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The competitiveness of Spanish tomato export in the European Union

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Abstract

This paper examines the export performance of Spanish tomatoes in the European Union (EU). The origins and destinations of Spanish tomato exports are examined: Almería is the main exporting province and Germany the biggest client. The performance of Spain's North African competitors in the tomato market (mainly Morocco) is also examined, and the structural competitiveness of the countries that export tomatoes to the EU is analysed. Spain has the greatest advantage in this respect, and the largest inter-industry trade. An export model is developed. This model shows that the export of tomatoes from Almería is not much influenced by shipments from Morocco.

Key words: trade, price, competition, strategy, cointegration.

Resumen

Posición competitiva de las exportaciones españolas de tomate en la Unión Europea

En este artículo se estudió el comportamiento de las exportaciones de tomate españolas en el entorno de la Unión Europea (UE). En primer lugar se analizaron los orígenes provinciales, así como los destinos de las exportaciones de tomate, siendo Almería la principal provincia exportadora, y Alemania el mayor cliente de los envíos de esta hortaliza. En segundo lugar se estudiaron los países que compiten con las exportaciones españolas, que son los procedentes de los países de la Cuenca del Mediterráneo, sobre todo Marruecos. También se analizó la competitividad estructural de las distintas exportaciones de tomate a la UE, teniendo España la mayor ventaja comparativa, así como un comercio de tipo interindustrial. Por último, se realizó un modelo de exportación en donde se aprecia cómo los envíos de tomate marroquí no parecen influir en la exportación de tomate de la principal provincia exportadora.

Palabras clave: comercio, precio, competencia, estrategia, cointegración.

Introduction

In a free market, competitiveness is of fundamental importance. This paper examines the factors, which have an influence in the competitiveness of Spain's horticulture/fruit production sector (factors which will persist in the near future), with special regard to its most important product: the tomato.

The European tomato trade is currently facing a time of uncertainty due to overproduction in the European Union (EU) and a significant increase in competition from other Mediterranean countries. This uncertainty is made worse by the EU-Morocco agreement. This allows Morocco to increase its exports to the EU to 220,000 t by 2007. This raises questions about Spain's competitiveness (the country most affected) and about what new variables need to be taken into account.

Both institutional and financial factors directly affect Spain competitiveness. The former includes the preferential treatment the EU shows to the non-members countries of the Mediterranean Basin, particularly Morocco, while the latter derives from the lower production cost in these countries. For example, the average agricultural wage in Morocco is €6 per day, while labourers of the *Campo de Dalías* in Almería are paid €36 per day[1].

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[1] There is more information on the cost of production in Morocco and Spain in AECI (1998) and Cáceres Hernández (2000).

This article first analyses the geographical origin of Spanish tomatoes and their export destinations. The EU imports countries are then analysed in order to know their capacity to continue buying tomatoes. The competitiveness of Spanish tomato exports will be studied. A table showing EU intra-industrial tomato trade was produced. Structural competitiveness was analysed using the revealed comparative advantage index (RCAI), the intra-industry trade index (IIT) and the horizontal and vertical intra-industry trade index. An export function was then estimated using cointegration methodology that allows elasticises to be determined and which shows whether Moroccan tomato exports have affected those of Almería.

Methodology

For the preparation of this article several analysis instruments[2] were used.

The Agro-food Consumption Analysis Method (ACAM[3]) was used to determine the export destinations of Spanish tomatoes. This model attempts to explain the existence of different types of market (sustainable, tough, declined and vulnerable), to answer questions on business vision rather than planning. The aim was to produce a league table of Spanish tomato importing countries using the Giacinti *et al.* (1998) methodology.

To make use of the ACAM, first we had to obtain the annual growth rate of consumption, by calculating the effective rate. This allowed us to consider the trend of the data analysed (calculated as a linear function to facilitate the final comparison of results). A cumulative growth coefficients matrix was later produced which allows the classification of four well-defined groups. We substituted the trend coefficient by the variation between two reference periods. This modification was made because the number of observations available. The model is therefore a simplified version.

Applying this model to the destination of Spanish tomato exports, we will consider:

Sustainable market: when there is an increase in tomato exports and a parallel increase in total vegetable exports.

Tough market: when vegetable exports have diminished and tomato exports have increased.

Declined market: when both tomato exports and total vegetable exports diminish.

Vulnerable market: when total vegetable exports have increased and tomato exports have diminished.

For the competition analysis, we made a table of intra-industry trade that shows the imports such as the exports of tomato from the different EU countries. The intensity of the commerce can be observed in this table, that is, the volume of commercial interchange of tomatoes between EU countries. With respect to the structural competitiveness of tomato in EU countries the indices of RCAI, IIT and vertical or horizontal intra-industry trade were used. The first index indicates the relative situation of commercial balance and supposes an approach to traditional commercial advantages. It can have negative values as positive. There will be a comparative advantage when the value is positive, and a disadvantage when the values are negative.

$$RCAI_i = \frac{X_i - M_i}{X_i + M_i} \times 100$$

The second index represents the value of the intra-industry trade in the i sector, being X_i the value of the exports and M_i the value of the imports: its values oscillate between 0 and 100. There will be a specialization perfect intra-industry when the value is 100, and a specialization perfect inter-industry when the value is 0. The differentiation of product, scale economies, and monopolist competition, are the three main explanations about the intra-industry trade. The IIT measures the percentage of this kind of commerce on the total i sector.

$$IIT_i = \frac{(X_i + M_i) - |X_i - M_i|}{X_i + M_i} \times 100$$

The vertical or horizontal intra-industry trade index is obtained from the quotient between export and import prices. If the gap between the prices of exports and imports is less than ±15%, the interchanged products are similar (differentiated horizontally). In the opposite case, the trade will be distinguished by the existence of different qualities. If the gap is higher than 15%, the commerce will be of high quality (Greenaway *et al.* 1994). These indices have been used in works on agrarian products (López Díaz-Delgado, 1995), food stuffs (Ben Kaabla and Gil, 1994), sweet fruit (Sala Ríos, 1995) and vegetables (De Pablo Valenciano, 2002).

[2] Forms to increase the competitiveness, not analysed in this work, can be seen in: Aldanondo (1992), Barceló (1987, 1993), Chrisney (2000), Juárez and García (2000) and Porter (2001).

[3] The model was constructed by M.A. Giacinti (Belgrano University, Argentina).

