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The Portuguese Tomato Processing sector: market structure, concentration and firm behaviour

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The Portuguese Tomato Processing sector: market structure, concentration and firm behaviour

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Abstract

The purpose of this paper is to study the evolution and the structure of the Portuguese processing tomato industry. We intend to pick up the dynamics, the strategic behaviour and structural the changes in the tomato industry in Portugal during the period of 1990-2005. An overview of world and domestic production and trade in the last two decades is followed by the descriptive analysis and by the development of the market structure. The market structure analysis was carried out during 1990 - 2002, under the Structure-Conduct-Performance framework. This paper examines the concentration effect on the performance and firm's strategy. The result indicates that, market concentration in tomato processing industry in quantity is a moderate concentrate market but the concentration level has increased over the years. In contrast the seller concentration has always been higher. The CR4 and HHI ratio indicates values between 75% - 91% and between 0.20-0.30 respectively. On some years, the power market measured by an approximation to the index Lerner indicates negatives values resulting from the negative net income. The results of the Index Lerner below 0,06, indicate, that the firms lacks market power. We did not find linkage between the market share and R&D expenses. Marketing costs are concentrated in four biggest companies but the concentration increase didn't change the marketing costs evolution and profits. The use of market share on advertising or research development is not observed.

Key-Words: Tomato processing industry; Concentration; Firm Strategy; market power; Competitiveness

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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 is as follows. Firstly, we outline both some theoretical considerations and a framework that bear upon the problem. Secondly, we summarize the evolution of the processed tomato sector to demonstrate the crucial importance of the tomato sector on the agro-food Portuguese industry and the role of the world tomato situation on the Portuguese tomato sector. Finally, we intend to pick up the dynamics of industry, the strategic behaviour and the structural changes in the agro-food sector in Portugal during a period of twenty years under the *Structure -Conduct-Performance* (SCP).

The traditional approach in Industrial Organization (IO) is known as the SCP paradigm. Economists, as Bain (1951) have examined performance differences among 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, pp. 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 firm's size (market concentration of sellers) and tested their impact, on profitability, on market power¹ and on 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 demonstrated that, correlations between profitability and concentration are spurious.

Recent studies suggest that the relationship between profitability and concentration is

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

discontinuous and found critical 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 development² (R&D) and increases in profitability has been found. Studies on the SCP have developed and the differences on results showed the need to introduce other explanatory variable. 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, and presents the result in a form simple enough that it is easy to interpret (Caves, 1992, pp. 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 is widely used to summarise indicators of structural change. The HHI, is a measure of the size of firms in relationship 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 index <0.1 indicates an unconcentrated index, a H index between $0.1 < HHI < 0.18$ indicates moderate concentration. A HH index above 0.18 indicates high concentration: The CR4 does not adjust as HHI does for variation in firm size. The HHI reflects the larger variation in relative firm size even though the number of firms is greater (Church and Ware, 2000, pp. 429).

To measure the profitability we shall apply to the Sales and Equity Capital Profitability. To measure the market power an approximation for the Lerner index will be applied. The Lerner Index

² Estimates of the effects barriers entry (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, p.431).

