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Research Article

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Posted Date: July 3rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10157703/v1

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Additional Declarations: No competing interests reported.

Assessing the Competitiveness of Apricot Exports: An Application of RCA, NRCA, and SRCA Indices

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Abstract

Apricot is one of the strategically important fruits in international trade due to its high nutritional value, wide range of fresh and processed uses, and its significant contribution to the agricultural economies of many countries. In recent years, the expansion of global agricultural trade has increased the importance of evaluating the international competitiveness of apricot-exporting countries. This study aimed to assess the international competitiveness of the world's leading apricot-exporting countries over the period 2015–2024. For this purpose, the export competitiveness of Türkiye, Uzbekistan, Iran, Italy, Algeria, France, Pakistan, Spain, Afghanistan, and Tajikistan was analyzed using the Revealed Comparative Advantage (RCA), Revealed Symmetric Comparative Advantage (RSCA), and Normalized Revealed Comparative Advantage (NRCA) indices.

The results revealed significant differences among countries in terms of export specialization and international competitiveness. According to the RCA and RSCA analyses, Uzbekistan, Türkiye, Spain, Afghanistan, and Tajikistan maintained strong and sustainable comparative advantages throughout the study period. Uzbekistan exhibited exceptionally high RCA values, indicating the highest degree of export specialization in the global apricot market, while Türkiye consistently preserved its strong competitive advantage. Spain emerged as one of the most competitive apricot exporters in Europe, whereas Afghanistan and Tajikistan also demonstrated high levels of export specialization. In contrast, Pakistan and Algeria maintained comparative disadvantages throughout the entire study period. Iran displayed considerable fluctuations in competitiveness, with a marked decline in comparative advantage during the final years of the analysis. The findings obtained from the NRCA index largely supported the results of the RCA and RSCA analyses.

Overall, the findings indicate that competitive advantages in the global apricot trade are concentrated in a limited number of countries and are closely associated with export specialization, production capacity, and integration into international markets. The results provide valuable insights for policymakers and industry stakeholders in developing strategies to enhance the international competitiveness and long-term sustainability of the apricot sector.

Keywords: Apricot trade, Competitiveness, Revealed Comparative Advantage (RCA), Symmetric Revealed Comparative Advantage (SRCA), Normalized Revealed Comparative Advantage (NRCA), International Trade

Introduction

Apricot (*Prunus armeniaca* L.) is one of the most economically important temperate fruit crops cultivated worldwide due to its high nutritional value, adaptability to diverse ecological conditions, suitability for both fresh consumption and industrial processing, and its contribution to rural livelihoods. Rich in vitamins A, C, and E, dietary fiber, potassium, phenolic compounds, and antioxidants, apricots are increasingly recognized as a functional food that meets the growing consumer demand for healthy diets. In addition to fresh consumption, apricots are widely processed into dried fruits, jams, marmalades, juices, concentrates, purees, and other value-added products, thereby enhancing their economic significance in global agricultural markets.

Growing consumer demand for healthy foods, expanding international fruit trade, and continuous improvements in cold-chain logistics have substantially stimulated global apricot production and trade over the last decade. According to the Food and Agriculture Organization (FAO, 2025), global apricot production exceeded 4.0 million tonnes in 2024. Türkiye remained the world's largest producer, followed by Uzbekistan, Iran, Algeria, Italy, Pakistan, Spain, Afghanistan, and Tajikistan. These countries account for a considerable share of global apricot

production and exports. Among them, Türkiye occupies a unique position as both the world's leading producer of dried apricots and one of the largest exporters. In particular, Malatya Province has become the global center of dried apricot production and trade, accounting for a substantial proportion of international exports.

The globalization of agricultural markets has intensified competition among exporting countries. Today, international competitiveness depends not only on production capacity but also on product quality, productivity, technological innovation, logistics infrastructure, value-added processing, branding strategies, compliance with international food safety standards, and access to foreign markets. Consequently, countries with high production volumes do not necessarily achieve comparable success in export markets. Understanding the competitive positions of exporting countries has therefore become increasingly important for policymakers, producers, exporters, and researchers.

The theoretical foundation of international competitiveness is based on Ricardo's Theory of Comparative Advantage, which argues that countries benefit from specializing in products they produce relatively more efficiently. Building upon this theory, Balassa (1965) introduced the Revealed Comparative Advantage (RCA) index, one of the most widely used indicators for evaluating international trade competitiveness. The RCA index compares the share of a specific product in a country's exports with its share in world exports. An RCA value greater than one indicates a comparative advantage, whereas a value below one reflects a comparative disadvantage.

In recent years, the RCA approach and its extensions have been extensively applied to evaluate the competitiveness of agricultural and horticultural products. Studies have examined the competitiveness of walnuts (Ketenci & Bayramoğlu, 2018), peaches and nectarines (Bayav & Çetinbaş, 2021), citrus fruits (Duru et al., 2022; Gültekin et al., 2022), oilseeds (Kadakoğlu et al., 2023), bananas (Ghani et al., 2023), cherries (Ninaquispe et al., 2024), grapes (Cano-Espinosa & Méndez-León, 2025; Topçu & Başer, 2025), and strawberries (Durmuş et al., 2025). These studies consistently demonstrate that export competitiveness is influenced by productivity, quality improvement, market diversification, technological development, and institutional support.

Research focusing specifically on the apricot sector has primarily addressed production economics, marketing systems, supply chains, export performance, and sustainability issues. Türkiye's dominant position in dried apricot exports has been emphasized by Akpınar et al. (2019) and Karlı and Çelik (2021), while Ercan and Yıldız (2022) and Bayramoğlu et al. (2023) highlighted the adverse impacts of spring frost events and climate variability on production sustainability. Similarly, Uzbekistan has strengthened its export performance through investments in post-harvest technologies and logistics infrastructure (Murodov et al., 2021; Abdullaev & Rakhimov, 2023). Although Iran possesses favorable climatic conditions and relatively low production costs, international sanctions, logistical constraints, and institutional barriers have limited its export competitiveness (Hosseini et al., 2020; Rahimi & Karami, 2022). In Europe, Spain and Italy have enhanced their competitiveness through quality certification systems, geographical indications, product differentiation, and strong integration into European retail supply chains (García-Muñoz et al., 2021; De Luca et al., 2023).

