COMPETITIVENESS ANALYSIS OF THE AGRI-FOOD INDUSTRY IN MEXICO

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ABSTRACT

This work provides a diagnosis of the position, in terms of competitiveness, of the export flows of the Mexican food industry compared to the total flows of the world food industry, in the 2001-2016 period. The analysis was made based on the measurements of the revealed comparative advantage, by applying the Indices of Normalized Revealed Comparative Advantage of Yu, Cai and Leung (heir to the well-known Balassa Index), and of Vollrath's Relative Commercial Advantage, using the flow of manufactured food (exports and imports) from Mexico and the rest of the world offered by the International Trade Map database. Its methodological design is oriented to the collection and analysis of relevant data, and it is repeatable in time and space. The results suggest that the Mexican food industry has a comparative advantage in 13 of the 44 tariff items analyzed. Thus, the research concluded that the country is specialized in decreasing order in the following food items: malt beer, ethyl alcohol, confectionery, bakery and pastry products, sugars, fruit juices, preserved vegetables and fruits, cereal-based products, yeasts, sauces and chocolate. In addition, the results also allow to identify the location of the least competitive sectors, which helps to plan rational business decisions and coordinate public actions, as well as to compare the successful experiences of each sector and to analyze its adaptability to other sectors and territories. In this sense, the main limitation found is that data on Mexican food imports and exports are only available for the country as a whole, which ruled out a state-by-state analysis.

Key words: Food industry, exports, imports, comparative advantage, Mexico, competitiveness, tariff headings

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RESUMEN

El presente trabajo proporciona un diagnóstico de la posición, en términos de competitividad, de los flujos de exportación de la industria de alimentos de México en comparación con los flujos totales de la industria alimentaria mundial, en el periodo 2001-2016. El análisis se establece a partir de las mediciones de la ventaja comparativa revelada, mediante la aplicación de los Índices de Ventaja Comparativa Revelada Normalizada de Yu, Cai y Leung (heredero del conocido Índice de Balassa) y de Ventaja Relativa Comercial de Vollrath, utilizando el flujo de alimentos manufacturados (exportaciones e importaciones) de México y del resto del mundo ofrecido por la base de datos *International Trade Map*. Su diseño metodológico está orientado a la recopilación y análisis de los datos relevantes y es repetible en el tiempo y el espacio. Los resultados sugieren que la industria de alimentos de México ostenta ventaja comparativa en 13 de las 44 partidas arancelarias analizadas. Así, se concluye que el país está especializado en orden decreciente en los siguientes artículos alimentarios: cerveza de malta, alcohol etílico, productos de confitería, panadería y pastelería, azúcares, jugos de fruta, hortalizas y frutas en conserva, productos a base de cereales, levaduras, salsas y chocolate. Además, los resultados permiten también identificar la localización de los sectores menos competitivos, lo que ayuda a planificar decisiones empresariales racionales y coordinar acciones públicas, comparar las experiencias exitosas de cada sector y analizar su adaptabilidad a otros sectores y territorios. En este sentido, la principal limitación encontrada es que los datos sobre importaciones y exportaciones de alimentos mexicanos solo están disponibles para el país en su conjunto, lo que descartó un análisis estado por estado.
Palabras clave: industria alimentaria, exportaciones, importaciones, ventaja comparativa, México, competitividad, partidas arancelarias

RÉSUMÉ

Ce travail fournit un diagnostic de la position, en termes de compétitivité, des flux d'exportation de l'industrie agroalimentaire mexicaine par rapport aux flux totaux de l'industrie agroalimentaire mondiale, sur la période 2001-2016. L'analyse est établie à partir des mesures de l'avantage comparatif révélé, en appliquant les indices d'Avantage Comparatif Révélé Normalisé de Yu, Cai et Leung (héritier du célèbre Indice Balassa), et de l'Avantage Commercial Relatif de Vollrath, en utilisant le flux d'aliments manufacturés (exportations et importations) du Mexique et du reste du monde, offert par la base de données *International Trade Map*. Sa conception méthodologique est orientée vers la collecte et l'analyse de données pertinentes, et elle est reproductible dans le temps et dans l'espace. Les résultats suggèrent que l'industrie alimentaire mexicaine a un avantage comparatif dans 13 des 44 positions tarifaires analysées. Ainsi, il est conclu que le pays est spécialisé par ordre décroissant dans les produits alimentaires suivants: bière de malt, alcool éthylique, confiserie, produits de boulangerie et pâtisserie, sucres, jus de fruits, conserves de légumes et fruits, produits à base de céréales, levures, sauces et chocolat. En outre, les résultats permettent également de localiser les secteurs les moins compétitifs, ce qui permet de planifier des décisions commerciales rationnelles et de coordonner les actions publiques, de comparer les expériences réussies de chaque secteur et d'analyser son adaptabilité à d'autres secteurs et territoires. En ce sens, la principale limite constatée est que les données sur les importations et les exportations alimentaires mexicaines ne sont disponibles que pour le pays dans son ensemble, ce qui exclut une analyse État par État.
Mots-clés : industrie alimentaire, exportations, importations, avantage comparative, Mexique, compétitivité, taux tarifaires

RESUMO

O presente estudo proporciona um diagnóstico da posição ocupada pelo México e de sua competitividade no que tange aos fluxos de exportação no âmbito da indústria alimentar mundial no período compreendido entre os anos 2001 e 2016. A análise se estabelece a partir das medições da vantagem comparativa e revelada, mediante a aplicação dos Índices de Vantagem Comparativa Revelada Normalizada de YUu, Cai e Leung (herdeiro do conhecido Índica de Balassa) e de Vantagem Relativa Comercial de Vollrath. Nessa aproximação fez-se uso do fluxo de alimentos manufaturados (exportações e importações) do México e do resto do mundo oferecido pela base de dados *International Trade Map*. O desenho metodológico está orientado à recopilação e análise de dados relevantes, sendo replicável no tempo e no espaço. Os resultados sugerem que a indústria de alimentos do México ostenta vantagem comparativa em 13 das 44 partidas alfandegárias analisadas. Desse modo, conclui-se que o país se especializa, em ordem decrescente

de importância, nos seguintes artigos alimentares: cerveja de malte, álcool etílico, produtos de confeitaria, padaria e confeitaria, açúcares, sucos de fruta, hortaliças e frutas em conserva, produtos à base de cereais, leveduras, molhos e chocolate. Ademais, os resultados permitem conhecer a localização dos setores menos competitivos, o que ajuda a planificar decisões empresarias racionais e coordenar ações públicas, comparar experiências exitosas de cada setor e analisar sua adaptabilidade a outros setores e territórios. Nesse sentido, a principal limitação encontra foi que os dados sobre importações e exportações de alimentos mexicanos só estão disponíveis para o país em seu conjunto, o que impede uma análise discriminada por estado.
Palavras-chaves: indústria alimentar, exportações, importações, vantagem comparativa, México, competitividade, tarifas alfandegárias

1. INTRODUCTION

In 21st century, international trade has expanded rapidly, making it easier to interchange products and access new markets anywhere in the world. Food sector has especially benefited from this form of trading; in 2015 Organization for Economic Co-operation and Development (OECD) and UN's Food and Agriculture Organization (FAO) forecast important changes in demand of developing countries, where population growth, increased per capita income and a move to cities will lead to a higher demand for foodstuffs in coming years. Higher incomes will motivate consumers to continue diversifying their food habits. Different regions have come to the fore in this sector, as in case of Latin America, which at present is the region with highest number of net food exports, followed by North America (FAO-OECD, 2015).