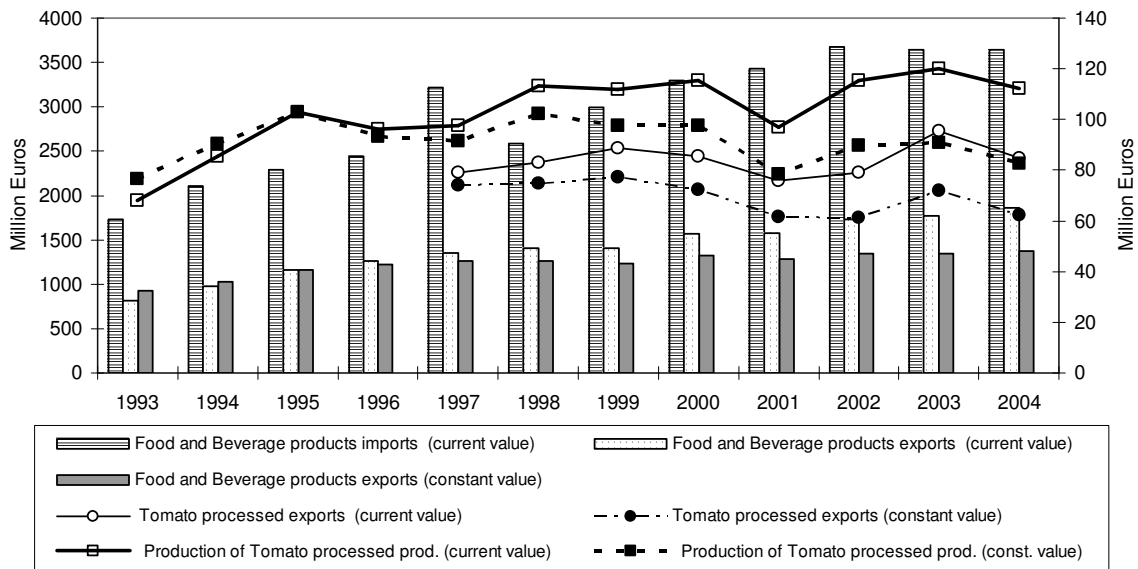
facing by firm i , can be defined as $Li = (Pi - MCi)/Pi$, where P is the Price and MC the firm's marginal cost, i. e $P-MC$ is firm's profit margin. When $P = MC$, the Lerner Index is zero and the firm has no market power. A Lerner Index closer to 1 indicates relatively weak price competition and the firm has market power. Nevertheless, since accounting data on marginal cost is 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 constants returns to scale), we can multiply both members of the Lerner ratio by the 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 the technology there are not constant returns to scale (for example are significant fixes costs), the Lerner index can be written as $Li = [Net\ income - Variable\ costs / Sales\ Revenues]$ (Cabral, pp.28-29). In this work we assumes that, tomato processing industry is characterized by constants returns to scale and we sell apply to the approximation of Lerner index= Net income/Sales. The Lerner index facing by the industry is a weighted average of each firm's Lerner index, and it can be written as: $L = \sum_{i=1}^n Li * Si$, where Si is the market share.

2. The tomato processed industry in Portuguese food industry

The industry of tomato for processing is one the most important sectors in agro-food Portuguese 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 value between 1993/04). In figure1, we observe the evolution of the tomato processing industry in the food industry. In more recent years, the food and beverage industry has shown stability (growth annual rate of 0.76% between 1993(05) and 2002(04) centred average), and represents about 6 % (average of 2001/03) of the 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 (represents 5% of the production and exports of the food industry, in value) and nearly all the Portuguese production is oriented for exportation.

Figure 1. Value of the Portuguese food industry and tomato products in current and constant values (10³ Euros)



Source: INE

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 exportation on the tomato products production and in food and beverage exportation has decreased from 81% to 75% and 5,9% to 4,6%, respectively between 1997 and 2004. Despite the importance and the role of the tomato processed sector in domestic and in international agro-food industry, this sector has only an annual growth rate of -0,29% for a weigh of 1,23% in the food industry value production.