Despite the growing importance of apricots in international agricultural trade, comparative studies evaluating the long-term competitiveness of the world's leading apricot-exporting countries remain limited. Existing research has generally focused on individual countries or specific aspects of production and marketing, leaving a significant gap in the comparative assessment of export competitiveness. Furthermore, climate change, stricter food quality standards, changing consumer preferences, and evolving international trade policies continue to reshape the competitive landscape of global fruit markets.

Therefore, the primary objective of this study is to evaluate the international competitiveness of the world's leading apricot-exporting countries during the 2015–2024 period using the Revealed Comparative Advantage (RCA), Revealed Symmetric Comparative Advantage (RSCA), and Normalized Revealed Comparative Advantage (NRCA) indices. By simultaneously applying these three complementary competitiveness measures, this study provides a comprehensive assessment of export specialization and comparative advantage in the global apricot market and contributes to the existing literature on international agricultural competitiveness.

According to FAOSTAT (2025), global apricot production reached approximately 4.1 million tonnes in 2024. Türkiye alone accounted for nearly 18% of global production, while Uzbekistan, Iran, Algeria, Italy, Pakistan, Spain, Afghanistan, Tajikistan, and Greece collectively represented a substantial share of world output. In addition,

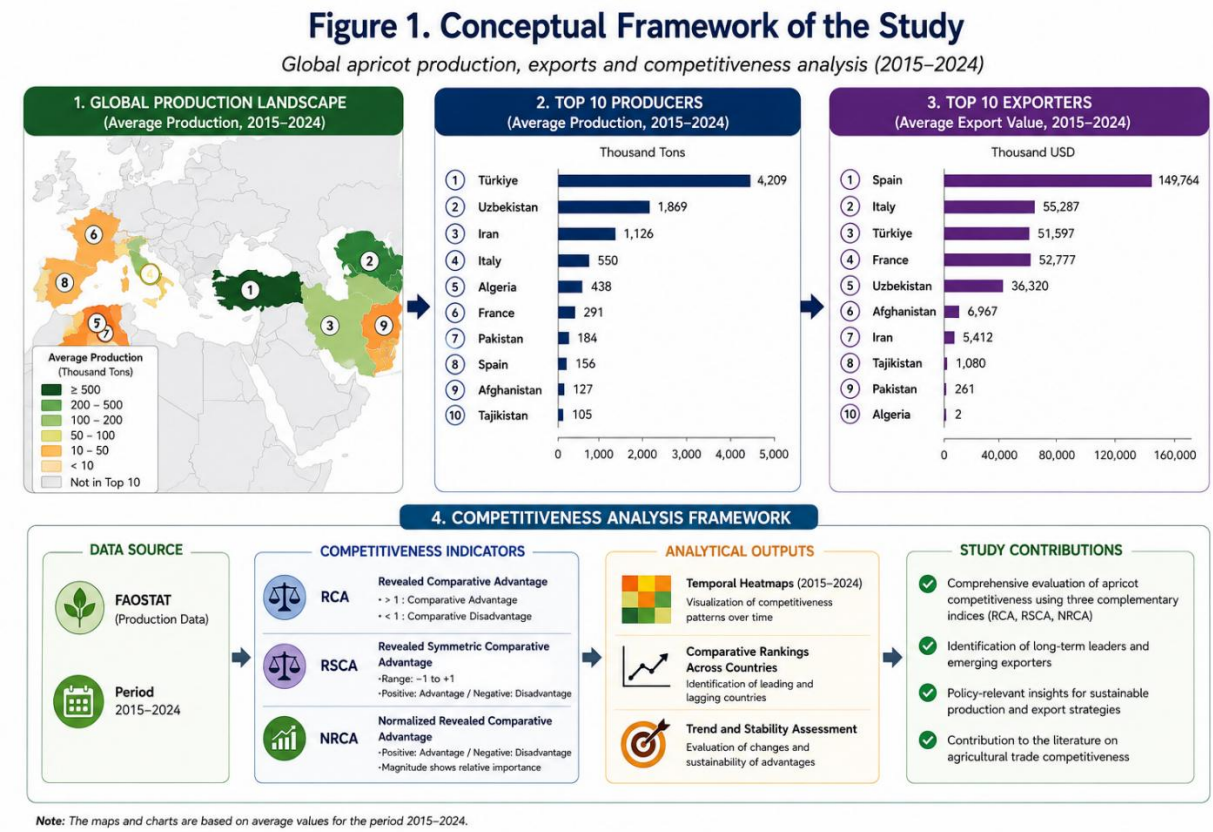
the global value of apricot exports has shown a steady upward trend over the last decade, reflecting increasing international demand for both fresh and processed apricot products.

In Europe, Spain and Italy are among the leading actors in the apricot sector, accounting for a substantial share of the continent's fresh apricot production and exports. According to FAOSTAT (2025), Spain produced approximately 136 thousand tonnes of apricots in 2024, while Italy produced approximately 199 thousand tonnes, placing both countries among the world's major producers. Spain has strengthened its international competitiveness through quality certification systems, product differentiation strategies, modern post-harvest technologies, and strong integration into European retail supply chains (García-Muñoz et al., 2021; Martínez-Carrasco and Colino, 2022). Likewise, Italy has maintained a competitive position in European markets through the production of high-quality fresh apricots, the widespread use of geographical indications (GI), and compliance with strict food quality and safety standards (De Luca et al., 2023). These competitive advantages have enabled both countries to sustain stable export performances despite increasing competition in international fruit markets.

Collectively, previous studies indicate that competitiveness in the apricot sector is determined by the interaction of multiple factors rather than production volume alone. Production efficiency, technological innovation, quality management systems, export diversification, logistics infrastructure, institutional support, and adaptation to climate change all play significant roles in shaping international competitiveness (Jambor and Babu, 2016; Caputo et al., 2020). Although Türkiye remains the world's leading exporter of dried apricots and one of the largest apricot producers, several competing countries, particularly Uzbekistan, Iran, Spain, and Italy, have significantly strengthened their positions in international markets over the last decade. According to FAOSTAT (2025), these five countries together account for more than two-thirds of global apricot production, highlighting the increasing concentration of production and export potential within a limited number of countries. This intensifying competition has made the global apricot market increasingly dynamic and has heightened the importance of evaluating comparative export performance.

Despite the growing importance of apricots in international fruit trade, studies examining the long-term revealed comparative advantages of the world's major apricot-exporting countries remain limited. Most previous studies have focused primarily on individual countries or specific aspects of production and marketing, while comprehensive cross-country competitiveness analyses remain scarce (Süygün, 2021; Karlı and Çelik, 2021). Furthermore, global megatrends—including climate change, stricter food safety and quality standards, changing consumer preferences toward healthy foods, and evolving international trade policies—are continuously reshaping competitiveness in global fruit markets (Bayramoğlu et al., 2023; FAO, 2025). Consequently, evaluating the comparative competitiveness of leading apricot-exporting countries has become increasingly important for understanding current market dynamics and developing effective agricultural and trade policies.

