Revealed comparative advantage of export mangoes and mangosteens to the Netherlands market, period 2019 – 2022

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Abstract-- International trade of goods and services is an important pillar in the economy of nations, and its competitiveness is defined by the ability to expand its market share. The present research focused on answering the following problem: What is the revealed comparative advantage of exporting mangoes and mangosteens from the main exporting countries to the Netherlands market, 2019 - 2022? Accordingly, the objective was set to determine the revealed comparative export advantage (VCRE) of mangoes and mangosteens from the main exporting countries to the Netherlands market during the period 2019 - 2022. Under a quantitative longitudinal approach, trade data of mango and mangosteen exports from Peru, Colombia, Brazil and Costa Rica were analyzed; obtained from the international trade platforms Veritrade and Wits. The econometric model of Balassa's Revealed Comparative Export Advantage (RCEA) index was applied to obtain the results, which indicate that all the countries in the study have a comparative advantage, but vary in degree. Brazil tops the list with an average ERVA index of 11.66, Peru with 11, Costa Rica with an average ERVA index of 9.42 and Colombia with the lowest average ERVA index with a value of 2.83.

Keywords-- Revealed Comparative Advantage; Export of Mangoes and Mangosteens; Agricultural industry.

I. INTRODUCTION

A country's competitiveness has been associated with its capacity to expand its market share, which is closely related to its export performance, including the productivity and quality of the goods produced [1].

The exchange of goods, according to the factor ratio theory, flows according to the resources available to the country and the way in which they are distributed. Thus, the country will specialize and export the good that uses that factor and import the good that uses the scarcer factor [2]. On the other hand, the postulate of the New Geography maintains that international trade occurs due to imperfect competition, since countries have different factors at the time of production. The production of countries is not homogeneous due to the different abundance or scarcity of resources they have, and the increasing economies of scale mean that the higher the production volumes, the lower the costs, the greater the efficiency and the greater the benefits for the consumer [3].

Mango fruit and mangosteens have increased their productivity and export dynamism in recent years. According to trade data [4], its exports under the international tariff heading "080450", have amounted to more than US$ 7 271640 in the period 2021, with a growth rate of 8% in the period 2017- 2021; the main exporters being Brazil, Peru, Colombia and Costa Rica.

Regarding exporting countries, the government agency PROCOLOMBIA [5] indicated that exports of Colombian mangoes and mangosteens have grown by 19.7% in 2022 compared to the previous year, with shipments to the Middle East, Canada and some European countries. In addition, the amount exported in the first half of 2022 totals US$11.4 million. Colombian mango exports have export potential with a view to entering the U.S. market, as Colombia has obtained phytosanitary eligibility to ship mango to the United States.

In the case of Brazil, Tiemi and Geraldine [6] stated that Brazilian exports of mangoes and mangosteens exceeded 2021 expectations. According to statistics, Brazil exported 270 thousand tons. They also point out that Brazil exports mangoes all year round, this being one of its advantages, but its highest season is from October to the first days of January, coinciding with the season in which Peru exports, this being its main competitor.

The Promotora de Comercio Exterior de Costa Rica [7] reported that exports from the agricultural sector in recent years have diversified into value-added fruits. In 2021, its main destinations have been the Netherlands and the United States, accumulating US$8 million of mango fruit. In 2022, the same sector has accounted for 19% of its total exports with 104 destinations.

Regarding Peru, García and Morales [8] mentioned that products from the Peruvian agricultural sector, such as grapes, mangoes, blueberries, bananas, among others, have a greater comparative advantage over their competitors. Specifically, fresh mango has been the second product exported by Peru in the agro sector, with a total of 52 918 tons in 2016 and a

revealed comparative advantage index of 53.33, which makes it competitive against the other exporting countries present in the international market.

According to the Ministry of Foreign Trade and Tourism [9], the main destination markets include the United States with a 16.6% share, followed by the European Union (EU) with a 28% share. The Netherlands, a member of the EU, was the second largest destination country for nontraditional agricultural exports, with shipments of US$252 million. In addition, it had a share in world mango imports of 8.5%, with an annual growth rate in quantity imported of 9% between the period 2017 - 2021 [10].

