatively affected. In this context, the urgent completion of consolidation works on fragmented and scattered agricultural lands throughout Türkiye is essential to reduce the costs of agricultural products and prevent major economic losses. This will significantly benefit producers, particularly in foreign trade. Policies supporting wheat and meslin, rice and maize cultivation and seed production will not only provide a competitive advantage in the global market, but also reduce import consumption. It is also of great importance to prepare support programmes for the export processes of wheat and meslin, rice and maize products. Support for producers and exporters should cover areas such as promoting new production technologies to increase productivity, addressing inefficiencies in the supply chain and optimising costs. Preventing increases in fertiliser and diesel prices is also an important cost factor for producers, state measures in these areas will ensure the sustainability of agricultural production. Moreover, improving the efficiency and quality standards of domestic production is necessary to remain competitive in foreign markets. Increasing export volume, finding new markets and strengthening relations with existing markets will be important factors in increasing the export to imports ratio. In summary, there is a need for appropriate proactive interventions to favourably affect the balance of trade, particularly in wheat and meslin, rice and maize trade, and agricultural trade in general.

Author Contributions

The percentages of the author' contributions are presented below. The author reviewed and approved the final version of the manuscript.

	Z.A.Ç.
C	100
D	100
S	100
DCP	100
DAI	100
L	100
W	100
CR	100
SR	100
PM	100
FA	100

C=Concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management, FA= funding acquisition.

Conflict of Interest

The author declared that there is no conflict of interest.

Ethical Consideration

Ethics committee approval was not required for this study because of there was no study on animals or humans.

References

Aktaş Çimen Z, Sarıçoban K. 2024. Türkiye'nin süs bitkileri ihracatındaki rekabet gücü. Uluslararası İktisadi İdari İnc Derg, 44: 151-168.

Amighini A. 2004. China in the International fragmentation of production: Evidence from the ICT İndustry. Università commerciale Luigi Bocconi, Milano, Italy, pp: 147.

Asciuto A, Carapezza R, Galati A, Schimmenti E. 2008. The competitiveness of the Italian flower andornamental plant sector. New Medit, 7(1): 26-37.

Aysu A. 2018. Buğday: beslenme kültürü ve politikalar. Meltem İzmir Akdeniz Akad Derg, 4: 82-90.

Balassa B, Noland M. 1989. Revealed comparative advantage in Japan and the United States. J Int Econ Integrat, 4(2): 8-22.

Balassa B. 1965. Trade liberalisation and "revealed" comparative advantage. Manchester School, 33(2): 99-123.

Balassa B. 1977. Revealed comparative advantage revisited: An analysis of relative export shares of the industrial countries, 1953–1971. Manchester School, 45(4): 327-344.

Banterle A, Carraresi L. 2007. Competitive performance analysis and European Union trade: The case of the prepared swine meat sector. Acta Agri Scand Section C, 4(3): 159-172.

Bashimov G. 2018. Kazakistan'ın bakır sektöründeki rekabet gücünün ölçülmesi. Ekon Sos Araş Derg, Özel Sayı, 55-68.

Bashimov G. 2022. Kazakistan'ın hububat ürünleri ihracatında karşılaştırmalı üstünlüğünün ölçülmesi. Asya Araş Uluslar Sos Bil Derg, 6 (2): 87-198.

Bin Rahman AR, Zhang J. 2023. Trends in rice research: 2030 and beyond. Food Ener Secur, 12(2): e390.

Can MB. 2023. Mısır ve buğday glüteninin ruminant beslemede kullanımı. Hayvansal Üretim, 64(2): 93-102.

Cornejo R, Singh S, Harris J. 2023. Do revisions to the harmonized system lead to distortions in rules of origin? A case study of India's selected free trade agreements. Legal Issues Econ Integrat, 50(2): 185-210.

Erbaş Köse ÖD, Mut Z. 2018. Tahıl ve tahıl ürünlerinin insan beslenmesi ve sağlık açısından önemi, Yozgat'ta tahılların durumu. 3rd International Bozok Symposium, May 03-05, Yozgat, Türkiye, pp: 1121-1130.

