
AN ANALYSIS OF THE PERFORMANCE OF CHILEAN AGRICULTURAL EXPORTS (1994-2004)

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SUMMARY

The relative success of the Chilean economy is due in a large measure to the application by the government of exchange rate and market liberalization policies oriented towards the promotion of exports in both traditional and non-traditional sectors, in order to turn them into an engine of growth. Farming in general has become a key component of the country's economy. In this paper, the performance of the agricultural sector exports for the period 1994-2004 is analyzed on the basis of indicators that account for specialization, commerce structure and competitiveness of exports. Altogether, seven tariff categories of the Harmonized System (2002) were covered. In the analysis of export specialization three indices were employed, namely, the revealed compar-

ative advantage, the contribution to trade balance, and the intraindustry commerce. The commerce structure was analyzed on the basis of the share of exports of the selected items to the total of exports. Competitiveness was analyzed with the use of indices of sector participation and market share. The results show a high level of specialization of agricultural exports and an increase in comparative advantage for products such as avocados, grapes and wine. Concerning competitiveness, the study revealed an increase in market share in almost all the destinations considered. The weakest tariff categories in this regard are edible vegetables and vegetable and fruit preparations, which so far have not been able to position themselves almost anywhere.

The world economic climate, with globalization and regional integration as hallmarks, has made possible a remarkable increase in the commercial flow between countries (both exports and imports). A country with a small internal market such as Chile requires an active participation in international commerce in order to maintain a sustained economic growth rate, employment level, technical innovation and efficiency in resource allocation.

The development strategy chosen by Chile is characterized by three principal features: unilateral action, via an across-the-board reduction of tariffs; multilateral action, via membership in international organizations such as the World Trade Organization (WTO) and APEC; and, finally, concerted collaboration with countries or groups of countries, mainly

as a party to Economic Complementation Agreements (ECA) and Free Trade Agreements (FTA).

Exports, therefore, have become the engine of growth of the Chilean economy, and thus the importance and interest in analyzing their behavior and evolution. In order to do that, diverse indicators may be employed (Gudiño, 2002; Sanz, 2002), of which particular mention is deserved by those measuring the specialization of exports, their structure, and their competitiveness. These three aspects, in addition to the analysis of exported volume and value explain almost completely the behavior of exports (Laursen, 1998; Gudiño, 2002; Utkulu and Seymen, 2002). No previous studies exist that incorporate these three elements in the analysis of Chilean farm-related exports.

By specialization is meant the concentration of production on those

goods in which the country has advantages. On the other hand, the export structure of some goods is their fraction of total exports. Competitiveness will be understood as the ability to conquer and maintain a share of foreign markets of some products or productive sectors.

In order to analyze the specialization of exports, three indicators (the term is used interchangeably with the term index) are employed: the revealed comparative advantage (RCA), the indicator of the contribution to trade balance (ICTB), and the intraindustry commerce indicator. These indicators combined adequately explain specialization (Gudiño, 2002; Arias and Segura, 2004). As pointed out, the commerce structure was analyzed on the basis of the share of exports of the selected items to the total of exports, whereas the competitiveness was analyzed with the use of indices of sector

KEYWORDS / Agriculture / Comparative Advantage / Competitiveness / Exports /

Received: 01/12/2007. Modified: 03/21/2007. Accepted: 03/23/2007.

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participation and market share as suggested by CEPAL's competitiveness analysis of nations (CAN) methodology. Improvements to this methodology were achieved by introducing statistical analysis and an extra category in the matrix classification.

On the other hand, the country's combined agricultural and stock farm sector has positioned itself as a key component of the economy, with about 13% of the labor force (in some regions it reaches 30%), and a contribution of ~5% to the GNP. These data concern the primary sector alone, excluding the associated industrial subsectors such as winemaking and processing of fruits and vegetables. As a consequence, it can be stated that the sector's importance is underestimated (CORFO 2005a, b).

Chile has steadily developed comparative and competitive advantages so as to become an important producer and exporter of a wide variety of products associated with the agricultural sector. CORFO (2005a, b) highlights the sector's comparative advantages: natural factors such as cost and quality of land and water resources, climate diversity, natural environmental protection, opposite seasonality with the northern hemisphere, and cost and productivity of the workforce. Regarding competitive advantages, CORFO mentions sanitary conditions, experience in international markets, bilateral and multilateral agreements, both signed and under negotiation, favorable investment climate, and Chile's prestige as a competitive, quality and reliable supplier in the agricultural sector.

Currently, Chile is among the top 20 food exporters in the world, with exports close to US\$ 7 billion/year (CORFO 2005a, b).

The main goal of this paper is the analysis of the performance of a chosen set of agricultural and farm-related Chilean exports by studying their specialization, structure, competitiveness and evolution of volume and value.