Table 1. Spanish tomato exports by Spanish provinces from 1995 to 2000

Province	1995		1996		1997		1998		1999		2000	
	t	%	t	%	t	%	t	%	t	%	t	%
Alicante	69,077	9	78,865	10	89,334	9	77,331	9	68,019	7	62,449	7
Almería	165,701	22	203,666	27	246,638	25	238,984	28	286,696	30	261,602	29
Murcia	156,394	21	182,029	24	196,565	20	169,504	20	188,976	20	187,972	21
Las Palmas	217,983	29	176,226	23	252,916	26	192,614	22	194,178	21	180,118	20
Tenerife	99,046	13	59,277	8	126,306	13	109,170	13	110,339	12	100,385	11
Valencia	13,353	2	29,050	4	37,256	4	23,934	3	35,806	4	32,255	4
Others	20,675	3	24,424	3	40,546	4	53,588	6	61,455	6	63,351	7
Total	742,229	100	753,537	100	989,561	100	865,127	100	945,473	100	888,132	100

Source: FEPEX data.

We made an export tomato function for the social economy companies of the province of Almería using the cointegration[4] methodology of Engle and Granger (1987). Some references are: Hallam *et al*. (1994), Johansen (1998), Sosvilla and Olloqui (1999), Chebil and Briz (2000) and Montañés and Sanso (2000).

Cointegration between variables implies that according to the theorem of representation of Granger the system admits an estimation in the form of a Vector Error Correction Model (VECM) and vice versa. The VECM gathers the deviations of the dependent variable with respect to their value of long term balance, using the residuals of the model of long-term balance (one period lagged) like a regressor in a dynamic model (Tambi, 1998). The stages in the analysis of cointegration, according to Engle and Granger (1987) are:

1. Determine the number of unitary roots using the Augmented Dickey Fuller (1979) test (ADF).
2. Investigate the minimum relationship among the variables that could be cointegrated studying the behaviour of the residuals in the regression by the ADF test.
3. Thirdly, estimate the function in the short and long term, using the non-linear least squares method: this model can be used like a verification test of the cointegration relationship by examining the coefficient of the error correction (Kremers *et al*., 1992). This estimation can improve the specification of the model and allows the examination of the causal relationship, to the long and short term, among variables (Guisán, 2002).

Provincial analysis of the Spanish tomato exports

Studying the provincial distribution of Spanish tomato exports shows that Almería is the main exporter. In five years, the exports have increased, with respect to the other producing zones, and are currently 29% of the total. This is more than in the other important provinces such as Las Palmas, Murcia or Tenerife, that represent (for 2000) 20%, 21% and 11% of the total respectively (Table 1). Differences are similar in value. The tomato export share of Almería is 28% (Table 2). Historically Spanish tomato exports were a Canary Islands[5] initiative. Later, in the 1940's, winter crops were introduced into Alicante and Murcia by the Canary Island companies (Cortés Pérez, 1989; p118).

Las Palmas and Tenerife export in similar months, between November and May. These provinces maintain a certain stability in their shipments. Murcia has a growing season which lasts longer than in the other provinces, and together with Alicante, has the earliest crops.

Although the provinces compete during the year, their production has different destinations. The main markets of the Almerian tomato exports are France and Germany (Pérez Mesa, 2001; p25). Alicante exports most of its tomatoes to the United Kingdom (UK) and Germany and Tenerife supplies the Dutch market. Las Palmas distributes its exports between the UK and the Netherlands, while Murcia exports to Germany and the

[4] If a model has non-stationary variables, it is possible that the residuals are not either; therefore the least squares estimates will provide slanted estimators and the estimated model could be spurious. However, we can find stationary relations between variables that are not, thus obtaining a long term balance with robust relationships (see Novales, 1999). In summary, cointegration enables us to know the behavior of the nonstationary variables and the short and long term relationships among them.

[5] In 1992, the Canary Islands exported tomatoes like Almería and Murcia.

Table 2. Tomato exports by Spanish provinces from 1995 to 2000

Province	1995		1996		1997		1998		1999		2000	
	€ × 10^6	%	€ × 10^6	%	€ × 10^6	%	€ × 10^6	%	€ × 10^6	%	€ × 10^6	%
Alicante	33	7	43	8	45	8	48	9	36	7	41	6
Almería	93	17	113	21	110	20	134	25	140	25	175	28
Murcia	74	14	96	18	98	18	101	19	102	18	124	20
Las Palmas	145	27	119	22	169	30	131	24	133	24	123	19
Tenerife	67	12	40	7	85	15	72	13	68	12	64	10
Valencia	8	1	17	3	21	4	14	3	20	5	26	5
Others	99	22	93	21	31	5	39	7	49	9	73	12
Total	435	100	451	100	559	100	541	100	548	100	625	100

Source: FEPEX data.

UK. Figure 1 shows the main customers for Spanish tomatoes: Germany, the UK, the Netherlands and France take 25%, 20%, 19% and 15% of the crop respectively. An important feature of Spanish exports is the concentration on markets with high purchasing power.

A more detailed analysis of Spanish tomato exports can be obtained through the study of export destinations and its evolution through the export season, that extends from week 36 to week 35 of the next year (Fig. 2). For this, we used weekly data from FEPEX (Spanish Federation of Provincial Associations of Exporting Growers of Fruits, Vegetables, Flowers and Plants).

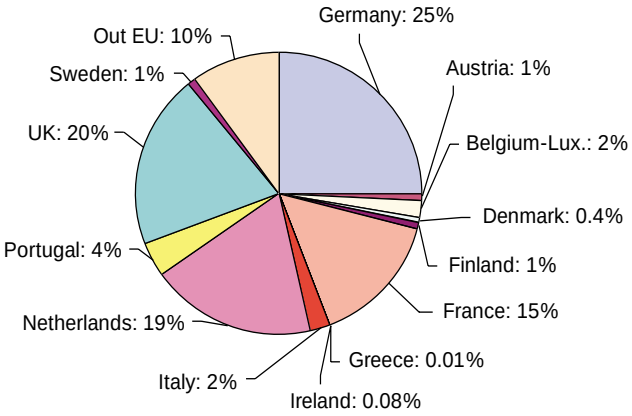

Figure 1. Destination (%) of Spanish tomato exports in 2002.

