

The Portuguese tomato processing sector: market structure, concentration and firm behaviour

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1. Introduction

This paper examines the strategic behaviour of processed tomato industry in Portugal in the last two decades. The structure of the paper follows. Firstly, we outline both some theoretical considerations and a framework that bears upon the problem. Secondly, we summarize the evolution of the processed tomato sector to demonstrate the crucial importance of the tomato sector in the framework of the Portuguese agri-food industry and the role played by the world tomato situation in the Portuguese tomato sector. Finally, we intend to focus on the industry dynamics, the strategic behaviour and the structural changes that took place in the agri-food sector in Portugal during a period of twenty years under the *Structure - Conduct - Performance* (SCP).

The traditional approach followed by Industrial Organization (IO) is known as the SCP paradigm. Economists, as Bain (1951), have examined performance differences among

Abstract

The purpose of this paper is to study the evolution and the structure of the Portuguese tomato processing industry. We intend to focus on the dynamics, the strategic behaviour and the structural changes that occurred in the Portuguese tomato industry throughout the period 1990-2005. An overview of the world and national production and trade in the last two decades is followed by a descriptive analysis of the market structure and development. This paper examines the concentration effect on the firms' performance and strategy. The result indicates that, from a quantitative point of view, the market concentration in tomato processing industry is moderate but the concentration level has increased over the last few years. In contrast, the seller concentration has always been higher. The CR4 and HHI concentration indices measure values between 75% and 91% and between 0.20 and 0.30 respectively. The market power measured by approximation to the Lerner index indicates negative values resulting from the negative net income. No linkage was found between the market share and R&D expenses. Marketing costs are concentrated in the four biggest companies but the concentration increase did not change the evolution of marketing costs and profits. The use of market share in advertising or in research and development was not observed.

Key-Words: Tomato processing industry; concentration; firm strategy; market power; competitiveness.

Résumé

Ce document étudie l'évolution et la structure de l'industrie portugaise de transformation de la tomate. Le but ultime est de focaliser l'attention sur les dynamiques, le comportement stratégique et les changements structurels de l'industrie portugaise de transformation de la tomate entre 1990 et 2005. Après une description générale de la production et du commerce à l'échelle mondiale et nationale de ces vingt dernières années, il y a une analyse descriptive de la structure et du développement du marché portugais. Cet article examine l'effet de la concentration sur la performance et sur les stratégies des entreprises. D'un point de vue quantitatif, la concentration du marché dans l'industrie de transformation de la tomate est modérée même si le niveau de concentration a augmenté ces dernières années. Par contre, la concentration des vendeurs a toujours été plus élevée. Les indices de concentration CR4 et HHI mesurent des valeurs entre 75% et 91% et entre 0,20 et 0,30 respectivement. Le pouvoir de marché, mesuré par approximation de l'indice de Lerner, montre des valeurs négatives dérivant du revenu net négatif. Aucune relation n'a été établie entre la part de marché et les dépenses de recherche-développement. Les frais de commercialisation se concentrent dans les quatre plus grandes entreprises mais l'augmentation de la concentration n'a pas changé l'évolution des frais et des profits de commercialisation. L'emploi de la part de marché dans la promotion ou dans le recherche-développement n'a pas été investigué.

Mots-clés: Industrie de transformation de la tomate; concentration; stratégie d'entreprise; pouvoir de marché; concurrence.

private manufacturing industries based on the SCP paradigm and assume that there is a stable, causal relationship between the structure of an industry, firm conduct and market performance (Church and Ware, 2000: 425). The SCP model predicts that the structure of an industry indirectly affects its performance through its impact on the market conduct. Since conduct is difficult to observe directly, the focus is on identifying market structure elements such as firms' size (market concentration of sellers) and testing their impact on profitability, market power¹ and strategic behaviour (Collins and Preston, 1969; Weiss, 1974; Bradburd and Over, 1980). Most of these studies have found out that industry profits are higher in more concentrated markets. The SCP paradigm predicts that if there are only a few firms in a market and if there are entry barriers, then these firms may collude to raise the product price and their profits. However, in the last decade, a number of studies have demonstrat-

ed that correlations between profitability and concentration are spurious.

Recent studies suggest that the relationship between profitability and concentration is discontinuous and found criti-

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¹ Market power refers to the ability of a firm (or group of firms) to raise profitability and maintain price above the marginal cost. The exercise of market power leads to reduced output and loss of economic welfare.

cal level of concentration where changes in concentration above or below this had little effect on the structure-performance. A positive relationship between advertising intensity, research and development (R&D) and increases in profitability has been found. Estimates of the effects of entry barriers (measures of entry barriers are based on advertising or research and development) on profitability are more robust and significant than for concentration (Church and Ware, 2000: 431). Studies on the SCP have developed and the differences on results showed the need to introduce other explanatory variables. A variety of additional variables determining profitability is tested to explain profit differences across firms and industries such as product differentiation, foreign trade, and growth rate of market demand. To describe the structure of an industry we need a measurement tool that takes into account "...both the number and the size distribution of firms in a market, yet presents the result in a form simple enough that it is easy to interpret" (Caves, 1992: 8).