Indicators

Indicators of specialization

The three pillars on which the analysis of the specialization of exports rests are:

Revealed comparative advantage (RCA). This indicator makes it possible to compare the export structure of countries and to determine whether or not it has comparative advantages. Commonly known as the Balassa index, it helps determine how specialized a country is in the production of a given good (Addison-Smyth, 2005). By definition,

$$RCA_{ij} = \frac{(X_{ij}/X_j)}{(X_i/X)} \times 100$$

where RCA_{ij} : RCA of product i from country j , X_{ij} : exports of product i from country j , X_j : total exports of country j , X_i : exports of product i by the world, and X : total world exports.

The RCA index compares the export structure of a product or group of products of a country in relation to the participation of that product or group of products in global commerce. It takes any positive value, and if it is >100 , the interpretation is that the country in question has indeed a revealed comparative advantage with regard to the given product (Laursen, 1998; Arias and Segura, 2004; Utkulu and Seymen, 2004). A limitation of this indicator is that it does not permit making a comparison or classification of the comparative advantages/disadvantages obtained. It turns out, for example, that when comparing two products, the one with a greater RCA does not necessarily have a greater comparative advantage.

Indicator of the contribution to the trade balance (ICTB). While the RCA focuses exclusively on exports of a given country and it is possible to be both exporter and importer at the same time, an index is needed to analyze the comparative advantage from net commerce data (exports minus imports). This can be achieved by the ICTB index, defined as

$$ICTB_{ij} = \frac{X_{ij} \cdot M_{ij}}{X_j + M_j} - \frac{X_j \cdot M_j}{X_j + M_j} \times \frac{X_{ij} + M_{ij}}{X_j + M_j}$$

where X_{ij} : exports of good i from country j , M_{ij} : imports of good i by country j , X_j : total exports of country j , and M_j : total imports of country j .

This indicator describes adequately the changes in patterns of commercial specialization. It may be any real number. When the indicator is positive, the given country has indeed a comparative advantage with regard to the product in question, and when negative, a disadvantage (Ventura-Dias *et al.*, 1999; Gudiño, 2002). As with the RCA, the ICTB is useless for comparison or ranking purposes.

Intraindustry commerce. This indicator, defined as the commercial exchange between two countries in the same industrial sector, measures the intraindustry commerce of a sector or group of sectors as a percentage of total commerce between countries or groups of countries. Its evolution in time reflects changes in the pattern of production specialization. This index was developed by Grubel and Lloyd (Gudiño, 2002; Tugores, 2002) and is defined as

$$IIC_i = 1 - \frac{X_i \cdot M_i}{X_i + M_i}$$

where IIC_i : intraindustry commerce of industry i between countries I and II , X_i : ex-

ports of good i from country I to country II , and M_i : imports of good i by country I from country II .

This indicator takes values between 0 and 1. It is 0 when either X_i or $M_i=0$, in which case there is no intraindustry commerce or, equivalently, all commerce is interindustrial. The index equals 1 when $X_i=M_i$. This indicates a maximum in intraindustry commerce. High values of the indicator imply a break with the classical (Ricardian) theory of international commerce, according to which commercial exchange is the result of comparative advantage and occurs only under low levels of intraindustry commerce. If both exports and imports are zero simultaneously, the index cannot be interpreted mathematically due to division by 0. From the economic standpoint, this situation would not warrant any analysis. A shortcoming of this indicator is that, in order to be a good estimator of the intraindustry commerce, it requires a homogeneous grouping, i.e., by sector, of the products under consideration.

Indicator of commerce structure

Commerce structure is defined as the ratio of exports of each good to the total of exports, and given by

$$PCE_{ij} = \frac{X_{ij}}{X_j}$$

where PCE_{ij} : participation of good i in the commerce structure of country j , X_{ij} : exports of good i by country j , and X_j : total exports of country j .

Indicators of competitiveness

For the purposes of this work, competitiveness will be understood as the ability to conquer and maintain a share of foreign markets of some products or productive sectors. Competitiveness represents the export efficiency of a country throughout time (Bonifaz and Mortimore, 1999).

The reference methodology for the estimation of export competitiveness is borrowed from CAN (Competitive analysis of nations), developed by CEPAL (*Comisión Económica para América Latina y el Caribe*). This methodology provides a series of indicators that are useful in the study of the competitiveness of Chilean products in different markets.

The CAN method measures the penetration and participation of countries in different areas of commerce. Changes in the commerce structure of a country are combined with modifications in market patterns, the result being a matrix classification of export sectors according to their competitiveness and the dynamism of the corresponding imports.

Dynamism or sector participation index (SP). The temporal evolution of this index provides a measure of growth of the participation of a good, or set of goods, in the total of imports of the country or region under consideration. It is given by

$$SP_i = \frac{M_i}{M_{total}} \times 100$$

where SP_i : sector participation of good i (or group of goods), M_i : imports of good i by the country or region under consideration, and M_{total} : total imports by the country or region under consideration.

