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Abstract

This paper analyzes interactions between producer concentration and research and development (R&D) activities of Taiwanese firms at the industry level. The paper first documents how producer concentration has varied across manufacturing industries over the last 2 decades or so. Then, it provides the analysis of correlation between firm concentration ratios and R&D-sales ratios. Although in Schumpeter's discussion, it is hypothesized that innovation increases with market concentration, a review of the empirical studies on this issue reveals that there are weak correlations between markets structure and innovative activities. The analysis of this paper also supports it, namely, clarifying that industrial concentration is not an independent and significant determinant of R&D intensity. In order to have a better understanding, it will be suggested that we might have to focus on the other factors such as the type of market demand, technological opportunity, and business model, the examination of which needs more accumulation of field researches as well as numerical analyses.

Keywords: concentration, imperfect competition, research & development (R&D), manufacturing, Taiwan

JEL Categories: D43, L20, L60, O30, O53

1. Introduction

The effect of market structure on firm behavior is one of the central issues in the field of industrial organization. In Schumpeter's discussion, a hypothesis is that innovation increases with market concentration. In detail, there are two distinct logics. First, it is recognized that firms need the expectation of keeping market power for a while to have the incentive to invest in research and development (R&D). Second, an oligopolistic market structure makes rivalry more predictable and thereby reduces the uncertainty that eventually leads to undermining the incentive to R&D investment. The empirical studies have focused on the effects of concentration on R&D investment, and a review of these studies concluded that industrial concentration is not an independent and significant determinant of innovative behavior and performance (Cohen, 1989).

This paper will analyze interactions between producer concentration and R&D activities of Taiwanese firms at the industry level. The paper will first make a review of literature in this topic in the next section, then, in section 3, it will be documented how producer concentration has varied across manufacturing industries over the last 2 decades or so. Second, in section 4, the trends in R&D intensity will be examined and I will clarify the variation in R&D intensities across industries, again for the last two decades or so. Third, causal relationships among producer concentration and R&D intensity will be analyzed. In section 5, we will focus on relationships between concentration and R&D-sales ratios. For example, R&D intensity may be closely related to the cost structures of industries and thus can be viewed as a determinant of producer concentration. On the other hand, producer concentration may also be argued to affect the level of R&D in an industry. These possibilities may be analyzed with some statistical methods, as well as a descriptive manner. In the final section, the concluding remark will be provided.

2. Review of Literature

The empirical literature has focused on the relationship between market concentration and R&D intensity. There are three main views on this topic. First, many studies that examine the relationship between market concentration and R&D intensity have found a positive connection (e.g. Mansfield, 1968; Scherer, 1967a). These studies predict that if competition intensifies and the expectation of monopoly rents is cut down, the incentive to innovate will decrease. Second, in contrast to this, some have found evidence that concentration has a negative effect on R&D, that is to say, market competition may stimulate innovation (e.g. Vickers, 1997; Boone, 2000). Third, in more recent work, the effect of concentration on R&D intensity is described as non-monotone, that is to say, it

depends on other industry-level variables. These variables, for example, include the degree of product differentiation (Comanor, 1967), the nature of the final product market (Shrieves, 1978), the degree of technological uncertainty (Angelmar, 1985), and the industry's stage in the technology life cycle (Mueller and Tilton, 1969). These results describe that market concentration is not an independent, significant determinant of innovative behavior.

In order to understand the difference among industries in the degree of innovation intensity, empirical researchers focus on three main variables: (a) market demand, (b) technological opportunity, and (c) appropriability conditions (Cohen, 1989).

(a) Market demand. Although the proposition that demand almost alone determines R&D intensity is not supported by empirical researchers, inter-industry differences in demand might be expected to affect intensity of innovative activity in two respects, namely, the size of the market, and price elasticity of demand.

(b) Technological opportunity. Although it is widely accepted that opportunities for innovation differ between industries and/or sub-sectors, there is no clear understanding on how to define the concept of technological opportunity and how to measure it. In some sectors, it seems that the development of technology may follow a natural trajectory that is relatively independent of market influence. In addition, knowledge sources external to the industry affect an industry's technological opportunity, for example, suppliers, customers, research institutes, government, and so on. Finally, acquiring knowledge from both intra- and extra-industry source is not costless. As Cohen and Levinthal (1989) formulated, firms must invest in R&D to develop "absorptive capacity"—the ability to recognize, assimilate, and exploit outside knowledge.