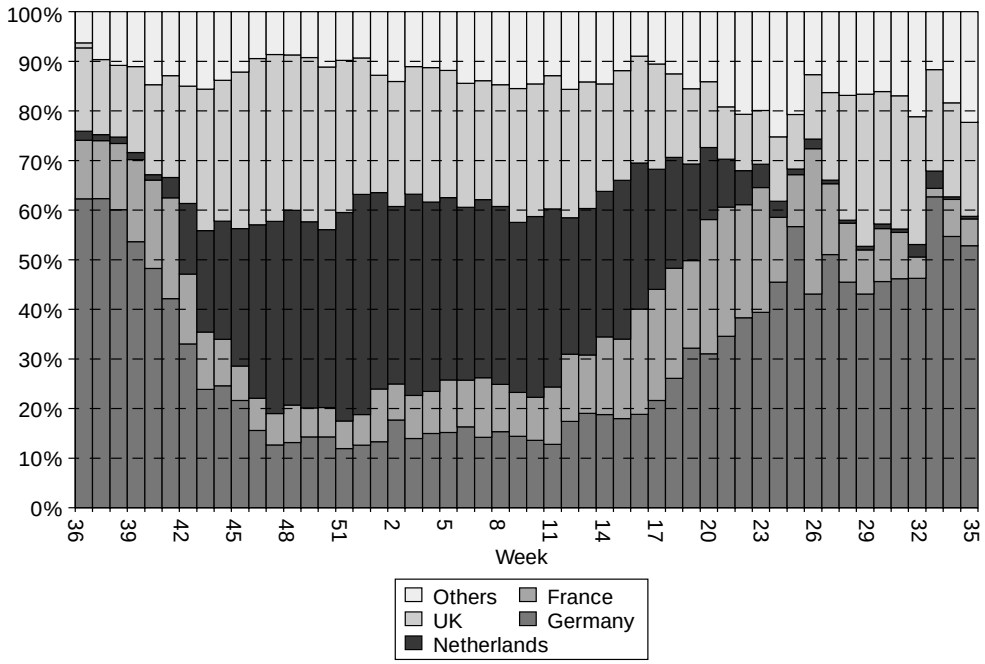

Figure 2. Evolution of Spanish tomato exports by destination. 2000/2001 season.

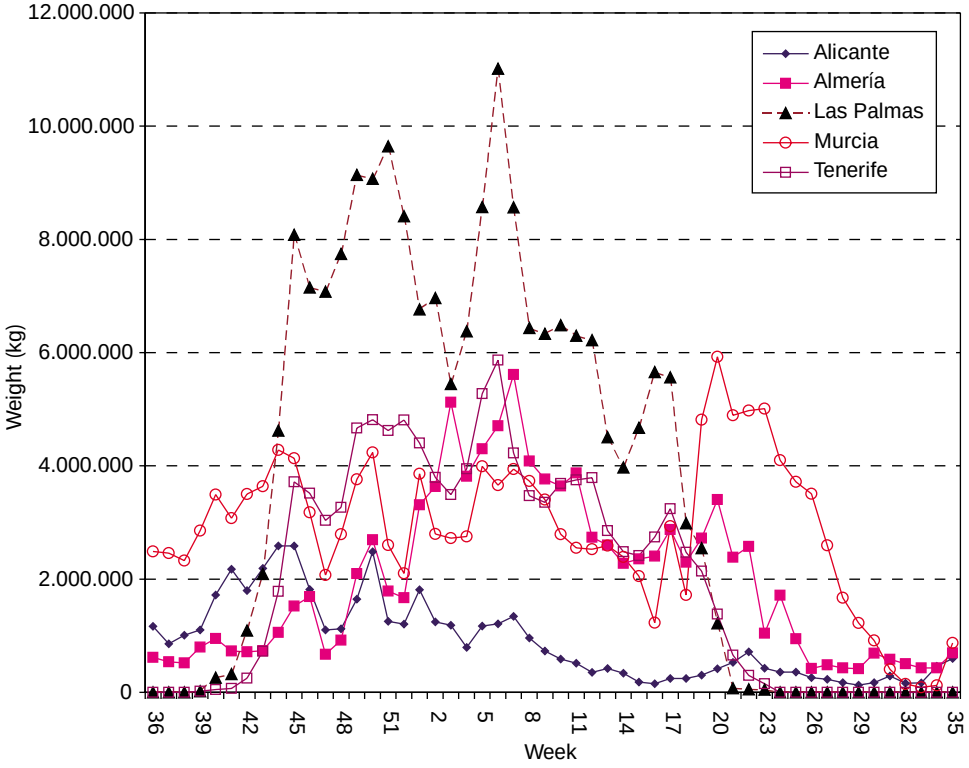

Figure 3. Evolution of Spanish tomato exports by FEPEX associations, 1999/2000 season.

The UK has the most stable demand during the season. The Netherlands import tomatoes in winter, when this country has very little of its own production. Germany buys tomatoes between weeks 36 and 46 and weeks 18 to the 34. France also has a stable demand between weeks 12 and 26.

The ranking of the importing countries changes over the export season. At the start and towards the end of the season the main importer is Germany. During the central months of autumn and winter, the purchaser number one is the Netherlands. The UK remains in second place during the whole season, being behind Germany or the Netherlands.

Analysing the weekly distribution of provincial exports (Fig. 3), Las Palmas and Tenerife have their maximums during the final weeks of the year and the beginning of February. Almería concentrates its tomato exports in the months of January and February. Murcia has a season more stable than other provinces, where the more important exports occur between week 20 and 26. Alicante exports in the autumn and winter and reduces its exports in the spring.

Table 3 shows the correlations indices between the exporting provinces. The Canary Islands provinces have similar durations (r = 0.98), as well as these with total Spanish exports. Alicante's season is more similar

Table 3. Correlation coefficients for Spanish tomato exports (kg). FEPEX associations. 1999/2000 Season

	Alicante	**Almería**	**Las Palmas**	**Murcia**	**Tenerife**	**Total**
Alicante		0.06	0.41	0.40	0.33	0.47
Almería	0.06		0.65	0.39	0.74	0.79
Palmas	0.41	0.65		0.21	0.98	0.95
Murcia	0.40	0.39	0.21		0.24	0.46
Tenerife	0.33	0.74	0.98	0.24		0.96
Total	0.47	0.79	0.95	0.46	0.96	

Source: FEPEX data.