Market Share (competitiveness)	Growing (competitive sectors)	Setting Stars	Rising Stars
	Decreasing (non-competitive sectors)	Setbacks	Lost Opportunities
		Decreasing (stagnating sectors)	Growing (dynamic sectors)
Sector Participation (dynamism)			

Figure 1. CEPAL competitiveness matrix.

Competitiveness or market share index (MS). This measures the ability of a country which exports a certain good to a given country or region (the target market) to increase its market share in the target market with respect to the rest of the countries exporting the same good to the same target market. By definition,

$$MS_{ij} = \frac{X_{ij}}{M_i}$$

where MS_{ij} : market share of good i produced by country j in the target market, X_{ij} : exports of good i by country j to the target market, and M_i : total imports of good i by the country or region forming the target market.

For the computation of the above indicators, the values of the imports and exports were obtained from moving averages estimated every three years. In order not to lose observations, the first and last years of the data were used to compute moving averages with the first two and the last two years, respectively. This is done to obtain more stable estimators since the bias introduced by atypical years is thus reduced (Bonifaz and Mortimore, 1999).

These indicators make possible the creation of the CAN model *competitiveness matrix*, which allows for the classification of the products or categories under analysis. This is accomplished by taking into account what has happened to the exported product as well as the characteristics of the importing markets. It is important to ascertain not only the market share growth, if any, of a given product, but also whether the target market for this product is growing, stagnating or decreasing. The CEPAL matrix is formed by the

four possible combinations obtained from two levels of a piece of competitiveness and dynamism, as shown in Figure 1 (Kosacoff *et al.*, 1998; Bonifaz and Mortimore, 1999).

This methodology shows some limitations. For instance, it does not explain the factors that are relevant for reaching the measured competitiveness, and it does not discriminate between a competitiveness achieved on a long-term sustainable basis from another obtained through illegitimate means. This is so because it does not separate prices and volumes, for example. Despite these limitations, this methodology contains indicators that are useful for describing and evaluating the international competitiveness milieu (Bonifaz and Mortimore, 1999).

The present study applies a variation of the above methodology. The conclusion was reached that the classification on the basis of competitiveness (market share) and dynamism (sector participation) could be considerably improved if it were based on the statistical significance of the tendency (the indicator's slope in a linear regression model with time as the regressor) in the evolution of each of the indicators, rather than simply considering whether they increase or decrease in time. A type I error of 10% in the estimation of the slope was used. In this way it is possible to obtain not only two categories in this evolution (increase or decrease) but three, after incorporating the category 'constant'.

Thus, if with a 10% significance of the slope of the indicator MS is positive, 0 or negative, competitiveness is increasing, constant and decreasing, respectively. The indicator SP is treated the same way. With these changes the competitiveness matrix now has nine entries, corresponding to three levels each of competitiveness and dynamism. Figure 2 shows the new competitiveness matrix to be used.

Chosen Products and Destinations

The analysis of Chilean agricultural exports, based on the above mentioned indicators, was performed only on some products (tariff categories) and des-

accordance with the Harmonized Commodity Description and Coding System of the World Customs Organization for 2002. Their official codes and full descriptions are:

- 07: Edible vegetables and certain roots and tubers
- 08: Edible fruit, nuts, peel of citrus fruit, melons
- 080610: Grapes, fresh
- 080440: Avocados, fresh or dried
- 20: Vegetable, fruit, nut, etc. food preparations
- 22: Beverages, spirits and vinegar
- 2204: Grape wines (including fortified), alcoholic grape must

The data under analysis correspond to the period 1994-2004. They were obtained from the UN statistical service Comtrade (<http://comtrade.un.org/db/>) and from the agency for the promotion of Chilean exports (ProChile: <http://www.prochile.cl/servicios/estadisticas/>). The geographical areas used for the computation of some of the indicators (intraindustry commerce and those on competitiveness) were the USA, the EU, Japan, China, Mexico and the World. The reason for this choice is that those regions represent the main destinations for exports originating in Coquimbo. Data for 2005 for some of the countries and regions in the study was missing, and in order to avoid inconsistencies arising from the utilization of a different database, the analysis was restricted to 1994-2004.

The European Union was treated differently. Since in the period of the study it did not exist as the present entity (end of 2006), the necessary units to mimic the current were assembled 25-economies block and this combination later became the basis for further analysis and classifications.

