RESEARCH ARTICLE

Commercial maps of the main Latin American countries in the international olive oil market

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Abstract

Aim of study: World trade in olive oil is undergoing structural changes, with the emergence of new relevant actors, notably South American countries. The objective of this study was to analyze the performance of emerging Latin American countries in the world olive oil market during the period 2010–2019.

Area of study: Major Latin American countries within an international context.

Material and methods: The study was conducted through an analysis of trade networks, the application of the export growth decomposition method, the index of import dependence, and competitiveness matrices developed from the statistical evolution of import share and market share indicators.

Main results: European countries continue to dominate international trade in olive oil, however, Chile and Argentina have managed to widen their role. Chile was the country with the highest growth rate in olive oil exports in terms of value and volume in the period analyzed, whereas Argentina was below the world average. Prices in general have been stagnant, although price variability between countries can be distinguished. This may be due to the re-export policy of some countries, the qualities, the format, and some intrinsic characteristics of the markets.

Research highlights: Chile and Argentina figure prominently for their commercial capacity, with the former focusing mainly on the USA and Brazilian markets, and the latter on the Spanish.

Additional key words: Argentina; Chile; competitiveness matrices; import penetration; decomposition of export growth; index of import dependence.

Abbreviation used: CMS (Constant Market Share); EU (European Union); HS (Harmonized System); MS (Market Share); SI (Share of Imports); RCA (Revealed Comparative Advantage).

Introduction

World olive oil production has increased significantly in the last few decades (Kashiwagi et al., 2020). Traditional European supplier countries are expected to focus increasingly on quality and sustainability rather than quantity, so in parallel with a slower growth of these traditional suppliers, a substantial increase in future production in new producing countries is foreseen (Mili & Bouhaddane, 2021); in the same time, a significant increase in global demand for olive oil in non-traditional markets is expected. Among the most important reasons for this

Table 1. Total production per country in 1000 tons and % increase for 1961 and 2019.

Year	2019	1961	% Δ
Argentina	1.0	0.3	262.5
Chile	0.6	0.2	187
Greece	9.7	16.6	-41.4
Italy	10.9	29.0	-62.6
Morocco	6.6	1.0	543.5
Spain	36.8	27.1	36.2
Syrian	5.4	0	5431.4
Tunisia	6.8	2.8	140.9
Türkiye	7.3	9.6	-23.6
Rest of world %	14.9	13.4	10.7

Source: Own elaboration based on FAOSTAT (2022).

increase, the following could be cited: changing lifestyles; rising incomes of different consumer segments; higher demand from pharmaceutical firms for personal skin and hair care products; and also an increasing awareness of the positive health and sustainability attributes of the olive oil (Klonaris & Agiangkatzoglou, 2018; Kashiwagi et al., 2020; Mili & Bouhaddane, 2021).

Olive tree (*Olea europaea* (syn. Zaytoun, Jetun)) has been cultivated alongside Mediterranean civilizations for more than 6000 years. There are evidences of olive oil production plants cultivation since the Bronce Age in different Mediterranean countries, such as Grece, Israel, Palestine Cyprus and Syria (Vossen, 2007; Kapellakis et al., 2008). The countries illustrated in Table 1 represented more than the 85% of the total world oil production in 2019. The total production was concentrated in the following European Union (EU) countries: Spain, Italy, and Greece (with around the 36%, 10.8% and 9.7% of the total production respectively). Second-tier non-European producers include Türkiye, Tunisia, Morocco, and Syria (with around the 7.3%, 6.7%, 6.6% and 5.4% of the production respectively), suited by Algeria, Egypt, Lebanon, and Jordan. The following most significant producer countries are Argentina (with around 1% of the total) and Chile (with around 0.6% of the total). However, the production of Latin American countries is very low compared with the Mediterranean basin production countries. Although there are other producers in the Latin American region (e.g. Mexico, Peru, and Uruguay), their production percentage is even minor compared to Argentina and Chile (FAOSTAT, 2022).

As explained by Milli & Zúñiga (2001), traditionally, the countries of the Mediterranean Basin were responsible for 95% of world production and 90% of world consumption. However, fundamental changes have occurred during the nineties, which are gradually altering these traditional patterns. Table 1 illustrates some relevant changes that have occurred in the olive oil production picture from 1961 to 2019. Among the most important EU producer countries, only Spain has increased its production from 1961 to 2019

(~ 36%), while Italy and Greece have reduced its production (~ 62% and ~ 41%, respectively). Among the second most important producers, Morocco has increased considerably its production (~ 543%) suited by Tunisia (~ 140%), while Türkiye has reduced its production in the cited period in a 23%. As regards the Latin American countries, as mentioned above, Argentina is the most important producer country, which a remarkable production increase (of 262% from 1961 to 2019) (see Table 1). As explained by Pefaur (2015), in Chile, the national olive industry was formed around 1950, but it was not until 1996 that a competitive Chilean olive growing industry began to develop. As illustrated in Table 1, its production increase has been also remarkable (~ 186%), well above the global average for the cited period (~ 10%).

The standard way to study competitiveness is to make country-level assessments for a product, product group or industry, using international trade data (exports, imports, trade balance and prices) (Laursen, 2015). One of the most commonly used analyses is the Balassa indicator of Revealed Comparative Advantage (RCA) and its adaptations based on trade flows (Bojnec, 2014; Laursen, 2015; Stellian & Danna-Buitrago, 2019). There are other techniques such as constant market share analysis (CMS), the gravity model and the intra-industry trade index. In all of them the main analysis variables are the export and import variables between countries, with some including the analysis of prices and other factors that indicate performance at the country level (Klonaris & Agiangkatzoglou, 2018; Stellian & Danna-Buitrago, 2019; Kashiwagi et al., 2020). Differences in competitiveness among exporters are attributable to changes in trade position due to comparative advantages or market circumstances, with greater differences existing between traditional and emerging producers (Klonaris & Agiangkatzoglou, 2018; Kashiwagi et al., 2020). An example of competitiveness assessment was the study on Türkiye versus the main olive oil exporting countries for the period 1990-2006 using aforesaid mentioned RCA, the Comparative Export Performance (CEP) and the Market Share Index

(MSI) (Türkekul et al., 2010). Another study focused on the competitiveness of Greek olive oil with the main European competitors in the markets of Germany, Italy, the UK and the USA, using the RCA index and performing an import demand system in each market (Klonaris & Agiangkatzoglou, 2018). Other authors highlight that olive oil production is expanding to non-traditional producing countries, such as the USA, Australia, and New Zealand. The authors analyze the factors affecting olive oil exports and imports in Mediterranean countries for the period 1998-2016 using the product-specific gravity model (Kashiwagi et al., 2020). In general, studies on international olive oil trade propose an approach to the global competitiveness of exporters using trade specialization.

As regards the analysis of the olive oil international market, there are some fundamental characteristics that should be kept in mind, especially such aspects related to the origin and quality of the product, and the form in which it is traded (i.e. in bulk or bottled). As explained by Bajoub et al. (2018), over the last decades, mainly due to the increasing worldwide popularity and the trade globalization of the olive oil, quality as well as authenticity control have become a relevant issue to the different agents in the market (i.e. consumers, suppliers, retailers, and regulators), not only in traditional, but also in emerging olive oil producing countries. According to Aparicio et al. (2013), the purpose of olive oil authenticity should be focused on the labeling control as well as on protecting the genuineness of olive oils with regard to their geographical origin and botanical variety.

Main traders of olive oil have different attributes to consider within their commercial strategies. For example, in the USA, Germany and Mexico, consumer preferences show that the most valued attributes are origin and price (Chamorro-Mera et al., 2020), while Germany has a strong preference for a higher quality (Scarpa et al., 2021), and Italy favors attributes of quality that are revealed by labels stating geographical indications and organic production (Gorgitano & Sodano, 2016; Roselli et al., 2017). As regards the form in which the olive oil is traded (i.e., in bulk or bottled), main destinations for Chilean oil are the USA, Brazil and Italy. To USA and Brazil, the product is exported in bottled form (implying a higher price per unit), instead to Italy it is exported mainly in bulk, because it enters free of duty, which is not the case with bottled oil (Pefaur, 2015). As explained by Mili & Zuñiga (2001), until 2001, a high proportion of the Spanish exports still were of bulk, with a low value added. Being Italy the second most important producer and exporter (in value), as pointed out by different authors, it is also one of the world's leading importers of bulk olive oil. Its main suppliers are Spain, Greece, Tunisia, Türkiye and Morocco (Klonaris & Agiangkatzoglou, 2018; Mili & Bouhaddane, 2021). As pointed out by Klonaris & Agiangkatzoglou (2018), the traditional strategy of different Italian olive oil processing companies consists of importing oil in bulk from different origins and qualities, thereafter they blend it producing a branded product, which is re-exported as an Italian product.

