Colegio de Postgraduados

Competitiveness of mexican pecans [*Carya illinoinensis* (Wangenh) K. Koch] and almonds [*Prunus dulcis* (Mill.) D. A. Webb] in the international market

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ABSTRACT

Objective: Measurement and analysis of the competitiveness of Mexican pecan nuts (*Carya illinoinensis*) and almonds (*Prunus dulcis*) in the international market with respect to the United States, during the period 2012-2021.

Design/Methodology/Approach: The Revealed Comparative Advantage Index was used to identify the factors that influence its performance and propose strategies to improve its market position.

Results: Mexican pecans to the United States are competitive (0.68 to 0.94) over the years. The IVCR of Mexican pecans to the United States remain consistently above zero (0.68 to 0.94) over the years.

Study Limitations/Implications: Information on the trade of Mexican pecan nuts and almonds may be limited, making it difficult to calculate the IVCR.

Findings/Conclusions: Mexican pecan nut shows favorable competitiveness in the U.S. market while almond its competitiveness is limited, it is not competitive with respect to the market.

Keywords: Production, Competitiveness, Revealed Comparative Advantage Index.

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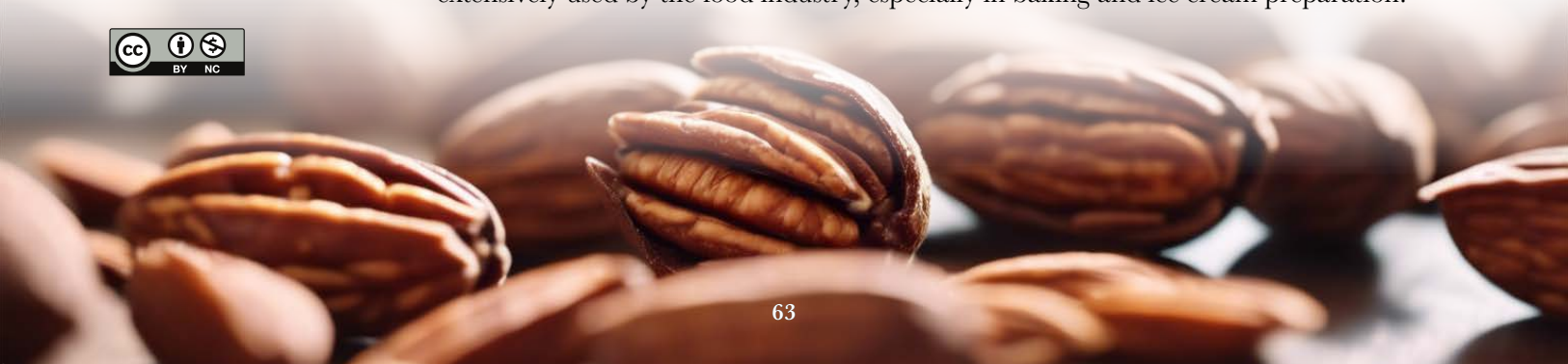
INTRODUCTION

Nowadays, food production faces a very important challenge: to produce enough high-quality food to supply the growing world population. According to Urrea and Urzúa (2016), pecans are just one of more than 20 existing nut species and one of the 13 nut species native to the USA. Pecans (*Carya ilinoinensis*) are obtained from the pecan tree. They are considered as the most important of all native American nut species and, as a result of their large amount of healthy nutrients, they are consumed by both wild animals and humans (Urrea and Urzúa, 2016).

Both pecans and almonds are two different types of nutraceuticals dry, as a consequence of their nutritional properties and health benefits (Brambila, 2006). In addition, they are extensively used by the food industry, especially in baking and ice cream preparation.



In recent decades, the pecan industry in Mexico has experienced a remarkable growth. According to data from the Servicio de Información Agroalimentaria y Pesquera (SIAP), pecan production in Mexico reached 139,000 tons in the 2019-2020 agricultural cycle, which accounts for a 10% increase, compared with the previous cycle (SIAP, 2020). Likewise, data from SIACON (2023) indicate that 143,721.55 hectares of pecans were planted in 2021, reaching a production of 133,195.39 tons. Out of this total, 8,275.84 tons were exported.

In addition, FAOSTAT (2023) recorded that 33 hectares were used to grow and harvest shell almonds in 2021, resulting in a production of 47.71 tons.

According to Porter (1980), "the competitiveness of a country is defined by the productivity with which it uses its human, economic, and natural resources" (Mathews, 2009). Suñol (2006) points out that the commonly accepted theory of competitiveness refers to the idea that, in poorly developed economies, there is a need to create productive factors and skills.