Two measures of seller concentration are the most widely used in SCP: the Four-Firm concentration ratio (CR4) and the Herfindahl-Hirschman Index (HHI). The CR4, which consists of the market share, as a percentage, of the four largest firms in the industry and changes in CR4 ratios are widely used to summarise indicators of structural change. The HHI is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. It is defined as the sum of the squares of the market shares of each individual firm ($H = \sum_{i=1}^n S_i^2$, where S_i is the market share of firm i in the market, and n is the number of firms). Decreases in the HHI index generally indicate a loss of pricing power and an increase in competition, whereas increases imply the opposite. A HHI < 0.1 indicates an unconcentrated index, an index between 0.1 and 0.18 indicates moderate concentration. A HHI index above 0.18 indicates high concentration. The CR4, "does not adjust as the Herfindahl-Hirschman Index does for variation in firm size" (Church and Ware, 2000: 429). The HHI reflects a larger variation in relative firm size even though the number of firms is greater (Church and Ware, 2000).

To measure the profitability we shall apply the Sales and Equity Capital Profitability. To measure the market power an approximation to the Lerner index will be applied. The Lerner index facing by firm i , can be defined as $Li = (Pi - MCi)/Pi$, where P is the Price and MC the firm's marginal cost, and $P-MC$ is the firm's profit margin. When $P=MC$, the Lerner Index is zero and the firm has no market power. A Lerner Index closer to 1 indicates relatively weak price competition and the firm has market power. Nevertheless, since accounting data on marginal cost are not usually available, there are several approximations for the Lerner Index. An alternative is to measure the market power through the price-cost margin [$PCM = (Sales Revenue - Payroll Costs - Cost of Material) / Sales Revenue$] (Church and Ware, 2000, p. 435). If the marginal cost is constant, due to constant returns to scale (technology is characterized

by constant returns to scale), we can multiply both members of the Lerner ratio by Q (quantity or output). We find that $Li = [(P - MC) * Q / (P * Q)] \Leftrightarrow Li = [(P * Q - MC * Q) / (P * Q)] \Leftrightarrow L = [Sales\ revenue - operational\ costs / Sales\ Revenues] \Leftrightarrow Li = [Net\ income / Sales\ Revenues]$. On the other hand, if there are not constant returns to scale (for example, there are significant fixed costs), the Lerner index can be written as $Li = [Net\ income - Variable\ costs / Sales\ Revenues]$ (Cabral, 2000: 28-29). In this paper we assume that the tomato processing industry is characterized by constant returns to scale and we shall apply the approximation of Lerner index = Net income/Sales.

The Lerner index faced by the industry is a weighted average of each firm's Lerner index, and it can be written as: $\sum_{i=1}^n L = Li * Si$, where Si is the market share.

2. The tomato processing industry in Portuguese food industry

The industry of tomato for processing is one of the most important sectors in the Portuguese agri-food industry. In value, the processed tomato industry represents 1.2% of the food and beverage industry and 30.8% of the fruit and vegetables processed sector (average values for the period 1993/2004).

In more recent years, the food and beverage industry has shown stability (annual growth rate of 0.76% between 1993(05) and 2002(04) centred average), and represents about 6% (average of 2001/2003) of Portuguese exports. Exports and imports have grown at the same level (the growth rate of food and beverage in current value (*constant value*) was 6.9% (3.0%) and 6.7% (2.8%) for the exports and imports, respectively between 1993(05) and 2002(04) (centred average). Processed tomato products are the main exports of the fruit and vegetable processing sector (representing 5% of production and exports of food industry, in value) and nearly all the Portuguese production is export-oriented.

The value weight of tomato products in vegetable and fruit processed production has decreased from 33% in 1997 to 25% in 2004. At the same time, the weight of tomato export on the tomato products production and in food and beverage export has decreased from 81% to 75% and from 5.9% to 4.6%, respectively between 1997 and 2004. Despite the importance and the role of the tomato processing sector in domestic and in international agri-food industry, this sector has only an annual growth rate of -0.29% for a weight of 1.23% in the food industry value production.

3. The world tomato processing industry

The production of tomatoes for processing rose from 21,159,000 metric tons in 1989 to 28,457,000 metric tons (MT) of raw product equivalents in 2006 (www.tomatoland.com, 2007). This represents a growth rate of 28% and 38% if we apply the centred average (annual growth rate of 2.7% in centred average). The develop-

ment of the World production is not only due to the production increase of traditional suppliers such as the European Union (EU), the United States of America (USA) and Turkey, but it is also due to the entry of new suppliers such as China. Between 1989 and 1999, China represented around 3% of the world's production, but this value has increased to 10% in 2005. China's annual growth rate between 1989(91) and 2003(05) was about 23% for a weight of 11% (centred average 2003/2005) in the world production, but in 2005/2006 the exports of tomato paste have only progressed by 2%. This is a very poor result for a sector more used to spectacular annual increases in previous years (www.tomatoland.com, 2006). In the EU, it is important to observe the industry's development in some countries such as Italy and Spain: in 2005, Italy accounted for about 17% of the world's production and 55% of the EU's production.