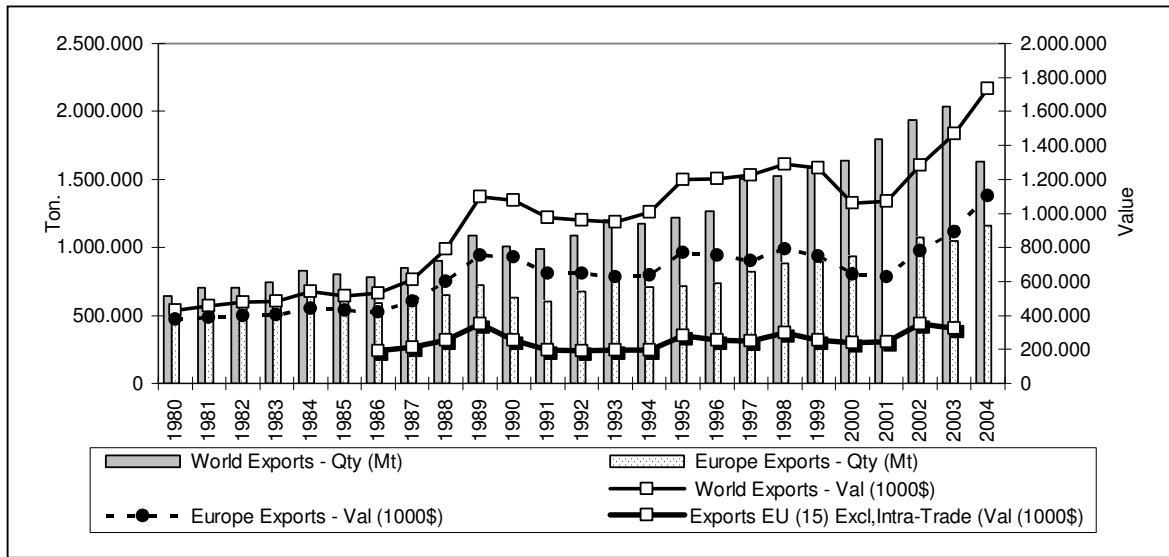
3. The world tomato processing industry

The production of tomatoes for processing rose from 21.159 in 1989 to 35.216 thousand metric tonnes in 2005 (for.). This represents a growth rate of 25% and 37% if we apply the centred average (annual growth rate of 2,2% in centred averages). The development of the World

production is, not only due to the production increase of traditional suppliers European Union (EU), 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 2003/05) in the world production, but in 2005/06 the exports of tomato paste have only progressed 2%. This is a very poor result for a sector more used to spectacular annual increases in previous years (Tomatoland, 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 relative position in the world between 1989 and 2005 hasn't 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 higher annual growth rate. Between 2003/05 the average production was 2.283 thousand tonnes (23% of EU production), but in the marketing year of 2005/06 the Spanish production were drops 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 tomato for the processing sector remained stable between 1989 and 2005.

According to the FAO database the world exports rose 174% since 1980 and 82% since 1990 in quantity (annual growth rate of 4,7%, centred average) while in value the exports rose 229% and 49% since 1980 and 1990, respectively (annual growth rate of 5,6%) in current values (centred average). Between 2002/04 the tomato paste exports decreased 16% in quantity and the exports increased 35% in value (Figure 2).

Figure 2. Evolution of tomato paste trade by volume and value (in this work the values are in US \$ dollars in current values represented as in FAO Database).



Source: FAO Database

Despite the price decrease of tomato processed trade, after 2001, we observe a change in the price evolution (Figure 1 on appendix). Therefore, the behaviour of countries such as Spain and China (increases in tomato processing may further flood the market and continue to drive down prices), in the last three years (2001 to 2004), the tomato price showed a recuperation while Spain and China's production dropped. Globalisation and world legislation have affected not only world production and trade (relation between Italy and China) but also the relationship between neighbouring countries such as Portugal and Spain. The behaviour (expansive production) of some countries such as Spain, China and Turkey in the early 90s shows a cyclical movement but the equilibrium between countries is set up in the long term.

3. The Portuguese tomato for processing sector

3.1- Production of tomatoes for processing

The bulk of the Portuguese tomato crop is produced under irrigation in the “Ribatejo-e-Oeste” region. The planted acreage and the production have changed significantly 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 it will expect the decline of total processing tomato production. In 2004/05 the processed tomato production 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 on the Common Agricultural Policy (CAP) and under these changes, the remuneration producers is made through aid plus free price (price is freely negotiated between PO and processors). In 2005 the price pay to the producer is less than the minimum price in 1978 (in current value). Between 2000/05 the producer price decreased 19,5% (annual growth rate -4,2% .).