Meanwhile, Ramírez (2006) mentions that "competitiveness is the ability of economic agents to take advantage of favorable scenarios that usually arise in the world of economics" and that "from the beginning, competitiveness has been linked to international trade and understood as the ability of a given nation to successfully insert itself into the international market." In addition, the Global Competitiveness Report 2010-2011 defines competitiveness "as the set of institutions, policies, and factors that determine the level of productivity of a country" (Bonilla, 2012).

Adam Smith points out that a country should specialize in the production and exportation of goods that it can efficiently produce at a lower cost, *i.e.*, goods that provide it with an absolute advantage (Escobar, 2010). Therefore, a competitiveness analysis that identifies the strengths and weaknesses of the productive sectors of each country is fundamental. García *et al.* (2017) mention that competitiveness analysis identifies the comparative advantages of the different sectors of a country, as well as the factors that limit its growth and development.

Contreras and Leos (2021) mention that Bela Balassa (1965) proposed the first and most popular empirical measure of comparative advantage. Nevertheless, if a given crop is to be competitive, its comparative advantages should help producers to understand its benefits within the market.

The objective of this research was to carry out a competitiveness study to determine the comparative advantages of pecans and almonds within the international market and to identify their capacity to compete in each market. Data from the Sistema de Información Arancelaria Vía Internet (SIAVI) were used to carry out this study.

MATERIALS AND METHODS

The competitiveness of the Mexican pecans (*Carya illinoinensis*) K. Koch] and almonds (*Prunus dulcis*) and almonds in the international market was analyzed for the 2012-2021 period. The database was obtained from SIAVI and included exports and imports data for pecans, almonds, and all registered nuts from the study period.

The methodology used was the ECLAC (2008) Revealed Comparative Advantage Index (RCAi), which can be determined using the following formula:

$$RCAi = \frac{X_{ij} - M_{ij}}{X_{iw} + M_{iw}}$$

Where: $RCAi$ = Revealed Comparative Advantage Index; X_{ij} = Value of the Mexican product i exports in market j; M_{ij} = Value of the Mexican product i imports in market j; X_{iw} = Value of the Mexican product i total exports in the world market w; M_{iw} = Value of the Mexican product i total imports in the world market w.

According to ECLAC (2008), when RCAi is >1, the exports of pecans or almonds are higher than their participation in world trade (*i.e.*, they have comparative advantages); meanwhile, if the result is <1, the exports of pecans or almonds are lower than their participation in world trade (*i.e.*, they have no comparative advantages).

The purpose of the Revealed Comparative Advantage Index (RCAi) proposed by Balassa (1965) is to determine whether a country has any competitive advantage or not, depending on the differentiation of its international trade, during a given period and taking a given year as reference.

RESULTS AND DISCUSSION

In the 2012-2021 period, the world market demanded two types of nuts: in-shell and shelled walnuts. The latter are the most demanded nuts in the USA market. In 2016, the Revealed Comparative Advantage Index for in-shell walnuts recorded 0.20 —*i.e.*, walnut exports for that year were very competitive. In the following years, the RCAi decreased (Figure 1). These results indicate that there were no comparative advantages, because the RCAi was <1.

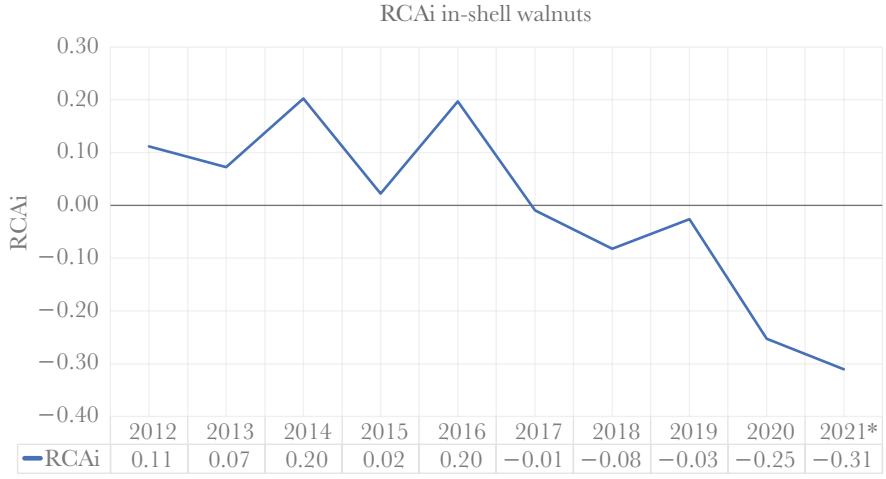


Figure 1. RCAi (IVCR) of Mexico compared with the USA, HTS codes 0802.31.
Source: Developed by the authors with statistical data from SIAVI (2023).