Accordingly, the primary objective of this study is to evaluate the international competitiveness of the world's leading apricot-exporting countries during the 2015–2024 period using the Revealed Comparative Advantage (RCA), Revealed Symmetric Comparative Advantage (RSCA), and Normalized Revealed Comparative Advantage (NRCA) indices. In this context, the export specialization, comparative advantages, and temporal changes in competitiveness of the major apricot-exporting countries are analyzed comparatively. By integrating three complementary competitiveness indices, the study provides a comprehensive long-term assessment of the competitive dynamics of the global apricot trade and contributes to the literature on international agricultural competitiveness.



Material-Method

Material

The data utilized in this study were obtained from the database of the Food and Agriculture Organization of the United Nations (FAO). In the research, apricot production volumes and apricot export values belonging to the 2015–2024 period were utilized. Production data were evaluated in terms of "1000 tons," whereas export data were evaluated in terms of "1000 USD." Furthermore, the total agricultural export data of the countries and the total global agricultural export data were also utilized in the analysis.

Within the scope of this study, the leading countries in global apricot exports were examined. The countries included in the analysis are Türkiye, Uzbekistan, Iran, Italy, Algeria, France, Pakistan, Spain, Afghanistan, and Tajikistan. These countries were selected based on their importance in global apricot exports during the 2015–2024 period and their significant contribution to international apricot trade.

There are no missing observations in the dataset used in this research. Although export values were relatively low in certain years for some countries, these fluctuations reflect changes in trade performance rather than data deficiencies. Lower export values were particularly observed for Algeria and Pakistan, indicating their relatively weak positions in international apricot trade. In contrast, Türkiye, Uzbekistan, Spain, and Italy consistently maintained strong export performances throughout the study period, while Afghanistan and Tajikistan also demonstrated relatively high levels of export specialization.

When the global apricot production and export data are examined, Türkiye stands out as the world's leading apricot producer and one of the largest exporters. Uzbekistan ranks among the leading producer and exporter countries, while Iran, Algeria, Italy, Pakistan, Spain, Afghanistan, and Tajikistan also make significant contributions to global apricot production. However, comparison of production volumes and export performances reveals that high production does not necessarily translate into strong export competitiveness. International competitiveness depends not only on production capacity but also on factors such as product quality, post-harvest handling, logistics

infrastructure, compliance with international standards, market diversification, value-added processing, and trade policies. Therefore, evaluating export competitiveness requires a comprehensive assessment that extends beyond production performance alone.

Although Algeria is among the world's leading apricot producers, its export competitiveness remains relatively weak, indicating that production capacity alone is insufficient to achieve a comparative advantage in international markets.

Method

In this study, Revealed Comparative Advantage (RCA), Symmetric Revealed Comparative Advantage (SRCA), and Normalized Revealed Comparative Advantage (NRCA) indices were utilized to determine the international competitiveness of the leading producer countries in the global apricot trade. Thus, not only the production sizes of the countries but also their specialization levels in global trade and their comparative advantage structures were evaluated.

Revealed Comparative Advantage Index (RCA)

In the study, the RCA index developed by Balassa (1965) was utilized first to measure competitiveness. The RCA index is based on the principle of proportioning a country's export share in a specific product to the share of the same product in world exports. The RCA index was calculated with the aid of the following formula:

$$RCA_j^i = \frac{(X_j^i / X^i)}{(X_j^w / X^w)}$$

Where;

- X_{ij}: represents the export value of country *i* in product *j*,
- X_i: represents the total agricultural exports of country *i*,
- X^w_j: represents the world exports of product *j*,
- X^w: represents the total world agricultural exports

  According to the RCA index;

- $0 < RCA \leq 1$: is classified as comparative disadvantage,
- $1 < RCA \leq 2$: is classified as weak comparative advantage,
- $2 < RCA \leq 4$: is classified as moderate comparative advantage,
- $RCA > 4$: is classified as a strong comparative advantage.

Symmetric Revealed Comparative Advantage Index (SRCA)

The SRCA index, developed by Laursen (1998) to mitigate the problems arising from the asymmetric structure of Balassa's RCA index, was also utilized in the study. The SRCA index was calculated as follows:

$$SRCA_j^i = \frac{RCA_j^i - 1}{RCA_j^i + 1}$$

The SRCA index ranges between −1 and +1, where positive values indicate a comparative advantage and negative values indicate a comparative disadvantage. Due to the symmetric structure of the index, the levels of competitiveness among countries can be compared in a more balanced manner.

Normalized Revealed Comparative Advantage Index (NRCA)

n the study, the NRCA index developed by Yu et al. (2009) was also utilized. The NRCA index provides more precise and comparable results by measuring the difference between the actual export performances of countries and their expected export levels. The NRCA index was calculated with the aid of the following formula:

$$NRCA_j^i = \frac{X_j^i}{X^w} - \frac{X_j^w X^i}{X^w X^w}$$

In the formula;

- X_{ij}: represents the export value of country *i* in product *j*,
- X_i: represents the total exports of country *i*,
- X^w_j: represents the world exports of product *j*,
- X^w: represents the total world exports.

In the NRCA index, a value of zero indicates the neutral point. Positive values signify a comparative advantage, whereas negative values signify a comparative disadvantage. The RCA, SRCA, and NRCA index values calculated within the scope of the research were analyzed comparatively across years. To render the analysis results visually more comprehensible, tables, heatmaps, comparative graphs, and world map-based spatial visualizations were prepared. Thus, both the temporal changes of the countries and their positions on a global scale were evaluated together.

Results

Figure 2 presents the average apricot production of the world's leading producing countries over the 2015–2024 period. The results indicate considerable differences in production capacity among the major producers. Türkiye ranked first with an average annual production of 844.7 thousand tonnes, substantially exceeding all other countries included in the analysis. Uzbekistan followed with an average production of 517.0 thousand tonnes, while Iran ranked third with 295.4 thousand tonnes. Italy, Algeria, and France formed a second group of producers, with average production levels ranging from 214.4 to 226.3 thousand tonnes. Pakistan, Spain, Afghanistan, and Tajikistan recorded comparatively lower average production, varying between 112.9 and 152.7 thousand tonnes.