There is little research for Latin America as regards the olive oil trade. For these countries, the agricultural sector provides a vital contribution to the generation of employment and growth. To ensure their growth and sustainability, it is important to analyze the performance of these industries in international trade (Losilla et al., 2019; Paus, 2019). Accordingly, studies that analyze trade relations and the evolution of the competitiveness of this type of good can help the sector's stakeholders develop business strategies. Considering that Argentina and Chile are emerging producers and Brazil is among their top buyers worldwide, studies that analyze the performance of these countries in the international olive oil market with international trade data are essential to assess and design trade strategies. This type of research is an instrument to promote the development of the value-added industry in Latin America (Pajares et al., 2014).

In this research, priority was given to the use of methodologies other than those traditionally used, namely CMS and RCA, to propose and validate new tools that contribute to a better understanding of trade competitiveness. Through neural networks it was possible to represent the complex flows in the olive oil trade, as well as employing competitiveness matrices to show dynamic indicators over time. Neural networks are proving to be a useful tool in various fields of science because they provide a quick, intuitive visualization to analyze complex relationships in terms of quantities of relationships and the magnitudes of these relationships.

Neural networks are quite frequently applied to financial markets and trade (Ballestra et al., 2019; Eachempati et al., 2021; Mateńczuk et al., 2021). One of the most common applications of neural networks is data prediction models, e.g., future stock market prices, calculated based on historical data (Mateńczuk et al., 2021). These methods are also increasingly applied to international trade of goods and services. Using trade data of ten countries, a recent study by Shen et al. (2021), developed a foreign trade forecasting method that relies on a neural network with long short-term memory (LSTM). The main goal in the study by Sokolov-Mladenović et al. (2016), was to predict economic growth based on trade in services, exports of goods and services, imports of goods and services, and merchandise trade based on artificial neural networks.

The objective of this study was to analyze the performance of emerging Latin American countries in the world olive oil market for the period 2010-2019.

Material and methods

Data

For the general characterization of the olive oil industry, trade data (COMTRADE, 2022) for category 1509 "Olive

oil and its fractions, whether or not refined, but not chemically modified" was used. Specific information relating to tariff code 150910 Olive oil, virgin (including extra virgin, virgin and lampante virgin, unfit for human consumption), and code 150990 "Olive oil (excl. crude & virgin) & fractions thereof, whether or not refined, but not chemically modified", i.e., mostly refined oil, was also used. Olive oil is a very heterogeneous product in terms of its qualities, including extraction method, organoleptic defects (aroma and flavor), and degree of free acidity (expressed as oleic acid). The harmonized commodity description and coding system (HS) prior to the 2017 and 2022 updates does not offer a disaggregation that allows the precise identification of the oil marketed according to its characteristics. Therefore, category 150910 does not allow differentiation between lampante olive oil, virgin olive oil and extra virgin olive oil. In order to improve the understanding of the results obtained, data from the customs offices of those countries that offer a more detailed classification were consulted.

The data used for exports and imports, expressed in tons (volume) and thousands of dollars (value), as well as the unit or average value (dollars per ton), were obtained from the United Nations Comtrade online database (COMTRADE, 2022). The data sample covers the period 2010-2019; however, in some indicators only data up to 2018 are used, due to the unavailability of information for 2019 or a high variability of the information for this year with respect to the rest of the series.

To assess competitiveness, the markets in which Argentine and Chilean exports compete were chosen. These markets were also considered to be representative of the main geographical areas and which play a leading role in global imports of this good (top 10). This is the case of USA, Brazil, Japan, and Spain.

Methods

Firstly, an analysis of the relationship between the main exporters and importers of olive oil was carried out, using a mesh graph made with UCINET software. This is an application that can represent networks and obtain indicators for analysis (Song et al., 2020). This case will provide a simplified way to show the main trade flows for the analyzed good.

Export efficiency

To analyze the overall export performance of Chile and Argentina with respect to the major exporting countries, a decomposition of export value growth was applied. This method consists in explaining the growth rate of the exported value by decomposing the growth rate of the exported quantity and the growth rate of the average unit value exported (hereinafter "price") (Guevara et al., 2021). Eq. 1 is proposed for a better understanding:

$$GR_{vj} = \left[(X_{(k+n)j}/X_{kj})^{\frac{1}{n}} - 1 \right] + \left[(P_{(k+n)j}/P_{kj})^{\frac{1}{n}} - 1 \right] \quad (1)$$

where GR_{vj}: growth rate of the value exported by country j; n: number of periods analyzed; X_{kj}: olive oil exports in period k (initial) by country j; $X_{(k+n)j}$: exports of olive oil in the period $k+n$ (present) by country j; P_{kj}: olive oil price in period k (initial) by country j; and $P_{(k+n)j}$: olive oil price in the period $k+n$ (present) by country j.

Import dependency

On the other hand, an index that evaluates the dependence of exporting countries on imports was applied. This was calculated using Eq. 2, which relates the imports of the good (M_i) divided by the exports of the good itself (Xi) for the country analyzed.

$$ID_{ij} = \frac{M_i}{X_i} * 100 \quad (2)$$

where IDij: dependence on imports to exports of good i in country j.

In general, this indicator evaluates what proportion of exports might hypothetically come from imports. Although these imports could also go to domestic consumption, they would still allow a greater quantity of the good to be available for export. If the value of the indicator is close to zero it means that the country does not depend on imports, whereas a value close to 100 indicates heavy dependence, and a higher value indicates that all exports and a part of domestic consumption are conditioned by imports.

To understand the importing behavior of exporting countries, a price analysis was carried out consisting of the difference between the export price ($Pije$) and the import price ($Piji$). If the result is negative, it indicates that the imports would be destined for domestic consumption for a market segment willing to pay for a better-quality product. On the contrary, if the result is positive, it indicates that the country could obtain a benefit by re-exporting the good, or by substituting domestic consumption with imported oil of lower value, devoting more of its domestic production to exports. In practice, however, it is impossible to establish the exact traceability of countries' import-export behavior. Therefore, in order to qualify the most significant results, specific information on the characteristics of imports and exports in these countries is analyzed.

$$\omega_{ij} = P_{ij}^e - P_{ij}^i \quad (3)$$

where ωij: net price of product i in country j.

The export-re-export strategy was analyzed by correlating the annual averages of the variables calculated in Eqs. 2 and 3.
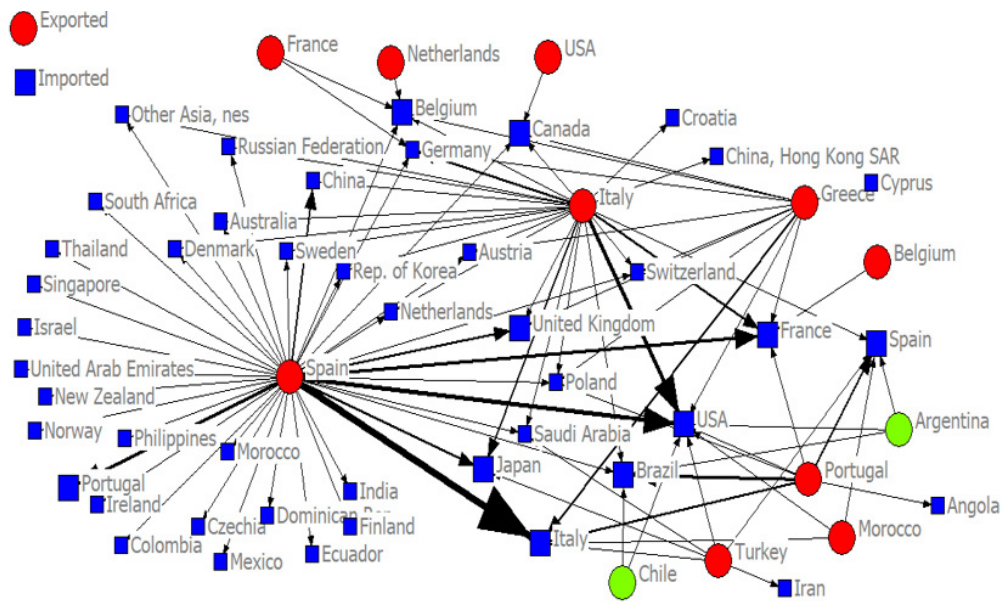
Figure 1. Map of networks of the 100 main commercial exchange flows of olive oil, year 2019. Own elaboration based on COMTRADE (2022).