Table 1. RCAi (IVCR) of in-shell walnuts, compared with the USA (2012-2021).

Year	EE. UU. $USD		World $USD		RCAi
	Exports	Imports	Exports	Imports	
2012	78,515,667	61,001,544	96,133,861	61,001,544	0.11
2013	64,586,072	54,727,103	81,331,587	54,727,103	0.07
2014	109,033,234	66,960,520	140,811,552	66,960,520	0.20
2015	99,434,497	94,164,229	146,009,609	94,164,229	0.02
2016	188,970,027	115,908,907	254,521,804	115,908,907	0.20
2017	113,450,584	115,916,125	143,114,621	115,916,125	−0.01
2018	155,168,382	185,325,370	183,402,241	185,325,370	−0.08
2019	131,993,689	141,733,878	236,327,561	141,733,878	−0.03
2020	81,325,543	151,283,796	125,823,966	151,283,796	−0.25
2021*	48,492,682	103,628,750	73,886,648	103,628,750	−0.31

* January-November.

Source: Developed by the authors with statistical data from SIAVI (2023).

Table 1 shows the RCAi of the in-shell walnut and its behavior and trend, during the analyzed period.

Comparing the results obtained from the analysis of the information from the SIAVI database with the research carried out by Ávila (2020) about the competitiveness and commercialization of the Mexican pecans, the demand for this dry fruit provides high benefits to the Mexican exports, particularly towards the USA, which is the most important commercial partner of Mexico.

Table 2 shows the RCAi of the shelled walnut and its behavior and trend, during in the analyzed period.

The Revealed Comparative Advantage Index (RCAi) for the shelled walnut was calculated to further the analysis of the studied period data and to evaluate the

Table 2. RCAi (IVCR) shelled walnuts, compared with the USA (2012-2021).

Year	EE. UU. $USD		World $USD		RCAi
	Exports	Imports	Exports	Imports	
2012	195,831,987	37,828,579	196,021,826	37,859,120	0.68
2013	177,965,218	18,865,523	178,088,097	18,865,523	0.81
2014	260,954,804	17,842,394	262,619,104	17,842,394	0.87
2015	299,424,991	18,930,793	301,046,505	19,118,203	0.88
2016	364,970,579	10,747,663	367,948,346	10,747,784	0.94
2017	441,210,238	15,419,897	444,566,207	15,431,369	0.93
2018	560,770,819	28,210,079	567,054,738	28,406,466	0.89
2019	557,257,978	29,592,621	567,916,720	30,130,266	0.88
2020	491,706,917	29,731,642	505,729,382	30,128,317	0.86
2021*	460,380,421	21,822,388	484,201,511	22,144,186	0.87

* January-November

Source: Developed by the authors with statistical data from SIAVI (2023).

competitiveness of this type of walnut in the USA market. Based on the results and the applied methodology, shelled walnuts have a ≈1 Revealed Comparative Advantage Index (Figure 2). This result (<1) indicates the existence of a Revealed Comparative Advantage in Mexico, regarding the shelled walnut exports to the USA.

Although the results identified that the Revealed Comparative Advantage Index follows a positive competitiveness trend, a higher value was recorded in 2016, followed by a decrease from that year on.

Ávila (2020) reviewed the results of the analysis of the competitiveness and marketing of the Mexican pecans in the international market and concluded that Mexico has a higher participation in the USA market. The behavior of Mexican exports has considerably increased both its competitiveness and its participation in the walnut market, keeping a stable trend over the years.

Nuts can also be sold in two different styles, each with its own HS code: whole or crushed/powdered. Whole nutmeg, mace, amoms, and cardamoms are included in the HS code 090811, while crushed or powdered nutmeg, mace, amoms, and cardamoms are included in the HS code 090812. Figure 3 shows the behavior of each fraction.

Whole nutmeg recorded a variable RCAi throughout the years. Table 3 show the variation in 2013, 2014, 2015, 2016, and 2017, showing a negative competitiveness. However, the RCAi improved and stabilized during the following years.