The production distribution demonstrates that global apricot production is highly concentrated in a limited number of countries. Türkiye's average production is approximately 1.6 times higher than that of Uzbekistan and nearly three times greater than that of Spain, highlighting its dominant role in global apricot production. Similarly, Uzbekistan has established itself as a major producer, maintaining an average production volume well above that of the remaining countries.

However, production capacity alone does not necessarily guarantee international competitiveness. As demonstrated by the RCA, RSCA, and NRCA analyses presented in this study, countries with relatively high production volumes do not always exhibit strong export competitiveness. For example, although Algeria and Iran rank among the leading apricot producers, their comparative advantage in international trade is considerably lower than that of Türkiye and Uzbekistan. Conversely, countries such as Spain have achieved relatively high export competitiveness despite producing smaller quantities of apricots. These findings suggest that international competitiveness depends not only on production volume but also on export specialization, product quality, post-harvest technologies, logistics infrastructure, market diversification, and trade policies.

Overall, Figure 1 indicates that apricot production is geographically concentrated, with Türkiye and Uzbekistan maintaining clear leadership throughout the study period. This concentration provides these countries with an important production base for international trade; however, sustaining competitive advantage in global markets requires the effective integration of production capacity with export-oriented policies, value-added processing, quality improvement, and efficient marketing strategies.

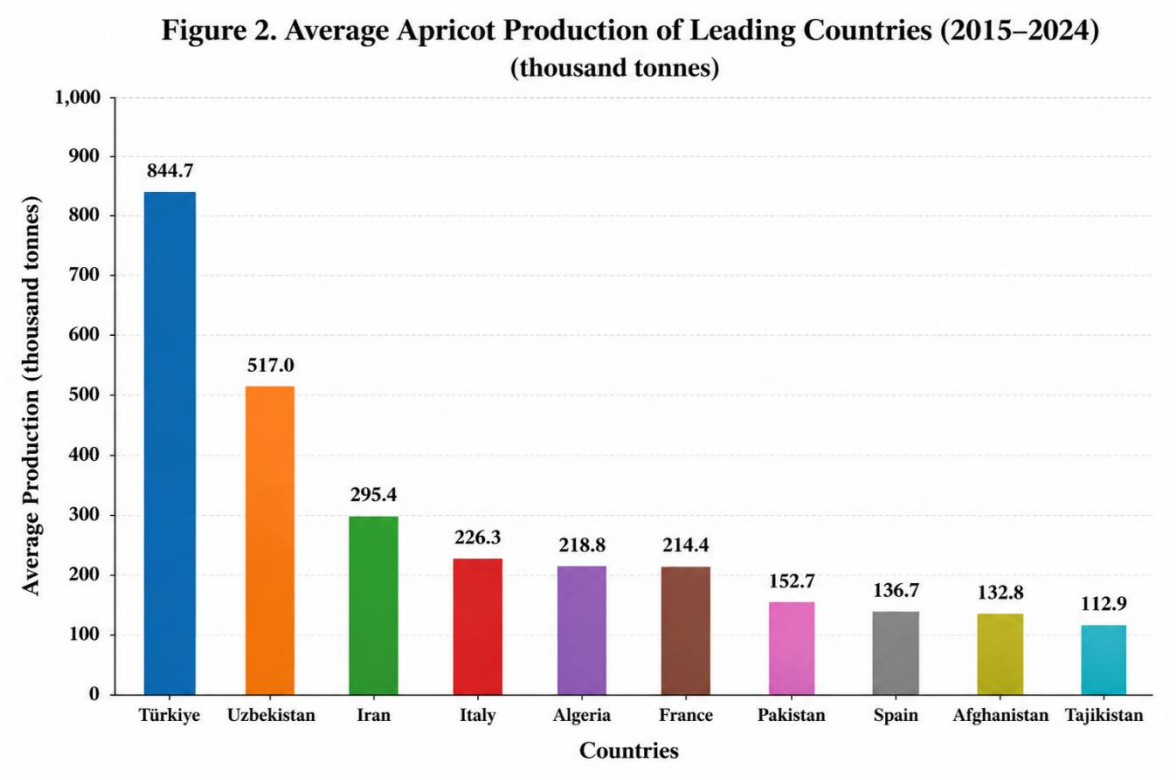
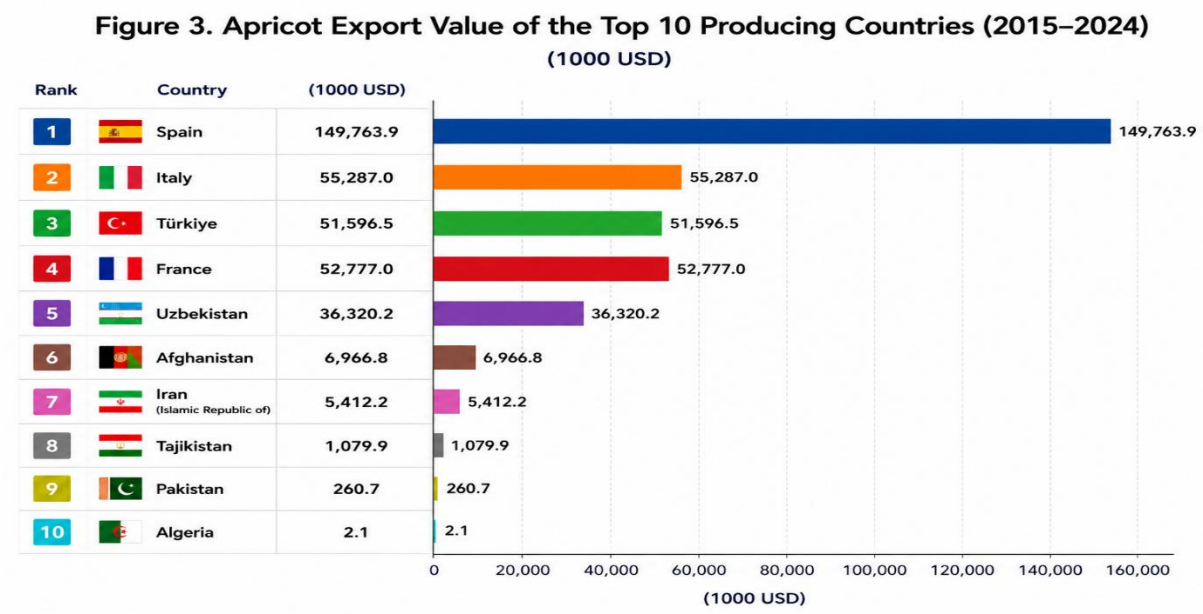


Figure 3 illustrates the average apricot export values of the world's ten leading apricot-producing countries over the 2015–2024 period. The results reveal substantial differences between production capacity and export performance. Among the countries analyzed, Spain recorded the highest average export value, reaching 149,763.9 thousand USD, demonstrating its dominant position in the international fresh apricot market. Italy, France, and Türkiye followed with average export values of 55,287.0 thousand USD, 52,777.0 thousand USD, and 51,596.5 thousand USD, respectively. Uzbekistan also exhibited a relatively strong export performance with an average export value of 36,320.2 thousand USD.