FAO. 2016. The agriculture sectors in the intended nationally determined contributions: Analysis, by Strohmaier R, Rioux J, Seggel A, Meybeck A, Bernoux M, Salvatore M, Miranda J and Agostini A. Environment and Natural Resources Management, Working Paper No. 62, Rome, Italy, pp: 92.

FAO. 2022. The state of agricultural commodity markets 2022. Food and Agriculture Organization. URL: https://openknowledge.fao.org/server/api/core/bitstreams/5b1d7bed-225a-444b-a041-c0844060a73c/content (accessed date: January 20, 2025).

French S. 2017. Revealed comparative advantage: What is it good for? J Int Econ, 106: 83-103.

Fukagawa NK, Ziska LH. 2019. Rice: Importance for global nutrition. J Nutrit Sci Vitaminol, 65(Supplement): S2-S3.

Geetha RS, Srivastava SK. 2018. Export of maize from India: Performance and determinants. Asian J Agri Extens Econ Sociol, 29(1): 1-11.

Govindasamy R, Bayramoğlu Z, Aziz S, Soysal U. 2023. Investigating the competitiveness of Pakistan agricultural products. Eurasian J Agri Econ, 3(2): 39-57.

Granabetter D. 2016. Revealed comparative advantage index: an analysis of export trade in the Austrian district of Burgenland. Rev Innov Competitiv, 2(2): 97-114.

Gutiérrez-Moya E, Adenso-Díaz B, Lozano S. 2021. Analysis and vulnerability of the international wheat trade network. Food Secur, 13: 113-128.

Hasan MR, Das D. 2024. What makes the second-largest apparel-exporting nation? An in-depth analysis of competitiveness and comparative advantage in Bangladesh's apparel industry. Competitiveness Review: An Int Busin J. https://doi.org/10.1108/CR-01-2024-0011

Hinloopen J, Van Marrewijk C. 2001. On the empirical distribution of the Balassa Index. Weltwirtschaftliches Archiv, 137(1): 1-35.

Jagadeesh MS, Jahnavi AP, Vinay HT, Abhishek GJ, Abhishek SS, Chikkalaki AS. 2024. Export competitiveness of Indian coffee: analysing trade potential in the global market. J Scient Res Rep, 30(9): 51-61.

Jambor A, Babu S. 2017. Competitiveness of global agriculture: Policy lessons for food security. International Food Policy Research Institute. URL: https://cgspace.cgiar.org/server/api/core/bitstreams/f6ef1522-be64-464f-8879-8391b815bcab/content (accessed date: January 18, 2025).

Ji G, Zhong H, Nzudie HLF, Wang P, Tian P. 2024. The structure, dynamics, and vulnerability of the global food trade network. J Cleaner Product, 434: 140439.

Kutkowska B, Szuk T. 2020. Competitiveness on the global cereal market. Ann Polish Assoc Agri Agribusin Econ, 22(2): 142-152.

Maqbool MS, Mahmood T, Hussain S, Ashraf M. 2020. Analysis of trade competitiveness of Pakistan cereal products in global perspective. Rev Econ Devel Stud, 6(1): 97-106.

Marković M, Krstić B, Rađenović Ž. 2019. Export competitiveness of the Serbian agri-food sector on the EU market. Економика пољопривреде, 66(4): 941-953.

Marković M. 2019. Analysis of comparative advantages of Serbian exports at the sectoral level. Ekonomika, 65(3): 55-64.

Mikic M. 2005. Commonly used trade indicators: a note. ARTNeT capacity building workshop on trade research. URL: https://repository.unescap.org/handle/20.500.12870/4195 (accessed date: January 10, 2025).

Nithyashree ML, Ganapati M, Balasubramanian M, Gadag RN. 2020. Export performance and prospectus of maize (Zea mays L.) in India. Maize J, 9(2): 125-130.

