

## Competitiveness of Mexico's Hass avocado exports in the world market

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### Abstract

At the international level, the national production of avocado in Mexico during the season from July 2019 to June 2020 reached 2.4 million tonnes, 6% more compared to the 2018 to 2019 cycle of the same period, regarding exports, they were close to 860 thousand tonnes, thus contributing more than 45% of the world market of exports. Michoacán is the main avocado-producing state in Mexico, with approximately 26 740 registered producers, contributing 74% of the national production (2.4 million tonnes), followed by the states of Jalisco and Mexico with 12 and 4%, respectively. Recent export estimates place avocado in third place, only behind tomatoes and beer. The fundamental purpose is to analyze the competitiveness of Mexico's avocado during the period from 1995 to 2020 in the world market, derived from the surplus in production and exports. The materials and methods used are based on the figures of production, exports and imports of avocado consulted in official sources, and through the calculation of trade competitiveness indicators, specifically the indicators of relative trade balance, tradability indicator, trade dependence coefficient and the degree of export openness. The results obtained reflect that avocado production in Mexico is competitive at the international level.

**Keywords:** avocado, exports, imports, production, trade balance.

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According to Williams (1977), the origin of the avocado (*Persea americana* Mills.) took place in the highlands of central and eastern Mexico and in Guatemala. The avocado is a tall woody plant, has leathery leaves and dicotyledonous seeds, the tree is leafy, its flowers appear in clusters, it is estimated that each tree can produce a million flowers, although only 0.1% of them end up transforming into fruit (SIAP, 2020). The fruit is a berry with a smooth or rough surface of greenish color and its skin can be thin or thick. It has a single seed and the weight range in the varieties that are marketed ranges from 120 g on average. The pulp of the avocado has the consistency of a hard butter, is an important source of proteins and fats, and has an oil content between 10 and 20%. The avocado plant belongs to the order Ranales and family Lauraceae. It comprises just over 50 genera and about 2 200 species. The highest harvest is reached from October to February, with a medium offer from March to May and a low production from June to September (Barrientos, 2010).

In reference to the climate, the avocado is sensitive to temperature and precipitation, droughts can cause the leaves to fall while excess rain can cause the fruit to fall. Planting is carried out by transplantation and can be carried out in soils of light texture with neutral or slightly acidic pH and even in clay soils, at altitudes between 0 and 2 500 masl. The harvest is usually done by hand from the age of five (if it is a grafted tree) and the yield increases over time. Among the different varieties of avocado, the most consumed in Mexico is the Hass avocado, although there are others such as Fuerte, Criollo, Choquette, Bacon and Pinkerton (SIAP, 2020).

The annual per capita consumption of the Hass variety in Mexico was 8.75 kg (FAOSTAT, 2020). Worldwide, Mexico is the main producer of avocado, in 2020 it reached about 2.4 million de tons, which represents about 43% of world production, as result of the harvest of 216 000 ha, with an average yield of 10.66 t ha<sup>-1</sup>, which highlights the weight that Mexico has in avocado production (STATISTA, 2020). The main avocado-importing countries are: USA, Israel, France, England, Canada and Japan, while the main exporting countries are: Mexico, Chile, Israel, South Africa, Spain and USA (FAOSTAT, 2020). Currently, the United States of America is the main buyer of Mexican avocado, approximately 76% of imports of this fruit come from Mexico, which represent about 60% of Mexico's total exports. During the cycle from July 2019 to June 2020, Mexico exported about 964 000 t of avocado to the United States of America, valued at more than 2.4 billion dollars (SIAVI, 2022).

On the other hand, the value of Mexican avocado exports increased 22% in the period from 2019 to 2020 (SIAVI, 2022). Since the inception of the North American Free Trade Agreement (now USMCA), the value of Mexican avocados has increased by more than 455% (USDA, 2020). Avocado is one of the most important agrifood export products in Mexico, in 2019 this fruit contributed 6.5% of the value of agricultural production, after beer with 8.1% and tomato with 7.2%. In the last five years, the growth rate of average annual production was 9.5%. Production projections are upward, a production of 2.61 and 3.16 million tonnes is estimated in 2024 and 2030, respectively (USDA, 2020).

Sharpley and Nilham (2010) refer to competitiveness as the ability to produce new and better products, increasing production capacity using best project and business management practices. Competitiveness can be based on the macroeconomic and microeconomic foundations of a nation.