In contrast, Afghanistan, Iran, Tajikistan, Pakistan, and Algeria recorded considerably lower export values throughout the study period. Particularly, Algeria and Pakistan exhibited the lowest export performances despite being among the world's leading apricot-producing countries. This finding suggests that high production capacity alone does not necessarily translate into strong export performance.

The comparison between production and export values indicates notable structural differences among countries. Although Türkiye is by far the largest apricot producer, Spain achieved the highest average export value during the study period. This outcome may be attributed to Spain's strong integration into European markets, well-developed marketing channels, efficient logistics infrastructure, and greater emphasis on high-value fresh apricot exports. Similarly, Italy and France generated relatively high export revenues despite producing substantially lower quantities than Türkiye.

Overall, the findings indicate that export performance is determined not only by production volume but also by factors such as product quality, export orientation, market diversification, value-added production, supply chain efficiency, and access to international markets. These results provide further evidence that production leadership and export competitiveness do not always coincide in the global apricot sector and highlight the importance of trade-oriented strategies in achieving higher export values.



RCA Index

The Revealed Comparative Advantage (RCA) index was employed to evaluate the comparative advantage of the major apricot-exporting countries during the 2015–2024 period. An RCA value greater than 1 indicates that a country possesses a comparative advantage in apricot exports, whereas a value below 1 indicates a comparative disadvantage. The RCA values of the selected countries are presented in Table 1.

The results reveal considerable differences in export specialization among the leading apricot-producing countries. Uzbekistan exhibited by far the highest RCA values throughout the study period, indicating an exceptionally high degree of specialization in apricot exports. The country's RCA increased from 74.86 in 2015 to a peak of 119.82 in 2019. Although the index declined sharply in 2021 and 2022 (16.80 and 12.79, respectively), it recovered to 72.21 in 2023 and 63.59 in 2024. These consistently high values confirm that apricots constitute one of the most specialized export commodities in Uzbekistan and underline the country's dominant position in the global apricot market.

Türkiye also maintained a strong and stable comparative advantage throughout the analysis period. The RCA value increased from 6.87 in 2015 to 11.58 in 2022 before declining slightly to 8.15 in 2024. The consistently high RCA values demonstrate that Türkiye has sustained a strong competitive position in international apricot trade. This finding is consistent with Türkiye's global leadership in dried apricot exports and its well-established production and export infrastructure.

Among the remaining countries, Afghanistan and Tajikistan also demonstrated remarkable comparative advantages. Afghanistan recorded exceptionally high RCA values during the study period, reaching 51.89 in 2022, indicating that apricots represent a highly specialized agricultural export product. Similarly, Tajikistan maintained strong comparative advantages throughout the period, with its RCA increasing from 15.23 in 2015 to 29.14 in 2024. The upward trend observed in recent years suggests a strengthening export specialization and an improvement in the country's competitive position.

Within Europe, Spain consistently exhibited strong comparative advantages, with RCA values ranging from 7.26 to 10.10. These results indicate that Spain has maintained a stable and competitive position in international apricot trade despite producing lower quantities than some major producers. Italy also retained comparative advantages throughout the study period, with RCA values varying between 2.22 and 5.70. Although Italy remained competitive, its comparative advantage was more moderate than that of Uzbekistan, Türkiye, Afghanistan, and Spain.

France maintained RCA values above the critical threshold of one during the entire period, confirming the existence of a comparative advantage in apricot exports. However, the index gradually declined from above 4.0 in

the early years to 1.37 in 2024, indicating a weakening degree of export specialization and competitiveness over time.

In contrast, Iran displayed considerable fluctuations in its RCA values. While the country achieved relatively high comparative advantages in 2020 (9.85) and 2022 (7.51), its RCA declined dramatically to 0.10 in 2024, indicating the loss of comparative advantage. This sharp deterioration may be associated with international sanctions, trade restrictions, logistical constraints, and structural changes in export markets.

Unlike the countries discussed above, Pakistan and Algeria consistently recorded RCA values below one throughout the study period. Pakistan's RCA never exceeded 0.40, while Algeria's values remained extremely low, ranging between 0.01 and 0.05. These findings indicate that both countries lack comparative advantages in apricot exports and remain relatively uncompetitive in international markets despite being among the world's leading apricot producers.

Overall, the RCA analysis demonstrates that comparative advantages in global apricot exports are highly concentrated in a limited number of countries. Uzbekistan, Türkiye, Afghanistan, Tajikistan, Spain, Italy, and France consistently maintained comparative advantages, although the degree of specialization differed considerably among them. In contrast, Iran experienced a substantial decline in competitiveness during the final years of the study period, whereas Pakistan and Algeria remained comparatively disadvantaged throughout the analysis period. These findings suggest that international competitiveness in apricot exports depends not only on production capacity but also on export specialization, market orientation, and the ability to sustain competitive advantages over time.

Table 1. RCA index scores of countries by years

Countries	Türkiye	Uzbekistan	Iran	Italy	Algeria	France	Pakistan	Spain	Afghanistan	Tajikistan
2015	6,87	74,86	1,61	3,03	0,01	4,38	0,19	8,34	31,01	15,23
2016	4,75	86,38	1,36	3,04	0,05	4,31	0,40	8,41	44,81	16,55
2017	8,36	43,89	3,79	3,82	0,02	4,01	0,24	7,62	29,71	10,79
2018	7,06	101,77	3,54	2,60	0,02	2,17	0,24	9,46	3,64	11,90
2019	6,06	119,82	0,54	3,97	0,01	1,66	0,35	7,52	40,29	14,70
2020	8,99	90,71	9,85	2,22	0,01	1,42	0,20	9,55	38,07	15,88
2021	9,07	16,80	5,77	3,90	0,01	1,71	0,09	10,10	11,46	5,73
2022	11,58	12,79	7,51	5,70	0,02	1,49	0,07	7,26	51,89	15,92
2023	7,18	72,21	0,45	3,17	0,01	2,12	0,08	8,30	28,58	33,64
2024	8,15	63,59	0,10	3,11	0,02	1,37	0,02	9,03	17,40	29,14

Temporal Classification of RCA Scores

To facilitate the interpretation of the competitiveness patterns, the RCA values were classified into four categories based on their degree of comparative advantage (Table 2). Accordingly, Group 1 represents comparative disadvantage (RCA < 1), Group 2 indicates weak comparative advantage, Group 3 represents moderate comparative advantage, and Group 4 corresponds to strong comparative advantage.