Results

Specialization

The index RCA shows that for almost all the products under study Chile had a comparative advantage ($RCA > 100$), which means a high degree of specialization, with the exception of category 07 (edible vegetables), which since 2002 presents comparative disadvantages (Figure 3). For the whole period under analy-

Market Share (competitiveness)	Increasing (competitive sectors)	C^+D^-	C^+D^0	C^+D^+
	Constant (sectors in transition)	C^0D^-	C^0D^0	C^0D^+
	Decreasing (non-competitive sectors)	C^-D^-	C^-D^0	C^-D^+
		Decreasing (stagnating sectors)	Constant (sectors in transition)	Increasing (dynamic sectors)
Sector Participation (dynamism)				

Figure 2. Modified competitiveness matrix.

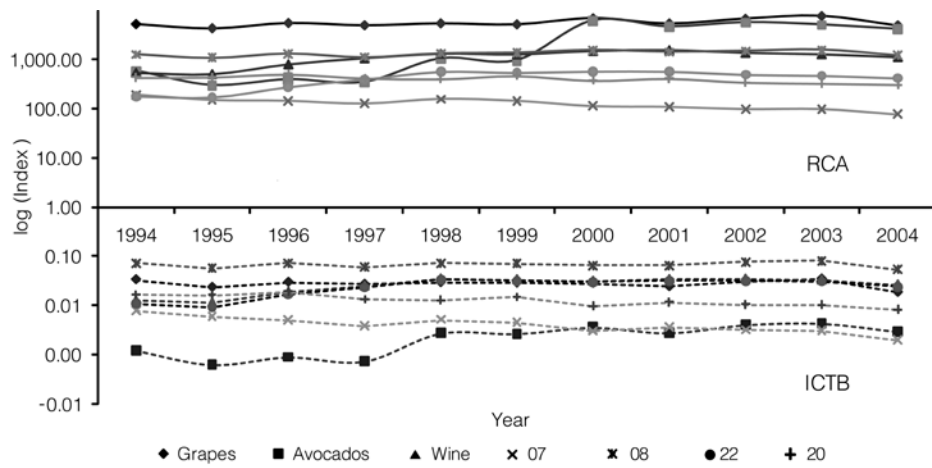


Figure 3. Evolution of the RCA and ICTB index for Chilean agricultural exports (1994-2004).