This value remained stable and Italy's relative position in the world between 1989 and 2005 has not changed. Italy, in spite of its highest production, has an annual growth rate of about 3%. Spain is another important producer in the EU, and its relative position has become more and more important in the last few years and it is the EU country with the highest annual growth rate. Between 2003 and 2005 the average production was 2,283 Million MT (23% of EU production), but in the 2006 marketing year, the Spanish production dropped to 1,580 Million MT, due to the effects of the subsidy penalties derived from the overshooting of the national production quota in previous years. Portugal has an annual growth rate of 2.5% for a weight of 10% in the EU production and represents about 3% and 11% of the world and of the European production, respectively. The Portuguese relative position in the world remained stable between 1989 and 2005.

According to the FAO database, the world exports have risen by 174% since 1980 and 82% since 1990 in quantity (annual growth rate of 4.7%, centred average), while in value exports have risen by 229 % and 49% since 1980 and 1990, respectively (annual growth rate of 5.6%) in current values (centred average). Between 2002 and 2004, the tomato paste exports decreased of 16% in quantity and of 35% in value. Despite the price trade decrease of processing tomato, after 2001, we observed a change in the price evolution (Appendix A).

Therefore, concerning the behaviour of countries such as Spain and China (increases in tomato processing may further flood the market and continue to drive prices down), in the last three years (2001 to 2004), the tomato price showed a recuperation while their production dropped. Globalisa-

tion and world legislation have affected not only world production and trade (relation between Italy and China) but also relations between neighbouring countries such as Portugal and Spain. The behaviour (expansive production) of some countries such as Spain, China and Turkey in the early 1990s shows a cyclical movement but the equilibrium between countries is set up in the long term.

The tomato industry and the tomato producers are facing two important issues: the fruit and vegetable (F&V) reform and the Doha Development Agenda (DDA)². In January 2007, the European Commission presented a Proposal for the reform of the fruit and vegetable sector. The reform intends to bring the fruit and vegetable sector closer to the rest of the reformed Common Agricultural Policy (CAP) to improve competitiveness and market orientation³. The fruit and vegetable market will become eligible for entitlements payment under the decoupled aid scheme which applies in other farm sectors. All existing support for processed fruits and vegetables will be decoupled and the national budgetary ceilings for the Single Payment Scheme (SPS) will be increased. The total amount that will be transferred to the Single Payment Scheme is around 800 million Euros. (<http://ec.europa.eu/agriculture>, 11/2007). The budget for producer organizations is currently about 700 million Euros, and it will gradually increase over the years according to the success of producer organizations. Currently, the yearly increase is 50 million Euros (Gain reports, E47023, 3/2007). For tomatoes, Member States will be allowed to apply transitional payments for a four-year transitional period (2008-2011), provided that the coupled proportion of the payment does not exceed 50 percent of the national ceiling. Moreover, the new possibility to produce fruits and vegetables in areas eligible to Single Farm Payments has raised serious concerns about competitiveness for traditional producers.

On the other hand, the "Doha negotiations jeopardise the continuation of both the processing aids and the market withdrawals" (Álvarez-Coque *et al.*, 2007). However, Petit (2006), regarding the effects of Doha Agenda on F&V sector, shows that "results of sectoral models do not indicate major impacts of trade liberalization" (Petit, 2006: 6), and suggests that the economic stakes are not so huge to justify a major political concern. Industrial Associations for tomato processing in Portugal, Spain, Italy and Greece complained about the proposal of the European Commission to modify the aids to the production and sent a letter to the commissioner for Agriculture but, as Álvarez-Coque *et al.* (2007) refer, the farmer's influence in political decisions seems to be weak.

4. The Portuguese tomato for the processing sector

4.1. Production of processing tomatoes

The bulk of the Portuguese tomato crop is produced under irrigation in the "Ribatejo-e-Oeste" region. The planted

² The EU priorities in the DDA are: *market access for industrial services and agricultural goods* that means increase trading opportunities and this objective should be achieved through tariff reduction. The EU is determined to reduce all forms of domestic support, eliminate export subsidies by 2013 and lower tariff for agriculture products imports.

³ The expected reform will have an influence on the "management of crisis", "Strengthening Producer Organizations", "Single Payment Scheme", "trade measures" and "consumption promotion" (Mariann Boel, SPEECH/07/31, EU)

acreage and the production have significantly changed between 1996 and 2005. Since 1999, it has been possible to observe improvements in yields and in production stability as well as in the increased surface by farmer. The replacement of small farms by modern farms with more than 15 ha permits the use of modern technology and irrigation as we referred before. In recent years, we have seen a slow growth of the production and, according to official sources, a decline of total tomato production for processing is expected. In 2004-2005, the production of processing tomato was slightly higher than the level of total tomato production processed by industry, as some of the local production is processed in Spain.

In November 2000, the EU approved changes in the Common Agricultural Policy (CAP) leading to the remuneration of producers through aid plus free price (price is freely negotiated between PO and processors). In 2005, the price paid to the producer was less than the minimum price in 1978 (in current value). Between 2000 and 2005, the producer price decreased by 19.5% (annual growth rate -4.2%).