At the macro level are the economic aggregates: interest rate, consumption, level of investment, exchange rate, inflation, trade performance, balance of payments, behavior of the exchange rate, as well as the scientific and technological activity of the country or the results of research institutions.

At the micro level, it is the sectors, companies and products in which competitiveness is evaluated, as well as the intrinsic factors of the product, quality, price, durability, seasonality (Castro, 2010). Some of the ways to measure and define competitiveness at this level are quantitatively based on market share, productivity and cost indicators, profit margins and net profits. As at the macro level, there are measurements and definitions that cover trade positioning figures, such as national production, exports and imports and the interaction between them (Lerma and Márquez, 2010).

Exports are based on competitive advantages and comparative advantages in the regions, which depend on: 1) an endowment of unique natural resources; 2) human resources with extensive knowledge, skills, abilities and experience related to production systems; 3) use of appropriate agricultural technology; 4) the economic potential of the region and its possibility of contributing to generating wealth; and 5) appropriate interactions of economic agents and appropriate economic policies (Echánove, 2008). The present research has as its fundamental objective to analyze the competitiveness of the avocado produced in Mexico during the period from 1995 to 2020 in the world market. The specific objectives are to calculate the indicators trade balance, apparent national consumption, relative trade balance indicator, tradability indicator, export specialization degree coefficient and trade dependence coefficient.

In the present work, a descriptive and analytical method was used, the analysis of the information was carried out for the period from 1995 to 2020, with the Microsoft® Excel software. The variables used were production, imports and exports, based on which competitiveness indicators were calculated. The information was obtained from official sites: Food and Agriculture Organization of the United Nations (FAOSTAT), Agrifood and Fisheries Information Service (SIAP, for its acronym in Spanish), Agrifood Consultation Information System (SIACON, for its acronym in Spanish) and Tariff Information System via Internet (SIAVI, for its acronym in Spanish). The calculated indicators are: trade balance (TB), apparent national consumption (ANC), tradability indicator (T), trade dependence coefficient (DI) and indicator of degree of export openness (DE).

The trade balance (TB), according to Durán and Alvarez (2008), is the difference resulting from exports (material goods sold abroad) and imports (material goods purchased abroad) by a country during a given period, usually one year. While the former originates the inflow of foreign currency or income, the latter cause the outflow of foreign currency for payment abroad. A positive TB indicates that the country exports more than it imports and therefore the balance is considered to be in surplus. Otherwise, if the TB is negative, it means that the country imports more than it manage to export and the balance is considered to be in deficit. In cases where the TB is zero, it indicates that exports were equal to imports and is in equilibrium. The procedure for calculating the trade balance is as follows:  $TB = X - M$ . Where: X= exports; M= imports.

The apparent national consumption (ANC) expresses the availability of the product consumed by a region, country or countries in a certain period of time, is estimated based on domestic production plus the trade balance (Ramírez, 2016). An ANC with an increasing behavior for a certain period means that the country or region has greater availability of the product for consumption, otherwise when it is decreasing, it reflects less production or less imports or greater exports, resulting in a decrease in consumption. The calculation procedure is.  $ANC = Y + M - X$ . Where:  $Y$ = national production;  $M$ = imports;  $X$ = exports.

The relative trade balance (RTB) indicator is used to identify net importing or exporting countries, as well as products destined for export that may have a competitive advantage (Montoya, 2008). This indicator indicates the presence of competitive advantage if the result is a positive value (+). On the contrary, if the result is negative (-), it indicates that the country is oriented to imports of the product (Balassa, 1965). It is obtained with the following formula:  $RTB_{ij} = \frac{(X_{ij}-M_{ij})}{(X_{ij}+M_{ij})}$ . Where:  $RTB_{ij}$ = relative trade balance of country  $j$  with respect to product  $i$ ;  $X_{ij}$ = exports of product  $i$  by a country  $j$  to the world market;  $M_{ij}$ = imports of a product  $i$  by a country  $j$  from the world market or a specific market.

The transability (T) indicator indicates the relationship between the value of the trade balance and the value of apparent consumption, measures the ability to generate net exportable surpluses in relation to domestic consumption. If the indicator is greater than zero ( $>0$ ), the sector is considered an exporter, since there is an excess of supply and the product is competitive, and if the indicator is less than zero ( $<0$ ), it is an importable product, consequently, it is presumed that it is not competitive in the domestic market because there is an excess of demand (Pat, 2017), the indicator is calculated as follows:  $T_{ij} = \frac{(X_{ij}-M_{ij})}{(Q_{ij}+X_{ij}+M_{ij})}$ . Where:  $T_{ij}$ = transability indicator;  $X_{ij}$ = exports of the product  $i$  by a country  $j$  to the world market;  $M_{ij}$ = imports of a product  $i$  by a country  $j$  from the world market or a specific market;  $Q_{ij}$ = domestic production of product  $i$  of country  $j$ .