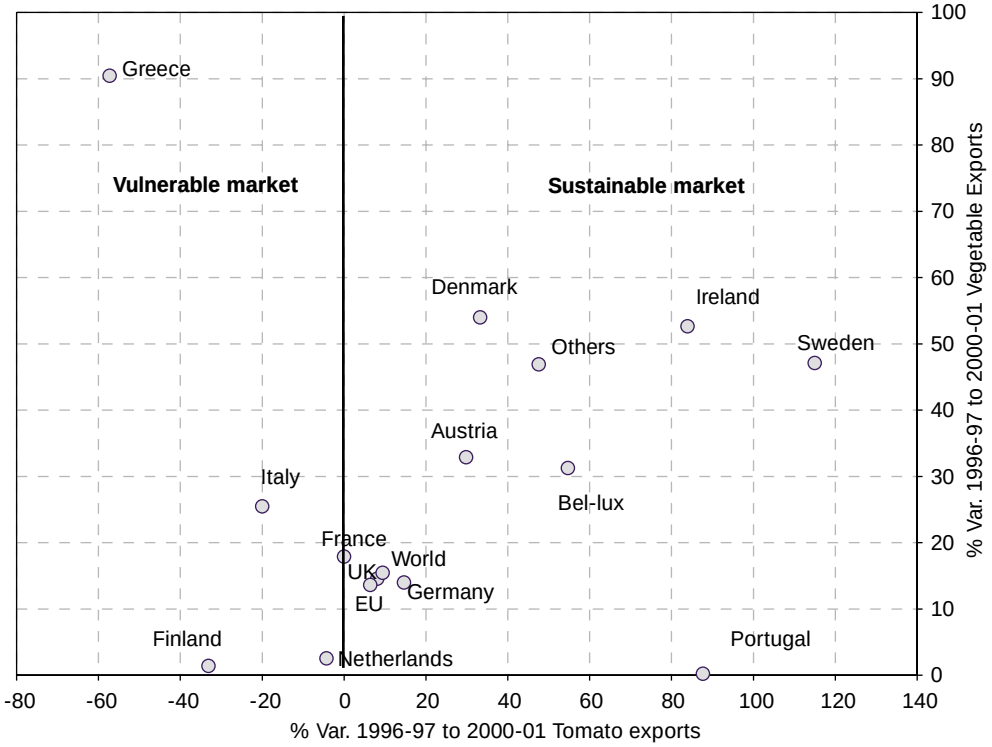

Figure 4. Strategic analysis of Spanish tomato exports (ACAM). Average variations, 1996-97 to 2000-01.

to that of Murcia, than that of Almería's. The duration in Almería is similar to the exports from Tenerife and Las Palmas (r = 0.74 and r = 0.65 respectively).

Strategic analysis of the destinations of the Spanish tomato exports

We used the Agro-food Consumption Analysis Method (ACAM) to analyse the main destinations of Spanish tomato exports.

Figure 4 shows that the four quadrants are reduced to two: a vulnerable and a sustainable market. The better-positioned countries are Denmark, Sweden, Ireland, Belgium, Luxembourg and Austria. This situation is logical, if we consider that these countries only take a small amount of Spanish tomato exports, their variations tend to be bigger. Germany, the main destination of Spanish tomato exports, has a bigger margin of growth than the UK. On the opposite side we find France and the Netherlands in a vulnerable zone.

Analysis of competition among tomato exporters to the EU

The intensity of the tomato commerce —commercial interchanges between countries— in the EU changes through the year (Table 4). Months with the greatest commercial intensity (highest competition) are December, January, February and March. There are three competing countries: Spain, the Netherlands[6] and Morocco. Spain, except in July, August and September, controls the EU tomato trade. In summer, the Netherlands is the most important tomato exporter. Between December and February, 24% of EU tomato imports come from countries outside the EU. Morocco is the second most important exporter to the EU between December and February.

Months with the lowest competition in the EU are: April, May, June, July, August and September.

Spain (44%), the Netherlands (30%) and Morocco (7.7%) control 82% of tomato imports from the EU; other export countries are: Italy (5.20%), Belgium-Luxembourg (6%) and France (2.7%).

[6] See Wijnands (2001): this author studies the international competitiveness of Holland and Spain exporting greenhouse products (tomatoes, peppers and cucumbers).

Table 4. Monthly tomato imports (t), intra and extra EU. Year 2000

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Total	188,441	204,630	183,458	142,508	165,599	159,608	114,138	116,217	98,515	116,089	146,605	182,643
Intra	157,877	172,568	153,930	129,185	160,739	158,740	113,768	115,567	97,354	109,647	128,294	146,395
Extra	30,564	32,062	29,528	13,323	4,860	868	370	650	1,161	6,442	18,311	36,248

■ Highest competition. □ Normal competition. □ Lowest competition. Source: Eurostat data.

Approximately 90% of the EU tomato imports are from intra-EU trade.

The EU Agrarian Policy forces Morocco to grow tomatoes the first months of the growing season (October to February) so they don't compete with Dutch production (García Álvarez Coque, 2000; p23). This is an important problem for the Spanish export sector. The competition between Spain and Morocco is very intense because they have similar macroclimatic and geographic features (AECI, 1998; p106):

— Their production seasons are similar.

— Their target markets are, at the moment and in the short term, the same: EU countries and central and eastern Europe.

— Their technologies and varieties are similar.

— Commercially both countries try to adapt to demand changes and follow similar guidelines.

The Tables 5 and 6 of intra-industry trade show exporter countries to the EU and importer countries from the EU.

Tomato exporters to the EU are (in t): Spain (799,300), The Netherlands (546,396), Morocco (140,785), Italy (95,320), Belgium-Luxembourg (108,996) and France (49.133). At present Spain exports most of its tomatoes to four countries (72%): the Netherlands, the UK, Germany and France. The most important destinations for Dutch tomato exports are Germany (53%), the UK (17%) and Sweden (10%). Belgium and Luxembourg export mainly to Germany and France. Traditionally, the Netherlands have dominated EU tomato exports. However, the increase in Spanish tomato exports since 1993 has broken the Dutch supremacy (AECI, 1998; p7).