(c) Appropriability conditions. The most representative mechanism for appropriating the returns from R&D investment is patent, but the effectiveness of patent protection differs among industries. In many industries, other mechanisms are regarded as quite effective, for example, investment in complementary sales and services efforts, ability to move quickly down the learning curve, the relative complexity of the products, and so on. However, the relationship between innovative activity and appropriability may not be monotonously proportional. Increase in spillovers (fall in appropriability) may enhance the technological capability of the receiving firms. It may also facilitate investment in "absorptive capacity" to take advantage of spillover effect.

There is another approach that tries to understand the differences in innovation along industrial sectors, namely, "a sectoral system framework" (Malerba, 2005). This framework focuses on three main dimensions of sectors: (a) knowledge and

technological domain, (b) actors and networks, and (c) institutions. In this framework, an industrial sector is characterized by a specific knowledge base, technologies and inputs. A sector is composed of various actors (organizations and/or individuals, firms and/or non-firms, subunits of organizations, groups of organizations), and innovation is considered to be generated through systematic interactions among the various actors. In other words, a sectoral system is composed of networks of relationships among heterogeneous actors with different competencies, beliefs, objectives, and behaviors. And actors' cognition, behaviors, and interactions are institutions, which include norms, routines, rules, established practices, standards, and so on. Considering the co evolution of these various elements, a sectoral system is not fixed, but changes over time.

3. Trends in Concentration: Level and Changes

Table 1 shows large firms sales as ratios to gross output in the national accounts in 1991, 1996, 2001 and 2006. You can find a trend toward concentration in the data of manufacturing average. There was a steady growth in 4-firm concentration ratios (CRs) from 13.2 percent in 1991, to 16.4 percent in 1996, 20.7 percent in 2001 and 33.6 percent in 2006. Likely, 8-firm concentration ratios had increased from 19.1 percent in 1991, to 23.5 percent in 1996, 28.4 percent in 2001 and 44.1 percent in 2006. Among the industrial sectors listed in the table, high concentration ratios (more than 30 percent in 4-firm CRs and 50 percent in 8-firm CRs in 2006) can be seen in 4 sectors including textiles, apparel, petrochemical products, and computer and peripheral. On the other hand, low CRs (less than 10 percent in 4-firm CRs and less than 15 percent in 8-firm CRs in 2001) are observed in 5 sectors including food and beverage, printing, chemicals, fabricated metal products, and machinery.

[Place Table 1 here]

Table 2 shows large firms sales as ratios to total revenue in the commercial censuses in 1991, 1996, 2001. On average, there was a steady, but not very rapid growth in 4-firm CRs from 12.5 percent in 1991, to 15.1 percent in 1996, and 17.7 percent in 2001. Likely, 8-firm CRs had increased from 18.2 percent in 1991 to 21.7 percent in 1996, and 23.9 percent in 2001. Among the industrial sectors listed in the table, high concentration ratios (more than 20 percent in 4-firm CRs and 30 percent in 8-firm CRs in 2001) can be seen in 6 sectors including textiles, paper and pulp, petrochemical products, rubber products, iron and steel, and motor vehicles and equipment. On the other hand, low CRs (less than 10 percent in 4-firm CRs and less than 15 percent in 8-firm CRs in 2001) are

observed in 5 sectors including tannery and leather goods, “plywood, wooden, bamboo, rattan products”, printing, chemicals, and machinery.

[Place Table 2 here]

Table 3 provides large firms sales as ratios to operating revenue in the commercial censuses in 1991, 1996, and 2001. Like in above-mentioned two kinds of ratios, on manufacturing average, you can see an increasing trend in both 4-firm CRs (12.8 percent in 1991, 15.6 percent in 1996, and 18.3 percent in 2001) and 8-firm CRs (18.6 percent in 1991, 22.3 percent in 1996, and 24.7 percent in 2001). Among the industrial sectors, high concentration ratios (more than 20 percent in 4-firm CRs and 30 percent in 8-firm CRs in 2001) can be seen in 6 sectors including textiles, paper and pulp, petrochemical products, rubber products, iron and steel, and motor vehicles and equipment. On the other hand, low CRs (less than 10 percent in 4-firm CRs and less than 15 percent in 8-firm CRs in 2001) are observed in 5 sectors including tannery and leather goods, “plywood, wooden, bamboo, rattan products”, printing, chemicals, and machinery.