World's demand for food has been growing. In 2015 world food consumption amounted to US$ 4,900 million and is expected to rise at an annual average growth rate (AAGR) of 5.7% between 2015 and 2020, when China and US will consume 44% of the total world food production. World food production was valued at US$ 5,100 million in 2015 and is expected to rise annually by 5.3% up to 2020 (ProMexico, 2015). In 2015 world food exports were worth US$ 608 million, with the main exporters being US, Germany, China and the Low Countries. Imports were worth US$ 557 million, with US, Germany, China, Japan and UK as biggest importers (ProMexico, 2015).

Mexico is in the main net exporting region of raw materials for food. Thanks to country's solid macro-economy, being competitive in attracting foreign investment and its capacities as an exporting platform to more than 40 countries with which it has trade agreements, its food industry is developing fast (ProMexico, 2016). Due to the diversity of its climate and land, the country has ideal conditions to grow a wide variety of agricultural products and offers business opportunities in trading and processing foodstuffs. In 2014 Mexican food industry produced US$ 135,500 million, or 23.4% of its manufacturing GDP and 3.9% of national GDP. In 2015-2020, this production is expected to rise by an AAGR of 2.5% (INEGI, 2015). At international level, with exports valued at US$ 8.3 million, in 2016 Mexico became the world's leading exporter of chewing gum, mushrooms and preserved truffles, mixed fruit, nuts and other preserved vegetables, beer and non-denatured ethyl alcohol (<80% vol.); second exporter of preserved sea cucumbers, cocoa powder with sugar, and frozen cooked strawberries; third exporter of solid fructose and fructose syrup with no flavoring or coloring, sweet cookies and prepared or preserved citrus fruits; and fourth exporter of fruit and vegetables preserved in vinegar, with main importers being US (71.1%), Japan (4.5%) and Canada (2.3%) (ProMexico, 2016).

According to the Economic Commission for Latin America and the Caribbean (CEPAL, 1989) and Porter (1990), competitiveness is the capacity to sustain or increase participation in international markets, with a parallel elevation of the population's standard of living. For the OECD it is the degree to which a country state or region produces goods in conditions of a free and competitive market, simultaneously

improving the population's real income and the productivity of its enterprises and the actions of its government (Ibarra and Trejo, 2014).

As regards international commerce, Krugman and Obstfeld (2006) define it as the interchange of goods and services among countries. They also state that countries participate in international trade for two basic reasons: firstly, because they are different and countries, like persons, can benefits from their differences in a relationship in which each one does what he is best at. Secondly, countries trade in order to achieve economies of scale in their production. Throughout history there have been different visions of international commerce; the first contributions were from the mercantilist and classical schools of thought, and classical theorists such as Adam Smith, David Ricardo and John Stuart Mill laid the foundations of trade between nations (Appleyard and Field, 2013). The present paper focuses on the concept of comparative advantage as expounded by David Ricardo.

Smith believed that the reason why trade between nations produces an increase in production, is that it allows each country to specialize in the production in which it has an absolute advantage over another, and since no nation has unlimited resources, the economy must stop producing the good in which it has a higher cost of production compared to other countries.

Later, in his book *The principles of political economy and taxation*, Ricardo emphasized that the potential gains from international commerce were not limited by an absolute advantage. He maintained that this trade does not require different absolute advantages but can be carried out when there are only comparative advantages, which occur when the relative work requirements between goods are different. This means that when the relative work requirements are different, the internal opportunity cost of the goods is different in both countries, i.e. the relations of the internal prices are different in both countries before the trade has taken place. This rule is known as the Theory of comparative Advantage, according to which the total product that is obtained from specialization and change, rather than autarky and economic isolation, will maximize if each country or region specializes in the production of those goods or services in which their comparative cost is relatively lower. Heckscher and Ohlin later demonstrated that the differences in the relative endowments of the inputs are enough to generate a basis for trade, even when there are no differences in their technologies or demands. According to its Factor endowment model, a country will export the merchandise that intensively uses its relatively abundant factor and will import goods that intensively use a relatively scarce factor (Appleyard and Field, 2013).

Michael Porter developed a theory of national competitiveness. In his book *The Competitive Advantage of Nations* (1990), he mentions that competitive advantage is created and sustained through a highly localized process, differences in values, cultures, economic structures, institutions and national histories contribute to competitive success. He points out that a nation's competitiveness depends on its industry's ability to innovate and perfect itself, and that companies gain an edge over the world's best competitors due to pressure and challenge. For Porter, innovation is very important for a company to be competitive, whether by including new technologies or new ways of doing things; he mentions that once a company obtains a competitive advantage through an innovation, it can only sustain it through an innovation unceasing improvement, since almost any advantage can be imitated. Porter points out that the determinants of national competitive advantage are four (*Porter Diamond*): factor conditions, demand conditions, related and supporting industries, and lastly the strategy, structure and rivalry of the firms. These factors create the national environment in which companies are born and learn to compete. Each point of the diamond affects the essential ingredients for international competitive success: the availability of the resources and skills necessary for competitive advantage in an industry; the information that determines the opportunities that companies perceive and the directions in which they deploy their resources and skills; the goals of the owners, executives and employees of the companies; and most importantly, the pressures for companies to invest and innovate.

The comparative advantage is a key concept in explaining the origin of commerce. It is the ability of an economy to manufacture a product more efficiently than other countries, which is reflected in direction of export and import specializations (Bojnec and Ferto, 2017; Carraresi and Banterle, 2015). In order to measure the Comparative Advantage, the use of Revealed Comparative Advantage (RCA) is prioritized in literature, which considers whether it is possible to extract the comparative advantages from observable flows of world trade, taking into account that real exchange of goods reflects the relative costs and also differences that exist between countries. Originated in the contributions of Balassa (1965), RCA indices are used to analyze comparative advantages or disadvantages in the interchange of goods of a country with its trading partners or diverse groups of countries (Durán and Álvarez, 2008). Their goal is to procure a more efficient assignation of a country's scarce resources, expand international trade in a more open environment, seek to specialize in more profitable activities and higher added value and evaluate the productive and commercial performance of a country in a given period in order to improve a nation's general welfare (Arias and Segura, 2004). Application of RCA indices has given rise to a line of research that uses them to compare different economic sectors or countries. Among the studies published in Mexico: Menéndez and Palacio (2013) offer a review of the present state of comparative advantages of Mexico and US in the world agro-food market, using Balassa's RCA to analyze 10 agricultural chapters and 14 agro-food in the Harmonized System of world trade; also with Balassa's RCA and information from FAO, Bonales, Arroyo and Tinoco (2016) quantify the competitive level of Mexican lemon exports as compared to Argentina, Spain and Turkey; and, Mendoza (2016) analyzes the performance of Mexican exports to US and China using a combination of Balassa's RCA and Grubel and Lloyd's Index.