Combined indicators to measure competitiveness

Finally, the calculation of import share indicators related to the market share indicator made it possible to assess competitiveness in the main markets selected for code 1509 (Guevara & Morales, 2018). Performance by grade (code 150910 vs. 150990) was also analyzed for the world market.

The share of olive oil imports (SI) was calculated by using Eq. 4:

$$SI_{IZ} = \frac{M_{iz}}{M_w} \qquad (4)$$

where SI_{IZ}: share of imports of product i by the importing country z; X_{ij}: exports of good i from country j to the importing country concerned; and M_{iz}: total imports of good i, from importing country z.

On the other hand, the market share (MS) indicator was calculated. One of the most used parameters is the competitiveness of companies or countries with respect to the share of participation in a specific market for a product or service (Damijan et al., 2020):

$$MS_{ijz} = \frac{X_{ij}}{M_{iz}} \qquad (5)$$

where MS_{ijz}: market share of product i by exporter j by importer z; X_{ij}: exports of good i from country j to the importing country concerned; and M_{iz}: total imports of good i, from importing country z.

The trends of the indicators SI and MS were evaluated by applying a linear regression with respect to time: the slopes of the functions $f_x(SI_{iz})$ and $f_x(MS_{ijZ})$. Using the sign of the coefficients, it was possible to determine whether the evolution of the specific MS, and the share of the evaluated product were statistically significant, for a confidence level of 95%, indicating the positive or negative sign if it is increasing or decreasing, respectively.

The competitiveness results evaluated in the markets analyzed allow us to understand the scenario that Chile and Argentina are facing in terms of reformulating their commercial strategies. The competitiveness was obtained from the calculation of the SI and MS indicators, the context of competitiveness used was not based on the magnitude of their results, but rather on the evolution of these over time. Therefore, it was possible to have both a high MS and negative competitiveness (Guevara & Morales, 2018).

The results obtained were represented in a nine-quadrant competitiveness matrix (Guevara & Morales, 2018). This allows representing the evolution of the MS of the exporting country in the importing country and the evolution of the share of the analyzed product in the importing country itself (Fig. S1 [suppl]).

Results

Chile and Argentina have managed to position themselves among the top 10 main olive oil exporting countries in 2019 (Fig. 1). The largest export flows, represented by thicker lines, are from Spain to Italy, USA, France, UK, and Portugal. In these destinations most of the exporters represented with circles converge.

Export efficiency price, volume, and value

Export efficiency is expressed as the capacity that a country has when it increases its exports harmoniously in
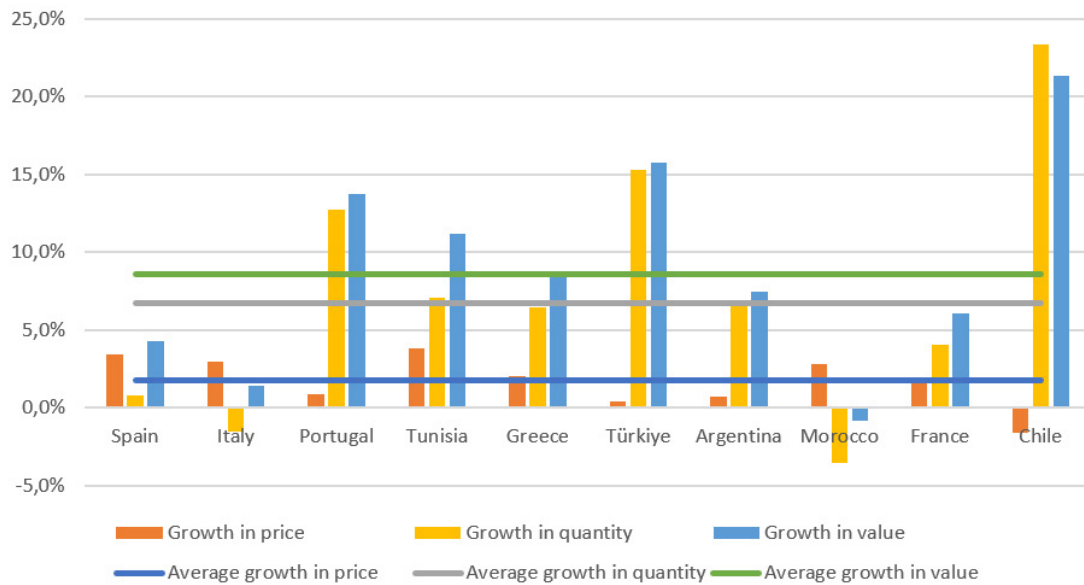
Figure 2. Average annual growth rate unit value, quantity, and value of the main olive oil exporters, 2010-2018 (in %). Own elaboration based on COMTRADE (2022).

terms of price and quantity, and as a result a significant increase in value. Fig. 2 shows that Chile is the country with the highest growth rate in olive oil exports in terms of value and volume in the period analyzed. Türkiye, Portugal, and Tunisia also had growth rates of volume and value above the average of the countries analyzed and although their prices grew, they did so below the average of the group analyzed. In the case of Argentina, all three variables analyzed grew below the average, which shows that the sector in this country is stagnating. In general, prices grew very little, which implies that those countries that have seen an increase in the value of their exports have depended mostly on an increase in the quantities exported. In general, the countries with the highest average export

prices are France (6598.9) and Italy (4841.7), which are much higher than those of Chile (3721.6) and Argentina (3514.3) ($/ton), respectively.

As for prices paid by the main importers (Fig. 3), a similar trend can be observed for all these countries, where none shows significant growth, confirming stagnation in the general prices of olive oil. In terms of absolute values, the countries that pay the highest prices are Japan and Brazil, whereas Spain, and Italy, lead in terms of lowest prices. The high price in the Japanese market is partly explained by the fact that it is a niche market, dependent on imports, which are mainly dominated by Spanish and Italian bottled extra-virgin oils, which benefit from trends towards Mediterranean gastronomy (Embassy of Peru, 2020; Rodríguez,
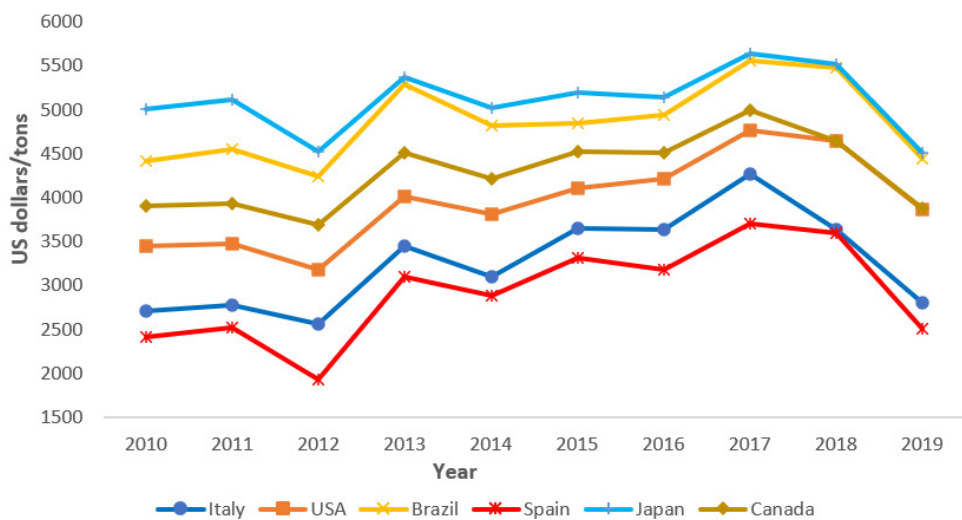