[Place Table 3 here]

4. Trends in R&D Intensity: Level and Changes

Table 4 shows data on R&D expenditures as a percentage of sales by industry in 1991, 1996, 2001 and 2005. In the manufacturing industry as a whole, it has gradually increased from 0.94 percent in 1991 to 1.33 percent in 2005. Among the industrial sectors in the table, R&D-sales ratios are very high, around 3 percent, in 3 sectors including “precision, optical, medical equipment, watches and clocks” (precision, hereafter), “computer, communication, and video and radio electronics products” (computer, hereafter), and “electronic parts and components” (electronic parts, hereafter) in 2005. In 4 sectors, namely, “electrical machinery, suppliers and equipment and repairing” (electrical machinery, hereafter), “transport equipment and repairing” (transport equipment, hereafter), “leather, fur and allied products” (leather, hereafter), and chemical products, the ratios are relatively high, between 1 and 2 percents in the same year. The other sectors show low ratios, less than 1 percent.

Among the sectors in the Table 4, in 5 sectors including leather, “printing and related support activities” (printing, hereafter), rubber products, computer and precision, R&D-sales ratios show upward tendencies after 2001. On the other hand, in 9 sectors,

namely, food and beverages, tobacco, furniture and fixtures, chemical materials, petroleum and coal products (petroleum, hereafter), plastic products, fabricated metal products, electronic parts, and electrical machinery, the ratios display downward tendencies after 2001. In the remaining sectors, we can find relatively small changes during the same period.

[Place Table 4 here]

Table 5 provides data on R&D expenditures as a percentage of total revenue and of operating revenue in 2001 by industry. Among the industrial sectors in the table, both R&D-total revenue and R&D-operating revenue ratios are very high, more than 2 percent, in 4 sectors including computer, transport equipment, precision, and electronic parts. In 6 sectors, namely, other industrial products, “machinery and equipment and repairing” (machinery, hereafter), rubber products, leather, electronic machinery, and chemical products, the ratios are relatively high, between 1 and 2 percents. The remaining sectors show low ratios, less than 1 percents.

[Place Table 5 here]

In Table 6, you can see data on the number of science and technology (S&T) staff as a percentage of total employment in 1991, 1996, 2001 and 2005. In the latest data of 2005, in 3 sectors, that is, electronic parts, precision, and computer, S&T staff-total employment ratios are high, more than 8 percent. In 10 industrial sectors including machinery, other industrial products, rubber products, tobacco, chemical material, electric machinery, petroleum, transport equipment, chemical products, and leather, the ratios are between 1 and 5 percents. The other sectors record low ratios, less than 1 percent.

In the manufacturing industry as a whole, it has gradually increased from 2.1 percent in 1991 to 3.5 percent in 2005. However, in terms of individual sectors, only two sectors, namely, leather and precision, have clearly developed a tendency to increase since 1991. On the other hand, in 4 sectors including textile, furniture and fixtures, chemical material, and plastic products, the S&T staff-total employment ratios have decreased since 1991. Regarding the other sectors, at least by reading the data on the Table 6, we can not find any straightforward upward or downward tendencies.

[Place Table 6 here]

5. Relationships between Concentration and R&D-Sales Ratios

Table 7 shows correlation between 4-firm concentration ratios and R&D-sales ratios and between 8-firm concentration ratios and R&D-sales ratios in 1991, 1996, 2001 and 2006. In all the years in the table, a correlation coefficient lies between -0.15 and 0.32, which means that there are very weak correlations. As mentioned in section 2, a literature review concluded that there is little evidence for the view that industrial concentration is an independent and significant determinant of innovative behavior. This is supported by our analysis on R&D activities of Taiwanese firms at the industry level.

[Place Table 7 here]

As mentioned in section 4, according to Table 4, in 2005, R&D-sales ratios were very high, around 3 percent, in 3 sectors including precision, computer, and electronic parts. In 4 industrial sectors, namely, electrical machinery, transport equipment, leather, and chemical products, the ratios were relatively high, between 1 and 2 percents. Because it seems that market concentration is not an important determinant of R&D intensity, other factors should be considered. The chemical products industry is a typical science-based sector, in which a large part of technological advancement is derived from investment in basic research. In regard to electronic parts, computers, and transport equipment, it is relatively easy to understand their high R&D-sales ratios considering ceaseless model changes, and accelerated introduction of new materials and process technologies in these sectors. The situation may be similar to a certain extent in sectors such as precision and electrical machinery. But in these sectors, high R&D-sales ratios may be related more to the fact that not a few machineries and equipment are developed and designed as customized products. In the leather industry which is usually seen as a “conventional, low-technology industry”, a large part of high ratio is considered as a result of many artistic design activities for a brand product market. To sum up, based on the technical terms by Cohen (1989) mentioned in section 2, it seems that the type of market demand and technological opportunity are important as a factor to influence the degree of R&D intensity.