The main contribution of this study is that it identifies Mexican food products and sectors that have a comparative advantage in world trade and provides an insight into its position in relation to its foreign competitors through its methodological design aimed at compiling and analyzing relevant data, repeatable in time and space. From this, implications are derived for academics and decision-makers since it provides solid and reliable commercial information for Mexicans to estimate and follow up on the results. It also locates the problems found in certain sectors, helps to plan rational business decisions and coordinate public actions, compares the successful experiences of each sector and analyzes their adaptability to other sectors and other territories. In this context, the general aim of the present study was to measure the competitive advantage of imports and exports of Mexican food industry sectors in the period 2001-2016, for which the following specific objectives were required: i) selection of variables related to international trade flows; and, ii) calculation of competitive economic indices to determine food products that have a comparative advantage and those that either have no advantage or have lost one.

2. MATERIALS AND METHODS

This section describes the method used to calculate RCA indices according to Mexican food import and export figures between 2001 and 2016. Information was obtained from International Trade Map (ITM) database, which belongs to International Trade Center, founded by World Trade Organization and United Nations. ITM provides indicators for exporting performance, international demand, alternative markets and competitive markets, as well as a directory of exporting and importing business companies. Database at present covers 220 countries and territories and 5,300 products of the Harmonized Commodity Description and Coding System (HS). Monthly, quarterly and yearly trade flows are provided up to the tariff line level. Universe of study was determined in accordance with section IV of HS: «Prepared foodstuffs, beverages, spirits and vinegar, tobacco and manufactured tobacco substitutes». For the sample, seven chapters of Section IV were chosen (Table Nº 1).

Table 1
Description of chapters of food and drinks sector

Chapter	Description of chapter
16	Preparations of meat, of fish or of crustaceans, mollusks or other aquatic invertebrates
17	Sugars and sugar confectionery
18	Cocoa and cocoa preparations
19	Preparations of cereals, flour, starch or milk; pastrycooks' products
20	Preparations of vegetables, fruit, nuts or other parts of plants
21	Miscellaneous edible preparations
22	Beverages, spirits and vinegar

Source: Compiled by the authors from the Harmonized System

Generally, among RCA indices that only contemplate exports in their calculation and those that also incorporate imports there is low consistency, so the use or not of commercial flow of imports can generate different results (Cervera and Compés, 2017). For this reason, to carry out the study to be calculated Vollrath's Relative Trade Advantage Index (RTAI), chosen for giving further information on imports and exports, and these were compared with Yu *et al*'s Normalized Revealed Comparative Advantage Index (NRCAI).

RTAI proposed by Vollrath

This index not only covers exports but also considers import data. It is calculated on up-to-date trade figures and thus incorporates the influence of factors such as relative income, efficiencies, policies and market structures (Vollrath, 1991):

$$VRC_a^i = VRX_a^i - VRM_a^i \; / \qquad (1)$$

$$VRX_a^i = (X_a^i / X_n^i)/(X_a^r / X_n^r); \qquad (2)$$

$$VRM_a^i = (M_a^i / M_n^i)/(M_a^r / M_n^r) \qquad (3)$$

Where: VRX = Relative export advantage; *VRM* = Relative import advantage; *X* = Exports; *M* = Imports; *a* = product analyzed; *I* = country analyzed; *r* = world minus country *i*; *n* = all products traded minus product a.

X_a^i: Exports of product (*a*) by country (*i*).

X_n^i: Exports of all products traded except for product a (n) by country (*i*).

X_a^r: Exports of product (*a*) in the world except for country *i* (*r*).

X_n^r: Exports of all products traded except product a (n) in the world except for country *i* (*r*)

M_a^i: Imports of product (*a*) by country (*i*).

M_n^i: Imports of all products traded except product a (*n*) by country (*i*).

M_a^r: Imports of product (*a*) in the world except for country *i* (*r*).

M_n^r: Imports of all products traded except product *a* (*n*) in the world except for country *i* (r)

A negative or positive index indicates a deficit or surplus in the total trade and expresses, respectively, a disadvantage or advantage in commercial interchanges. In other words, an RTAI of more than *0* indicates the existence of a competitive sector with potential, while a negative indicates a net importing sector lacking competitiveness in relation to third markets (Durán and Álvarez, 2008).

NRCAI proposed by Yu, Cai & Leung

The most recent RCA index is that developed by Yu *et al.* It was created with the aim of correcting the problems found in Balassa's RCA (Lamadrid, Martínez, Salazar, Martínez & Nañez, 2012). Balassa's RCAI can be used to assess whether or not a country has a comparative advantage for a certain product, but has limitations in comparative studies, as it tends to offer inconsistent and deceptive results since it is biased when it determines there is a strong comparative advantage for countries with small quotas of the world export market. It also has another problem with its fixed lower limit of 0, with 1 being the neutral advantage and no upper limit (Yu *et. al.*, 2009). The

NRCAI measures the degree of deviation from product j's present level of exports by country i in relation to its neutral comparative advantage in terms of its relative scale with regard to the world export market (Yu *et al.*, 2009):

$$VCRN_j^i = \Delta E_j^i / E = (E_j^i / E) - [(E_i E_j)(EE)]$$

Where: E_j^i: value of exports of commodity *j* by country *i*; *E*: value of world exports of all commodities; E_i: value of total exports of country *i*; E_j: value of total world exports of commodity *j*.

NRCAI > 0 indicates that exports by country i of commodity j are larger than its neutral world level and the country has a comparative advantage in this commodity. *NRCAI = 0* is neutral, while *< 0* indicates a disadvantage with the rest of the world. The higher the result the higher the comparative advantage and vice versa.

3. RESULTS

3.1. ANALYSIS BY CHAPTER

The chapter results offer a general panorama of the comparative advantages enjoyed by Mexico's food industry. As can be seen in Figures 1 and 2, the chapters with the biggest comparative advantage confirmed by both RCA indices are, in descending order, Chapters 22, 17 and 19. In Chapters 20 and 18 NRCAI indicate a comparative disadvantage, which in the case of Chapter 20 is very near to being neutral. When imports are considered, Vollrath's index shows a comparative advantage with values of 0.47 and 0.12, respectively. There is no doubt that Chapters 21 and 16 face a comparative disadvantage. As regards evolution during the study period, Chapter 17 shows a clearly upward trend although with abrupt rises and falls. Chapters 18, 19 and 20 also show a positive trend, as do 16, 21 and 22, although to a lesser extent.

3.2. ANALYSIS BY HEADINGS

Results were also analyzed by headings (4 digits) to identify specific products that determine the sector's comparative advantage in each chapter. The description of headings can be found in Table Nº 2 and results in Table Nº 3.