Thus, this research arose from the need to understand the competitiveness of Peru in relation to the other main countries exporting mangoes and mangosteens to the Netherlands market, based on theories accepted by the scientific community that generate academic reflection and discussion [11], such as the econometric model of the Revealed Comparative Advantage (RCA).

David Ricardo's theory of Comparative Advantage formulates that a nation should produce several goods even when they do not have absolute advantage, since it will allow them to have comparative advantage due to lower costs. Garcia [12] indicates that comparative advantage explains inter-industrial trade involving countries at different levels of development. Country A (capital-abundant) only exports manufactures and country B (labor-abundant) only exports food, reaffirming the concept that producing a good with comparative advantage will drive its specialization.

Bela Balassa was the pioneer in coining and using the term "Revealed Comparative Advantage", which consisted of analyzing international trade data. Regarding the application of the formula, it has provided the opportunity for countries to know how advantageous their exports are, and to take the respective measures to enhance these products [13].

Finally, the research stated as general objective: To determine the revealed comparative advantage of exporting mangoes and mangosteens from the main exporting countries to the Netherlands market 2019 - 2022. As a general hypothesis, the following was formulated: There is revealed comparative advantage of Peruvian mango and mangosteen exports to the Netherlands market compared to Colombia, Brazil and Costa Rica in the period 2019 - 2022.

II. Methodology

The present study follows a quantitative approach, descriptive level, non-experimental design - ex post facto and longitudinal cut [14].

The econometric model of the Balassa Revealed Comparative Advantage Index of Exports was used. This model argues that each nation's costs differ, so countries tend to specialize in the production of goods where they have more comparative advantages [15]. The formula used in this study to obtain the required results (1):

$$VCRE = \left[\frac{\frac{X_j^i}{X_{ij}^T}}{\frac{X_w^i}{X_{iw}^T}} \right] \qquad (1)$$

Where:

X_j^i = Exports of the product α from the country to the country i to the country j.

X_{ij}^T = Total exports from the country i to the country j.

X_w^i = Exports of the product α by the country to the world i to the world (w).

X_{iw}^T = Total exports from the country i to the world (w).

Interpreted: If the result of the VCRE is between 0.33 and 1 or more, it is resolved that the country is exporting to the country of origin. i is exporting to the country j the product α in a considerable volume compared to the exports of the other products it has, it is concluded that the nation has a revealed comparative advantage. In the case that the result is between -0.33 and -1, it is interpreted that the country has little potential in the exports of the product to the country. α to the country j that is, a comparative disadvantage. If a value between -0.33 and 0.33 is obtained, there is an intra-product market tendency [16].

For data collection, according to Sánchez et al [17], documentary analysis is the process by which relevant information is extracted from the documents considered in the study population. Arias [18] highlights the documentary analysis card as a useful tool for retrospective searches.

According to Hernández and Mendoza [19], the population of a research is the set of cases that meet certain characteristics. This study is related to trade factors of nations, therefore, the population is made up of foreign trade data that are strictly related to the application of the formula of the Revealed Comparative Export Advantage (VCRE) of the study countries (Peru, Colombia, Brazil and Costa Rica) to the Netherlands within the period 2019 - 2022.

The foreign trade data of the nations considered in the research were obtained from the data universe of the Veritrade and Wits platforms, using as a filter the international tariff heading "080450", which corresponds to "mangos and mangosteens". These data were processed using descriptive statistics, based on the creation of tables to apply the formula of the Revealed Comparative Export Advantage (RCEV) index and determine the average RCEV of each country. Graphs and trend charts were also used to reflect the behavior of mango and mangosteen exports from the study nations to the Dutch market between 2019 - 2022.

III. RESULTS

Based on the data collected and applying the econometric model of the Bela Balassa Revealed Comparative Export Advantage Index to the trade data of the main exporting countries of mangoes and mangosteens to the Netherlands market, it was found that the country with the highest average VCRE of mangoes and mangosteens is Brazil, with an index of 11.66, slightly surpassing Peru, which has a VCRE index of 11. For Colombia and Costa Rica, the average VCRE indexes are 2.83 and 9.42, respectively.