France imports about 96% of the tomato exports from Morocco. The Moroccan authorities due to pro-

Table 5. Amount of EU tomato imports. Columns = exporters, rows = importers. Year 2000

Countries	France		Netherlands		Germany		Italy		UK		Belgium		Sweden		Austria		Others		Total	
	%	t	%	t	%	t	%	t	%	t	%	t	%	t	%	t	%	t	%	t
Spain	43.9	162,698	85.9	198,294	29.0	181,283	50.1	23,418	58.5	168,161	28.0	15,228	8.4	5,179	27.4	12,524	33.9	32,515	43.9	799,300
Netherl.	5.9	21,939	0.0	0	47.2	295,035	29.2	13,661	33.2	95,568	42.2	22,917	86.1	53,339	17.3	7,902	37.6	36,035	30.0	546,396
Morocco	37.2	137,585	0.1	330	0.0	277	0.3	145	0.1	177	1.1	583	0.4	242	0.0	0	1.6	1,536	7.7	140,875
Belgium	6.3	23,463	4.4	10,130	9.9	61,699	3.7	1,718	2.5	7,290	0.0	0	0.1	83	0.9	422	4.4	4,191	6.0	108,996
Italy	3.4	12,540	0.7	1,519	10.0	62,290	0.0	0	1.0	2,897	3.9	2,128	0.1	78	24.5	11,208	2.8	2,660	5.2	95,320
France	0.0	0	1.8	4,078	3.3	20,836	9.9	4,636	1.5	4,179	18.6	10,086	0.4	223	2.8	1,286	4.0	3,809	2.7	49,133
Germany	0.7	2,593	3.3	7,562	0.0	0	6.1	2,872	0.3	773	1.2	676	0.0	0	13.9	6,345	5.1	4,854	1.4	25,675
Israel	1.1	4,112	1.9	4,341	0.0	57	0.2	110	1.2	3,343	4.5	2,459	0.0	25	0.1	64	0.0	26	0.8	14,537
Turkey	0.5	1,752	0.3	664	0.4	2,284	0.1	40	0.1	201	0.0	13	0.0	25	12.8	5,864	1.5	1,405	0.7	12,248
UK	0.2	605	0.2	377	0.0	39	0.0	1	0.0	0	0.0	21	0.0	0	0.0	0	7.1	6,803	0.4	7,846
Others	0.8	3,035	1.5	3,448	0.3	1,922	0.3	163	1.8	5,047	0.5	250	4.4	2,756	0.2	110	2.2	1,394	1.0	18,125
Intra-EU	60.5	224,128	96.5	222,600	99.5	622,479	99.1	46,328	98.6	283,670	94.0	51,122	99.5	61,639	86.9	39,726	96.3	92,372	90.4	1,644.064
Extra-EU	39.5	146,194	3.3	7,551	0.5	3,242	0.9	436	1.4	3,966	6.0	3,239	0.5	311	13.1	5,999	3.6	3,449	9.6	174,387
Total	100	370,322	100	230,743	100	625,722	100	46,764	100	287,636	100	54,361	100	61,950	100	45,725	100	95,228	100	1,818.451
Total Imports	20		13		34		3		16		3		3		3		5		100	

Source: Eurostat data.

Table 6. Incomes of EU tomato imports. Columns = exporters; rows = importers. Year 2000

Countries	France		Netherlands		Germany		Italy		UK		Belgium		Sweden		Austria		Others		Total	
	%	(×1000 €)	%	(×1000 €)	%	(×1000 €)	%	(×1000 €)	%	(×1000 €)	%	(×1000 €)	%	(×1000 €)	%	(×1000 €)	%	(×1000 €)	%	(×1000 €)
Spain	41.5	130,518	86.6	217,332	22.9	157,483	47.2	21,623	57.1	232,103	27.9	16,805	7.5	6,068	25.5	11,981	27.6	28,672	41.2	822,585
Netherl.	6.6	20,700	0.0	0	51.6	354,866	32.3	14,798	33.5	136,241	43.8	26,372	86.8	70,114	16.2	7,601	44.6	46,260	33.9	676,952
Morocco	7.3	22,890	3.8	9,530	10.0	68,580	3.8	1,763	2.7	11,054	0.0	0	0.2	191	1.2	563	4.9	5,076	6.0	119,647
Belgium	36.4	114,473	0.1	243	0.0	166	0.3	151	0.0	123	0.6	363	0.3	220	0.0	0	1.4	1,483	5.9	117,222
Italy	3.3	10,377	0.1	376	11.5	78,858	0.0	0	1.4	5,762	3.3	1,978	0.2	173	26.3	12,366	3.4	3,579	5.7	113,469
France	0.0	0	1.7	4,337	3.5	23,899	8.8	4,030	1.7	6,865	16.8	10,147	0.5	382	3.0	1,424	4.4	4,555	2.8	55,639
Germany	1.0	3,159	3.2	7,932	0.0	0	6.6	3,016	0.4	1,425	1.2	715	0.0	0	12.8	6,039	3.1	3,265	1.3	25,551
Israel	1.9	5,846	2.5	6,351	0.0	95	0.5	218	1.2	4,775	5.8	3,466	0.1	49	0.2	111	0.0	38	1.0	20,949
Turkey	0.6	1,930	0.3	652	0.3	2,238	0.1	42	0.1	282	0.0	14	0.0	28	14.6	6,849	1.0	1,027	0.7	13,062
UK	0.3	988	0.1	321	0.0	78	0.0	0	0.0	0	0.1	75	0.0	0	0.0	0	8.2	8,561	0.5	10,023
Others	1.2	3,786	1.5	3,743	0.3	1,815	0.4	190	2.0	8,009	0.5	299	4.4	3,534	0.2	89	1.2	583	1.1	22,048
Intra-EU	60.1	189,012	95.9	240,520	99.6	685,023	98.7	45,247	98.6	401,082	93.3	56,192	99.6	80,447	85.1	40,000	97.1	100,713	92.0	1,838,236
Extra-EU	39.9	125,654	3.9	9,852	0.4	3,053	1.3	584	1.4	5,558	6.7	4,041	0.4	312	14.9	7,025	2.7	2,832	8.0	158,911
Total	100	314,667	100	250,817	100	688,078	100	45,831	100	406,639	100	60,234	100	80,759	100	47,023	100	103,099	100	1,997,147
Total Imports	16	130,518	13	217,332	34	157,483	2	21,623	20	232,103	3	16,805	4	6,068	2	11,981	5	28,672	100	822,585

Source: Eurostat data.

tectionist problems in the UE, improved their competitiveness through reductions of the type of change, currency devaluations (dirham), and using new technologies (AECI, 1998; p45).