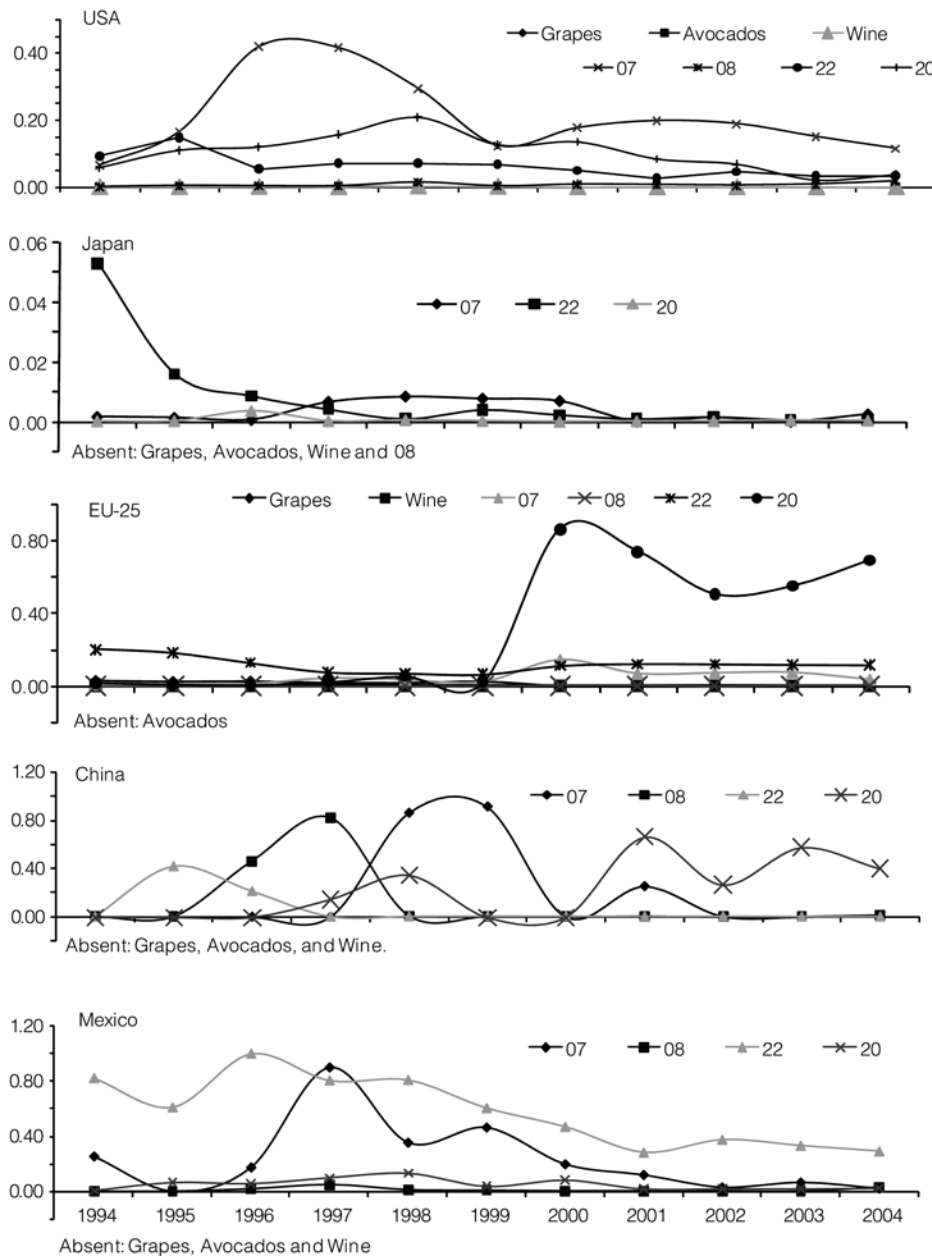


Figure 4. Evolution of the IIC, by country (1994-2004).

sis this index shows that the product with the highest growing comparative advantage was 080440 (avocados), followed by 08610 (fresh grapes), 2204 (wine of fresh grapes) and 08 (edible fruits). These results notwithstanding, the RCA index for avocados and grapes has decreased in the last few years.

The comparative advantages of category 20 (preparations of vegetables and fruits) have also diminished during the period under study, as well as those of category 07, the difference being that the former, as opposed to the latter, at the end of the period still maintains them.

As for the ICTB it must be said that it shows (Figure 3), in line with the RCA index, the presence of comparative advantages on all products. According to this index, the products with a greater increase in comparative advantage are wine (2204) and category 22, beverages and spirits, followed by avocados (080440). It must be stressed that both wine and category 22 saw a decline in sales in 2004. Comparative advantages measured by the indicator ICTB for grapes and category 08 (of which grapes are a subcategory) remained stable during the period in study. Finally, even though categories 07 and 20 still have comparative advantages, they experienced a decrease in them over time. This result stands in contradiction with the conclusions reached using the indicator RCA.

Comparing the conclusions reached with both indicators ICTB and RCA, it may be stated that they are identical except for grapes and category 07. For grapes, the RCA shows increasing advantages, whereas the ICTB suggests they are constant. Likewise, for category 07 both indicators show decreasing advantages, with the RCA indicating disadvantages for the last years.

At the end of the analysis the index measuring the interindustry commerce (IIC) for 5 specific markets, namely, USA, Japan, China, EU and Mexico was computed. The results are shown separately, first by country and then by product (Figures 4 and 5, respectively).

In Figure 4 some products and categories are marked as absent because the country in question (target market) either does not export or does not import the given product (category). In Figure 5, the role is reversed and countries are marked as absent for lack of imports or exports of the given product.

In the commercial exchanges Chile-USA dominate those of the interindustry type. With regard to Japan, there was a medium level of intraindustry exchanges in category 22 (beverages and spirits) which disappeared towards 1995. Since then, the most important exchanges are of interindustry type. As for the case

of China, the exchanges have been somewhat irregular in the period under study: intraindustry in category 08 (1996 and 97), category 07 (1998 and 99) and to a lesser degree in category 20 (beginning in 2001). With the EU most exchanges are of the interindustry type, save for category 20 (preparations of vegetables and fruits). Finally, the intraindustry trade with Mexico is in the category 22 (beverages and spirits); the IIC index reached a value of 0.99 in 1998, but has declined steadily.

Commerce structure

The index of commerce structure shows the relative weight of products and categories as a share of the total exports by Chile (Figure 6). It should be stressed that the main exports of the sector are from category 08 (edible fruits) and within it, as the star product, the subcategory 080610 (fresh grapes), with a mean share of 7% and 3%, respectively. Next in importance is category 22 (beverages and spirits), of which wine (2204) on average represents 99%. Category 22 represented on average about 3% of Chilean exports for the period in question.

Finally, it is important to emphasize that, while Chilean total exports grew at an average annual rate of 11%, the exports of avocados and wine grew at rates of 21% and 19%, respectively, whereas the exports of grapes grew at a paltry 4%.

Competitiveness of exports

Figures 7 and 8 show the results of the competitiveness analysis, performed by the destination country and by the product and tariff category, respectively. This type of analysis is done with a given trade partner in mind and, as a result, the competitiveness of a product may differ as a function of the trade partner. Indices for market share (MS; competitiveness of a product in the target market) and for sector participation (SP; dynamism of the product in the target market) were calculated. There were no exports of avocados to either China or Mexico, and hence the appearance of incompleteness in the category avocado.