3.2. Processing tomato for industry

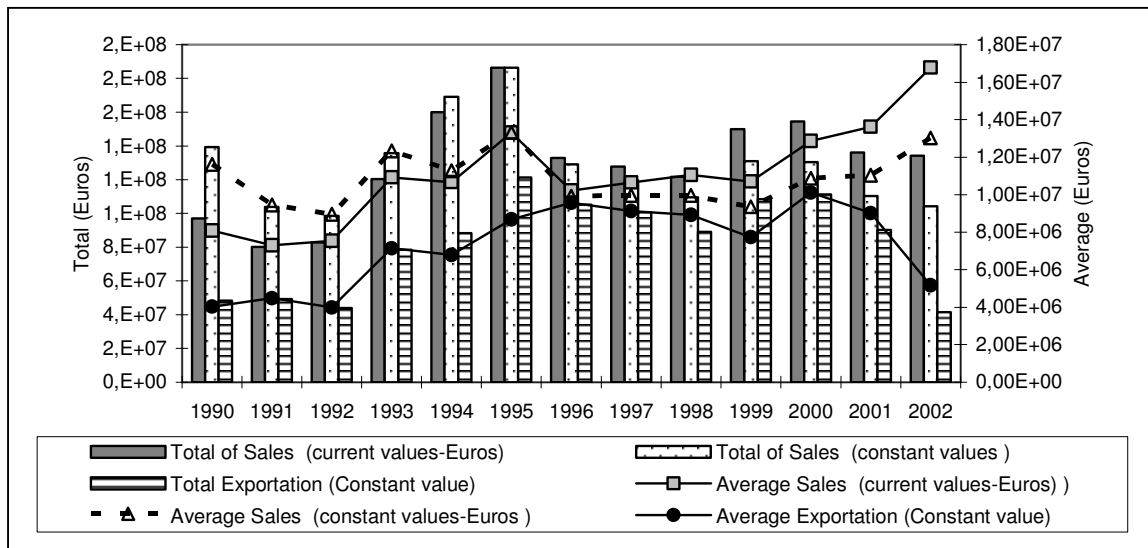
The aim of this section is to analyze the relations between the SCP elements. The focus will be in market structure measured by the concentration ratio. The market power and the firm's performance will be analysed. The numbers present in this industry decreased from 25 firms to 11 firms and have found some stability in the last three years. On table 1 (appendix), we observe an exponential increase of the raw tomato delivered by firm and this is essential due to the decrease of the firm number and not to the production increase. The increase of the concentration quota on the four biggest firms is visible. The quota of the four leading enterprises (built with the quota and with the raw tomato delivered in firm), has increased from 40 % to 65 % between 1990 and 2005, which indicates a strong concentration, but after 2001 it is possible to observe stability. The evolution of the HHI ratio is similar (Table 1 on appendix).

The analyses carried out, with the above cited pointers is criticisable because the quotas are expressed in terms of installed capacity and the analysis of the concentration depends on the production capacity used. Only in the case where the use of the installed capacity is equal between the different firms can the analyse of the concentration provide a correct idea of the concentration in production terms (Barros, 1999, pp. 55). Tomatoes for processing are under the Common Agricultural Policy and until 2000 the subsidy was delivered to the processors. In this 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.

The 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” (Vegetables and fruit processed: 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 (Table 1 on appendix). From 1990-2002, 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 the data of different years. The results of the firm’s sales don’t show an increase of the total sales and exports, but the increase on the average resulting from the concentration seller is visible (Figure 3).

Figure 3. Sales and exports, total and average in current and constant values



Source: INE

Table 2 (appendix), 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 expense on marketing is less concentrated but it is concentrated in the biggest four firms. The concentration of the sector can explain the concentration in other variables such as working costs

and External Services Costs. The decrease on staff costs formation variable it is visible, until this disappears on sheets accounting. Nevertheless the expense on the strategic variables such as marketing and research & development has decreased in the period studied. This decline is more clear on R&D expenses. We observe stability on marketing cost (Table 2, 3, appendix).