The Portuguese producers of processing tomatoes have been negative and they argued that, with this system, it can happen the same as in others crops and similarly to what has already happened in other agricultural cultures, with production loss of 50% being impossible to keep the levels of raw material supply and soon the competitiveness of this industry will be threatened. If the supports are attributed based on historical production of the last years, each farmer only has to guarantee that he takes care of the land. The results in other sectors such as cereals (excluding rice) show that the crop land area decreased between 2003 and 2007, 32%, the production decreased of around 9%, but the yields increased of 34% (Eurosat, 2007). These changes are not only due to the CAP reform but also result from the new outlet for cereals production.

The Agro.Ges study about the CAP reform on the tomato processing sector shows that decoupling will have effects on the economic competitiveness of the tomato for processing chain. In the case of no changes in the prices paid to the producer, the cultivated area will decrease as the tax of partial decoupling increases, however, this trend will be less visible if it is connected with the aid in variable value. The cropland will tend to completely disappear in the context of a total decoupling scenario. The trend of production of processing tomato will follow the same trend as the cropland, but it will not be so abrupt due to the increase in productivity.

In global terms, the future profit (global producer's profit) will be higher in the case total decoupling is followed by partial decoupling and the *status quo* will show the lowest future profit. In the future, in all scenarios, the global profit will be higher than the 2005 profit. The bigger the decoupling tax, the higher the income levels. Regarding the farmer's profit, with the exception of the *status quo* scenario, in all the scenarios, the future profit

of the producers that are going to abandon the sector will be higher than the current profit (*enterprise* profit).

For current farmers who will keep on producing in the future, the increase in profit is higher in the partial decoupling than in the *status quo* or in full decoupling. For the current farmers that will stop producing in the future, the future profit will be inferior in the partial decoupling scenario than in the full decoupling which is nevertheless always significantly higher than the current profit.

4.2. Processing tomato for industry

The aim of this section is to analyze the relations between the SCP elements. The attention will be focused on the market structure measured by the concentration ratio. The market power and the firm's performance will be analysed. In this industry, the number of firms decreased from 25 to 11 and these firms have found some stability in the last three years. On table 1, we observe an exponential increase in the raw tomato delivered by firm and this is essentially due to the decrease in the firm number and not to the production increase.

The increase of the concentration quota in the four biggest firms is visible. The quota of the four leading enterprises (built with the quota and with the raw tomato delivered in firms) has increased from 40 % to 65 % between 1990 and 2005, which indicates a strong concentration, but after 2001 it is possible to observe some stability. The analysis carried out, with the above cited pointers, is arguable because the quotas are expressed in terms of installed capacity and the analysis of the concentration depends on the production capacity used. Only where the use of the installed capacity is equal for the different firms, analyses of concentration can give a correct idea of the concentration in production terms (Barros, 1999: 55).

Tomatoes for processing are under the Common Agricultural Policy and until 2000 the subsidy was delivered to the

Tableau 1 – Firms number, four-firm concentration ratio /CR4), Average Market share, Herfindahl-Hirschman Index (HHI) and number (%) of answers.

Year	Number of Firms in the sector	Raw material delivered in firms (kg)	Quota of biggest four-firm concentration ratio	Four-firm concentration ratio	Average Market Share	HHI	Answers to INE inquiry (number)	% of answers
1990	25	825,294	293,711	40.1%	4.0%	0.07	12	48%
1991	26	706,374	308,886	37.8%	3.8%	0.06	11	42%
1992		446,734					11	
1993	21	501,508	345,877	42.4%	4.8%	0.07	11	52%
1994	18	836,626	462,190	56.6%	5.6%	0.11	15	83%
1995	16	830,284	485,802	59.5%	6.3%	0.13	14	88%
1996	19	863,314	478,928	58.7%	5.9%	0.12	13	68%
1997	18	771,696	550,367	63.5%	5.9%	0.13	12	67%
1998	16	987,884	528,364	59.4%	5.9%	0.12	11	69%
1999	16	996,526	556,567	62.9%	6.7%	0.13	14	88%
2000	15	854,656	516,083	62.8%	7.1%	0.13	12	80%
2001	14	917,237					10	71%
2002	11	812,200					8	73%
2003	11	857,674	561,686	65.5%	9.1%	0.14		
2004	11	1,011,331	641,017	63.4%	9.1%	0.13		
2005	11	998,022	653,591	65.5%	9.1%	0.14		

* Until 2002, data on raw material concerned the quota firm for tomato pasta. Between 2003 and 2005, the raw material was the raw tomato delivered in firms. There are not data for 1991-1992 and for 2001-2003.

** The instability ratio of 1993 was established between 1991 and 1993. Source: National Intervention and Guarantee Institute (INGA).

processors. At the moment, the production subsidy is provided directly to the growers via producer organizations (POs) rather than to processors. For this reason, it is reasonable to suppose that the installed capacity will be similar between different firms.

Data for the firm’s analysis come from a longitudinal file of manufacturing firms that was built upon the Annual Manufacturing Industry Survey carried out by the National Institute of Statistics (INE). For this study, we used the dataset of the firms whose main activity is “processing tomato” (processed fruits and vegetables: exclusion of processed potatoes and fruit juices, CAE 1533). The results of this survey were chosen for this study because of their high answer rate and truthfulness, based on the accounting sheets.