The trade dependence (DI) coefficient expresses the percentage (%) that indicates the measure of international competition for domestic demand. If the indicator has a range between 0 and 1, it means that as the indicator approaches zero (0), the competitiveness of the sector or production chain is greater and that imports can become null, even dedicating part of the national production to export (Pat, 2017). It is calculated as follows:  $DI_{ij} = \frac{M_{ij}}{(Q_{ij}+X_{ij}+M_{ij})}$ . Where:  $DI_{ij}$ = degree of import penetration of product  $i$  in country  $j$ ;  $M_{ij}$ = imports of product  $i$  of country  $j$ ;  $X_{ij}$ = exports of product  $i$  of country  $j$ ;  $Q_{ij}$ = domestic production of product  $i$  of country  $j$ .

The indicator of degree of export openness (DE) means the share of exports of a product over apparent consumption and the degree of insertion in a specific market, the higher the value of the indicator, the greater the competitiveness, it is calculated with the following procedure:  $DE_{ij} = \frac{X_{ij}}{(Q_{ij}+X_{ij}+M_{ij})}$ . Where:  $DE_{ij}$ = degree of export openness;  $X_{ij}$ = exports of product  $i$  of country  $j$ ;  $M_{ij}$ = imports of product  $i$  of country  $j$ ;  $Q_{ij}$ = domestic production of product  $i$  of country  $j$ .

The increased competitiveness of avocado partly reflects a more intensive use of technologies and practices that allows producers to achieve the quality standards required in foreign markets, climatic conditions and geographical location (Bonales and Sánchez, 2003). Another important aspect to note is that the demand for avocado in international markets has maintained an increasing trend and according to Williams *et al.* (2017), it will continue to increase. In this sense, market demand is one of the main factors that originate processes of regional agricultural specialization. Likewise, the production of avocado with export quality, under food safety standards, has proven to be highly competitive, due to the increase in yields, the optimization in the use of production factors and above all, the higher sale price generates economic viability to the crop and an apparent long-term stability to the system (Franco *et al.*, 2018).

During 2020, Mexico was the main avocado-exporting country worldwide, followed by the Netherlands and Peru. In descending order, they were followed by: Spain, Chile, the United States of America, Kenya, South Africa, New Zealand and Colombia. While Mexico exported avocado for a value of 2.392 billion dollars, the Netherlands did so for 734 million dollars (FAOSTAT, 2020).

The production and apparent consumption during the period from 1995 to 2020 show a continuous growth, leaving a gap between production and apparent consumption, with production above apparent consumption (Table 1), so it can be asserted that there is competitiveness in avocado production in Mexico, and therefore there is greater availability of the product, for domestic consumption and the external market. On the other hand, the calculated trade balance (TB) of the avocado produced in Mexico presents very high positive values, which are similar to the value of exports (Table 1), this indicates that Mexico did not import or bought very little avocado from abroad during the period from 1995 to 2020. That is, the trade balance of this product is in surplus, so it can be said that there is no trade dependence of avocado in Mexico, and it demonstrates its high export capacity.

The RTB indicator corresponding to the avocado produced in Mexico with values close to one (Table 1) reflects the importance of avocado exports in relation to imports of the product. According to the data for the period from 1995 to 2020, Mexico was a net exporter of avocado, reaching a relative trade balance of one for the period from 1995 to 2020. The indicator T with values higher than zero indicates competitiveness of the product (Table 1), it showed an excess in the supply of avocado, so it satisfies the domestic market and there were avocado exports, reflecting the existence of advantages in the exchange.

The DI analyzed from 1995 to 2020 and considering the variables corresponding to the national production of avocado, as well as imports and exports of avocado, showed values close to zero (Table 1), which means that the competitiveness of the export sector is higher and that avocado imports are marginal. As the values of this indicator approach zero, the competitiveness of the sector is higher.