The classification results demonstrate that Uzbekistan, Türkiye, Spain, Afghanistan, and Tajikistan consistently remained in Group 4 (strong comparative advantage) throughout the 2015–2024 period. This finding indicates that these countries have maintained a high degree of export specialization and sustained their competitive positions in the global apricot market over the long term. Among them, Uzbekistan exhibited the highest and most persistent level of comparative advantage, confirming its position as the most specialized apricot-exporting country throughout the study period.

Türkiye also remained within the strong comparative advantage category during the entire analysis period. The stability of its competitiveness reflects the country's well-established export structure, particularly its global leadership in dried apricot exports, extensive production experience, and strong international market presence. Likewise, Spain consistently maintained strong comparative advantages, highlighting its stable position as one of Europe's leading apricot exporters. Afghanistan and Tajikistan also remained in Group 4 throughout the study period, suggesting that apricot exports constitute an important component of their agricultural export structures.

Unlike the countries mentioned above, Italy exhibited a relatively moderate competitiveness profile. The country was classified in Group 3 (moderate comparative advantage) during most of the study period and reached Group 4 only in 2022. Although Italy maintained a competitive position in international apricot trade, its level of export specialization remained below that of the leading exporting countries.

The competitiveness of France gradually weakened over time. While the country belonged to the strong comparative advantage category during 2015–2017, it subsequently shifted to moderate and weak comparative advantage groups, with only a temporary improvement observed in 2023. This downward trend suggests a gradual decline in France's export specialization and competitiveness in the global apricot market.

Among all countries, Iran exhibited the greatest temporal variability. The country moved repeatedly between all four competitiveness categories during the analysis period, reaching strong comparative advantage in 2020–2022 but falling back to comparative disadvantage in 2019, 2023, and 2024. These fluctuations indicate that Iran has been unable to maintain a stable competitive position in international apricot trade, possibly reflecting the effects of external economic and trade-related constraints.

In contrast, Pakistan and Algeria remained in Group 1 (comparative disadvantage) throughout the entire study period. The persistent absence of comparative advantage suggests that apricot exports account for only a limited share of their export structures and that both countries have experienced considerable difficulties in achieving international competitiveness despite their production potential.

Overall, the temporal classification confirms that comparative advantages in global apricot exports are concentrated in a relatively small group of countries. The long-term stability observed in Uzbekistan, Türkiye, Spain, Afghanistan, and Tajikistan contrasts sharply with the fluctuating performance of Iran and the declining competitiveness of France. These findings emphasize that sustaining comparative advantage requires not only production capacity but also consistent export specialization, effective trade strategies, and the ability to adapt to changing market conditions.

Table 2 Temporal Visualization of RCA Scores across Countries

Countries	Türkiye	Uzbekistan	Iran	Italy	Algeria	France	Pakistan	Spain	Afghanistan	Tajikistan
2015	4	4	2	3	1	4	1	4	4	4
2016	4	4	2	3	1	4	1	4	4	4
2017	4	4	3	3	1	4	1	4	4	4
2018	4	4	3	3	1	3	1	4	3	4
2019	4	4	1	3	1	2	1	4	4	4
2020	4	4	4	3	1	2	1	4	4	4
2021	4	4	4	3	1	2	1	4	4	4
2022	4	4	4	4	1	2	1	4	4	4
2023	4	4	1	3	1	3	1	4	4	4
2024	4	4	1	3	1	2	1	4	4	4

1: Disadvantage, 2: Weak advantage, 3: Moderate advantage, 4: Strong advantage.

SRCA Index

In the study, the SRCA index was also utilized to mitigate the asymmetry problem in Balassa's RCA index. The SRCA index ranges between −1 and +1, where positive values indicate a comparative advantage and negative values indicate a comparative disadvantage.

According to the SRCA results, Chile is observed to be the country possessing the highest positive values throughout the entire period. Chile's SRCA values occurred within the 0.81–0.84 range. This result confirms that the country possesses a highly strong and stable competitive advantage in the global apricot trade.

Revealed Symmetric Comparative Advantage (RSCA) Analysis

Table 3 presents the Revealed Symmetric Comparative Advantage (RSCA) values for the major apricot-exporting countries over the 2015–2024 period. Unlike the RCA index, the RSCA index transforms RCA values into a symmetric scale ranging from −1 to +1, thereby facilitating more balanced comparisons among countries. Positive RSCA values indicate comparative advantage, whereas negative values indicate comparative disadvantage. Values approaching +1 represent stronger export competitiveness and a higher degree of specialization.

Overall, the RSCA results closely corroborate the findings obtained from the RCA analysis, confirming that comparative advantages in global apricot exports are concentrated in a relatively small number of countries. Uzbekistan consistently recorded the highest RSCA values throughout the study period, ranging between 0.85 and 0.98. The persistently high values indicate an exceptional degree of export specialization and confirm Uzbekistan's dominant position in the global apricot market. The stability of the country's RSCA performance further suggests that its competitive advantage has been sustained over the long term.

Similarly, Afghanistan and Tajikistan maintained consistently high positive RSCA values during the entire study period. Afghanistan's RSCA values remained close to 0.90 in most years, while Tajikistan's values ranged between 0.70 and 0.94. These findings indicate that apricots represent one of the most specialized export commodities for both countries and that they have maintained strong comparative advantages in international markets.

Türkiye also exhibited consistently positive and relatively stable RSCA values, varying between 0.65 and 0.84 during the study period. The highest value was observed in 2022, reflecting an improvement in export competitiveness. The persistence of high positive RSCA values confirms Türkiye's strong and sustainable comparative advantage, which is supported by its global leadership in dried apricot exports and its well-established export structure.