The most important EU tomato importers are (in t): Germany (625,722), France (370,322), the UK (287,636) and the Netherlands (230,743). These four countries buy about 83% of all EU tomato imports. Holland and Spain supply the German market. Morocco and Spain supply France. The UK buys in Spain and the Netherlands while the Netherlands buy from Spain but also reexports to other countries in Europe and in the Americas.

Table 7 shows (Gini index) that Morocco is the country with more concentrated exports (mainly to France). This situation could change with new EU negotiations. The EU members still have to accept it, but there is a new quota with a base of 175,000 t, and an additional 15,000 t quota that will initially apply in 2003/2004. It will be increased annually to 45,000 t or 25,000 t in 2006/2007. The increase in additional quota will be variable, depending on whether there is penalty for exporting more than is allowed. By 2007, without penalty, Morocco would have a total quota of 220,000 t, or 200,000 t with a penalty[7].

Table 7. Gini index for the most important tomato exporters to the EU in 2000

Country	t	€
Spain	0.54	0.58
Netherlands	0.70	0.71
Morocco	0.99	0.99
Belgium	0.79	0.78

Source: Eurostat data.

The rise in Moroccan exports will cause Spanish exports to be diversified towards new countries. It is also necessary to take into account the need to help less developed Mediterranean countries (Jordán Galduf, 1996; p170).

Another comparative advantage is relative to production costs. The Moroccan total cost in France is 10% and 27% under that of the Iberian Peninsula and the Canary Islands total cost respectively. When transport is taken into account the advantage in total costs diminishes[8] although this cost is no different in relation to the Canary Islands (AECI, 1998; p108). Nevertheless, Morocco has a comparative disadvantage due to the seasonality of its exports that do not assure a return. Most of the transport is by truck, using Algeciras as transit point and Perpignan as entrance to France.

[7] The actual situation changes: for the 2002/2003 season the quota was 168,757 t/year.

[8] See Calatrava and Mafhoud (2001): Acording to these authors, the cost of Moroccan and Spanish tomatoes in the market at Rungis, France, is similar.

Table 8. Revealed comparative advantage index (RCAI) and the intra-industry trade index (IIT[9]). EU countries

	RCAI (t)		IIT (t)		RCAI (€)		ITT (€)	
	2000	**1995**	**2000**	**1995**	**2000**	**1995**	**2000**	**1995**
France	–77	–73	23	27	–69	–68	31	32
Belgium-Lux	30	67	70	33	29	62	71	38
Netherlands	41	34	59	66	45	35	55	65
Germany	–92	–97	9	3	–92	–97	8	3
Italy	34	45	66	55	–71	47	29	53
UK	–95	–94	5	6	–64	–94	36	6
Ireland	–92	–91	8	9	–99	–92	1	8
Denmark	–79	–73	21	27	–72	–71	28	29
Greece	–36	–51	64	49	–84	–64	16	36
Portugal	–67	–33	33	67	22	–27	78	73
Spain	98	96	2	4	97	97	3	3
Sweden	–99	–99	1	1	–94	–99	6	1
Finland	–98	–98	2	2	–98	–98	2	2
Austria	–95	–97	5	3	–96	–97	4	3
EU	–5	–4	95	96	–4	–4	96	96

Source: Eurostat data.

The Gini indexes of Belgium-Luxembourg and Holland also have high values (its exports are absorbed by Germany). Spain has greater export diversification, that is an advantage from the point of view on risk with respect to other competing countries.

Analysis of competitiveness in EU countries

Table 8 shows the value of the RCAI and IIT indices in 1995 and 2000 for the EU countries. In general, the EU has a comparative disadvantage represented by values of the RCAI of –5% in weight and –4% in monetary value.

Sweden, Finland, UK, Austria, Germany and Ireland have the greater comparative disadvantage in physical values. When monetary values are considered the results are similar, with the exception of the UK, its RCAI decreased from –94 to –64. Countries with the greater comparative advantage are Spain, the Netherlands, Italy and Belgium-Luxembourg.

Analysing the intra-industry trade index (CII), in physical and monetary value, we can consider EU trade like intra-industry trade.

Among countries, taking as a reference the physical and monetary values of the CII, there is clear differentiation: Sweden, Spain, Finland, UK, Austria, Germany and Ireland have inter-industry trade while Italy, the Netherlands and Greece have intra-industry trade.

Comparing 1995 and 2000 (Table 8), there is no clear trend towards intra-industry trade in Spain. This is desirable to increase EU competitiveness. For example, Spain maintains its value at 3%. It is important to complement the analysis with the vertical and horizontal intra-industry trade index (Table 9).The

Table 9. Vertical intra-industry trade index

Country	2000	1995
Spain	1.06	1.72
Netherlands	1.18	1.02
UK	1.30	0.92
France	1.23	1.28
Belgium-Lux	0.27	0.83
Germany	1.23	1.01
Italy	0.79	1.05
Others	1.18	0.90

Source: Eurostat data.

[9] The table shows the relationship between both indices: the sum of both in absolute value is always equal to 100. Nevertheless, two countries can have an equal IIT and a RCAI with a different sign: the RCAI relates to the sign of the trade balance, that is, our competitiveness measured like an index of penetration into the market. In this work the IIT is a measurement of commercial intensity (for example, the capacity to resell the production of other countries).

Table 10. Augmented Dickey-Fuller test (ADF). Lagged differences = 1

Variable	(1)	(2)	(3)	▲(1)	▲(2)	▲(3)
XAL_t	–0.600	–1.315	–1.197	–4.210	–3.893	–3.679
XMA_t	–2.967	–1.904	–0.750	–4.745	–4.788	–4.444
PAL_t	–1.472	–1.654	–1.577	–4.651	–3.276	–3.207
XFE_t	–0.426	–1.718	–0.087	–4.424	3.638	–3.341
PX_t	–1.754	–0.150	–0.321	–5.252	4.490	–4.812

(1) Intercept and trend. Mackinnon value (5%) = 3.561; (2) Intercept. Mackinnon value (5%) = 2.959; (3) None. Mackinnon value (5%) = 1.951. ▲ = 1st difference.

Netherlands, France, Germany and UK have a vertical intra-industry trade characterized by higher quality standards. The Netherlands has constantly added value to its tomato exports, improving its vertical index. Spain sells standard (indifferent) tomatoes and it is a commercial disadvantage.