The products showing an increasing competitiveness according to market destination are fresh grapes (to EU, Japan, World), avocados (to EU, USA, World), wine (to EU, China, Mexico), edible vegetables (to Japan, Mexico, China), edible fruits (to World, EU, Japan, USA, Mexico) and beverages, spirits (to EU, USA, Mexico, China, World).

The products showing an increasing dynamism according to market destination are fresh grapes (to China, USA), avocados (to Japan, World), wine (to Mexico,

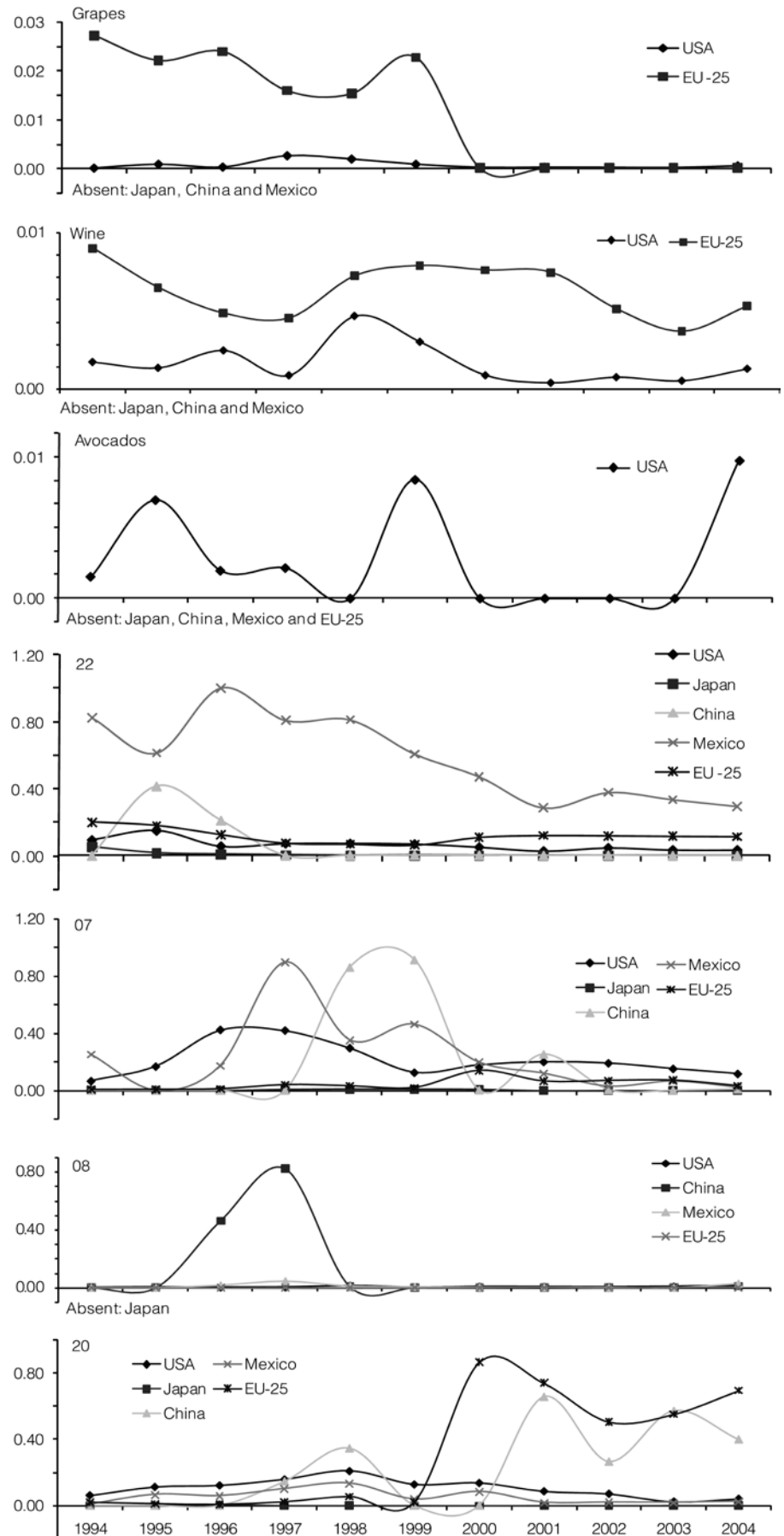


Figure 5. Evolution of the IIC index by product (1994-2004).

USA), edible vegetables (to China, USA), beverages, spirits (to USA) and preparations of vegetables and fruits (to Mexico, China).

The best positioned products are those showing an increasing competitiveness in markets with increasing dynamism. In this category fall avocados in the World, wine in Mexico, edible vegetables in China and beverages and spirits in the USA.