Figure 3 shows the variation of the Revealed Comparative Advantage Index and the lowest peak of competitiveness (2015). Thereafter, compared with the USA market, competitiveness increased and reached a RCAi of 0.07 in 2020, getting closer to 1.

Crushed or powdered nutmeg (HS code 090812) had a variable trend throughout the analyzed period, ranging from −0.21 (2012) to −0.12 (2021). In conclusion, there is no competitiveness for this type of nuts. In recent years, nutmeg has recovered its competitiveness; however, its RCAi is still negative.

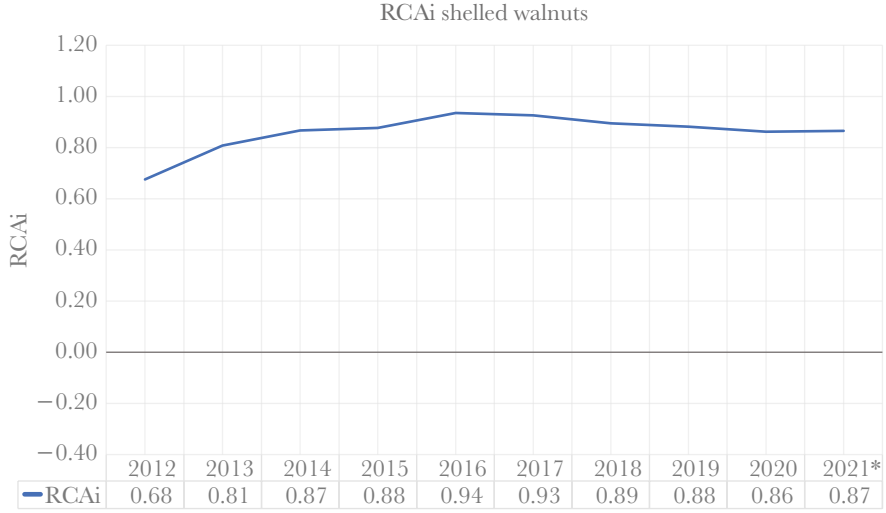


Figure 2. RCAi (IVCR) of Mexico, compared with the USA, Mexico HS code 08023201, shelled walnut. Source: Developed by the authors with statistical data from SIAVI (2023).

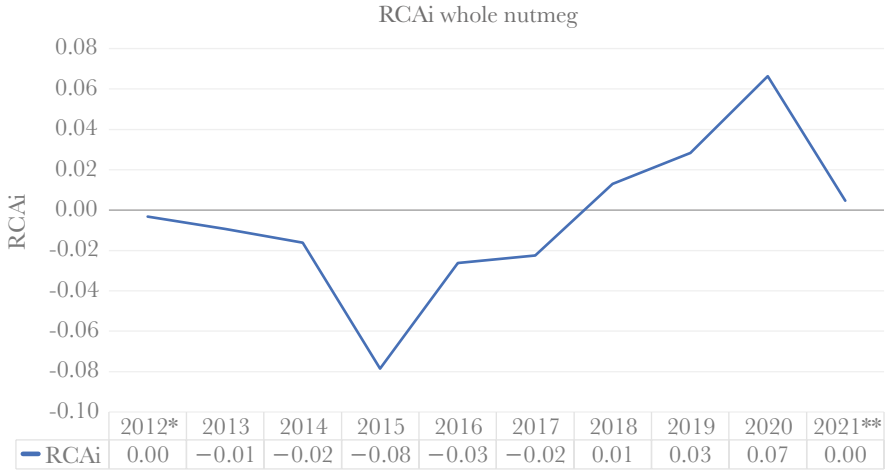


Figure 3. RCAi (IVCR) of Mexico, compared with the USA, HS code 090811, whole nutmeg, mace, amoms, and cardamoms. Source: Developed by the authors with statistical data from SIAVI (2023).

Table 3. RCAi (IVCR) of whole nutmeg, compared with the USA (2012-2021).

Year	EE. UU. $USD		World $USD		RCAi
	Exports	Imports	Exports	Imports	
2012*	10	515	1,835	151,542	0.00
2013	109	3,787	109	391,132	−0.01
2014	577	2,962	577	146,749	−0.02
2015	78	4,566	272	56,895	−0.08
2016	1,459	6,753	2,694	199,240	−0.03
2017	2,988	6,547	2,988	155,380	−0.02
2018	7,374	4,037	7,376	248,436	0.01
2019	6,957	5,221	6,957	54,301	0.03
2020	10,551	4,221	10,551	84,879	0.07
2021**	6,430	5,487	9,838	191,057	0.00

* July-December

** January-November

Source: Developed by the authors with statistical data from SIAVI (2023).