From 1990 to 2002, the average was 69% and in the last five years the rank was 76% which constitutes a fairly high response rate. Statistics secret prevents me from revealing the company’s identity as well as comparing data from different years. The results of the firm’s sales do not show an increase in total sales and exports, but the increase in the average resulting from the concentration seller is visible (Figure 1).

Table 2 – Four-firm concentration ratio (CR4), HHI, and variable values.

Year	Index	Total of Sales	Exportation	External Services Costs	R&D costs	Marketing costs	Staff Training Costs	Working costs	Costs of Sales and materials
1990	CR4	80.54%	55.77%	0.70	100.00%	98.43%	95.83%	62.94%	68.20%
	HHI	0.20	0.20	0.19	1.00	0.56	0.68	0.14	0.16
1991	CR4	79.20%	61.88%	70.48%	0.00%	99.66%	62.67%	71.48%	67.21%
	HHI	0.24	0.18	0.19	1	0.56	0.35	0.19	0.16
1992	CR4	81.54%	62.55%	80.20%	100.00%	98.78%	96.99%	73.71%	74.60%
	HHI	0.28	0.18	0.26	1	0.62	0.76	0.22	0.20
1993	CR4	79.37%	68.88%	82.00%	5.82%	99.65%	81.26%	74.30%	73.51%
	HHI	0.24	0.25	0.26	0.71	0.64	0.67	0.21	0.18
1994	CR4	74.51%	62.88%	77.65%	99.93%	97.58%	86.92%	66.53%	66.43%
	HHI	0.21	0.21	0.23	0.92	0.59	0.45	0.17	0.15
1995	CR4	74.77%	67.17%	55.23%	83.13%	97.10%	94.67%	67.60%	70.80%
	HHI	0.20	0.22	0.20	0.72	0.60	0.71	0.17	0.17
1996	CR4	78.29%	62.67%	75.11%	17.44%	0.87		68.87%	75.11%
	HHI	0.29	0.31	0.25	0.31	0.76		0.20	0.25
1997	CR4	80.93%	61.61%	79.00%	59.42%	92.64%		76.17%	78.95%
	HHI	0.27	0.26	0.26	0.50	0.86		0.25	0.24
1998	CR4	85.74%	67.76%	80.88%	0.00%	91.24%		80.61%	82.97%
	HHI	0.35	0.34	0.33	1.00	0.84		0.26	0.30
1999	CR4	76.18%	78.11%	74.57%	0.00%	92.91%		66.19%	68.95%
	HHI	0.28	0.27	0.24	1.00	0.86		0.19	0.19
2000	CR4	80.41%	82.27%	79.72%	18.93%	98.77%		78.24%	77.63%
	HHI	0.28	0.28	0.27	0.69	0.97		0.25	0.25
2001	CR4	86.46%	91.22%	88.79%	0.00%	97.68%		85.10%	88.13%
	HHI	0.35	0.35	0.34	0.96	0.95		0.35	0.34
2002	CR4	90.98%	91.54%	93.94%	0.00%	98.77%		89.79%	92.67%
	HHI	0.32	0.32	0.35	0.00	0.99		0.37	0.34

Source INE

Figure 1 – Sales and exports, total and average current and constant values. Source: INE.

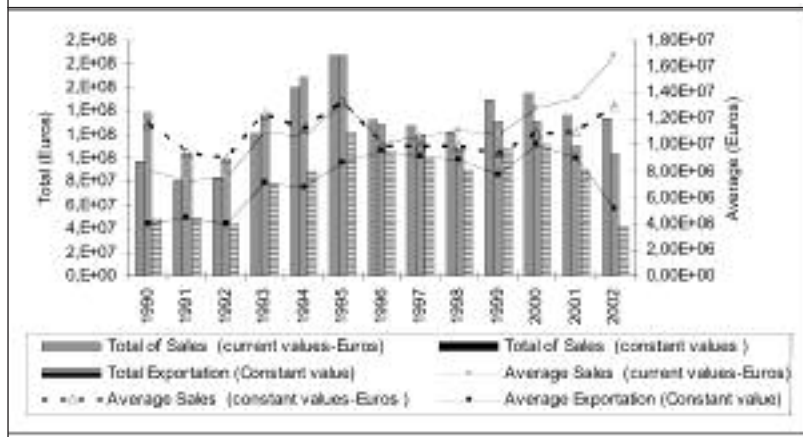
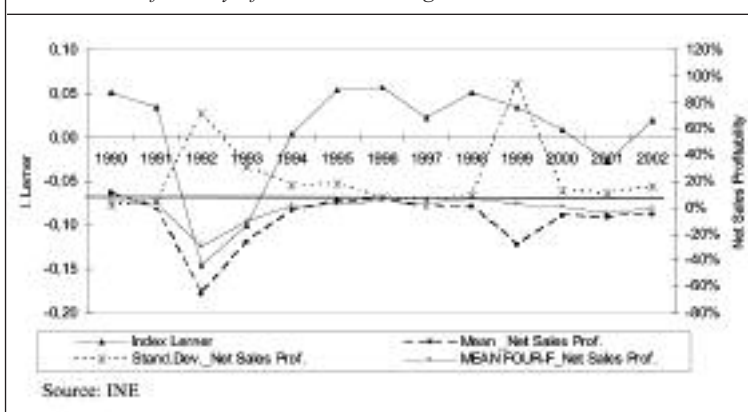