Oktan G. 2024. Türkiye'nin hububat ürünlerindeki rekabet gücünün G7 ülkeleri ile karşılaştırılması. Yüksek lisans Tezi, Recep Tayyip Erdoğan Üniversitesi, Lisansüstü Eğitim Enstitüsü, Rize, Türkiye, pp: 84.

Pascucci F. 2018. The export competitiveness of Italian coffee roasting industry. British Food J, 120(7): 1529-1546.

Ranum P, Peña-Rosas, JP, Garcia-Casal MN. 2014. Global maize production, utilization, and consumption. Ann New York Acad Sci, 1312(1): 105-112.

Reed T. 2024. Export-led industrial policy for developing countries: Is there a way to pick winners? J Econ Perspect, 38(4): 3-26.

Rodríguez ML, Guaita PI, Marques PI. 2024. Competitiveness in theagricultural sector: a literature review. Clío América, 18(35): 52-69.

Saboniene A. 2009. Lithuanian export competitiveness: Comparison with other Baltic States. Eng Econ, 62(2): 49-57.

Şahin D. 2016. Tarımsal gıda ürünlerinde karşılaştırmalı üstünlüğün ölçümü: Türkiye örneği. Uluslar Sos Araş Derg, 9(43): 2177-2184.

Sarıçoban K, Kösekahyaoğlu L, Erkan B. 2017. Türkiye'nin tekstil ihracatındaki rekabet gücü düzeyinin belirlenmesi: 1996-2015 dönemi için bir analiz. Kesit Akad Derg, 8: 186-203.

Sarıçoban K, Kösekahyaoğlu L. 2016. Türkiye'nin tarimsal ürünlerdeki ihracat rekabet gücünün ölçülmesi: 1996-2015 dönemi üzerine bir analiz. ASSAM Uluslar Hakemli Der, 4(7): 78-96.

Sarıçoban K, Kösekahyaoğlu L. 2017. Ticaret sonrası verilerle rekabet gücünün ölçülmesinde kullanılan indeksler üzerine bir literatür taraması. Akad Sos Araş Derg, 47(47): 424-444.

Sing V. 2022. Three crops rule the world: Over-dependence on wheat, maizeand rice threatens the future of wildlife survival and global food security. State of India's Environment – 2022: A Down to Earth Annual. Centre for Science and Environment, New Delhi, India, pp: 241-241.

Sovcovici V, Lopotenco V, Staver, L. 2024. Competitiveness of Moldovan agri-food exports at the regional level in the context of current crises. Scient Papers Ser Manag Econ Eng

Agri Rural Devel, 24(2): 865-874.

Statistics How To. 2025. Trimmed Mean / Truncated Mean: Definition, Examples. URL: https://www.statisticshowto.com/trimmed-mean/ (accessed date: January 28, 2025).

Thomé KM, Paiva VAL, Gois TCD. 2023. Wine international market structure and competitiveness. Int J Wine Busin Res, 35(4): 561-579.

Thomé KM, Paiva VAL. 2020. Sparkling wine international market structure and competitiveness. Wine Econ Policy, 9(2): 37-47.

Trade Map. 2023. Trade statistics for international business development. URL: https://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1%7c792%7c%7c%7c%7c10%7c%7c%7c4%7c1%7c1%7c2%7c2%7c1%7c1%7c1%7c1%7c1 (accessed date: January 16, 2025).

Umair Riaz U, Samreen T, Ijaz F, Rashid S, Hussain S, Ahmed Z, Malik HA, Zulqernain M, Mehdi SM. 2020. Rice production: Knowledge and practices for ensuring food security. Austin Publishing Group, Punjab, Pakistan, pp: 128.

United Nations Conference on Trade and Development. 2025. Data Hub: Empowering development through data and statistics. URL: https://unctadstat.unctad.org/datacentre/reportInfo/US.RCA accessed date: January 19, 2025).

Vollrath TL. 1991. A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage. Weltwirtschaftliches Archiv, 127(2): 265-280.

World Bank. 2024. Indicators. URL: https://databank.worldbank.org/source/world-development-indicators# (accessed date: January 17, 2025).