In addition, in order to understand the nature of innovative activities, it may be quite important to examine what kind of business model is dominant in a specific sector of a specific country (or region). A business model consists of several important elements including the target of technological development (e.g. focusing on forefront technologies or relatively mature ones), the type of actors undertaking innovation and

relationship between them (e.g. networks between small innovative firms or in-house R&D by large vertical integrated manufacturers), and institutional factors such as tacit norms and business cultures as well as formal rules and standards. In this respect, the concept of “sectoral systems” (Malerba, 2005) mentioned in section 2 may provide a meaningful perspective.

6. Conclusion

This paper began by introducing the concern of empirical researchers on the relationship between markets structure and innovative activities. Although in Schumpeter’s discussion, it is hypothesized that innovation increases with market concentration, a review of the empirical studies on this issue revealed that industrial concentration was not an independent and significant determinant of R&D intensity. In order to make sure of this, I dealt with the same issue by using data of Taiwan. First, in section 3, I examined how producer concentration varied across manufacturing industries. As the result, high concentration ratios were observed in 4 sectors including textiles, apparel, petrochemical products, computer and peripheral, motor vehicles and equipment, paper and pulp, rubber products, and iron and steel in at least one of three indexes (namely, large firms sales as ratios to gross output, large firm sales as ratios to total revenue, and large firm sales as ratios to operating revenue). Second, in section 4, the trends in R&D intensity were examined and it was clarified that, as of 2005, R&D-sales ratios were very high in 3 sectors including precision, computer, and electronic parts. And in 4 industrial sectors, namely, electrical machinery, transport equipment, leather, and chemical products, the ratios were relatively high.

Based on the examination in the previous sections, section 5 provided the analysis of correlation between firm concentration ratios and R&D-sales ratios. As the result, it was revealed that there were very weak correlations. This result is considered to support a conclusion by a review of empirical studies that industrial concentration is not an independent and significant determinant of innovative behavior. In order to have a better understanding, it was suggested that we might have to focus on the other factors such as the type of market demand, technological opportunity, and business model, the examination of which needs more accumulation of field researches as well as numerical analyses.

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Table 1: Top 4- and 8-Firm Concentration Ratios: Large Firms Sales as Ratios to Gross Output (at current prices) in the National Accounts

	4-Firm Concentration Ratios (%)				8-Firm Concentration Ratios (%)			
	1991	1996	2001	2006	1991	1996	2001	2006
Manufacturing Average	13.2	16.4	20.7	33.6	19.1	23.5	28.4	44.1
Food and Beverage	5.1	5.9	9.4	7.4	9.0	10.2	14.8	12.9
Textiles	22.9	29.4	35.0	80.5	32.1	40.5	47.2	88.1
Apparel	5.2	8.7	17.6	46.2	8.0	14.8	25.2	62.7
Footwear	-	-	-	-	-	-	-	-
Tannery and Leather Goods	2.8	9.3	15.2	18.2	5.1	15.2	25.5	27.8
Plywood, Wooden, Bamboo, Ratan Products	7.5	13.9	11.6	10.4	13.0	23.3	20.3	13.1
Paper and Pulp	24.8	25.7	27.0	29.9	33.0	33.8	33.6	37.2
Printing	-	-	6.4	5.7	-	-	8.4	7.8
Chemicals	6.9	3.9	5.6	6.6	9.7	6.6	8.7	9.8
Petrochemical Products	17.2	23.2	44.0	63.1	22.9	29.5	50.5	69.3
Rubber Products	25.2	22.4	25.4	34.6	36.6	32.7	34.6	44.0
Plastics Processing	20.1	14.7	15.4	21.5	23.4	17.6	19.4	25.1
Non-Metallic Mineral Products	20.0	17.7	24.1	24.4	27.1	23.3	30.8	32.2
Iron and Steel	5.5	22.9	25.4	23.5	8.1	27.7	31.9	32.0
Fabricated Metal Products	9.7	9.2	10.6	9.4	16.1	16.0	18.1	13.7
Machinery	3.2	5.2	4.8	3.9	5.1	7.4	7.0	6.0
Precision Machinery	-	-	31.6	11.5	-	-	41.0	18.6
Computer and Peripheral	7.4	19.5	27.9	186.9	11.8	29.8	42.4	258.9
Electronic and Electrical	15.4	16.6	25.9	27.2	24.3	26.5	39.2	39.4
Motor Vehicles and Equipment	26.0	30.8	31.0	27.5	38.9	45.5	41.1	39.4