These results are similar to those of [20], who points to Brazil and Peru as the main mango and mangosteen producing countries in the South American region. Their specific destinations are the Netherlands and the United Kingdom during the period 1999 - 2020. It should be noted that Brazil presented a relatively higher index than Peru.

In addition, Ayyaz et al [21] in their longitudinal research during the period 2010 - 2016, states that in the Americas region, Brazil has had small variations in the value of exports of mangoes and mangosteens, obtaining a VCRE index of 5.20 with increasing trend. Likewise, the research of [22], analyzed the performance of exports of mangoes and mangosteens from Brazil during 1997 - 2017, using the constant market share tool, obtained a positive trajectory of growth of exports of mangoes and mangosteens. These results validate those obtained from the current research, since, total exports of Brazilian mangoes and mangosteens is an indicator considered for applying the VCRE formula.

[23] and [24] have conducted longitudinal research to evaluate Peruvian exports of mangoes and mangosteens. They have found that the flow of exports to the Dutch market is 90% favorable for Peru, visualizing development opportunities and the influence of national production on the export price and international price.

The behavior of Peruvian exports of mangoes and mangosteens to the Netherlands reflects a growth rate of 3% during 2019 - 2022, despite the decline of -11.83% in 2022 compared to the previous year. In addition, the flow of world exports of Peruvian mangoes and mangosteens reveals an increasing trend being its highest peak in the period 2021 with approximately 24% more compared to 2019, among its main destinations are the Netherlands, the United States and South Korea.

TABLE I

REVEALED COMPARATIVE ADVANTAGE OF PERUVIAN MANGO AND MANGOSTEEN EXPORTS TO THE NETHERLANDS MARKET 2019 – 2022

Peru - Netherlands (In USD)				
INDICATORS	2019	2020	2021	2022
X_{ij}	96,276,880.00	102,221,924.00	112,555,481.00	99,231,793.00
XT_{ij}	1,434,590,391.00	1,410,969,078.00	1,912,350,062.00	1,763,127,074.00
X_{iw}	260,507,659.00	281,872,535.00	322,950,390.00	297,387,732.00
X_{tiw}	46,131,564,000.76	38,757,234,000.04	56,260,115,000.20	58,172,424,000.00
VCRE	11,88	9,96	10,25	11,01

Source: Veritrade and Wits (2023).

Brazil has consolidated as a net exporter of mangoes and mangosteens, the data collected reveal the behavior during 2019 - 2022 in world exports of this fruit in 2022 have varied by more 7.79% compared to 2019, being its main destinations Netherlands, Spain and the United States. As for the VCRE indexes, they have grown consecutively, the values obtained are greater than 0.33 (minimum value at which VCRE is considered VCRE) and the average VCRE of the years considered amounts to 11.66.

TABLE II

REVEALED COMPARATIVE ADVANTAGE OF BRAZILIAN MANGO AND MANGOSTEEN EXPORTS TO THE NETHERLANDS MARKET 2019 -2022

Brazil - Netherlands (USD)				
INDICATORS	2019	2020	2021	2022
X_{ij}	97,153,966.00	102,003,367.00	101,415,726.00	91,200,083.00
Xt_{ij}	10,168,544,577.00	7,483,079,729.00	9,259,521,235.00	11,786,032,366.00
X_{iw}	219,187,609.00	244,772,274.00	245,379,525.00	202,095,118.00
Xt_{iw}	221,126,807,000.65	209,180,241,000.66	280,814,577,000.46	334,463,079,000.00
VCRE	9,64	11,65	12,53	12,81

Source: Veritrade and Wits (2023).

Due to the opening of the market, world exports of Colombian mangoes and mangosteens have increased significantly in 2022, with more 131.5% compared to 2019. In particular, exports to the Netherlands in 2022 increased by 74.7% compared to the value recorded in 2019. However, the countries of the Middle East region are found as the main destinations of the Colombian product, justifying the averages obtained in the VCRE.