Figure 3. Evolution of the average unit value paid by the main importing countries analyzed, 2010-2019 (in US dollars/tons). Own elaboration based on COMTRADE (2022).
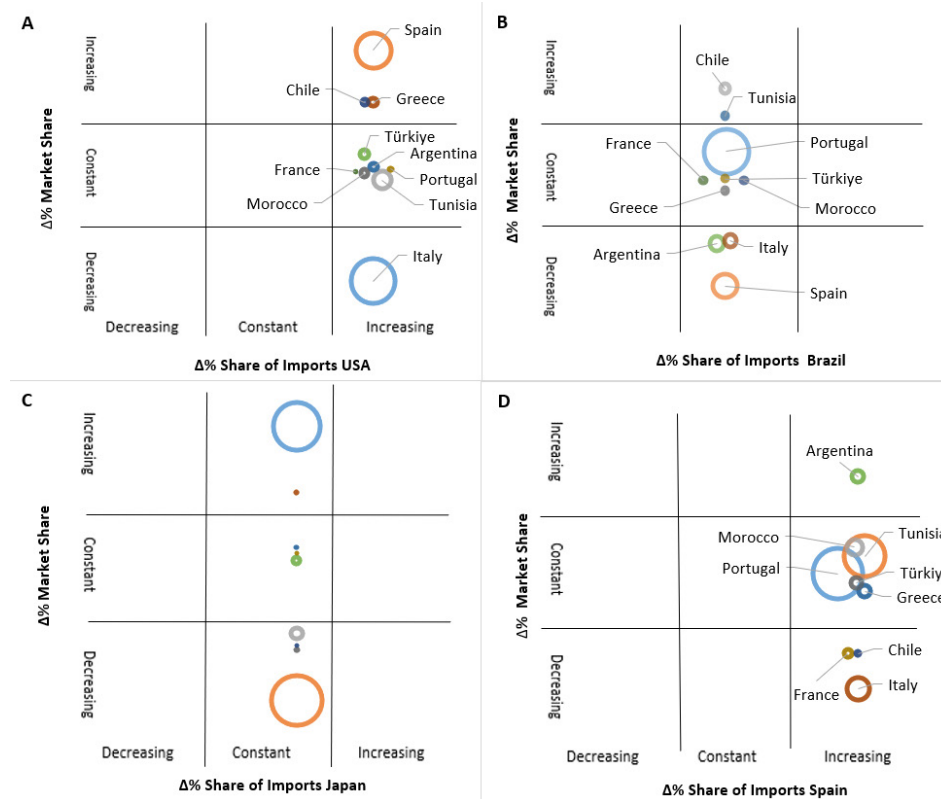
Figure 4. Competitiveness matrices of the main exporters in the main markets, 2010-2019. Own elaboration based on COMTRADE (2022).

2021). The Brazilian market is also highly dependent on olive oil imports, which are driven by the increasing demand from a growing middle class that is increasingly aware of the need for a healthier diet, as well as a marked interest in the enjoyment of gastronomy (Rosell, 2021). The Italian market, although it has an important production, is not able to cover its consumption and exports. On the other hand, the Spanish market produces large quantities of high-quality oil, with the capacity to satisfy its domestic consumption. However, in both Italy and Spain, part of their imports responds to commercial strategies of re-export through blending operations and bottling in different formats (a more detailed analysis of the Spanish, Japanese and Brazilian markets is developed in the section on competitiveness).

Import dependency analysis

From the previous analysis it can be seen that Spain, Italy, and Portugal play a major exporting and importing role, meaning that their imports are re-exported taking advantage of the reputation and experience of their companies. This practice seems to be used in other countries as well. To corroborate this hypothesis, an analysis of the participation of imports vs. exports in volume and an analysis of the net price (export price minus import price) was carried out.

Argentina has very little dependence on imports, only surpassed by Tunisia (Table 2). This shows that in these countries both their domestic consumption and exports are covered by their domestic production. In the case of Chile, its average value in the period analyzed is 15.4, making it the fifth most import-dependent country among the countries analyzed. However, this proportion is not very significant compared to France and Italy, where their imports are much higher than 100% of their exports, which means that their exports and/or internal consumption may be conditioned by the behavior of their imports.

The results in Table 3 show that European countries are those that have a higher net price from the exporting industry than the importing one. The case of France is relevant because without being a large producer it manages to have significant export values, which is achieved through the net price (re-export). France is a country with a small olive oil production of 5900 tons (FAOSTAT, 2022), of which 30% corresponds to lampante oil, and at the same time has a high consumption of high-quality oil (Vilar et al., 2018). Despite this, statistics place it in 2019 as the ninth largest exporter of olive oil, for which it has implemented a commercial strategy based on imports mainly of virgin olive oil from Spain (58.7%), Italy (16.7%) and Tunisia (16.1%). Part of this oil is re-exported to Germany (35.9%) and Belgium (19.3%) and other northern European countries. Its exports correspond to 82% extra virgin oil, 15% virgin oil and only 3% lampante oil, out of a total of more

Table 2. Rate of participation of imports in exports for the main exporter.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Tunisia	0.3	0.6	0.1	0.3	1.5	0.3	3.8	1.7	0.3	0.4
Argentina	0.5	0.9	0.4	0.5	1.1	0.4	0.6	0.5	7.7	1.6
Greece	2.9	2.2	1.1	2.4	20.5	2.2	0.6	2.2	1.1	2.8
Türkiye	0.0	0.2	0.3	0.1	0.5	20.5	7.3	0.0	7.4	56.6
Spain	5.8	5.5	8.5	16.6	5.2	24.8	11.2	11.1	18.5	13.7
Chile	30.5	12.9	8.3	7.2	6.6	13.9	19.8	11.8	21.0	21.9
Morocco	12.1	12.7	30.8	154.9	45.7	25.3	58.4	97.4	77.9	20.5
Portugal	154.5	110.2	105.5	108.0	81.9	85.4	76.8	78.7	67.3	68.6
Italy	165.7	160.8	147.8	132.8	167.7	171.2	150.4	170.8	171.5	185.8
France	2008.3	1848.6	1816.4	1821.8	1660.4	1057.0	1442.9	1288.5	1480.2	1276.4

Source: Own elaboration based on COMTRADE (2022).

than 8021 tons of oil classified as extra virgin. In the case of other oils classified in category 150909 in 2019 it exported 1581 tons to the same countries.

A high correlation was found between import dependence and net price (ρx,y = 0.71), showing that in those countries with a higher proportion of import dependence, their export price was higher than their import price, offering an opportunity for re-export. This is not the case of Argentina and Chile, which have negative ones, showing that, in general, imports in these countries are destined for domestic consumption.

Competitiveness analysis

United States

The US market shows a positive slope function (y = 0.1964x + 15.74) and a p-value =0.01, meaning that olive oil imports are growing significantly in this country (Fig. 4A). This market is the second largest at a global level. The country that exports most to the USA is Italy with an average of 46.5% MS. However, Italy was the loser in the growing market, being the only country with a decrease in its competitiveness. This loss was exploited by Spain, Greece, and Chile, who managed to gain competitiveness by positioning themselves as winners in a booming market. Meanwhile, Argentina remained persistent in this booming market. The competitiveness achieved by Chile is given by an average annual growth rate of 16.2% in the period analyzed. In 2019, approximately 78% of the value of exports was in bulk format, 49% of which corresponded to virgin oil for consumption and 28% to organic virgin oil. Chilean bulk exports respond to the demand of the North

American gastronomic sector, which normally makes large bulk purchases, and on the other hand, supermarkets that use their own brands (ProChile, 2015). Another important factor to consider is the elimination of tariffs on Chilean exports, thanks to the free trade agreement signed in 2003. In general, the increase in the competitiveness of Spain, Greece, and Chile is largely explained by the large drop in Italian production, which went from 526,778 tons in 2010 to 336,581 tons in 2019 (FAOSTAT, 2022).