Table 2 summarises the statistics of the structural and financial firm’s variables. Our results exhibit a very concentrated sector in all the variables. It is important to observe the relation between marketing costs, R&D expenses and seller concentration. On the other hand, the marketing expense is less concentrated but it is concentrated in the four biggest firms. The concentration of the sector can explain the concentration of other variables such as working costs and External Services Costs. The decrease in the staff training costs variable is visible, until it disappears from accounting sheets. Nevertheless, the expense for strategic variables such as marketing and research & development has decreased during the studied period. This decline is clearer for R&D expenses. We observe stability in marketing costs (Table 2 and Appendix B).

Table on Appendix C and figure 2 clearly indicate that firms have no market power. The Lerner Index is close to zero and reveals a negative profitability in some years. Between 1991 and 1994 and between 1999 and 2001, we observed a strong decline in the firm’s profitability.

This evolution coincides with the decrease in firms’ number in the same period: from 26 to 18 in the first period and from 16 to 11 in the second period. The four leading firms seem to have better supported the above-mentioned period. Results reveal that it is not possible to find a positive correlation between concentration and firm’s profit. An accepted question is whether industry consolidation increased firms’ abilities to generate operating profits. Industry consolidation is expected to improve its efficiency by reducing production costs through

Figure 2 – Lerner Index, Net Sales Profitability, Standard Deviation and Net Sales Profitability of the Four Leading Firms.



greater economies of scale, as well as by technological innovations through larger R&D investments.

There are plausible hypotheses of a positive as well as a negative impact of the number of firms on new products introduction. Schumpeter (1942), Dasgupta and Stiglitz (1980) state that innovations increase with a declining number of firms. Other authors emphasise the importance of oligopolistic market structures and state that the relationship between the number of firms and innovation is not linear (see Scherer and Ross, 1999: 637). Roder *et al.* (2000) find that new product introductions are driven by market structure variables and industry-specific characteristics.

The number of firms, the degree of existing product differentiation and the size of the market show a positive influence on the number of innovations. To sum up, in some industries at least, there are appreciable economies of scale in several aspects of sales promotion and product differentiation. Nevertheless, product differentiation or innovation can also cut in opposite direction. Through innovation, smaller firms may be able to carve out for themselves a small but profitably niche market (Scherer and Ross, 1990: 137).

The differences between CR4 and the HH index measured by the quantity of processed raw tomato and measured by the sales of firms can suggest that biggest firms sell their tomato products with high added value. The differences between the sale price of the biggest firm and the other firms can explain the differences between these ratios. The declining R&D and the lack of investment in marketing costs can be explained by the recognition of the quality of Portuguese tomato pasta by the international market. This trust in actual buyers and in Portuguese tomato quality can explain the data evolution, but it does not justify the low investment in marketing and staff training.

The growth of demand can explain some changes in the market structure. Economists have offered two different scenarios and the answers point two different directions: The first scenario says that if the market demand grows fast enough that firms can expand their production capacities, even if new entrants are coming in, there is little incentive to fight for market share. This scenario brings high profits. The second scenario assumes that the product is differentiated, and that having market share this year makes it easier for firm to claim a large market share next year, consequently fast growth implies more competition and brings low profits. This is a growing market, between 1994 and 1995 and between 2004 and 2005, the apparent consumption of tomato paste in the European Union increased by 66%, from 5.3 to 8.9 million tonnes and from 5.3 to 8.9 million tonnes (Tomato News Dec, 2006).

The general trend is the increase of differentiated products with high added value, such as sauces, Ketchup and "other products" such as peeled frozen, peeled crushed and diced, unpeeled whole, unpeeled crushed and diced, sauces, juice, flakes. If we observe the evolution of the production

of Portuguese tomato products we do not observe a positive evolution in added value products. Most tomato products are tomato pasta. Between 1986 and 2005, 93% of the tomato products were represented by tomato pasta and this ratio ranged between 90 and 95% in 2005. If we apply to the FAO exports data, between 1980 and 2004 nearly 99% of the Portuguese tomato products exports in value were tomato pasta. Only between 1989 and 2001 an increase in tomato juice was visible (1% of the value of tomato products exports in 1999).