Among the European exporters, Spain maintained consistently high RSCA values, ranging from 0.76 to 0.82, indicating a stable and highly competitive export structure. Italy also recorded positive RSCA values throughout the analysis period and reached its highest level (0.70) in 2022. Although Italy maintained a comparative advantage, its competitiveness remained below that of the leading exporters, particularly Uzbekistan, Türkiye, and Spain.

In contrast, France displayed a gradual decline in competitiveness over time. Although the country maintained positive RSCA values throughout the study period, the index decreased steadily from 0.63 in 2015 to 0.15 in 2024. This downward trend suggests that France has retained its comparative advantage while experiencing a gradual reduction in export specialization and international competitiveness.

Among all countries included in the analysis, Iran exhibited the greatest variability in RSCA performance. The country achieved relatively strong comparative advantages during 2017–2018 and 2020–2022, but the index declined sharply in 2019, 2023, and particularly in 2024, when the RSCA value fell to −0.82. The transition from positive to negative values indicates a substantial deterioration in Iran's competitive position, which may be associated with international sanctions, trade restrictions, logistical challenges, and structural changes in export markets.

Conversely, Pakistan and Algeria consistently recorded negative RSCA values throughout the study period. Algeria's RSCA values remained between −0.91 and −0.99, while Pakistan's values ranged from −0.43 to −0.97, indicating persistent comparative disadvantages. These results suggest that apricot exports constitute only a minor component of the export structures of both countries and that neither has achieved a competitive position in international apricot trade.

Overall, the RSCA analysis confirms the robustness of the RCA findings. The consistent superiority of Uzbekistan, Türkiye, Spain, Afghanistan, and Tajikistan demonstrates that these countries have maintained strong and sustainable comparative advantages throughout the study period. In contrast, the fluctuating performance of Iran and the persistently negative RSCA values observed for Pakistan and Algeria indicate that comparative advantage in apricot exports is unevenly distributed across countries. These findings further emphasize that long-term

competitiveness depends not only on production capacity but also on sustained export specialization, market integration, and the ability to adapt to changing international trade conditions.

Table 3. SRCA index scores of countries by years

Countries	Türkiye	Uzbekistan	Iran	Italy	Algeria	France	Pakistan	Spain	Afghanistan	Tajikistan
2015	0.75	0.97	0.23	0.50	-0.98	0.63	-0.68	0.79	0.94	0.88
2016	0.65	0.98	0,15	0,51	-0,91	0,62	-0,43	0,79	0,96	0,89
2017	0.79	0.96	0,58	0,59	-0,96	0,6	-0,61	0,77	0,93	0,83
2018	0.75	0.98	0,56	0,44	-0,96	0,37	-0,61	0,81	0,57	0,84
2019	0.72	0.98	-0,3	0,6	-0,98	0,25	-0,48	0,77	0,95	0,87
2020	0.80	0.98	0,82	0,38	-0,99	0,17	-0,67	0,81	0,95	0,88
2021	0.80	0.89	0,7	0,59	-0,97	0,26	-0,84	0,82	0,84	0,7
2022	0.84	0.85	0,76	0,7	-0,96	0,2	-0,86	0,76	0,96	0,88
2023	0.76	0.97	-0,38	0,52	-0,98	0,36	-0,85	0,78	0,93	0,94
2024	0.78	0.97	-0,82	0,51	-0,97	0,15	-0,97	0,8	0,89	0,93

NRCA Index

Normalized Revealed Comparative Advantage (NRCA) Analysis

Table 4 presents the Normalized Revealed Comparative Advantage (NRCA) values for the major apricot-exporting countries during the 2015–2024 period. Unlike the RCA and RSCA indices, the NRCA index evaluates the deviation of a country's actual export performance from its expected export performance under global trade conditions. Positive NRCA values indicate comparative advantage, whereas negative values indicate comparative disadvantage. Moreover, the magnitude of the NRCA value reflects the relative contribution of a product to a country's export structure and its competitiveness in international markets.

The NRCA results are generally consistent with the findings obtained from the RCA and RSCA analyses, confirming that comparative advantages in global apricot exports are concentrated in a limited number of countries. Among the countries analyzed, Spain consistently recorded the highest NRCA values throughout the study period. The country's NRCA increased from 0.000088 in 2015 to a peak of 0.000104 in 2018 and remained at a high level (0.0000857) in 2024. These results indicate that Spain has maintained a strong and stable contribution to global apricot exports, reflecting its well-developed export-oriented production system and its strategic position within the European Union market.

Türkiye and Uzbekistan also exhibited consistently positive NRCA values during the study period. Türkiye's NRCA values ranged between 0.0000149 and 0.0000394, reaching their highest level in 2022. The persistently positive values confirm the country's sustainable comparative advantage and strong contribution to global apricot trade, which is closely associated with its leadership in dried apricot exports. Similarly, Uzbekistan maintained positive NRCA values throughout the analysis period and reached its highest value (0.0000462) in 2019. Although the country experienced temporary declines in 2021 and 2022, the subsequent recovery observed in 2023 and 2024 indicates that its competitive position remains strong despite short-term fluctuations.

Among the European exporters, Italy consistently recorded positive NRCA values and achieved its highest level (0.0000374) in 2022. Although Italy maintained a stable comparative advantage, its competitiveness remained below that of Spain and Türkiye. France, in contrast, experienced a continuous decline in NRCA values over time. While the country recorded one of the highest NRCA values (0.0000576) in 2015, the index gradually decreased to 0.0000044 in 2024, indicating a substantial weakening of its contribution to international apricot exports.

Afghanistan and Tajikistan also maintained positive NRCA values throughout the study period, confirming the existence of comparative advantages in apricot exports. Afghanistan achieved relatively higher values during 2019 and 2020, whereas Tajikistan exhibited lower but consistently positive NRCA values, suggesting a stable, although more moderate, export specialization.

In contrast, Iran displayed considerable fluctuations in NRCA performance. Positive values observed during 2017–2018 and 2020–2022 were followed by negative values in 2019, 2023, and 2024, indicating a deterioration in export competitiveness during the latter part of the study period. These findings are consistent with the RCA and RSCA analyses and suggest that Iran's declining competitiveness may be associated with external economic constraints, trade restrictions, and structural changes affecting export performance.

Unlike the countries discussed above, Pakistan and Algeria recorded negative or near-zero NRCA values throughout the entire study period. Pakistan reached its lowest value (−0.0000011) in 2024, while Algeria consistently maintained values close to zero or below zero. These results indicate that apricot exports make only a marginal contribution to the export structures of both countries and confirm their persistent comparative disadvantages in international markets.