Brazil

The Brazilian market shows a constant slope function (y = -0.0024x + 4.6733) with a of p-value =0.97, indicating that olive oil imports in this country have remained constant. The analysis in this country (Fig. 4B) produces very interesting results for the evolution of Chile, placing it as the leader in a stable market for the period analyzed, a position only shared with Tunisia, which allows the two countries to position themselves as the best performers in this market. Chile, in 2019 exported 99.1% of its oil in formats smaller than 5 L, of which 96.1% is virgin oil and 3% organic virgin oil (Chile Customs, 2022). These variables favor their prices, which are above US$5,000 per ton and are among the best for this market. Portugal leads the average participation with 61%; however, it does not evidence an increase in its competitiveness. Its historical, linguistic and cultural ties offer an advantage in relations with Brazil. In addition, it has maintained a sustained growth in its olive oil production from 62,914 to 154,063 tons in the period studied. This allowed its exports to Brazil to exceed 60,000 tons in 2019, of which 85% corresponded to virgin oil (150910), of which more than 99% belongs to virgin olive oils (excluding others

Table 3. Export-import price difference for major exporters, 2010-2019, in U.S. dollars per ton.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
France	2975	2835	2852	2930	3597	1039	2223	1736	2785	2824
Italy	1561	1715	1532	1548	1509	4982	1180	1404	1937	2156
Portugal	1340	1151	1000	989	902	647	479	487	638	814
Greece	1032	1053	914	924	1766	1803	720	666	864	1078
Spain	532	513	953	570	558	580	629	705	386	641
Chile	-41	-238	156	907	424	59	-625	-771	-687	1487
Morocco	-140	-156	113	235	192	1349	157	-246	-439	42
Tunisia	590	1276	-582	-150	273	-351	980	502	-44	383
Argentina	-1466	-934	-1593	-1004	-1211	-40	-1637	-1629	245	-26
Türkiye	-2498	-270	1075	-1243	-1077	1064	202	-4813	1872	1015

Source: Own elaboration based on COMTRADE (2022)

and lampante). This category has been growing while category 150990 has been decreasing. Argentina, on the other hand, shows a loss of competitiveness, which is influenced by a decrease in the volume of virgin oils. In the case of Spain, the market study carried out by ICEX (Spain Export and Investment) describes the main problems faced by exporters as bureaucratic obstacles, the existence of a high number of cascading taxes, and the need to export in bottled format to avoid the adulterations that frequently occur in this market (Roselló, 2014).

Japan

Competitiveness in the Japanese market is especially important because it is the main Asian market of the category and the country that pays the highest price. Its import behavior ($y = 0.0655x + 3.4$) with p-value = 0.06 was very close to showing statistically significant growth but based on the established decision criteria it was placed as a stable market (Fig. 4C). Chile showed a discreet performance for this destination, with a steady ranking in a stable market. Although in general Chilean exports have grown, it has not allowed it to increase its PM significantly, which on average has been 0.23%. With 96.4% of oil exported in the category of bottled extra virgin oil, according to data reported in 2019 by Chilean Customs (2022). Argentina, on the other hand, showed poor performance (tendency to zero), losing competitiveness, and becoming the loser in a stable market, as did Türkiye, France, and Italy. The best performance for this destination was that of Spain, which saw its competitiveness increase. Olive oil has been penetrating Japanese culture through mediterranean gastronomy, offering an advantage in this case for Italian oils (Rodríguez, 2021). Its consumption is focused on high quality oils, which are distributed in the on-trade and supermarket channel, the latter being the fastest growing in recent times (ProChile, 2018). In 2019, 94.8% of Chilean exports to this destination were bottled virgin and organic virgin oil. Found in supermarkets fundamentally the presence of Italian and Spanish extra virgin oil in formats of approximately 250 g and 500 g at high prices (Embassy of Peru, 2020). Spain currently leads exports to Japan with more than 50% of the value of its imports and together with Italy dominate more than 94% of the market. In 2019, 70.6% of the value of Spanish exports to Japan of olive oil was concentrated in extra virgin oil for consumption of which 67.0% was bottled. In contrast, other olive oils belonging to classification 150990 with 29.4%, only 20.7% was marketed bottled (DataComex, 2022). Historically, Italy had dominated this market; however, since the 2014 season, the amount of oil imported from Spain has moved into first place. Some factors that may have influenced this result are the drop in Italy's production (FAOSTAT, 2022), together with a focus on Spain's investment in the production of high quality oils, and consequently a higher production capacity, as well as the promotional campaigns supported by the Spanish government (Capogna & Gómez, 2016).

Spain

The Spanish market shows a positive slope function ($y = 0.4606x + 1.7667$) and a p-value =0.03, i.e. in this country the participation of the olive oil imports grows significantly. As we can see in Fig. 4D, Argentina is the only country that gained competitiveness by positioning itself as a front-runner of the booming market. This competitiveness was ceded by France, Italy, and Chile. All the other countries
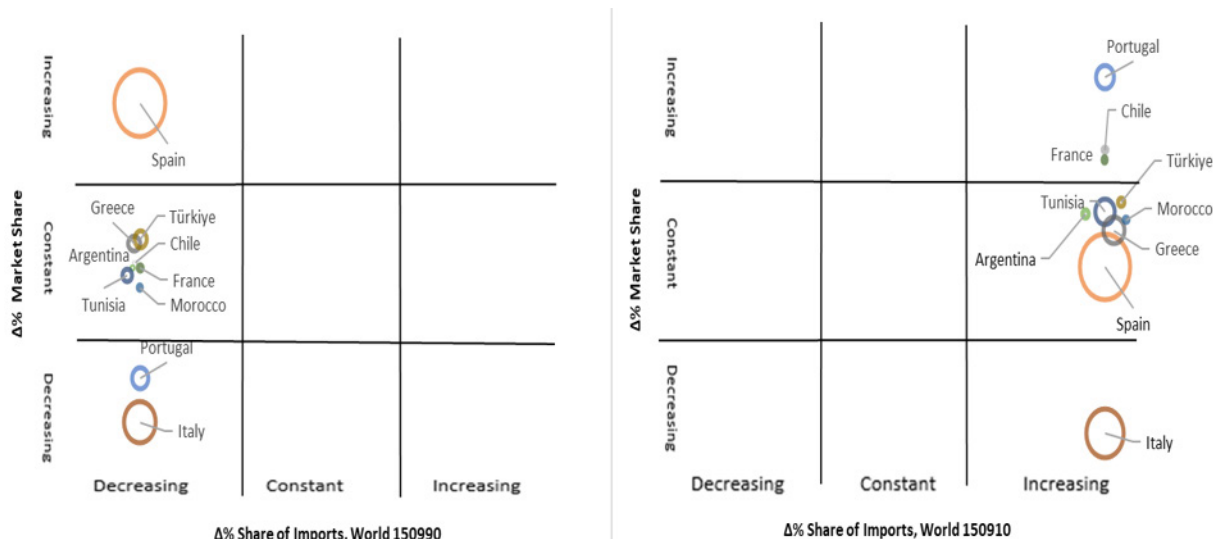
Figure 5. Competitiveness matrices of the main exporters in the international market, for categories 150990 and 150910. Own elaboration based on COMTRADE (2022).

analyzed maintained their competitiveness by positioning themselves persistently in the booming market. In 2018 Spanish imports ranked third worldwide, exceeding 166 thousand tons, of which 33.7% was extra-virgin oil mostly in bulk or containers larger than 5 L, in second place with 30.6% lampante oil. Unlike Chile and European countries such as France, Portugal and Italy, Argentine exports have found an ideal structure for their low cost and composition in the Spanish market. With an important growth of lampante oil from zero to more than 3921 thousand tons, representing 47.2% of its exported volume, the other 51.5% corresponded to extra-virgin oil in bulk (DataComex, 2022). On the other hand, as explained above, Italian oil exports have been affected by the decrease in their production (FAOSTAT, 2022). In the case of Chile, there is a decrease in the segment of extra virgin oils in bulk. This may be related to a change of strategy towards other markets such as Brazil, which through a change to the bottled format allows it to achieve better prices.