5. Conclusion

The world tomato processing is progressing but this evolution has not apparent effects on the Portuguese tomato industry. It is difficult to draw a simple conclusion concerning the relationship between the market structure and performance, when firms show a negative net income during several years. We saw that the Portuguese export sales did not increase as it could be expected in a growing market such as the tomato processing one. The declining price in the world market can explain the behaviour and results of some firms. Portuguese firms do not show a strategic behaviour. Besides this uncompetitive behaviour, the Portuguese tomato processing industry maintains a stable position on the world competition. The results do not indicate any correlation between concentration, profits and development of strategic variables. The future of this system will be possible if there is an increase in tomato price; an industry restructuring with the aim at producing higher value added processed products and through a reduction of land value in the production costs (Aviliez *et al.*, 2004). The product differentiation is also important because it "expands the market strategies open to the producers and makes the firm's demand less elastic (...). The firm's strategic options also expand, because it can now react to changing market conditions by changing the traits of the product as well as its price" (Caves, 1992: 20). The lower strategic firm behaviour, the development of consumer needs and the development of world tomato products suppliers can put the Portuguese industry in difficulties that can be dangerous in the future. Another issue for the tomato industry is the OCM reform. Portuguese government supports the inclusion of the market of fruits and vegetables in a Single Payment System and requests aids to support the industry because the Portuguese tomato industry can be surpassed in the external competition to the EU, to start with the Chinese industry.

In the long term, in the context of the actual CAP reform, the trend will be the reduction of the crop area due to the abandonment of the less competitive farmer. The results of the world-wide market disclose that a potential market for the tomato products exists, but that the Portuguese industry will need to be more efficient. If in current conditions it seems that the Spanish industry (according to Inga Data, in 2003/2004 the quantity of Portuguese raw material processed in Spanish industry was 5% and in 2005/2006

this value was 17% of total Portuguese raw tomato production) is capable of catching the Portuguese production, if the Portuguese industry wants to keep the tomato supply, it will have to pay a higher price or give better market conditions by paying for example the transport costs to the producer in order to balance the loss due to the CAP reform.

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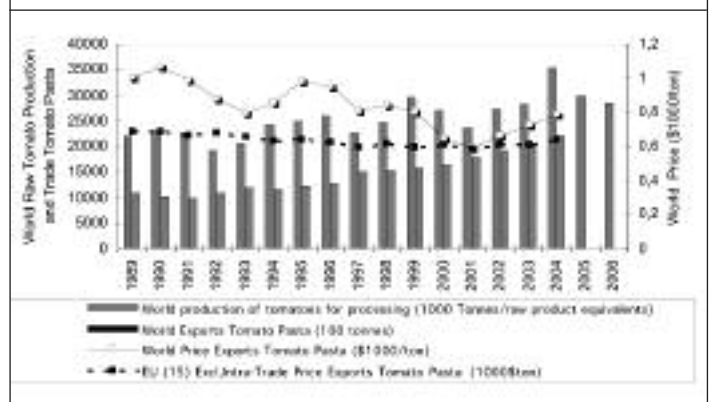
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8. Appendices

Appendix A – World Production of Tomatoes, Tomato Pasta Exports and World and EU, Exports Prices (\$1000/ton) in current value.



Appendix B – Summary of firm’s variables in current values (Euros).

Variables	R&D costs	Marketing costs	Staff Costs	Formation	Working costs	Costs of Sales and materials
1990						
Total	77,887	1,975,040	1,232	14,812,734	92,691,638	
Mean	11,127	184,587	103	1,167,731	7,724,303	
Stand. Dev.	297,255	395,210	275	979,076	7,575,907	
1991						
Total	2,998	2,330,952	30,746	14,714,362	66,958,456	
Mean	500	211,905	2,785	1,383,952	5,422,149	
Stand. Dev.	1,117	483,595	4,703	1,370,440	5,156,486	
1992						
Total	357,000	3,153,365	18,216	15,213,575	59,643,639	
Mean	59,500	286,679	1,856	1,383,952	5,422,149	
Stand. Dev.	133,046	694,790	4,505	1,644,288	5,978,950	
1993						
Total	179,557	4,579,311	30,736	18,956,304	83,208,531	
Mean	22,445	398,119	2,798	1,726,937	7,618,957	
Stand. Dev.	48,635	979,262	7,085	1,892,834	7,500,338	
1994						
Total	1,100,722	5,266,583	38,951	23,163,622	116,649,921	
Mean	366,907	478,780	6,492	1,544,241	8,709,995	
Stand. Dev.	488,724	1,119,522	8,422	1,829,546	9,784,262	
1995						
Total	248,436	5,628,951	44,957	23,219,616	131,136,817	
Mean	124,213	489,079	7,493	1,858,544	9,366,916	
Stand. Dev.	82,214	1,165,545	13,507	1,880,414	10,985,594	
1996						
Total	45,820	1,467,803		17,442,280	113,300,865	
Mean	7,637	146,780		1,341,714	8,715,451	
Stand. Dev.	7,194	378,355		1,733,170	10,172,284	
1997						
Total	70,065	2,040,315		15,618,974	104,696,121	
Mean	23,355	226,702		1,361,581	8,724,677	
Stand. Dev.	16,483	588,217		1,718,209	12,032,018	
1998						
Total	2,993	1,927,346		14,811,912	105,250,327	
Mean	2,993	240,918		1,346,537	9,568,212	
Stand. Dev.	0	574,529		1,857,939	14,662,446	
1999						
Total	56,554	2,317,615		20,441,560	137,398,151	
Mean	56,554	231,762		1,460,111	9,528,439	
Stand. Dev.	0	639,215		1,867,426	12,184,925	
2000						
Total	65,218	2,078,511		20,750,724	121,989,819	
Mean	32,609	207,851		1,726,277	10,165,818	
Stand. Dev.	20,264	612,115		2,388,567	14,360,511	
2001						
Total	33,021	2,614,544		19,706,659	89,975,433	
Mean	3,302.1	326,818		1,870,665	8,997,343	
Stand. Dev.	9,708,276	840,077		3,189,017	13,798,184	
2002						
Total	0	1,929,563		17,808,949	75,828,166	
Mean	0	275,652		2,226,996	9,478,521	
Stand. Dev.	0	671,692		3,895,382	12,363,021	