Table 4 and figure 2, appendix clearly indicates that firms have no market power. The Index Lerner is close to zero, and reveals a negative profitability in some years. Between 1991/ 1994 and between 1999/2001, we observe a strong decline on the firm's profitability. This evolution coincides with the decrease of firm's number in the same period from 26 to 18 in the first period and from 16 to 11 firms, in the second period. The four leading firms seem to have supported better the period appointed above. The 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 efficiency by reducing production costs through 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) argues that innovations increase with a declining number of firms. Other authors emphasizes the importance of oligopolistic market structures and argue that the relationship between the number of firms and innovation is not linear (see Scherer and Ross, 1999, pp.637). Roder et al. (2000) finds 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 at least some industries, there are appreciable economies of scale in several aspects of sales promotion and product differentiation, nevertheless, the product differentiation or innovation can also cut in opposite direction. Through innovation, smaller firms may be able to carve out for themselves small but profitably niche market (Scherer and Ross, 1990, pp. 137).

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

The demand growth can explain some the market structure changes. Economists have offered two different scenarios and the answers point in to different directions: The first scenario says if the market demand grows fast enough that firms can expanding 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. The general trend is the increase of differentiated products with high value added, such as sauces, Ketchup and "Other products" such 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 don't observe a positive evolution on value added on products. Most tomato products are tomato pasta. Between 1986 and 2005, 93% of the tomato products are tomato pasta and in last three years this ratio range 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 are tomato pasta. Only between 1989 and 2001 an increase on tomato juice was visible (1% in 1999 of the value of tomato products exports).

4. Conclusion

The world tomato processing is progressing but this evolution has not apparent effects on the

³ Between 1994/1995 and 2004/05 the apparent consumption of tomato paste in the European Union increased by 66% from 5.3 to 8.9 million tonnes from 5.3 to 8.9 million tonnes (Tomato News, Dec, 2006)

Portuguese tomato industry. It is difficult to draw simple conclusion concerning the relationship between the market structure and performance, when the firms show a negative net income in several years. We saw that the Portuguese sales exports didn't increase as it could be expected in a growing market, such as the tomato processing market. The declining price in world market can explain the behaviour and results of some firms. Portuguese firms don't show a strategic behaviour. Besides this uncompetitive behaviour, the Portuguese tomato processing industry maintains a stable position on the world competition. The results don't indicate any correlation between concentration, profits and development on strategic variables. The future of this system will be possible if there is an increase in tomato price through industry with restructuring in the aim to produce higher value added processed products and reduction of land value in the production costs (Avillez et al., 2004). The product differentiation is also important because it "expands the market strategies open to the producers and it 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, pp.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 and can be dangerous in the future

References

- Bain, J.S. (1951), Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936-1940, *Quarterly Journal of Economics*, Vol.65. No.3, pp.293-324.
- Barros, P. (1999), *Exercícios de Economia Industrial*, McGraw-Hill, Portugal.
- Bradburd, R., Over, A. (1980) "Organizational costs , 'Sticky' Equilibria and Critical Levels of Concentration, *Review of Economics and Statistics*, 64: 50-58.
- Cabral, L., (2000), *Economia Industrial* , McGraw-Hill, Portugal.
- Caves, R. (1992), *American Industry: Structure, Conduct, Performance*, Havard University.
- Church J., Ware, P., (2000) *Industrial Organization: A Strategic Approach*, McGraw-Hill.
- Collins, N.R. and Preston, L.E. (1969), "Price-Cost Margins and Industry Structure", *Review of Economics and Statistics*, Vol.51, August , pp.224-242.
- Dasgupta P., Stiglitz JE. (1980). Industrial Structure and the nature of innovative activity. *Economic Journal* : 90: 266-293.