Competitiveness by qualities

Transactions in the world olive oil market for the period studied corresponded to 81.13% of the oil virgin (150910), which has increased its share of imports with respect to the oil non-virgin category (150990) (Fig. 5). By country, Portugal, Chile, and France show a notable increase in competitiveness for the virgin category (winner of the booming market). At the same time, in the case of oil other than virgin, Spain leads the growth (winner in a depressed market). In both categories, Italy is the biggest loser, accompanied by Portugal in the case of oil other than virgin. Argentina maintained a constant share in both categories, together with the rest of the countries analyzed. This result shows that the increase in Chile's global competitiveness

is due to its focus on markets that demand better quality oils and, in turn, these are the ones with the highest growth and best prices, with an offer of organic oils as a value proposition (Chile Customs, 2022). The main recipients of Chilean oil are the USA and Brazil, the latter being the recipient of the packaged product, obtaining a higher price per unit (Pefaur, 2015).

Discussion

Chile's increased competitiveness in the world olive oil market is due to two factors: a focus largely on the markets with the greatest demand and size, such as the USA and Brazil, combined with a better performance in virgin oil exports in the packaged segment at a price in the market average. While some authors state that the organoleptic characteristics of olive oil is a relevant attribute for its commercialization (Sayadi et al., 2017; Clodoveo et al., 2020), in the case of the Brazilian market, it was identified that customers are mostly influenced by extrinsic signals such as brand, labeling, and packaging (Roselli et al., 2018), so as with the US consumer they do not consciously consider the quality of olive oil as a predominant attribute when making the purchase (Santosa et al., 2013; Vázquez-Araújo et al., 2015). In general, consumers are unable to distinguish the differences between the different categories of olive oil (García Moral et al., 2018). Therefore, growth strategies based on competitive pricing can continue to be effective for Chile if they are improved in aspects such as branding, labeling, packaging, and always accompanied by promotional campaigns. Always bearing in mind that these Latin American countries are still small producers compared to the European leaders. Therefore, their supply capacity in the market is insignificant, unable to have an impact on the balance between supply and demand. It is

common practice to assess competitiveness among countries. However, in the case of the olive oil market in the EU countries, certain relevant aspects of globalization and the global value chain are reflected, therefore, the quantitative assessment of competitiveness may not reflect the real state of the national industries. To cite two examples: the first is that an important part of Spanish olives and olive oil is processed in Italy; the second example is the Spanish investments made in Portugal in this sector. This reflects the important nuances that characterize the international olive oil market.

On the other hand, it is interesting to benchmark against Spain, which is the country with the highest trade exchange in 2019 with a total value of US$3.64 billion, approximately 25% of all world trade in this oil, thus maintaining its historical position (Klonaris & Agiangkatzoglou, 2018). These results can be explained in part because it is the nation that presents the greatest number of commercial networks with other nations from the position of exporter (1st) and importer (5th). Spain's dynamism cannot be attributed solely to its successful commercial strategies in important markets such as the USA and Japan (Capogna & Gómez, 2016). To form this large supply chain in the olive oil market, this Spanish agro-industrial sector together with Italy have led the innovations reflected in the number of patents in all areas related to the production and use of olives, among which oil production stands out (Torrecillas & Martínez, 2022). Another important aspect that offers greater competitiveness to Spanish companies is the work with monovarietal olive oils, achieving controlled blends to obtain new flavors, aromas, or healthy attributes, which strengthens quality by eliminating the deficiencies of some oils (Pardo et al., 2013, 2021). All the above has allowed Spaniards to position a product with greater added value in the international market.

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Benchmarking with respect to Spain and European countries can offer Chile and Argentina an important guide to formulate their strategies. As noted above, there are some success factors that can strengthen these countries, such as innovation (Torrecillas & Martinez, 2022), blending work to increase consumers' sensory satisfaction (Pardo et al., 2021), and the creation of global value chains, including between the two countries. The market diversification strategy may be an alternative that Chile and Argentina could employ, with an increase in their imports, identifying producing countries that offer their oils in bulk at low costs in the international market, similar to the triangulations carried out by European countries such as France with Spain, Italy, Tunisia and Greece; Spain with Portugal, Tunisia, Morocco and Argentina; and Italy with Spain, Greece and Tunisia. In this case Argentina appears on the side of low-cost exporters. Therefore, its first strategy should be aimed at reversing this aspect from its own productive structure. Although this may have its origin in the natural characteristics that condition the quality of its oils. Turcato & Mattar (2014) conducted a sensory study of the different attributes of Argentinian oils from the San Juan region, where they found that some varieties were unbalanced, which despite their extra virgin status may not be to the liking of the average consumer. Therefore, the study of blends to improve consumer perception may be elemental for a better performance of these oils.

Globally, the olive oil industry is showing good results in terms of export volume growth. It is very likely that demand will continue to grow as a consequence of the growth of a middle class with healthy habits in many countries, together with research that has demonstrated the benefits of olive oil consumption to prevent cardiovascular diseases, among others (Donat-Vargas et al., 2022). As such, the challenge for this industry is to maintain harmonious price growth. The slight price growth and the rapid increase in volume worldwide could indicate that for some markets olive oil is no longer considered a luxury item. This could have consequences in those countries where its production factors are more costly because it directly affects their profitability (Roselli et al., 2017). In the specific case of Chile, the price is falling, which has impacted the total value of its olive oil exports. This implies that, although it shows the best performance among exporters in terms of the rate of growth of the value exported, this increase has depended on volume. In Argentina, the volume of exports has also had a much higher growth rate than the price. While this reflects strengths in its domestic industries in terms of production, it implies a challenge for its international trade strategy to improve prices. This productive strength is also demonstrated by the low dependence on imports; both countries should only increase imports for re-export purposes whenever there is evidence of a positive impact on the net price relationship. Global prices may also be impacted by the growth shown by countries such as Tunisia, which has 125 thousand hectares of which 40% is organic, which will open the door to more demanding markets and therefore more direct competition (Arfaoui et al., 2021). In this sense, the white brands promoted by many markets in countries such as the USA are also a threat, for which bulk imports are less demanding in terms of quality and at a lower cost.

In the U.S. market, there is a convergence of the main exporters, motivated by the size and dynamism of this market. Argentina has a better average share than Chile in this market, 2.3% vs 1.6% respectively; however, it has not achieved the statistically significant growth achieved

by Chile's opening trade policy with unilateral (tariff reductions), bilateral (signing of treaties) and multilateral (participation in multilateral organizations) strategies (Tosoni, 2017). In contrast to the Spanish market, which also showed a growing participation, Argentina proved to be more competitive than Chile. These results show divergences in the approach to markets that these nations have developed. By relating this analysis to the prices paid by these destination markets, it can be inferred that the policy of Chilean exporters to strengthen their presence in the USA was more effective than that of Argentina towards the Spanish market, with the lowest import price among the countries analyzed. As demonstrated in the analysis of competitiveness by market, the price of Argentine oil is affected by the destination of its exports and its structure, which has a high bulk component and a significant share of lampante oil. Chile, on the other hand, has opted for a higher value-added production, through packaging and greater commercial capacity. On the other hand, Argentina has accepted the benefits of being part of the large value chain of Spanish companies that can move large volumes of oil with a higher value proposition to large markets, for which it depends to a certain extent on lower-cost suppliers.

Brazil, on the other hand, is a Latin American country identified as an opportunity for exports of this good (Pajares et al., 2014). Chile's positive performance in this market has been to the detriment of traditionally leading countries such as Spain and Italy, prompting a notable change in the structure of this market. This performance could be associated with a component of geographical proximity; however, Argentina is losing competitiveness, even though it shares a long border with this destination. An approach to this would offer a competitive advantage, considering the attractive conditions of this buyer, its large size, its potential for economic growth and that it pays the second-best price. At the same time, these same conditions make it a market with a high concentration of exporters as shown by the results.

The Japanese market is considered interesting because it is the one that pays the highest price. However, the recognition and strong presence of Italian and Spanish exports make it difficult for emerging countries to increase their competitiveness in this destination. In addition, distance and international transportation costs become a major barrier for exports from Latin American countries when it comes to low volumes (Zamora & Pedraza, 2013).