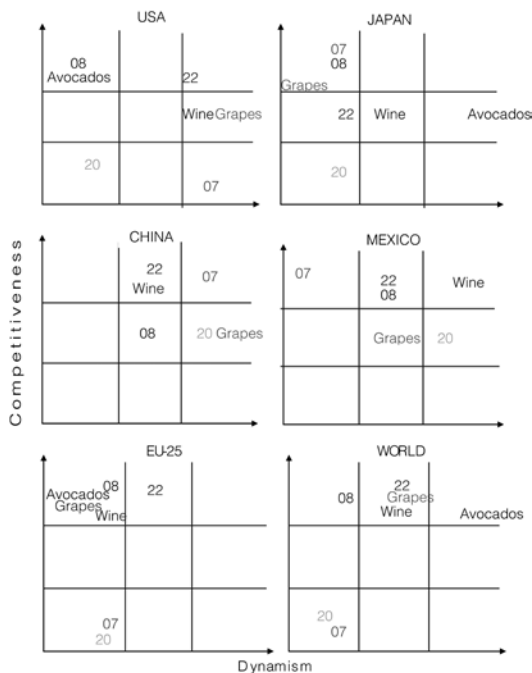


Figure 7. Competitiveness Matrices by destination. Three levels (rows and columns) per category: decreasing, constant, increasing. See Figure 2.

The most troublesome products and markets are those showing decreasing competitiveness and dynamism. Among them are edible vegetables in EU and in the World, and preparations of vegetables and fruits in USA, Japan, EU and the World.

Value and volume analysis of exports

The analysis of exports relying solely on indicators may lead to erroneous conclusions, for example when the value of exports increases due to an increase in price only. In order to clarify this point, an analysis of both value and volume of Chilean exports was performed (Table I). Most products and categories exported show real growth, since the growth rate of volume exceeds the growth rate of value. The excep-

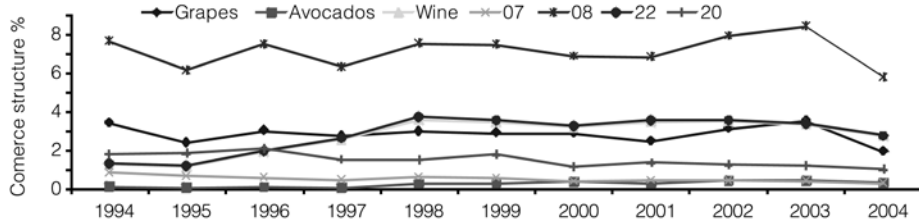


Figure 6. Evolution of commerce structure for Chilean agricultural exports (1994-2004).

tions are category 22 (mostly represented by wine), wine, and category 07 (edible vegetables). From Table I it is clear that the first two are being exported at an increasing price. Category 07, although sold at increasing price also, shows a decline in both volume and value.

Conclusions

The analysis of the specialization of Chilean agricultural exports shows that the country has a high degree of specialization. This is further demonstrated by an increase in the comparative advantage of avocados, wine and fresh grapes. On the other hand, the advantages of edible vegetables and of preparations of vegetables and fruits are not only not consolidated but in decline.

From the analysis of intraindustrial trade it can be seen that the Chilean commercial exchange in the agricultural sector with the chosen destinations follows a pattern that is clearly influenced by the comparative advantages of the trade partners. In most cases, Chile comes out as a net exporter of agricultural products because it has greater advantages than its commercial partners.

In a future work it would be of interest to ascertain the degree of specialization in the products under analysis, both of the trade partners of Chile as well as the Chilean regions.

TABLE I
MEAN ANNUAL GROWTH RATE OF CHILEAN EXPORTS (1995-2005)

Product/Category	Mean annual growth rate	
	Volume	Value
Fresh grapes	5.98%	3.60%
Wine	12.53%	17.09%
Avocados	27.61%	9.97%
07	-4.02%	-3.39%
20	2.37%	1.83%
08	5.06%	4.18%
22	12.11%	16.77%

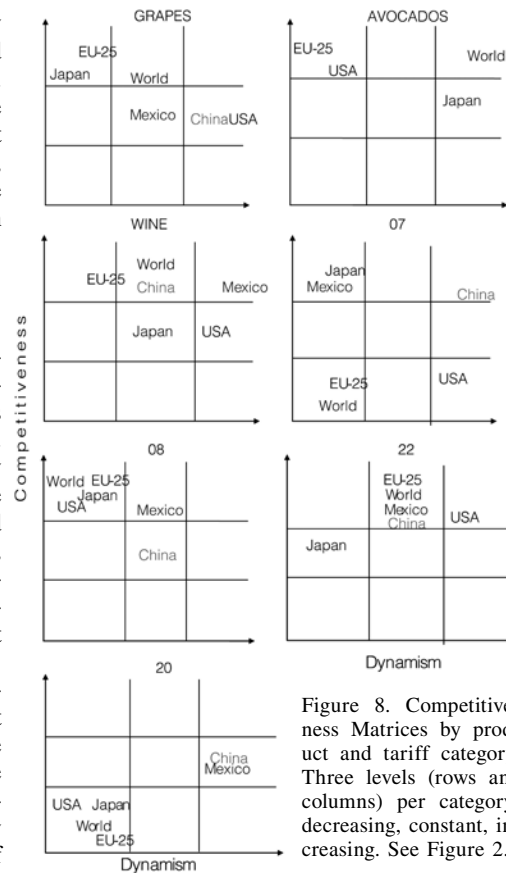


Figure 8. Competitiveness Matrices by product and tariff category. Three levels (rows and columns) per category: decreasing, constant, increasing. See Figure 2.