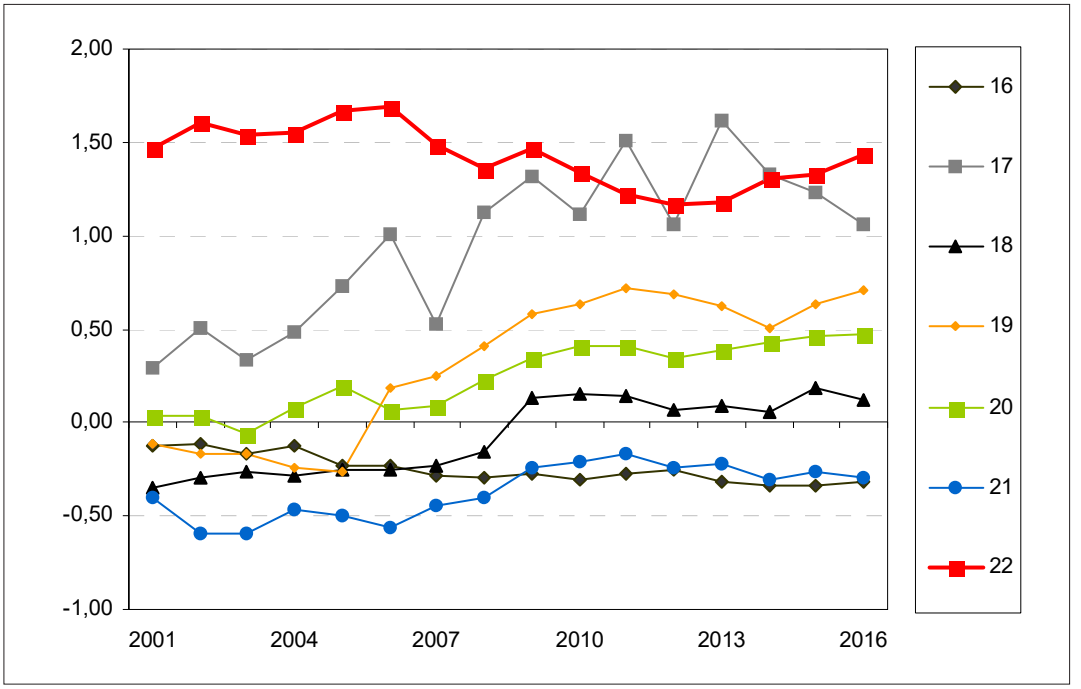

Figure 1. Results by chapter: RTAI. Source: compiled by the authors

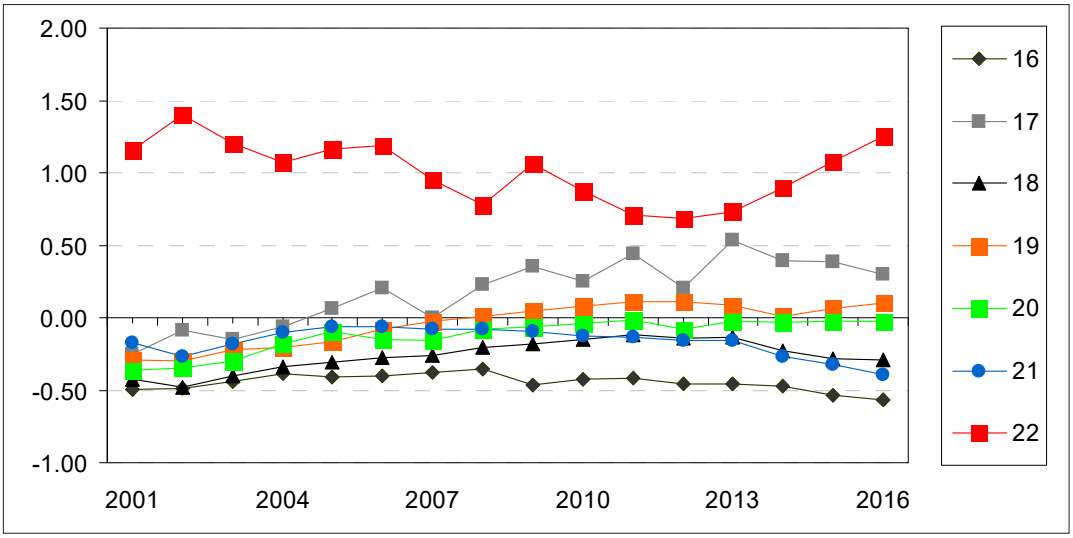

Figure 2. Results by chapter: NRCAI. Source: compiled by the authors

Table 2
Description of headings

	Description of headings
1601	Sausages and similar products, of meat, meat offal or blood; food preparations based on these products
1602	Other prepared or preserved meat, meat offal or blood (excl. Sausages and similar products, meat extracts an juices)
1603	Extracts and juices of meat, fish or crustaceans, mollusks or other aquatic invertebrates
1604	Prepared or preserved fish; caviar and caviar substitutes prepared from fish eggs
1605	Crustaceans, mollusks and other aquatic invertebrates, prepared or preserved
1701	Cane or beet sugar and chemically pure sucrose, in solid form
1702	Other sugars, including chemically pure lactose, maltose, glucose and fructose, in solid form; sugar syrups not containing added flavoring or coloring matter; artificial honey, whether or not mixed with natural honey; caramel
1703	Molasses resulting from the extraction or refining of sugar
1704	Sugar confectionery (including white chocolate), not containing cocoa
1801	Cocoa beans, whole or broken, raw or roasted
1802	Cocoa shells, husks, skins and other cocoa waste
1803	Cocoa paste, whether or not defatted
1804	Cocoa butter, fat and oil
1805	Cocoa powder, not containing added sugar or other sweetening matter
1806	Chocolate and other food preparations containing cocoa
1901	Malt extract; food preparations of flour, groats, meal, starch or malt extract, not containing cocoa or containing less than 40% by weight of cocoa calculated on a totally defatted basis, not elsewhere specified or included; food preparations of goods of headings 04.01 to 04.04, not containing cocoa or containing less than 5% by weight of cocoa calculated on a totally defatted basis, not elsewhere specified or included
1902	Pasta, whether or not cooked or stuffed (with meat or other substances) or otherwise prepared, such as spaghetti, macaroni, noodles, lasagne, gnocchi, ravioli, cannelloni; couscous, whether or not prepared.
1903	Tapioca and substitutes thereof prepared from starch, in the form of flakes, grains, pearls, siftings or in similar forms
1904	Prepared food obtained by the swelling or roasting of cereals or cereal products (for example, corn flakes); cereals (other than maize (corn)), in grain form or in the form of flakes or other worked grains (except flour, groats and meal), pre-cooked or otherwise prepared, not elsewhere specified or included.
1905	Bread, pastry, cakes, biscuits and other bakers' wares, whether or not containing cocoa; communion wafers, empty cachets of a kind suitable for pharmaceutical use, sealing wafers, rice paper and similar products.
2001	Vegetables, fruit, nuts and other edible parts of plants, prepared or preserved by vinegar or acetic acid.
2002	Tomatoes prepared or preserved otherwise than by vinegar or acetic acid
2003	Mushrooms and truffles, prepared or preserved otherwise than by vinegar or acetic acid.