It is important to note that Chile has an advantage for olive oil trade, as it has reduced tariffs under the free trade agreements signed with these markets (with Brazil recently in 2022). Argentina, on the other hand, has zero tariffs, in Brazil because it is a Mercosur partner, and in the USA because of the system of preferences with developing countries (Picardi et al., 2015).

At present there are important conditions that can reshape the world olive oil market and especially the US market and that in some way can be favorable for secondary and/or emerging producers. The first is the retaliatory tariffs imposed by the USA on the EU for the illegal aid to the Airbus company that harmed the American company Boeing. This includes tariffs of up to 25% on Spanish olive oil exports (Hammami & Beghin, 2021) using a calibrated multi-market partial-equilibrium displacement model. The model accounts for four differentiated types of retail olive oil in the U.S. market. U.S. retailer-blenders source olive oil in eight foreign markets and domestically and for two qualities of oil (virgin, other. This represents unequal competition for Spanish companies in the agricultural sector, which has no connection with the aeronautics sector. Secondly, the fall in olive oil production in Italy (FAOSTAT, 2022), while some markets are increasing their demands. This situation was initially well exploited by Tunisia and Portugal.

Conclusions

The olive oil market has been led by European countries for decades, however, the results obtained are encouraging for Latin American countries. Chile and Argentina are prominent for their commercial capacity, with the first is mainly focused on the U.S. market, and the second on the European market (especially Spain).

Chile is more diversified in terms of the number of destination markets than Argentina, which is due to a trade policy derived from a greater number of trade agreements signed. This has allowed it to have a more independent commercial strategy from the saturated European market.

The strategies of these Latin American countries have focused on growing export volumes without allowing them to compete with the world's major exporters. Chile leads the growth, supported by a better-quality bottled oil segment, which has allowed it to access better prices. Argentina, on the other hand, remains in the world average, with low average unit values, supplying oil mainly in bulk, with a significant share of lampante oil, as was corroborated in the case of the Spanish market. It would be expected that its commercial strategies would focus on a significant improvement in prices in the target markets through brand positioning tactics, with higher quality and value-added product. Focusing on the USA, Brazilian and Japanese markets could help consolidate its commercial position in the price variable, provided that its value offer is improved.

To develop the full potential of these markets, it is necessary to promote the development of cross-border projects that will help boost trade between these countries, such as the "Chile-Mercosur" central bi-oceanic corridor, which plans to unite Atlantic-Pacific trade by passing through Chile, Argentina, and Brazil, with a focus on Asian countries. At the same time, they should continue to strengthen trade with North America (USA, Canada, and Mexico) due to its market size, income level and average olive oil prices.

Chile can continue to improve its position among exporters by taking advantage of the fact that its production factors are cheaper than in countries that traditionally export this good. Argentina, on the other hand, although it has more experience in this market, should reformulate its export strategy and focus on nearby markets such as Brazil, where it can have an edge by taking advantage of the geographical proximity that would allow it to gain competitiveness using logistics as a key factor of success.

Finally, future lines of research include studies focused on Latin America on associative work models for small olive producers. Also, topics such as brands based on geographical indications, designations of origin, fair trade, and the sustainability of the sector.

Authors' contributions

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References

Aparicio R, Morales MT, Aparicio-Ruiz R, Tena N, Garcia-Gonzalez DL, 2013. Authenticity of olive oil: Mapping and comparing official methods and promising alternatives. Food Res Int 54(2): 2025-2038. https://doi.org/10.1016/j.foodres.2013.07.039

Arfaoui M, Boulaares M, Boudiche S, 2021. Competitiveness of Tunisian olive oil exports in a changing world market: A shift share analysis. Eur J Econ Manag Sci 4: 42-52. https://doi.org/10.29013/EJEMS-21-42-52

Bajoub A, Bendini A, Fernandez-Gutierrez A, Carrasco-Pancorbo A, 2018. Olive oil authentication: A comparative analysis of regulatory frameworks with especial emphasis on quality and authenticity indices, and recent analytical techniques developed for their assessment. A review. Crit Rev Food Sci Nutr 58(5): 832-857. https://doi.org/10.1080/10408398.2016.1225666

Ballestra LV, Guizzardi A, Palladini F, 2019. Forecasting and trading on the VIX futures market: A neural network approach based on open to close returns and coincident indicators. Int J Forecast 35(4): 1250-1262. https://doi.org/10.1016/j.ijforecast.2019.03.022

Bojnec Š, 2014. Trade and revealed comparative advantage measures: Regional and Central and East European agricultural trade. East Eur Econ 39(2): 72-98. https://doi.org/10.1080/00128775.2001.11040990

Capogna D, Gómez MI, 2016. Olive oil: an overview of the Japanese market. Oilseeds Fats Crop Lipids: 23(6): 608-619. https://doi.org/10.1051/ocl/2016041

Chamorro-Mera A, Román-Suero B, García-Galán MD, 2020. The structure of preferences of olive oil importers: The country of origin effect. J Food Prod Mark 26(7): 457-469. https://doi.org/10.1080/10454446.2020.1802380

Chile Customs, 2022. Dynamic Export Database. https://www.aduana.cl/base-de-datos-dinamicas-de-exportaciones/aduana/2020-11-19/151830.html

Clodoveo ML, Corbo F, Tsiami A, 2020. Gastronomic cultural evolution of the virgin olive oil consumption model at the restaurant. Int J Gastron Food Sci 22: 100238. https://doi.org/10.1016/j.ijgfs.2020.100238

COMTRADE 2022. United Nations Commodity Trade Statistics Database. https://comtrade.un.org/db/mr/rfCommoditiesList.aspx?px=H2&cc=1509

Damijan J, Konings J, Yergabulova A, 2020. Increasing market power in Slovenia: Role of diverging trends between exporters and non-exporters. World Econ 43(5): 1327-1345. https://doi.org/10.1111/twec.12932

DataComex, 2022. DataComex - Descarga de Datos. https://datacomex.comercio.es/Data

Donat-Vargas C, Sandoval-Insausti H, Peñalvo JL, Moreno MC, Amiano P, Bes-Rastrollo M, et al., 2022. Olive oil consumption is associated with a lower risk of cardiovascular disease and stroke. Clin Nutr 41(1): 122-130. https://doi.org/10.1016/j.clnu.2021.11.002

Eachempati P, Srivastava PR, Kumar A, Tan KH, Gupta S, 2021. Validating the impact of accounting disclosures on stock market: A deep neural network approach. Technol Forecast Soc Change 170: 120903. https://doi.org/10.1016/j.techfore.2021.120903

Embassy of Peru, 2020. Olive oil profile in Japan: 1-16. https://cdn.www.gob.pe/uploads/document/file/1469411/atae%20-%20noviembre-2020.pdf.pdf

FAOSTAT, 2022. Crops and livestock products. FAO, Roma. https://www.fao.org/faostat/es/#data/QCL

García Moral F, Martínez C, Moral E, 2018. Evolución de las exportaciones españolas de aceite de oliva y composición geográfica de su crecimiento (2008-2017). Boletín Económico ICE 3101: 19-30. https://doi.org/10.32796/bice.2018.3101.6616

Gorgitano MT, Sodano V, 2016. Differentiation policies in the italian market of extra virgin olive oil. Calitatea 20: 274-279. https://www.proquest.com/docview/2198413536.

Guevara W, Morales C, 2018. Analysis of the export competitiveness of the main products exported by Chile and Peru. J Glob Compet Govern 12(2): 38-56.