Tomato export function for the social economy companies of the province of Almería

In this section we analyse the most important factors, which explain the international tomato trade in the Almerian social economy companies[10] that are characterized by selling their tomatoes at their destination, which is a different system to the auction, which sells at origin.

Chebil and Briz (2000) studied export functions by using regressors of Spanish vegetable exports, variables of competitiveness like the Spanish price in comparison with the EU price, as well as variables of rent and a variable of domestic demand (production + exports – imports). Tambi (1999) took one variable of total production in its export function of cacao and coffee and used, in addition, two variables of domestic and export prices; this made an additional variable of the relationship between both avoiding multi-colineality. Murúa and Araiztegui (1994) preferred to use production variation like an exogenous variable in the model jointly with the domestic and international prices (in this case for almonds).

In our function, we used the method of Engle and Granger (1987) to study the cointegration between variables. The variables used are:

XAL_t = weekly Almerían exports of social economy companies for the season 1998/99.

XMA_t = weekly Moroccan exports for the season 1998/99.

XFE_t = exports of the rest FEPEX associations (Murcia, Alicante, Palmas and Tenerife) for the 1998/99 season.

PX_t = the price at origin of the tomato crop. These prices are the weekly average at auction[11] (1998/99 season).

PAL_t = the weekly Almerían tomato production of the social economy companies (1998/99 season).

The study included available[12] data from week 41 of 1998 to week 20 of 1999. We worked with data in logarithms[13]. The estimated coefficients were elasticises. The proposed model is:

$$XAL_t = a_1 + b_1\, XMA_t + b_2\, XFE_t + b_3\, PX_t + b_4\, PAL_t + e_t$$

To study the collinearity problem[14] we calculated the matrix of correlations between the dependent variables (see Table 11). According to the determinant of

[10] Cooperatives and another type of companies, similar to cooperatives, called "Agrarian Societies of Transformation".

[11] The cooperatives pay the grower at least the price fixed as a minimum for the auction. If it was not that way, the growers would prefer to sell their product at auctions. Because of this fact, the price of reference is valid as well for organizations of social economy (operators at the destination) as for auctions (markets at the origin). The export price of the social economy companies is closely related to the price at the origin. The cost for handling, transport and commission have to be added. For a more detailed explanation see Escánez (2000). A description of the behavior of vegetables prices and the formation of commercial margins can be found in Martínez-Carrasco (2001).

[12] The series for Morocco was from the Ministry of Moroccan Agriculture web site. Nevertheless this series was eliminated from the web because it was used for the control of Moroccan quotas to the EU by Spanish associations of export companies.

[13] A simple way to reduce heteroskedasticity is to use a log transformation (Pulido, 1989). We have determined the number of unitary roots using the ADF test (see Table 10).

[14] If collinearity makes a bigger variance in the estimators the significant variables are rejected.

Table 11. Correlation matrix between dependent variables

	PAL_t	PX_t	XFE_t	XMA_t
PAL_t		–0.604	0.395	–0.060
PX_t	–0.604		–0.299	0.057
XFE_t	0.395	–0.299		0.692
XMA_t	–0.060	0.057	0.692	

Source: FEPEX and COEXPHAL data.

the matrix[15] (0.20) there is moderate collinearity. The greater problem is in the variables XFE_t and XMA_t. To study their effects we estimated two additional models (2 and 3 in Table 12):

1. $XAL_t = f(PX_t, PAL_t, XFE_t)$.
2. $XAL_t = f(PX_t, PAL_t, XMA_t)$.

The collinearity decreased in both models (determinant of 0.53 and 0.63 respectively). It was only significant for the variables PXt, and PALt in both functions[16]. Homocedasticity and normality were analysed by the White (1980) and Jarque Bera test (1980) respectively. The results were not significant.

Finally, we used model 4 for the long term (Table 12) to prove the vector correction error (VEC). The analysis of the residuals by the ADF test showed the existence of a long-term relationship only when the test was applied without trend.

The coefficient of the VEC was significant and very near to one (Table 13). It was negative. This indicates that every week is corrected by 99% of the deviations from the previous period. This reinforces the intensity of cointegration between the variables.

The price elasticity was below one, therefore price changes will produce a less than proportional increase in Almerían tomato exports (lack of demand elasticity). This corroborates that price has less importance in the relationships between supply and demand: there are other important factors like quality and service.

The model, in logarithms, supposes the estimation of a Cobb-Douglas function, that implies constant elasticises, it could be a simplification of reality. Therefore, as a complement, we estimated model 2 of a linear form[17] (see Tables 14, 15 and 16) and obtained

Table 12. Long-run logarithmic functions[19]. Dependent variable = XAL_t. Ordinary least squares

	Model 1	Model 2	Model 3	Model 4
Intercept	5.256	1.497	1.963	2.621
	(2.687)	(3.294)	(3.413)	(2.097)
PX_t	–0.276	–0.238	–0.329	–0.266
	(–2.260)	(–3.645)	(–3.757)	(–2.559)
PAL_t	0.894	0.811	0.829	0.845
	(13.411)	(17.832)	(18.032)	(15.466)
XFE_t	–0.257		–0.094	
	(–1.650)		(–1.404)	
XMA_t	0.054	–0.011		
	(1.102)	(–0.605)		
Ajusted R^2	0.971	0.968	0.970	0.966
Durbin Watson	2.009	1.958	2.075	1.772
F-statistic	230.980	333.624	352.391	443.124
ADF (1)	–3.420	3.114	3.121	–3.177
ADF (2)	–3.365	3.081	3.051	–3.128
ADF (3)	–3.498	3.197	3.224	–3.196
Jarque-Bera	1.301	1.492	1.432	5.006
White Test	9.682	10.459	10.058	4.485

In brackets t-ratio. ADF (1) Augmented Dickey Fuller test with intercept and trend. ADF (2) Augmented Dickey Fuller test with intercept. ADF (3) Augmented Dickey Fuller test without intercept and trend.

elasticises for each week[18]. This showed that 96% of tomato exports had an elasticity-price of less than one, this is 91% of the production elasticity. These results are similar to those obtained by the logarithmic model.

It is also possible to observe that Moroccan tomato exports do not seem to influence Almerian exports. This could be due to the EU limiting exports from Morocco (168,757 t per year) (for the 1998/99 season, between October and March, the tomato quota was 150,676 t).

The exports of the other FEPEX associations are a non-significant variable. This is a meaningful behaviour if we consider that in Spain there is a certain market distribution and it is therefore a non-substitute

[15] The determinant is 1 in orthogonal vectors.