Likewise, export and import figures, as well as the Revealed Comparative Advantage Index, were used to measure the competitiveness of almonds in the USA market.

Table 4 shows the growth of the Mexican almond exports to the USA. Until November 2021, exports reached a very high level, while imports from the USA to Mexico also showed an increasing trend, reaching 69,762,997 units. These results shows that the RCAi was constantly below zero (−0.81 to −0.93); consequently, these data indicate that Mexico does not have a revealed comparative advantage regarding almond exports to the USA, regarding the world market.

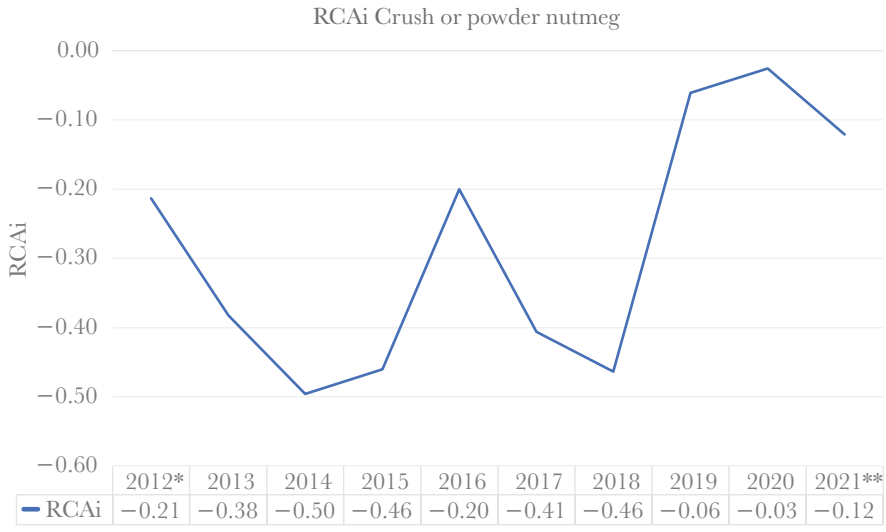


Figure 4. RCAi (IVCR) of Mexico, compared with the USA, HS 090812 Crush or powder nutmeg, mace, amoms, and cardamoms. Source: Developed by the authors with statistical data from SIAVI (2023).

Table 4. RCAi (IVCR) of Mexican shelled almonds, compared with the USA (2012-2021).

Year	EE. UU. $USD		World $USD		RCAi
	Exports	Imports	Exports	Imports	
2012	3,261,569	46,043,266	3,287,089	49,304,483	−0.81
2013	4,710,998	70,261,409	4,723,428	75,457,633	−0.82
2014	24,502	80,736,700	35,483	80,853,196	−1.00
2015	43	103,169,649	4,500,248	104,601,826	−0.95
2016	72,213	73,786,603	76,495	75,476,995	−0.98
2017	130,484	68,832,519	222,160	69,204,618	−0.99
2018	117,202	73,441,750	231,592	74,841,532	−0.98
2019	22,721	84,299,569	46,682	85,044,854	−0.99
2020	782,253	80,493,955	841,487	80,655,667	−0.98
2021*	2,164,339	69,762,997	2,169,749	70,584,759	−0.93

Source: Developed by the authors with statistical data from SIAVI (2023).

CONCLUSIONS

In a dynamic economic environment, competitiveness is a key element for the success and sustainability of both companies and countries. Competitiveness helps the ongoing adaptation, innovation, and improvement of commerce, maintaining and strengthening it in a globalized and highly competitive market. Throughout the years, the RCAi of Mexican pecans in the USA has remained consistently above zero (0.68-0.94). These results show that Mexico has a comparative advantage in pecan exports to the United States, compared with the world market. The results of the analysis show that Mexican pecans have a favorable competitive position in the USA market, as a result of its positive RCAi. Although Mexico has increased its almond exports to the USA, its competitiveness

in both the USA market and the world market is still limited. The negative RCAi values indicate that other countries have higher efficiency and competitiveness regarding their almond exports. Overall, pecans are a competitive product in Mexico, as a result of their quality, demand, and the capacity of the producers to adapt to changing market conditions. Meanwhile, almonds are not a competitive product in Mexico. Although they are grown and produced in some regions of the country, the production and demand for almonds in Mexico is relatively lower than in the USA.

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