Roder, C., Herrmann, R., Connor, J. (2000) Determinants of new product introductions in the US food industry: a panel-model approach *Applied Economics Letters*, Volume 7, Number 11/November 1, 2000.

Scherer, F.M., Ross D. (1990) *Industrial Market Structure and Economic Performance*, 3 ed, Houghton Mifflin Company, Boston.

Schumpeter, J. A. (1942) *Capitalism, Socialism, and Democracy*, Harper, New York.

Weiss, L. (1974). "The Concentration – Profits Relationship and Antitrust" In Harvey J. Goldschmid et al. (eds.) *Industrial Concentration: The New Learning*: Boston: Little Brown: 201-220

Appendix: Tables and Figures

Table 1. Firms number, Concentration four-firm ratio (CR4), Average Market share, Herfindahl-Hirschman Index (HHI) and number (% of total) of answers answer

| Year | Number of Firms on sector | Raw material delivered in firms (kg) | Quota of biggest four-firm concentration ratio | Four-firm concentration ratio | Average Market Share | HHI | Answered to INE inquiry (number) | % of answers |
|------|---------------------------|--------------------------------------|--|-------------------------------|----------------------|------|----------------------------------|--------------|
| 1990 | 25 | 823294 | 293711 | 40,1% | 4,0% | 0,07 | 12 | 48% |
| 1991 | 26 | 706374 | 308886 | 37,8% | 3,8% | 0,06 | 11 | 42% |
| 1992 | | 446734 | | | | | 11 | |
| 1993 | 21 | 501508 | 345877 | 42,4% | 4,8% | 0,07 | 11 | 52% |
| 1994 | 18 | 836626 | 462190 | 56,6% | 5,6% | 0,11 | 15 | 83% |
| 1995 | 16 | 830284 | 485802 | 59,5% | 6,3% | 0,13 | 14 | 88% |
| 1996 | 19 | 863314 | 478928 | 58,7% | 5,9% | 0,12 | 13 | 68% |
| 1997 | 18 | 771696 | 550367 | 63,5% | 5,9% | 0,13 | 12 | 67% |
| 1998 | 16 | 987884 | 525364 | 59,4% | 5,9% | 0,12 | 11 | 69% |
| 1999 | 16 | 996526 | 556567 | 62,9% | 6,7% | 0,13 | 14 | 88% |
| 2000 | 15 | 854656 | 516083 | 62,8% | 7,1% | 0,13 | 12 | 80% |
| 2001 | 14 | 917237 | | | | | 10 | 71% |
| 2002 | 11 | 812200 | | | | | 8 | 73% |
| 2003 | 11 | 857674 | 561686 | 65,5% | 9,1% | 0,14 | | |
| 2004 | 11 | 1011331 | 641017 | 63,4% | 9,1% | 0,13 | | |
| 2005 | 11 | 998022 | 653591 | 65,5% | 9,1% | 0,14 | | |

Note: (*) Until 2002 the data of raw material is the quota firm for tomato pasta. Between 2003-2005 the raw material is the tomato raw delivered in firms. There are not data for 1991-1992 and for 2001-2003. (**) The instability ratio of 1993 was between 1991/93. **Source: National Intervention and Guarantee Institute (INGA)**