The analysis on relative participation shows that the most representative products of the Chilean agricultural sector are, by far, fresh grapes and wine. However, the category 'avocados' has achieved greater notoriety due to its high rate of growth compared with the average growth of Chilean exports.

With regard to competitiveness, the remarkable growth on market share shown on average by the products under analysis in most of the target markets in the study deserves especial attention. In this respect, the weakest categories are 07 (edible vegetables) and 20 (preparations of vegetables and fruits), which have not been able to position themselves in almost any destination.

The markets which seem to be most promising are China and Mexico, because despite their being highly dynamic the Chilean exports to these countries are gaining market share.

Chile must be careful with exports of fresh fruit because, even though it has managed to increase the market share in all target markets, most of them show a decreasing dynamism. Chile can ill afford losing market share.

ACKNOWLEDGEMENTS

The authors thank Juan Aravena and Marcelo Olivares, students from the Universidad Católica del Norte, for their contribution to the preparation of this article.

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ANÁLISIS DEL COMPORTAMIENTO DE LAS EXPORTACIONES AGRÍCOLAS CHILENAS (1994-2004)

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RESUMEN

El éxito relativo de la economía chilena se ha debido en gran medida a la aplicación por parte del gobierno de políticas tanto cambiaria como de apertura económica orientadas a favorecer el desarrollo de actividades exportadoras en sectores tradicionales y no tradicionales, para hacer de ellas el motor del crecimiento económico. El sector agropecuario en el país se ha llegado a situar como un componente clave en la economía. Este trabajo analiza el comportamiento de las exportaciones del sector agrícola para el periodo 1994-2004, con base en una serie de indicadores que dan cuenta de la especialización, la estructura del comercio y la competitividad de las exportaciones. Se estudiaron siete categorías arancelarias del Sistema Armonizado (2002). Para analizar la especialización de las exportaciones se utilizaron tres indicadores, la ventaja comparativa revelada, el índice

de la contribución a la balanza comercial y el de comercio intra-industrial. La estructura de comercio fue analizada en base a la participación de las exportaciones de los productos seleccionados en el total exportado. La competitividad se estudió por medio de los índices de participación sectorial y participación de mercado. Los resultados muestran un alto nivel de especialización de las exportaciones agrícolas y un incremento de las ventajas comparativas de los aguacates, las uvas y el vino. En cuanto a la competitividad, el estudio reveló un incremento en la cuota de mercado en la mayoría de los destinos considerados. Las categorías más débiles en este aspecto son las hortalizas y las frutas y verduras elaboradas, que no han sido capaces de posicionarse casi en ningún mercado.

ANÁLISE DO COMPORTAMENTO DAS EXPORTAÇÕES DO SETOR AGRÍCOLA CHILENO (1994-2004)

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RESUMO

O êxito relativo da economia chilena é devido, em grande medida, à aplicação por parte do governo de políticas tanto cambiária como de abertura econômica orientadas a favorecer o desenvolvimento de atividades exportadoras em setores tradicionais e não tradicionais, para fazer delas o motor de crescimento econômico. O setor agropecuário no país chegou a se situar como uma peça chave na economia. Este trabalho analisa o comportamento das exportações do setor agrícola para o período 1994-2004, com base em uma série de indicadores que dão conta da especialização, a estrutura do comércio e a competitividade das exportações. Estudaram-se sete categorias de taxas alfandegárias do Sistema Harmonizado (2002). Para analisar a especialização das exportações foram utilizados três

indicadores, a vantagem comparativa revelada, o índice da contribuição à balança comercial e o de comércio intra-industrial. A estrutura de comércio foi analisada baseada na participação das exportações dos produtos selecionados no total exportado. A competitividade foi estudada por meio dos índices de participação setorial e participação de mercado. Os resultados mostram um alto nível de especialização das exportações agrícolas e um incremento das vantagens comparativas dos abacates, as uvas e o vinho. Quanto à competitividade, o estudo revelou um incremento na quota de mercado na maioria dos destinos considerados. As categorias mais frágeis neste aspecto são as hortaliças e as frutas e verduras elaboradas, que não tem sido capazes de posicionar-se em quase nenhum mercado.