During the four study periods, exports of mangos and mangosteens from Colombia to the Netherlands have had a comparative advantage, with indices above 0.33, which is considered the minimum value for the ERV. Its peak was in 2020, with a value of 4.88 and the average ERV for the years considered amounts to 2.83.

TABLE III

REVEALED COMPARATIVE ADVANTAGE OF COLOMBIAN MANGO AND MANGOSTEEN EXPORTS TO THE NETHERLANDS MARKET 2019 - 2022.

Colombia - Netherlands (USD)				
INDICAT ORS	2019	2020	2021	2022
Xij	465,502.00	1,032,046.00	966,228.00	813,209.00
Xtij	1,215,072,401.00	699,383,989.00	981,102,434.00	2,699,595,915.00
Xiw	5,857,153.00	9,386,951.00	13,787,443.0 0	13,559,067.00
Xtiw	39,849,359,000.46	31,055,810,000.66	41,389,989,000.05	38,950,952,000.00
VCRE	2,61	4,88	2,96	0,87

Source: Veritrade and Wits (2023).

Costa Rica has also diversified its agricultural exports. Although world exports of Costa Rican mangoes and mangosteens decreased by 44.1% in 2022 compared to 2019, exports to the Netherlands increased from 2019 to 2021.

In the Dutch market, Costa Rican exports of this product have increased from 2019 to 2021, however, in 2022 these exports decreased by 100% compared to 2021. Throughout the period from 2019 to 2022 the VCRE indices for Costa Rican mango and mangosteen exports have been above 0.33, indicating a comparative advantage in all years of this period. The highest value was recorded in 2021, with a value rising to 21.26 and the average ERVR of the years considered is 9.42.

TABLE IV

REVEALED COMPARATIVE ADVANTAGE OF COSTA RICAN MANGO AND MANGOSTEEN EXPORTS TO THE NETHERLANDS MARKET 2019 - 2022.

Costa Rica - Netherlands (In USD)				
INDICAT ORS	2019	2020	2021	2022
Xij	559,720.00	1,138,094.00	2,568,970.00	630,360.00
Xtij	310,435,395.00	301,708,910.00	345,855,219.00	822,728,387.00
Xiw	6,107,174.00	4,565,830.00	5,011,827.00	3,408,404.0 0
Xtiw	11,451,993,000.08	11,622,755,000.15	14,345,395,000.57	15,319,907,000.00
VCRE	3,38	9,60	21,26	3,44

Source: Veritrade and Wits (2023).

IV. CONCLUSIONS

The four countries considered in the study have a comparative advantage in mango and mangosteen exports. Brazil has the greatest comparative advantage revealed in exports of mangoes and mangosteens to the Netherlands, with an index of 11.6. In second place is Peru with an index of 11, followed by Costa Rica with an index of 9.42 and, lastly, Colombia with an average index of 2.83, which is far from the results of the other three countries. The fluctuation in the results obtained is due to some factors such as Free Trade Agreements, the production capacity of the nations and phytosanitary requirements.

The Netherlands, as a trading partner, is one of the main importers of mangoes and mangosteens. Therefore, it is recommended that institutions involved in foreign trade in Brazil and Peru promote trade missions to help position their country brand and promote the internationalization of agroexporting companies in that nation.

Regarding the strengths of the research, the descriptive statistical analysis of the dimensions of the formula of the Revealed Comparative Advantage of the author Balassa stands out. This analysis made it possible to study the behavior and trends of each nation's exports and to understand the results obtained from another perspective. As a weakness, the study period was limited to only four years due to the lack of updated data. This led to the use of two databases to obtain the dimensions required by the econometric model used, specifically Colombia and Costa Rica. It is recommended that the corresponding institutions provide updated information and carry out studies on the competitiveness of this fruit, since studies on these nations have been very limited.

For future research, it is recommended that this study be used as a reference to analyze the comparative advantages of other potential products belonging to the agricultural sector,

such as pitahaya, pineapple, avocado, among others. In addition, it is suggested to use more econometric modeling tools, such as the normalized Revealed Comparative Advantage, to obtain a broader perspective of the behavior of the exchange of goods and services.

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