Table 2. Four-firm ratio (CR4), HHI, and values variables

| Year | Index | Total of Sales | Exportation | External Services Costs | R& D costs | Marketing costs | Staff Costs Formation | 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% | 70,46% | 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% | 86,99% | 73,71% | 74,60% |
| | HHI | 0,28 | 0,18 | 0,26 | 1 | 0,62 | 0,76 | 0,22 | 0,20 |
| 1993 | CR4 | 79,37% | 68,08% | 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% | 62,98% | 77,65% | 99,93% | 97,58% | 86,92% | 66,52% | 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% | 70,93% |
| | HHI | 0,20 | 0,22 | 0,20 | 0,72 | 0,60 | 0,71 | 0,17 | 0,17 |
| 1996 | CR4 | 78,29% | 82,67% | 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% | 81,61% | 79,00% | 59,42% | 92,64% | | 76,17% | 78,95% |
| | HHI | 0,27 | 0,26 | 0,26 | 0,50 | 0,86 | | 0,23 | 0,24 |
| 1998 | CR4 | 85,74% | 87,76% | 80,08% | 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 | | 0,23 | 0,25 |
| 2001 | CR4 | 86,46% | 91,22% | 88,79% | 0,00% | 97,68% | | 85,10% | 88,13% |
| | HHI | 0,33 | 0,35 | 0,34 | 0,96 | 0,95 | | 0,35 | 0,34 |
| 2002 | CR4 | 90,98% | 91,54% | 93,04% | 0,00% | 99,77% | | 89,79% | 92,67% |
| | HHI | 0,32 | 0,32 | 0,35 | 0,00 | 0,99 | | 0,37 | 0,34 |

Source: INE

Table 3. Summary of firm's variables in current values

| | 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 | 14.012.774 | 92.691.638 |
| | Mean | 11.127 | 164.587 | 103 | 1.167.731 | 7.724.303 |
| | Stand. Dev. | 27.255 | 395.210 | 275 | 979.976 | 7.573.907 |
| 1991 | Total | 2.998 | 2.330.952 | 30.746 | 14.314.362 | 66.968.456 |
| | Mean | 500 | 211.905 | 2.795 | 1.301.306 | 6.088.041 |
| | 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 | 286.670 | 1.656 | 1.383.052 | 5.422.149 |
| | Stand. Dev. | 133.046 | 694.790 | 4.505 | 1.644.298 | 5.978.950 |
| 1993 | Total | 179.557 | 4.379.311 | 30.776 | 18.996.304 | 83.808.531 |
| | Mean | 22.445 | 398.119 | 2.798 | 1.726.937 | 7.618.957 |
| | Stand. Dev. | 48.635 | 979.262 | 7.085 | 1.952.834 | 7.500.338 |
| 1994 | Total | 1.100.722 | 5.266.583 | 38.951 | 23.163.622 | 130.649.921 |
| | Mean | 366.907 | 478.780 | 6.492 | 1.544.241 | 8.709.995 |
| | Stand. Dev. | 488.724 | 1.119.522 | 8.422 | 1.929.346 | 9.744.362 |
| 1995 | Total | 248.426 | 5.628.951 | 44.957 | 23.219.616 | 131.136.817 |
| | Mean | 124.213 | 469.079 | 7.493 | 1.658.544 | 9.366.916 |
| | Stand. Dev. | 82.314 | 1.165.545 | 13.507 | 1.980.414 | 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 | 378.335 | | 1.723.170 | 10.172.284 |
| 1997 | Total | 70.065 | 2.040.315 | | 15.618.974 | 104.696.121 |
| | Mean | 23.355 | 226.702 | | 1.301.581 | 8.724.677 |
| | Stand. Dev. | 16.453 | 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 | 574.329 | | 1.857.939 | 14.662.446 |
| 1999 | Total | 56.554 | 2.317.615 | | 20.441.560 | 133.398.151 |
| | Mean | 56.554 | 231.762 | | 1.460.111 | 9.528.439 |
| | Stand. Dev. | 0 | 639.215 | | 1.907.426 | 12.184.925 |
| 2000 | Total | 65.218 | 2.074.511 | | 20.750.724 | 121.989.819 |
| | Mean | 32.609 | 207.451 | | 1.729.227 | 10.165.818 |
| | Stand. Dev. | 20.264 | 612.115 | | 2.308.567 | 14.360.511 |
| 2001 | Total | 33021 | 2.614.544 | | 19.706.650 | 89.973.433 |
| | Mean | 3302,1 | 326.818 | | 1.970.665 | 8.997.343 |
| | Stand. Dev. | 9708,276 | 840.077 | | 3.109.017 | 13.798.184 |
| 2002 | Total | 0 | 1.929.563 | | 17.808.049 | 75.828.166 |
| | Mean | 0 | 275.652 | | 2.226.006 | 9.478.521 |
| | Stand. Dev. | | 671.692 | | 3.095.382 | 12.363.021 |