Table 2 *(Continuation)*

	Description of headings
2004	Other vegetables prepared or preserved otherwise than by vinegar or acetic acid, frozen (excluding preserved by sugar, and tomatoes, mushrooms and truffles).
2005	Other vegetables prepared or preserved otherwise than by vinegar or acetic acid, not frozen (excluding preserved by sugar, and tomatoes, mushrooms and truffles)
2006	Vegetables, fruit, nuts, fruit-peel and other parts of plants, preserved by sugar (drained glacé or crystallized).
2007	Jams, fruit jellies, marmalades, fruit or nut purée and fruit or nut pastes, obtained by cooking, whether or not containing added sugar or other sweetening matter.
2008	Fruits, nuts and other edible parts of plants, prepared or preserved, whether or not containing added sugar or other sweetening matter or spirit (excluding prepared with vinegar, preserved with sugar but not laid in syrup, and jams, fruit jellies, marmalades, fruit purée and pastes, obtained by cooking).
2009	Fruit juices (including grape must) and vegetable juices, unfermented and not containing added spirit, whether or not containing added sugar or other sweetening matter.
2101	Extracts, essences and concentrates, of coffee, tea or maté and preparations with a basis of these products or with a basis of coffee, tea or maté; roasted chicory and other roasted coffee substitutes, and extracts, essences and concentrates thereof.
2102	Yeasts, active or inactive; other dead single-cell micro-organisms, prepared baking powders (excluding single-cell micro-organisms packaged as medicaments).
2103	Sauce and preparations therefor; mixed condiments and mixed seasonings; mustard flour and meal, whether or not prepared, and mustard.
2104	Soups and broths and preparations therefor; food preparations consisting of finely homogenized mixtures of two or more basic ingredients such as meat, fish, vegetables or fruit, put up for retail sale as infant food or for dietetic purposes.
2105	Ice cream and other edible ice, whether or not containing cocoa
2106	Food preparations not elsewhere specified or included.
2201	Waters, incl. natural or artificial mineral waters and aerated waters, not containing added sugar, other sweetening matter or flavoured; ice and snow.
2202	Waters, incl. mineral waters and aerated waters, containing added sugar or other sweetening matter or flavoured, and other non-alcoholic beverages (excluding fruit or vegetable juices and milk).
2203	Beer made from malt
2204	Wine of fresh grapes, incl. fortified wines; grape must, partly fermented and of an actual alcoholic strength of > 0,5% vol. or grape must with added alcohol of an actual alcoholic strength of > 0,5% vol.
2205	Vermouth and other wine of fresh grapes flavored with plants or aromatic substances
2206	Cider, perry, mead and other fermented beverages and mixtures of fermented beverages and non-alcoholic beverages, n.e.s. (excluding beer, wine or fresh grapes, grape must, vermouth and other wine of fresh grapes flavoured with plants or aromatic substances).
2207	Undernatured ethyl alcohol of an alcoholic strength by volume of 80 % vol. or higher; ethyl alcohol and other spirits, denatured, of any strength.
2208	Undenatured ethyl alcohol of an alcoholic strength by volume of less than 80% vol.; spirits, liqueurs and other spirituous beverages.
2209	Vinegar, fermented vinegar and substitutes for vinegar obtained from acetic acid.

Source: Compiled by the authors from the Harmonized System

Chapter 16. Results confirm that all the headings present a comparative disadvantage, with the exception of heading 1603, which, according to Vollrath, has had a certain comparative advantage since 2002, while Yu *et al.* classify it as neutral. In descending order, this would be 1603, 1605, 1601, 1602 and 1604, although Vollrath puts 1601 in last place. No exceptional facts can be seen in the evolution of headings, and there are not significant quantitative variations in the study period, with negative trends in almost all cases. Results suggest that Mexico, in spite of its long coastline, has the greatest international disadvantage in meat, fish and mollusk preparations.

Chapter 17. In this chapter Mexican food industry occupies second place and has a marked advantage. Indices confirm that these headings at present have a comparative advantage, in descending order: 1704, 1701, 1702 and 1703. There are two exceptions:

Table 3
Results by chapter: RCAI y NRCAI

Heading	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1601	-1,55	-1,62	-1,49	-1,11	-0,84	-0,61	-0,61	-0,80	-1,10	-1,09	-1,14	-1,16	-1,11	-1,17	-1,20	-1,26
1602	-0,16	-0,22	-0,23	-0,11	-0,26	-0,28	-0,30	-0,28	-0,25	-0,29	-0,25	-0,26	-0,31	-0,34	-0,31	-0,27
1603	0,88	-0,04	0,14	0,29	0,53	0,25	0,45	0,18	0,12	0,17	0,11	0,39	0,32	0,27	0,22	0,18
1604	-0,10	-0,06	-0,09	-0,14	-0,23	-0,25	-0,35	-0,32	-0,18	-0,22	-0,16	-0,16	-0,17	-0,23	-0,30	-0,25
1605	0,33	0,39	0,21	0,16	-0,02	-0,03	-0,06	-0,08	-0,13	-0,15	-0,13	0,02	-0,28	-0,14	-0,10	-0,11
1701	0,11	0,41	-0,18	-0,40	0,29	0,44	-0,08	0,95	0,49	0,62	1,37	0,68	1,86	1,49	1,42	1,16
1702	-1,58	-0,52	-0,27	-0,45	-1,27	-2,17	-2,86	-2,82	-2,85	-5,24	-5,71	-5,94	-4,34	-3,04	-3,41	-3,25
1703	2,27	1,69	0,71	0,75	1,97	1,23	1,19	1,45	1,70	0,81	2,23	0,54	3,23	3,07	1,22	0,77
1704	1,02	1,26	1,57	2,02	2,47	2,73	2,65	2,78	2,91	2,46	2,26	2,18	2,14	2,14	2,14	2,24
1801	-0,01	-0,05	-0,03	-0,07	-0,11	0,01	0,04	-0,10	-0,07	-0,26	-0,25	-0,19	-0,34	-0,44	-0,32	-0,45
1802	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-0,04	0,00	0,00	0,02
1803	-0,02	-0,04	-0,07	-0,03	-0,08	-0,02	0,02	0,07	0,00	-0,02	-0,04	0,02	-0,01	-0,01	-0,08	-0,88
1804	0,13	0,26	0,24	0,22	0,23	0,17	0,12	0,02	0,15	0,20	0,27	0,25	0,18	0,33	0,20	-0,14
1805	-1,40	-1,44	-1,51	-1,78	-1,44	-1,34	-1,11	-1,05	-0,93	-0,81	-0,57	-0,61	-0,42	-0,35	-0,49	-0,41
1806	-0,51	-0,42	-0,39	-0,35	-0,36	-0,41	-0,41	-0,24	0,31	0,44	0,35	0,31	0,27	0,21	0,50	0,57
1901	-1,16	-1,31	-1,49	-1,66	-2,15	-0,75	-0,66	-0,25	-0,09	0,17	0,19	0,23	0,28	0,03	0,18	0,09
1902	0,23	0,12	0,11	0,07	0,13	0,13	0,16	0,29	0,28	0,22	0,30	0,25	0,23	0,18	0,21	0,21
1903	-0,09	-0,15	-0,18	-0,69	-0,57	-0,80	-0,57	-0,24	-0,36	-0,33	-0,25	-0,28	-0,38	-0,47	-0,42	-0,48
1904	0,35	-0,11	0,00	-0,05	0,06	0,56	0,94	0,93	1,45	1,64	1,80	1,55	1,39	1,26	1,33	1,24
1905	0,19	0,25	0,30	0,27	0,41	0,56	0,55	0,66	0,84	0,81	0,87	0,92	0,82	0,79	0,94	1,18
2001	5,32	5,90	5,37	5,67	5,83	5,26	4,45	4,98	4,27	4,53	4,51	4,21	3,92	3,66	4,14	3,94
2002	-0,20	-0,16	-0,44	-0,38	-0,54	-0,66	-0,37	-0,38	-0,48	-0,44	-0,55	-0,43	-0,51	-0,50	-0,59	-0,62
2003	0,15	0,13	0,02	-0,41	-0,30	-0,21	-0,16	-0,39	-0,14	-0,23	-0,37	-0,32	-0,59	-0,57	-0,49	-0,55
2004	-0,73	-0,86	-1,10	-1,03	-1,15	-1,14	-1,13	-1,17	-0,93	-0,89	-0,81	-0,84	-0,72	-0,75	-0,70	-0,64
2005	-0,25	-0,38	-0,03	0,31	0,30	0,03	0,12	0,03	0,27	0,11	0,18	0,28	0,20	0,14	0,16	0,17
2006	0,36	0,24	0,48	1,15	0,69	0,64	0,14	0,67	0,83	0,77	0,65	0,63	0,48	0,92	0,25	0,86
2007	-0,29	-0,20	-0,18	-0,05	-0,05	0,18	-0,02	-0,03	0,19	0,54	0,46	0,27	0,31	0,36	0,43	0,36
2008	-0,44	-0,53	-0,70	-0,60	-0,45	-0,49	-0,64	-0,19	0,16	0,39	0,22	0,18	0,20	0,28	0,44	0,53
2009	0,38	0,44	0,25	0,43	0,75	0,56	0,68	0,86	0,91	0,98	1,06	0,72	1,13	1,28	1,21	1,23
2101	0,73	0,55	0,79	0,78	0,83	0,64	0,88	0,67	0,58	0,44	0,61	0,44	0,49	0,31	0,34	0,20
2102	2,70	2,42	2,31	2,00	1,63	1,59	1,78	2,27	2,87	2,28	2,20	2,08	2,29	2,63	2,77	2,55
2103	0,07	-0,24	-0,24	-0,10	-0,06	-0,11	-0,09	-0,03	0,02	0,13	0,11	0,13	0,15	-0,17	0,07	0,06
2104	-2,10	-2,40	-2,51	-3,13	-3,48	-3,46	-3,44	-3,02	-3,01	-2,83	-2,69	-2,89	-2,88	-4,21	-3,55	-3,76
2105	-0,65	-0,68	-0,59	-0,67	-0,69	-0,80	-0,79	-0,78	-0,58	-0,58	-0,65	-0,71	-0,77	-0,63	-0,62	-0,60
2106	-0,28	-0,45	-0,46	-0,30	-0,45	-0,62	-0,56	-0,55	-0,37	-0,37	-0,33	-0,39	-0,37	-0,42	-0,44	-0,48
2201	0,07	0,36	0,14	0,04	0,14	0,07	0,08	0,00	0,55	0,03	0,03	0,02	0,01	-0,12	-0,18	-0,06
2202	0,63	1,15	0,69	0,78	0,97	0,90	0,81	0,61	0,48	0,46	0,41	0,28	0,28	0,32	0,22	0,37
2203	8,56	8,54	9,17	9,35	10,27	10,98	9,96	9,79	10,35	9,66	9,72	9,18	9,00	9,62	9,88	10,73
2204	-0,15	-0,15	-0,18	-0,18	-0,21	-0,24	-0,24	-0,29	-0,28	-0,27	-0,27	-0,27	-0,30	-0,29	-0,28	-0,28
2205	-0,10	-0,10	-0,13	-0,06	-0,07	-0,12	-0,12	-0,14	-0,06	-0,08	-0,09	-0,09	-0,10	-0,13	-0,13	-0,10
2206	2,05	-0,64	-0,99	-1,00	-0,98	-0,85	-0,97	-0,80	-0,45	-0,39	-0,33	-0,31	-0,33	-0,35	-0,43	-0,37
2207	-1,70	-1,90	-1,67	-1,44	-0,93	-0,41	-0,23	-0,20	-0,70	-0,72	-0,51	-0,57	-0,52	-0,57	-0,47	-0,44
2208	1,47	1,67	1,62	1,62	1,67	1,59	1,44	1,35	1,30	1,30	1,21	1,14	1,23	1,50	1,56	1,59
2209	-0,13	-0,2	-0,27	-0,26	-0,29	-0,29	-0,29	-0,26	-0,31	-0,3	-0,35	-0,28	-0,31	-0,32	-0,28	-0,31