Overall, the NRCA analysis reinforces the findings obtained from the RCA and RSCA indices. Spain, Türkiye, Uzbekistan, and Italy consistently demonstrated positive and relatively high NRCA values, confirming their strong contributions to global apricot exports. Afghanistan and Tajikistan also maintained positive comparative advantages throughout the study period, whereas Iran experienced a noticeable decline in competitiveness during the final years of the analysis. In contrast, Pakistan and Algeria remained persistently disadvantaged. The consistency among the three competitiveness indices enhances the robustness of the results and demonstrates that export competitiveness in the global apricot market is concentrated in a relatively small number of specialized exporting countries.

he consistency observed among the RCA, RSCA, and NRCA indices indicates that the competitiveness rankings are robust regardless of the measurement approach, thereby increasing the reliability of the empirical findings.

Table 4 NRCA index scores of countries by years

Countries	Türkiye	Uzbekistan	Iran	Italy	Algeria	France	Pakistan	Spain	Afghanistan	Tajikistan
2015	0,0000264	0,0000149	0,0000276	0,0000242	0,0000220	0,0000331	0,0000316	0,0000394	0,0000263	0,0000315
2016	0,0000233	0,0000203	0,0000141	0,0000330	0,0000462	0,0000325	0,0000044	0,0000029	0,0000232	0,0000312
2017	-0,0000006	-0,0000005	0,0000038	0,0000031	-0,0000003	0,0000108	0,0000039	0,0000038	-0,0000003	-0,0000003
2018	0,0000222	0,0000214	0,0000295	0,0000183	0,0000328	0,0000131	0,0000281	0,0000374	0,0000203	0,0000214
2019	-0,0000001	-0,0000001	-0,0000001	-0,0000001	-0,0000001	-0,0000001	-0,0000001	-0,0000001	-0,0000001	0,0000000
2020	0,0000576	0,0000504	0,0000444	0,0000187	0,0000100	0,0000058	0,0000089	0,0000053	0,0000133	0,0000044
2021	-0,0000010	-0,0000006	-0,0000007	-0,0000008	-0,0000007	-0,0000007	-0,0000007	-0,0000006	-0,0000008	-0,0000011
2022	0,0000880	0,0000866	0,0000761	0,0001040	0,0000789	0,0001019	0,0000952	0,0000531	0,0000727	0,0000857
2023	0,0000034	0,0000050	0,0000049	0,0000004	0,0000077	0,0000072	0,0000017	0,0000057	0,0000042	0,0000027
2024	0,0000006	0,0000006	0,0000004	0,0000005	0,0000006	0,0000005	0,0000002	0,0000005	0,0000013	0,0000010

Conclusion

In this study, the international competitiveness of the world's leading apricot-exporting countries during the 2015–2024 period was evaluated using the Revealed Comparative Advantage (RCA), Revealed Symmetric Comparative Advantage (RSCA), and Normalized Revealed Comparative Advantage (NRCA) indices. The findings revealed that competitive advantages in the global apricot trade are concentrated in a limited number of countries and that significant differences exist in the degree of export specialization among the major exporters. The consistency of the results obtained from the three competitiveness indices enhances the reliability and robustness of the analysis.

The RCA and RSCA analyses indicated that Uzbekistan, Türkiye, Spain, Afghanistan, and Tajikistan maintained strong and sustainable comparative advantages throughout the study period. In particular, Uzbekistan emerged as the country with the highest level of export specialization in the global apricot market, exhibiting exceptionally high RCA and RSCA values. Türkiye consistently preserved its strong competitive advantage over the entire period, reinforcing its strategic position in international apricot trade. Türkiye's leadership in dried apricot exports,

well-established international reputation, and long-standing production experience have been the key factors underpinning its sustained competitiveness.

The NRCA results further demonstrated that Türkiye, Uzbekistan, Spain, and Italy made positive contributions to global apricot trade. Spain, in particular, recorded consistently high NRCA values, reflecting its strong position and export performance within the European market. In contrast, Pakistan and Algeria exhibited negative or near-zero NRCA values throughout the study period, indicating persistent comparative disadvantages and limited competitiveness in international apricot trade.

One of the most notable findings of this study is the considerable fluctuation observed in Iran's competitiveness performance. Although Iran exhibited strong comparative advantages in several years, significant declines in its RCA, RSCA, and NRCA values were observed during the final years of the study period. These findings suggest that international sanctions, trade restrictions, logistical challenges, and changes in export market conditions have substantially affected the country's competitiveness in the global apricot market.

Overall, the findings indicate that success in the global apricot trade depends not only on production volume but also on export-oriented production systems, quality standards, product diversification, branding, marketing strategies, and access to international markets. Countries that have maintained their competitive advantages over time have successfully supported their production capacity with effective export policies, efficient supply chains, and strong market integration.

From the perspective of Türkiye, maintaining its current competitive advantage requires continuous improvements in quality-oriented production systems, more effective international promotion of geographically indicated apricot products, expansion of value-added processed apricot exports, and the development of new export markets. Furthermore, climate change, sustainable water resource management, and increasing global competitive pressures are expected to play decisive roles in shaping Türkiye's future export performance.

In conclusion, this study demonstrates that competitive advantages in the global apricot market are largely concentrated in specialized exporting countries, particularly Uzbekistan, Türkiye, and Spain. The consistent comparative advantage maintained by Türkiye throughout the study period confirms its position as one of the leading actors in international apricot trade. The findings provide valuable insights for policymakers, exporters, and other stakeholders involved in the apricot sector and contribute to the growing literature on international agricultural competitiveness. Future research should incorporate additional analytical approaches, such as market concentration indices, gravity models, trade policy variables, and climate change indicators, to provide a more comprehensive understanding of the dynamics shaping global apricot trade.

Finally, the future development of global apricot trade will be influenced not only by market and trade dynamics but also by the increasing impacts of climate change on agricultural production. In particular, rising temperatures, water scarcity, and the growing frequency of extreme weather events in the Mediterranean Basin and Central Asia are expected to significantly affect apricot production and export performance. Therefore, these factors should be incorporated into future competitiveness studies to better understand the long-term sustainability of the global apricot sector.

Funding: No funds, grants, or other support was received.

Data availability statement: Data will be made available upon reasonable request.

Conflict of interest: The author declares that there is no conflict of interest.

Ethical standards: For this article no studies with human participants or animals were performed by any of the authors. All studies mentioned were in accordance with the ethical standards indicated in each case.

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