Source: INE

Appendix C – Summary of firm's variables in current values (Euros).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Lerner Index	0.05	0.05	-0.15	-0.10	0.01	0.05	0.06	0.02	0.05	0.04	0.01	-0.03	0.02
Stand.Dev.	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Net Sales													
Prof.													
Mean	11.2%	-0.2%	-66.0%	-27.0%	-2.7%	5.3%	5.7%	1.2%	1.1%	-28.2%	-6.4%	-7.3%	-5.3%
Stand.Dev.	2.1%	4.8%	71.4%	31.2%	16.9%	18.0%	7.4%	3.3%	8.8%	94.0%	12.4%	11.0%*	16.2%
Mean Four-F	4.9%	2.6%	-29.0%	-10.8%	2.3%	2.7%	4.9%	2.4%	6.9%	2.2%	0.2%	-4.6%	0.1%
Equity													
Capital Prof.													
Mean	13.2%	5.7%	95.9%	32.5%	-12.1%	35.1%	14.1%	-1.6%	3.2%	0.3%	-3.4%	-15.0%	1.9%
Stand.Dev.	12.9%	12.9%	164.9%	52.3%	62.3%	67.2%	14.2%	19.9%	15.2%	15.3%	52.9%	72.2%	16.2%
Mean Four-F	17.2%	17.0%	109.2%	22.1%	-49.2%	18.8%	20.9%	3.1%	12.1%	3.6%	0.2%	-62.3%	-5.9%
R&D													
Mean	0.03%	0.01%	0.09%	0.32%	0.21%	0.07%	0.14%	0.07%	0.01%	0.06%	0.06%	0.11%	0.00%
Stand.Dev.	0.09%	0.02%	0.28%	0.89%	0.65%	0.17%	0.38%	0.16%	0.02%	0.21%	0.16%	0.31%	0.00%
Mean Four-F	0.09%	0.00%	0.25%	0.02%	0.78%	0.12%	0.02%	0.08%	0.00%	0.00%	0.02%	0.00%	0.00%
Work. H.													
Mean	30	30	27	48	34	46	37	43	46	50	58	60	93
Stand.Dev.	16	18	19	20	20	24	17	22	20	20	25	25	44
Mean Four-F	31	29	25	60	56	72	34	65	65	64	71	76	107
Staff F. C.													
Mean	0.11%	0.05%	0%	0%	0.02%	0.01%							
Stand.Dev.	0.25%	0.08%	0%	0%	0.03%	0.02%							
Mean Four-F	0.26%	0.02%	0%	0%	0.04%	0.02%							
Work C.													
Mean	26%	30%	29%	19%	18%	16%	18%	15%	15%	39%	17%	44%	14%
Stand.Dev.	16%	21%	16%	6%	7%	8%	8%	6%	6%	80%	5%	86%	4%
Mean Four-F	12%	18%	20%	16%	14%	11%	13%	12%	13%	13%	15%	14%	12%
Mark. C.													
Mean	0.81%	1%	1.14%	1.09%	1.01%	1.08%	0.34%	0.73%	0.64%	0.43%	0.26%	0.62%	0.37%
Stand.Dev.	1.73%	2%	1.98%	2.67%	2.32%	2.51%	1.20%	1.24%	1.37%	1.04%	0.75%	1.11%	0.91%
Mean Four-F	2.20%	2%	2.48%	2.91%	2.89%	2.88%	0.49%	0.79%	0.65%	0.73%	0.69%	0.88%	0.70%
Exp./Sale													
Mean	60%	72%	78%	79%	60%	69%	65%	74%	70%	69%	69%	62%	54%
Stand.Dev.	34%	29%	20%	25%	38%	39%	38%	33%	34%	34%	34%	41%	42%
Mean Four-F	37%	60%	62%	64%	61%	67%	88%	87%	88%	90%	90%	89%	87%

* In 2001, this ration was eliminated because the value was outside of the normal evolution.

Legend

Lerner Index = Σ [(net income/sales)*market Share];

Mean Four-F: Mean of Four Biggest Firms in Sales;

Stand Dev.: Standard Deviation;
Net Sales Profitability = Net Income/Sales;

Equity Capital Prof. = (Return on owners' equity) = Net Income / Equity;

R&D = R&D intensity Research Development costs/Sales;

Work H. = Sales/Working Hours;

Staff F. = Staff Formation Costs/Sales;

Work C = Working Costs /Sales;

Mark C. = Marketing Costs/Sales;

Exp/Sa = Export/ Total sales.

Source: INE