Guevara W, Hidalgo-Alcázar C, Rojas JL, 2021. Análisis de la agroindustria chilena del aguacate (palta) en el mercado internacional. Chil J Agric Anim Sci 37(1): 54-64. https://doi.org/10.29393/CHJAAS37-6AAWG30006

Hammami AM, Beghin JC, 2021. The trade and welfare impacts of the U.S. retaliatory tariff on EU olive oil. Agric Econ 52(5): 807-818. https://doi.org/10.1111/agec.12655

Kapellakis IE, Tsagarakis KP, Crowther JC, 2008. Olive oil history, production and by-product management. Rev Environ Sci Bio/Technology 7(1): 1-26. https://doi.org/10.1007/s11157-007-9120-9

Kashiwagi K, Yamna, Arfa L, Zaibet L, 2020. Growing olive oil export and intra-industry trade in mediterranean countries: Application of gravity model. Sustain 12(17): 7027. https://doi.org/10.3390/su12177027

Klonaris S, Agiangkatzoglou A, 2018. Competitiveness of Greek virgin olive oil in the main destination markets. Br Food J 120(1): 80-95. https://doi.org/10.1108/BFJ-07-2016-0331

Laursen K, 2015. Revealed comparative advantage and the alternatives as measures of international specialization. Euras Bus Rev 5(1): 99-115. https://doi.org/10.1007/s40821-015-0017-1

Losilla LV, Engler A, Otter V, 2019. Internationalization paths of fruit export companies from emerging economies: Are they regionally or globally oriented? Int J Emerg Mark 15(2): 320-343. https://doi.org/10.1108/IJO-EM-12-2017-0562

Mateńczuk K, Kozina A, Markowska A, Czerniachowska K, Kaczmarczyk K, Golec P, et al., 2021. Financial time series forecasting: Comparison of traditional and spiking neural networks. Procedia Comput Sci 192(3): 5023-5029. https://doi.org/10.1016/j.procs.2021.09.280

Mili S, Zúñiga M, 2001. Exploring future developments in international olive oil trade and marketing: A Spanish perspective. Agribusiness 17(3): 397-415. https://doi.org/10.1002/agr.1024

Mili S, Bouhaddane M, 2021. Forecasting global developments and challenges in olive oil supply and demand: A delphi survey from Spain. Agriculture 11(3): 191-213. https://doi.org/10.3390/agriculture11030191

Pajares E, Martínez JD, Moral A, Jurado E, Viruel MJ, 2014. Recursos locales y competitividad global: La exportación de aceite de oliva virgen en Andalucía. Bol Asoc Geogr Esp 69: 539-559.

Pardo JE, Sena E, Cuesta MA, Granell JD, Valiente J, Alvarez-Ortí M, 2013. Evaluation of potential and real quality of virgin olive oil from "Campos de Hellín" (Albacete, Spain). J Am Oil Chem Soc 90(6): 851-862. https://doi.org/10.1007/s11746-013-2222-3

Pardo JE, Rabadán A, Suárez M, Tello J, Zied DC, Álvarez-Ortí M, 2021. Influence of olive maturity and season on the quality of virgin olive oils from the area assigned to the protected designation of origin of "Aceite de la Alcarria" (Spain). Agronomy 11(7): 1439-1452. https://doi.org/10.3390/agronomy11071439

Paus E, 2019. Innovation strategies matter: Latin America's middle-income trap meets China and globalisation. J Dev Stud 56(4): 657-679. https://doi.org/10.1080/00220388.2019.1595600

Pefaur J, 2015. El aceite de oliva. Oficina de Estudios y Políticas Agrarias, Ministerio de Agricultura, Gobierno de Chile 1-7.

Picardi MS, González GH, Valls L, 2015. Aceite de oliva: el mercado mundial y el desempeño comercial de la Argentina. Rev Agroaliment 21(41): 81-93. https://dialnet.unirioja.es/servlet/articulo?codigo=6318164&info=resumen&idioma=ENG

ProChile, 2015. The olive oil market in the United States. ProChile, Office in Chicago. http://www.normalizacion.gob.ec/wp-content/uploads/downloads/reglamentos/reglamentos.pdf

ProChile, 2018. Estudio de mercado aceite de oliva Japón. ProChile, Ministerio de Relaciones Exteriores.

Rodríguez A, 2021. El mercado del aceite de oliva en Japón. ICEX, Oficina Económica y Comercial de España en Tokio (ICEX España).

Rosell FJ, 2021. El mercado del aceite de oliva en Brasil. Ed. ICEX España Exportación e Inversiones.

Roselli L, Clodoveo ML, Corbo F, De Gennaro B, 2017. Are health claims a useful tool to segment the category of extra-virgin olive oil? Threats and opportunities for the Italian olive oil supply chain. Trends Food Sci Technol 68: 176-181. https://doi.org/10.1016/j.tifs.2017.08.008

Roselli L, Carlucci D, Rover OJ, De Gennaro B, 2018. The effects of extrinsic cues on olive oil price in Brazil. J Int Food Agribus Mark 30(1): 70-87. https://doi.org/10.1080/08974438.2017.1387883

Roselló E, 2014. El mercado del aceite de oliva en Brasil. IICEX España Exportación e Inversiones. Oficina Económica y Comercial de la Embajada de España en São Paulo.

Santosa M, Clow EJ, Sturzenberger ND, Guinard JX, 2013. Knowledge, beliefs, habits and attitudes of California consumers regarding extra virgin olive oil. Food Res Int 54(2): 2104-2111. https://doi.org/10.1016/j.foodres.2013.07.051

Sayadi S, Erraach Y, Parra-López C, 2017. Translating consumer's olive-oil quality-attribute requirements into optimal olive-growing practices: A quality function deployment (QFD) approach. Br Food J 119(1): 190-214. https://doi.org/10.1108/BFJ-05-2016-0228

Scarpa R, Bazzani C, Begalli D, Capitello R, 2021. Resolvable and near-epistemic uncertainty in stated preference for olive oil: an empirical exploration. J Agric Econ 72(2): 335-369. https://doi.org/10.1111/1477-9552.12398

Shen ML, Lee CF, Liu HH, Chang PY, Yang CH, 2021. Effective multinational trade forecasting using LSTM recurrent

neural network. Expert Syst Appl 182: 115199. https://doi.org/10.1016/j.eswa.2021.115199

Sokolov-Mladenović S, Milovančević M, Mladenović I, Alizamir M, 2016. Economic growth forecasting by artificial neural network with extreme learning machine based on trade, import and export parameters. Comput Human Behav 65: 43-45. https://doi.org/10.1016/j.chb.2016.08.014

Song H, Yang X, Yu K, 2020. How do supply chain network and SMEs' operational capabilities enhance working capital financing? An integrative signaling view. Int J Prod Econ 220: 107447. https://doi.org/10.1016/j.ijpe.2019.07.020

Stellian R, Danna-Buitrago J, 2019. Revealed comparative advantages and regional specialization: Evidence from Colombia in the Pacific Alliance. J Appl Econ 22(1): 349-379. https://doi.org/10.1080/15140326.2019.1627722

Torrecillas C, Martínez C, 2022. Patterns of specialisation by country and sector in olive applications. Technol Soc 70: 102003. https://doi.org/10.1016/j.techsoc.2022.102003

Tosoni GA, 2017. Free trade, growth and potential product in Chile, Mexico, and Peru. Econ UNAM 14(42): 1-23. https://doi.org/10.1016/j.eunam.2017.09.001

Turcato A, Mattar S, 2014. Olive oils from South America. Olive Oil Sens Sci 337-357. https://doi.org/10.1002/9781118332511.ch14

Türkekul B, Günden C, Abay C, Miran B, 2010. Competitiveness of mediterranean countries in the olive oil market. New Medit 9(1): 41-46.

Vázquez-Araújo L, Adhikari K, Chambers E, Chambers DH, Carbonell-Barrachina AA, 2015. Cross-cultural perception of six commercial olive oils: A study with Spanish and US consumers. Food Sci Technol Int 21(6): 454-466. https://doi.org/10.1177/1082013214543806

Vilar J, Pereira JE, Urieta D, Menor A, Caño S, Barreal J, et al., 2018. L'Oléiculture internationale. Diffusion historique, analyse stratégique et vision descriptive. Fundación L' Oléiculture Internationale.

Vossen P, 2007. Olive oil: history, production, and characteristics of the world's classic oils. HortScience 42(5): 1093-1100. https://doi.org/10.21273/HORTSCI.42.5.1093

Zamora AI, Pedraza OH, 2013. International transport as a competitive factor in foreign trade. J Econ Financ Adm Sci 18(35): 108-118. https://doi.org/10.1016/S2077-1886(13)70035-0