Source: Compiled by the authors

Table 3 *(continuation)*

Heading	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1601	-0,05	-0,05	-0,04	-0,03	-0,02	-0,01	-0,01	-0,02	-0,04	-0,04	-0,04	-0,05	-0,04	-0,04	-0,05	-0,05
1602	-0,14	-0,16	-0,15	-0,13	-0,15	-0,14	-0,14	-0,13	-0,16	-0,14	-0,14	-0,15	-0,15	-0,16	-0,18	-0,19
1603	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1604	-0,23	-0,22	-0,19	-0,16	-0,16	-0,16	-0,15	-0,15	-0,17	-0,15	-0,15	-0,17	-0,17	-0,17	-0,19	-0,20
1605	-0,08	-0,06	-0,07	-0,07	-0,08	-0,08	-0,07	-0,06	-0,09	-0,09	-0,08	-0,09	-0,08	-0,09	-0,11	-0,12
1701	-0,35	-0,19	-0,28	-0,23	-0,15	0,00	-0,18	0,04	0,09	0,06	0,28	0,02	0,35	0,18	0,17	0,09
1702	-0,03	-0,04	-0,02	-0,02	-0,02	-0,03	-0,03	-0,01	-0,01	-0,01	-0,01	-0,02	0,00	0,01	0,00	0,01
1703	0,03	0,01	0,00	0,00	0,01	0,00	0,00	0,00	0,01	0,00	0,01	0,00	0,02	0,02	0,00	0,00
1704	0,12	0,15	0,18	0,21	0,25	0,24	0,22	0,22	0,28	0,22	0,18	0,17	0,18	0,19	0,22	0,25
1801	-0,09	-0,14	-0,11	-0,09	-0,08	-0,07	-0,06	-0,07	-0,13	-0,11	-0,10	-0,11	-0,08	-0,11	-0,15	-0,17
1802	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-0,01	0,00	0,00	0,00	0,00
1803	-0,02	-0,03	-0,03	-0,02	-0,02	-0,02	-0,02	-0,02	-0,03	-0,03	-0,03	-0,03	-0,03	-0,04	-0,05	-0,05
1804	-0,04	-0,04	-0,04	-0,04	-0,04	-0,04	-0,04	-0,05	-0,05	-0,04	-0,03	-0,02	-0,03	-0,04	-0,06	-0,06
1805	-0,02	-0,03	-0,04	-0,03	-0,02	-0,01	-0,02	-0,01	-0,02	-0,04	-0,04	-0,03	-0,03	-0,02	-0,03	-0,04
1806	-0,25	-0,23	-0,18	-0,16	-0,14	-0,13	-0,12	-0,06	0,04	0,07	0,08	0,07	0,04	-0,01	0,00	0,00
1901	-0,10	-0,09	-0,07	-0,06	-0,05	-0,04	-0,02	0,00	-0,03	0,00	0,01	0,00	0,01	-0,04	-0,05	-0,10
1902	-0,07	-0,08	-0,07	-0,07	-0,06	-0,06	-0,05	-0,05	-0,06	-0,06	-0,05	-0,05	-0,06	-0,07	-0,07	-0,08
1903	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1904	0,00	-0,02	-0,01	-0,02	-0,02	0,01	0,04	0,03	0,07	0,08	0,08	0,07	0,06	0,05	0,07	0,06
1905	-0,12	-0,12	-0,05	-0,06	-0,03	0,01	0,01	0,03	0,07	0,05	0,07	0,10	0,08	0,07	0,13	0,24
2001	0,11	0,13	0,10	0,10	0,10	0,08	0,07	0,07	0,08	0,07	0,07	0,06	0,06	0,06	0,08	0,08
2002	-0,05	-0,05	-0,05	-0,04	-0,04	-0,03	-0,03	-0,04	-0,05	-0,05	-0,04	-0,04	-0,04	-0,05	-0,06	-0,05
2003	-0,01	-0,02	-0,02	-0,02	-0,01	-0,01	-0,02	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,02	-0,02
2004	-0,09	-0,09	-0,08	-0,07	-0,05	-0,06	-0,06	-0,05	-0,06	-0,06	-0,05	-0,05	-0,06	-0,06	-0,06	-0,07
2005	-0,12	-0,12	-0,05	0,00	0,01	-0,01	-0,03	-0,04	-0,03	-0,04	-0,04	-0,03	-0,04	-0,05	-0,06	-0,07
2006	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2007	-0,02	-0,02	-0,02	-0,01	-0,01	-0,01	-0,02	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,02
2008	-0,08	-0,09	-0,06	-0,07	-0,07	-0,05	-0,05	-0,01	0,01	0,03	0,02	0,01	0,03	0,03	0,04	0,06
2009	-0,10	-0,10	-0,13	-0,07	-0,02	-0,05	-0,02	0,02	0,02	0,03	0,06	-0,01	0,06	0,07	0,07	0,08
2101	0,00	-0,01	0,01	0,02	0,03	0,00	0,02	0,01	0,01	0,01	0,01	0,01	0,03	0,01	0,00	-0,02
2102	0,05	0,04	0,04	0,03	0,02	0,02	0,02	0,03	0,05	0,04	0,03	0,03	0,04	0,05	0,06	0,06
2103	0,02	-0,01	0,00	0,02	0,02	0,01	0,01	0,01	0,01	0,02	0,01	0,01	0,02	0,01	0,02	0,01
2104	-0,01	-0,01	0,00	-0,01	-0,03	-0,02	-0,02	-0,02	-0,02	-0,01	-0,01	-0,01	-0,01	-0,02	-0,02	-0,02
2105	-0,05	-0,05	-0,05	-0,04	-0,04	-0,04	-0,03	-0,03	-0,04	-0,04	-0,03	-0,03	-0,03	-0,03	-0,04	-0,05
2106	-0,17	-0,23	-0,17	-0,10	-0,05	-0,04	-0,07	-0,07	-0,09	-0,13	-0,13	-0,16	-0,18	-0,27	-0,32	-0,36
2201	-0,06	-0,04	-0,04	-0,04	-0,03	-0,03	-0,03	-0,03	-0,01	-0,03	-0,02	-0,02	-0,02	-0,03	-0,03	-0,03
2202	0,02	0,12	0,02	0,03	0,05	0,05	0,04	0,01	0,00	0,00	-0,02	-0,05	-0,04	-0,04	-0,07	-0,07
2203	1,40	1,51	1,42	1,27	1,29	1,36	1,15	0,99	1,29	1,10	0,99	1,01	1,02	1,12	1,36	1,58
2204	-0,54	-0,56	-0,52	-0,45	-0,41	-0,39	-0,39	-0,34	-0,38	-0,36	-0,35	-0,36	-0,37	-0,38	-0,44	-0,48
2205	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01
2206	0,02	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,02	-0,02	-0,02
2207	-0,03	-0,03	-0,03	-0,03	-0,05	-0,07	-0,06	-0,07	-0,08	-0,08	-0,10	-0,10	-0,09	-0,08	-0,10	-0,10
2208	0,36	0,43	0,38	0,33	0,34	0,30	0,28	0,24	0,27	0,27	0,23	0,23	0,27	0,35	0,41	0,42
2209	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01	-0,01

Source: Compiled by the authors

according to Vollrath, Heading 1702 shows a marked disadvantage in RTAI while 1703 is quite close to neutrality, according to Yu *et al.* Headings 1704 and 1701 have a clearly positive growth trend; 1704 has reduced its advantage since 2010, although indices reveal a new trend. 1701 is quite volatile and has reduced its advantage since 2013. Heading 1702 has also improved, except with Vollrath, and 1703 is the only one with a negative evolution. To sum up,

Mexican exports of sugars and confectionary are in very good health.

Chapter 18. Results confirm that 1806 is the only one that shows a comparative advantage. Vollrath also awards a comparative advantage to 1804, but this was lost in 2016. 1802 stays neutral. And 1803, which has stayed close to neutrality according to Vollrath, presents negative values in 2016. Headings 1805 and 1801 have comparative disadvantages. As regards the evolution throughout the study period, the most remarkable is the rise shown by 1806 and 1805. The remainder do not show relevant changes or are slightly negative. Chocolate and cocoa preparations are thus the star export products in chapter.

Chapter 19. Mexico is internationally competitive in commodities contained in this chapter. Calculations gave headings 1904 and 1905 a comparative advantage in the indices, as well as 1902 and 1901, according to Vollrath. 1903 shows a disadvantage, although, according to Yu *et al.* it is very close to neutrality. Evolution: headings 1904 and 1905 obtained an advantage in 2006 and show steady growth. 1901 also improved its advantage, according to Vollrath. 1902 and 1903 stayed constant or slightly declined. Comparative advantage of chapter is led by exports of corn flakes and other cereal products prepared by swelling or roasting, as well as bakery and confectionary products.

Chapter 20. Dealing with prepared vegetables and in fourth place in the chapter ranking of Mexican food industry, with a certain advantage in world trade at the present time. Advantage to headings, in descending order: 2001, 2009, 2008 and 2006. Vollrath's RTAI also gives advantages to 2007 and 2005. 2002, 2003 and 2004 have an evident disadvantage. The evolution of 2001 in time is outstanding, which has always had a strong advantage, even though this shows a slight tendency to decline. Headings 2008 and 2009 show a firm tendency to grow. In the other cases, the evolution during this period doesn´t present significant changes or is slightly negative. This means that prepared fruits and vegetables or preserved in vinegar or otherwise, plus fruit juices, are the products that perform best in international markets.