A positive DE indicator, above zero (Table 1), indicates that Mexico produced enough to cover domestic demand and competed in the foreign market. Being Mexico the main producer of avocado worldwide and the first exporter of this product and having an average indicator of 0.2557 during

the period studied from 1995 to 2020, it means that the Mexican avocado is a competitive product. The tradability indicator and the export specialization coefficient are the equal, which have the same value, explained by the fact that imports are marginal, as long as they tend to zero. As imports increase, both indicators tend to be different.

**Table 1. Economic variables and indicators of avocado competitiveness in Mexico.**

Year	Q (t)	X (t)	M (t)	TB (t)	ANC (t)	RTB (u)	T (u)	DI (u)	DE (u)
1995	790 030	54 595	0	54 595	735 435	1	0.07	0	0.07
1996	837 699	78 556	0	78 5560	759 143	1	0.1	0	0.1
1997	762 336	49 824	0	49 824	712 512	1	0.07	0	0.07
1998	876 623	71 226	0	71 226	805 397	1	0.09	0	0.09
1999	878 856	55 402	0	55 402	823 454	1	0.07	0	0.07
2000	907 309	89 270	0	89 270	818 039	1	0.11	0	0.11
2001	940 229	71 621	0	71 621	868 608	1	0.08	0	0.08
2002	901 075	94 243	0	94 243	806 832	1	0.12	0	0.12
2003	905 041	124 239	0	124 239	780 802	1	0.16	0	0.16
2004	987 323	136 496	421	136 075	851 248	1	0.16	0	0.16
2005	1 021 515	229 166	0	229 166	792 349	1	0.29	0	0.29
2006	1 134 250	208 346	2 114	206 232	928 018	1	0.22	0	0.22
2007	1 142 892	310 260	91	310 169	832 723	1	0.37	0	0.37
2008	1 162 429	326 333	393	325 940	836 489	1	0.39	0	0.39
2009	1 230 973	396 825	0	396 825	834 148	1	0.48	0	0.48
2010	1 107 135	368 615	6 598	362 017	745 118	1	0.49	0	0.49
2011	1 264 141	400 552	940	399 612	864 529	1	0.46	0	0.46
2012	1 316 104	557 693	923	556 770	759 334	1	0.73	0	0.73
2013	1 467 837	646 812	2 211	644 601	823 236	1	0.78	0	0.79
2014	1 520 695	746 967	73	746 894	773 801	1	0.97	0	0.97
2015	1 644 226	989 721	0	989 721	654 505	1	1.51	0	1.51
2016	1 889 354	1 022 210	18	1 022 192	867 162	1	1.18	0	1.18
2017	2 029 886	989 653	0	989 653	1 040 233	1	0.95	0	0.95
2018	2 184 663	1 198 203	0	1 198 203	986 460	1	1.21	0	1.21
2019	2 300 889	1 280 930	0	1 280 930	1 019 959	1	1.26	0	1.26
2020	2 393 849	1 346 215	0	1 346 215	1 047 634	1	1.29	0	1.29

Q= production; X= exports; M= imports; TB= trade balance; ANC= apparent national consumption; RTB= relative trade balance; T= transability indicator; DI= trade dependence coefficient; DE= indicator of degree of export openness. Elaborated with data from FAOSTAT (2020).

In the analysis of trade indicators, the trade dependence coefficient was zero, which implies that imports are marginal, coinciding with the distinction of net exporter and own supplier, for this same period the transability indicator is greater than zero, so in Mexico there is an excess of avocado



production, which qualifies this product as competitive in the internal and external market. Likewise, the degree of export openness of Mexico in avocado production was close to one, indicating that the country is a strong supplier of the domestic market in terms of avocado consumption and has high export capacity, showing its competitiveness in the foreign market.

## Conclusions

The production and international trade of avocado had a continuous growth in the analysis period from 1995 to 2020. Mexico is an internationally competitive country, throughout the study period, a high competitiveness is observed, as reflected by the competitiveness indicators. The positive behavior of the indicators of trade balance and relative trade balance reflect the importance of avocado exports in relation to imports, Mexico was a net exporter of avocado.

The transability indicator showed an excess in the supply of avocado, satisfying the domestic market, so Mexico maintained a competitive advantage in the trade of avocado for the period studied. On the other hand, the degree of export openness indicates that Mexico produced enough to cover its domestic market and competed in the foreign market. Mexico being the main producer of avocado worldwide and the first exporter of this product. The trade dependence coefficient of avocado indicates that the competitiveness of the export sector is very high and that avocado imports are marginal. Finally, for further research or studies on the subject, it is advisable to analyze the revealed comparative advantages and the determinants of avocado competitiveness.

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