[16] The variable XMA + XFE was non-significant.

[17] Cases *et al.* (1993) made a similar study.

[18] $\varepsilon_{PX} = \frac{XAL_t}{PX_t} \cdot \frac{PX}{XAL_t}$, the estimation is similar for the elasticity of production (ε_{PAL}).

[19] The cointegration in model 1 means that the estimation is very strong (the estimators are non-normal), therefore it is not possible to decide about the inclusion of variables through the t-student contrast test. However, Banerjee *et. al.* (1986) showed that error in finite pattern is inversely linked with the R^2 of the static regression of cointegration.

Table 13. Exportation function[20]. Dependent variable = ▲XAL_t. Non-linear least squares

	Coefficient	
Intercept	148.168	(2.752)
▲PX_t	–0.289	(–2.348)
▲PAL_t	0.783	(5.932)
VEC	–0.997	(–5.030)
XAL_{t-1}	*1	
PX_{t-1}	–0.349	(3.427)
PAL_{t-1}	0.806	(16.786)
Ajusted R^2	0.790	
Durbin Watson	2.006	
F-statistic	25.078	
Jarque-Bera	0.837	
White test	0.553	

In brackets t-ratio. VEC: error correction. * Restricted coefficient.

competition (Pérez, 2001). In the same way, Almerian production changes will induce a less than proportional increase in exports: we find preferences for domestic markets when there is an unexpected overproduction.

Conclusions

The most characteristic feature of Spanish tomato exports is the export market orientation. At the moment,

Table 14. Lineal model. Dependent variable = XAL_t. Ordinary least squares

	Coefficient	
Intercept	1.015.171	(2.403)
PX_t	–11.772	(–2.330)
PAL_t	0.326	(12.950)
Ajusted R^2	0.945	
Durbin Watson	2.150	
F-statistic	277.650	
ADF (1)	3.755	
ADF (2)	3.670	
ADF (3)	3.847	
Jarque-Bera	0.078	
White test	11.822	

In brackets t-ratio. ADF (1) Augmented Dickey Fuller test with intercept and trend. ADF (2) Augmented Dickey Fuller test with intercept. ADF (3) Augmented Dickey Fuller test without intercept and trend.

Table 15. Pattern of price elasticity. Linear model

Week	XAL_t (kg)	PX_t (€/100 kg)	ε_{PX}
41	621,390	90	–1.70
44	690,058	69	–1.17
45	1,011,072	57	–0.66
47	1,323,693	51	–0.45
20	3,073,536	35	–0.13
6	4,508,542	30	–0.08
8	4,210,732	25	–0.07
Total average	2,205,575	51	–0.27

Almería, Murcia, Las Palmas and Tenerife are the main Spanish export areas, being Almería the province with the highest growth rates in tomato exports.

The Spanish provinces compete with each other during several months of the year (principally in the winter); however, this is not quite true if we take the different destinations of their exports into account.

Germany is the principal destination of Spanish tomato exports, followed by the Netherlands, UK and France. One of the most important features of the Spanish tomato exports is their concentration in markets of greater purchasing power.

The German imports have a considerable potential for growth, being smaller in the case of the UK. On the other hand, both France and the Netherlands can be considered to be vulnerable markets.

The intensity of competition in the EU market varies throughout the year, reaching its peak in December, January, February and March: Spain should extend the tomato production cycle to 12 months.

Three countries compete in the EU tomato market: Spain, the Netherlands and Morocco. Spain is the most

Table 16. Pattern of production elasticity. Linear model

Week	XAL_t (kg)	PAL_t (kg)	ε_{PAL}
10	4,872,916	13,281,331	0.89
13	4,043,809	12,707,863	1.02
7	4,307,220	11,490,142	0.87
14	4,023,963	10,624,293	0.86
6	4,508,542	10,509,476	0.76
16	3,372,784	8,591,219	0.83
41	621,390	1,260,570	0.66
Total average	2,205,575	7,651,577	0.85

[20] The weekly data and the local frame of this study make it difficult find an income indicator and other variables.

important exporter throughout all months of the year except for July, August and September.

Morocco has concentrated its tomato exports in France. Morocco has considerable potential to expand into other European countries due to institutional factors and lower production costs; for example, the preferential agreement with EU, and the higher production cost in Spain give a positive gap for Morocco in total cost of production.

An increase in Moroccan tomato exports will damage the Almerian tomato export sector in the short-run. Almería is the most important Spanish exporter to France, which is also the principal destination for Moroccan tomatoes.

In the future other Mediterranean Sea countries such as Tunisia, Turkey and Egypt may become suppliers to the EU.

Spanish tomato exports are more diversified than tomato exports from other countries, which is clearly an advantage from the point of view on risk.

Generally, the tomato sector in the EU has a comparative disadvantage. Spain, as well as countries like the Netherlands, Italy and Belgium, has a greater comparative advantage than Sweden, Finland, UK, Austria, Germany and Ireland.

In a way the EU tomato trade has an intra-industry character. However, in this respect there are important differences among individual countries: Sweden, Spain, Finland, the UK, Austria, Germany and Ireland have an inter-industry trade whereas Italy, France, The Netherlands and Greece have an intra-industry trade.

The Netherlands and France show the highest intra-industry trade in the EU. These countries have a tendency towards a type of vertical trade, characterized by high quality standards. The Netherlands has continued to incorporate added value to their own exports, whereas Spain sells a non-differentiated standard tomato.

We have estimated an export function for the Almerían companies, applying co-integration methodology. We show how the prices at the origin have influence on export quantities, although the elasticity is less than one. This means that the changes in the prices at origin do not cause a proportional variation in provincial exports. We consider that the variable «price» is losing weight in connection with other parameters like quality and service.

We found that Moroccan tomato exports did not influence Almerían tomato exports during the 1998-1999 season. This was mainly due to the quota allowed to Morocco by the EU (156,676 t between October and May) left an acceptable volume for the market. This situation may change with the newly approved higher quota of 220,000 t/year.

With respect to the production elasticity, the difficulty in exports clearly increases when unexpected production peaks occur.

In summary, the study of tomato exports from other countries is very important for the Spanish tomato production sector. According to Pérez Mesa (2002), a collapse in the tomato sales would affect 92% of the social economy companies in Almería and about 30% of their turnover on average.

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