Source: INE

Table 4. Index Lerner and structural and financial ratio

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|-----------------------|--------------|-------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|-------------|
| Index Lerner | 0,05 | 0,03 | -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% | 5,5% | 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% | 2,5% | 0,5% | -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 | 54 | 63 | 63 | 64 | 71 | 76 | 107 |
| Staff F. C | | | | | | | | | | | | | |
| Mean | 0,11% | 0,03% | 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% | 0,54% | 0,73% | 0,64% | 0,45% | 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% | 0,75% | 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% | 26% | 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% | 67% |

Note: (*) In 2001, on firms was eliminated of this ratio, because the value was outside of the normal evolution.

Legend: Index Lerner = Σ [(net income/sales)*market Share; Mean Four-F: Mean of Four Biggest Firm on Sales; Stand Dev.: Standard Deviation; Equity Capital Prof. = (Return on owners' equity) = Net Income / Equity; Net Sales Profitability = Net Income/Sales; 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 = Exportation/ Total sales

Source: INE

Figures:

Figure 1. World Production of Tomatoes, Tomato Pasta Trade (1000Tonnes) and World and EU, Exports Prices (\$1000/ton) in current value

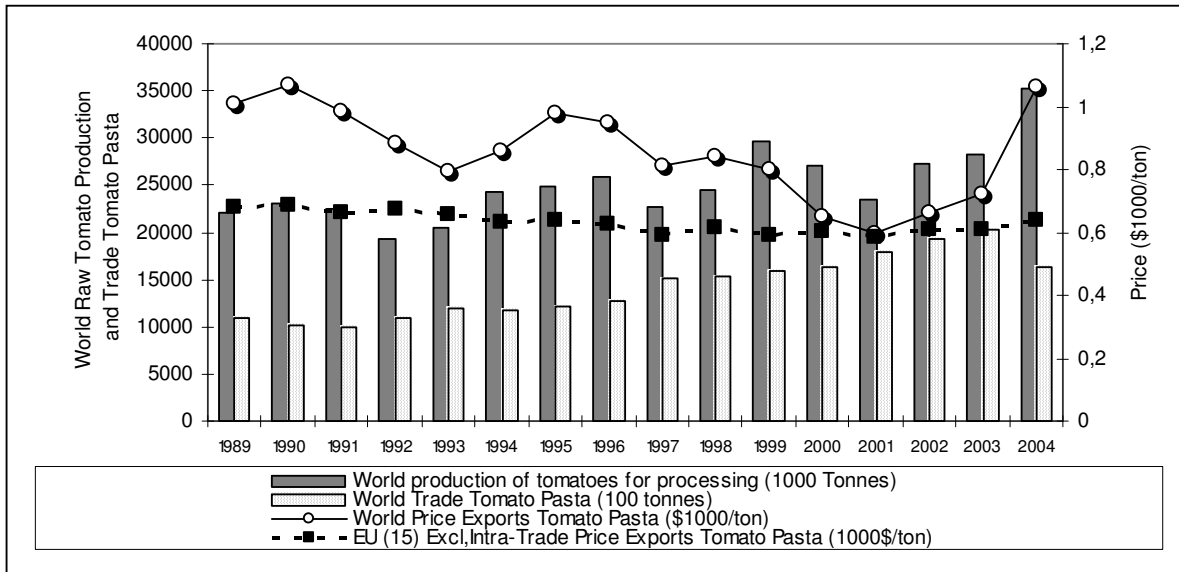


Figure 2: Lerner Index, Net Sales Profitability, Standard Deviation and Net Sales Profitability of the Four Leading Firms