Chapter 21. In spite of the fact that chapter as a whole doesn´t enjoy a comparative advantage for exports, results shown that headings 2102, 2103 and 2101 have always had an advantage, although, according to Yu *et al.,* 2101 lost its advantage in 2015, and Vollrath predicts that it will do so quite soon. Headings with a disadvantage include 2104, 2105 and 2106. In evolution there aren´t abnormal features, with negative tendencies in most cases, and more marked in 2104 and 2106. Some products in chapter are exported with advantages, especially yeasts and other monocellular micro-organisms, coffee-based products, tea, maté and its substitutes, and even sauces, condiments and seasonings.

Chapter 22. This chapter is in best competitive position in international trade. Only four of nine headings have a comparative advantage: 2203, 2208, 2202 and 2201. In 2203, malt beer, there is a spectacular advantage with values between 9 and 10 according to Vollrath. 2202, water with added sugar and other non-alcoholic drinks, lost its advantage, according to Yu *et al.*, although by the minimum amount in 2013. 2201, water with no added sugar, is given an advantage by Vollrath until 2013. Headings 2204, 2205, 2206, 2207 and 2209 have clear disadvantages. As regards evolution, principal headings 2203 and 2208 improved their advantages throughout this period; 2204, 2205 and 2209 remained unchanged from beginning to end; and 2201, 2202, 2206 and 2207 became negative (with the exception of 2207, which is regarded as positive by Vollrath). Malt beer is undoubtedly the star export in trade with the rest of the world, while Mexico also has an advantage in exports of undenatured ethyl alcohol.

4. DISCUSSION AND CONCLUSIONS

Results show that indicators RTAI and NRCAI are alternative indicators to measure competitiveness (not substitutes), a consequence of imports, which only enter into the calculation of RTAI, being the factor responsible for the divergences between them. This fact suggests the possible use of both indicators on a complementary basis. In this sense, when NRCAI shows a competitive disadvantage, RTAI has a greater value as

exports exceed imports and at the same time grow faster than the latter.

Table Nº 4 contains a summary of the results. Headings are classified into 4 groups according to their situation in 2016: those that have always had an advantage, those who achieved it at some point during the study period, those that have never had an advantage, and those that have lost an advantage. Headings marked with an (*n*) mean that the heading is close to neutral. It should be noted that 2 of the 13 headings with a comparative advantage are close to neutral, i.e. they are at risk of losing it, while 8 of the 31 headings with no advantage are also close to neutral. In this classification NRCAI is considered to be valid, due to its higher power (Yu *et al.,* 2009). The same system has been followed by other authors (Ahmad, Qayum and Iqbal, 2017).

The calculations show that in Mexico only 3 of the 7 customs' chapters of the country's food industry have a comparative advantage: in first place is Chapter 22 «Beverages, spirits and vinegar»; second is Chapter 17 «Sugars and sugar confectionery», and third is Chapter 19 «Preparations of cereals, flour, starch or milk; pastrycooks' products». After a detailed analysis of the headings, the conclusion was reached that at the present time Mexico has a comparative advantage in 13 of its 44 analyzed customs' headings (or approximately 30% of the headings, in agreement with other studies in the literature). In other words, the country specializes in the following food products, in descending order: malt beer, undenatured ethyl alcohol; confectionery, bread and cakes; sugars; fruit juices; preserved fruit and vegetables; cereal products; yeasts; sauces; and chocolate. Expressed in other words, the participation of Mexican food products with an advantage in the country's exports is greater than the participation of the same products in the world's export flows. Of the 13 products with a revealed comparative advantage, 5 were found to have an advantage during the entire study period (malt beer, undenatured ethyl alcohol (d» 80% vol.), liqueurs and other spirits, confectionery with no chocolate, fruit and vegetables preserved in acetic acid or vinegar, and yeasts. The remainder obtained an advantage at a certain time during this period. In addition, some of the country lost the comparative advantage of certain products in which it had specialized in previous years (8 additional headings), as follows: meat extracts and juices, fish, crustaceans and mollusks, molasses, malt extracts and dairy products, candied fruit and vegetables, coffee extracts and concentrates, tea and yerba maté, water with added sugar or coloring and other soft drinks, cider, mead and other fermented drinks.

Throughout the 21st century, the annual average Mexican advantage has grown in half the headings analyzed, especially in: cocoa powder; sugars; chocolate; fruit and vegetables preserved without vinegar or acetic acid; fruit juices; cakes and pastries. In the other half, the advantage in terms of the annual average is decreasing, especially in: cider; mead and other fermented drinks; undenatured ethyl alcohol (e» 80% vol.); cocoa beans; meat juices and extracts; fish, crustaceans and mollusks; vinegar and vinegar substitutes. This could have been due to the effects of the world crisis, which began in 2008, with the US, Mexico's main trading partner, being one of the most affected countries. To this can be added the effect of higher prices due to a higher exchange rate, which reduces competitiveness in the world market. In other words, the smaller the difference between the Nominal Exchange Rate and the Real Exchange Rate, the higher the competitiveness, while in the opposite case, as the difference increases, the lower the competitiveness.

On the other hand, empirical evidence available in recent years (see Boussemart, Leleu and Mensah, 2017; Gaitan, Meuwissen and Lansink, 2017; Kannen, Donaubauer and Herzer, 2017; Ng and Ng, 2016; Candia, Aguirre, Correa and Herrera, 2016…) reveals that the existence of comparative advantage in Mexican food industry has a productivity differential between its chapters, so that chapters that enjoy a comparative advantage are the same ones that show higher levels of Total Factors Productivity (chapters 17, 22 and 19). Chapters with low levels of competitiveness are linked to the deterioration of their productivity, particularly the labor factor. Foreign investments in Mexican industry have boosted the productivity of the capital

Table 4
Summary of the results

Source: Compiled by the authors

factor, providing more technology to productive plants and greater access to innovation.

The results obtained in this study suggest a need to adopt active public and private policies to strengthen the comparative advantages of the Mexican food industry (Olguin, Kartzow and Huenchuleo, 2019). Considering the national map of comparative advantages, it is recommended to implement measures to maintain and improve exports through action plans to protect and promote Mexican food products in world markets; increase investments, and improve infrastructures, credit facilities, innovation, technological advances, training and recruitment programs, etc. Neither should it be forgotten that low levels of competitiveness are linked to lower productivity, especially as regards the work factor and the investment factor. Better promotion of the food sector is also recommended, especially in international trade (Fuentes *et al.*, 2015), as well as improved distribution channels, improved product differentiation by means of appellations of origin and international certificates, and better collaboration between higher education institutes and the food industry for the development of new food technologies. Attention should also be given to obtaining new trading partners, especially in new unsaturated emerging markets, and taking advantage of Mexico's large number of Free Trade Agreements and Commercial Treaties.

As regards the limitations encountered while carrying out this study, the data on Mexican food imports and exports is only available for the country as a whole, which ruled out a state-by-state analysis to compare the different regions. Another limitation was the fact that product competitiveness was analyzed according to the tariff code, since in a few cases the code had been changed in different HS reviews. This meant that some headings were affected (such as headings 1802, 1803, 1903 and 2205), which were either added or eliminated and therefore could not be analyzed for the complete duration of the study period.

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