Source) Appendix Table 1, Appendix Table 2

Table 2: Top 4- and 8-Firm Concentration Ratios: Large Firm Sales as Ratios to Total Revenue in the Commercial Censuses

	4-Firm Concentration Ratios (%)			8-Firm Concentration Ratios (%)		
	1991	1996	2001	1991	1996	2001
Manufacturing Average	12.5	15.1	17.7	18.2	21.7	23.9
Food and Beverage	6.6	6.8	9.9	11.6	11.8	15.4
Textiles	21.1	28.6	33.4	29.6	39.5	45.1
Apparel	9.7	6.9	12.1	15.0	11.8	17.4
Footwear	-	-	-	-	-	-
Tannery and Leather Goods	5.4	9.9	8.0	9.7	16.1	13.5
Plywood, Wooden, Bamboo, Ratan Products	7.3	10.5	8.1	12.7	17.5	14.1
Paper and Pulp	24.3	23.1	24.3	32.3	30.4	30.2
Printing	-	-	5.3	-	-	6.9
Chemicals	7.0	4.0	5.0	9.8	6.8	7.9
Petrochemical Products	15.8	21.8	52.4	21.1	27.6	60.3
Rubber Products	18.1	20.2	22.1	26.2	29.4	30.2
Plastics Processing	15.8	12.8	12.9	18.3	15.3	16.1
Non-Metallic Mineral Products	18.4	15.5	19.7	25.0	20.4	25.1
Iron and Steel	5.6	22.9	28.9	8.1	27.8	36.3
Fabricated Metal Products	8.6	7.7	8.9	14.2	13.3	15.0
Machinery	3.3	5.3	3.7	5.3	7.5	5.4
Precision Machinery	-	-	18.3	-	-	23.8
Computer and Peripheral	6.9	17.1	17.5	10.9	26.2	26.6
Electronic and Electrical	14.7	14.2	18.9	23.3	22.6	28.7
Motor Vehicles and Equipment	24.1	30.2	27.0	35.9	44.6	35.8

Source) Appendix Table 1, Appendix Table 3

Table 3: Top 4- and 8-Firm Concentration Ratios: Large Firm Sales as Ratios to Operating Revenue in the Commercial Censuses

	4-Firm Concentration Ratios (%)			8-Firms Concentration Ratios (%)		
	1991	1996	2001	1991	1996	2001
Manufacturing Average	12.8	15.6	18.3	18.6	22.3	24.7
Food and Beverage	6.9	7.2	10.5	12.1	12.4	16.4
Textiles	21.7	29.6	34.6	30.4	40.8	46.7
Apparel	9.8	7.0	12.4	15.2	12.0	17.8
Footwear	-	-	-	-	-	-
Tannery and Leather Goods	5.4	10.2	8.6	9.8	16.6	14.5
Plywood, Wooden, Bamboo, Ratan Products	7.3	10.6	8.2	12.8	17.7	14.3
Paper and Pulp	24.9	23.8	24.8	33.1	31.2	30.9
Printing	-	-	5.3	-	-	7.0
Chemicals	7.3	4.2	5.2	10.2	7.1	8.2
Petrochemical Products	16.2	22.5	53.0	21.5	28.5	60.9
Rubber Products	18.5	20.6	22.7	26.8	30.0	31.0
Plastics Processing	16.0	13.1	13.2	18.6	15.6	16.6
Non-Metallic Mineral Products	19.1	16.1	20.9	25.9	21.1	26.7
Iron and Steel	5.7	23.3	29.7	8.3	28.3	37.3
Fabricated Metal Products	8.6	7.7	9.0	14.3	13.5	15.3
Machinery	3.3	5.3	3.7	5.4	7.6	5.5
Precision Machinery	-	-	19.1	-	-	24.8
Computer and Peripheral	7.1	17.7	18.4	11.2	27.0	28.0
Electronic and Electrical	15.1	14.7	19.9	23.9	23.3	30.2
Motor Vehicles and Equipment	24.6	31.1	27.9	36.7	45.8	37.1

Source) Appendix Table 1, Appendix Table 4

Table 4: R&D-Sales Ratios from Science and Technology Indicators (R&D Expenditures/Sales Ratios, %)

	1991	1996	2001	2005
Food and Beverages	0.43*	0.42	0.39	0.28
Tobacco	0.13**	0.45	0.74	0.32
Textiles Mills	0.55	0.28	0.29	0.30
Apparel, Clothing Accessories and Other Textile Products	0.24	0.25	0.18	0.12
Leather, Fur and Allied Products	0.45	0.43	0.94	1.49
Wood, Bamboo Products and Non-metal Furniture	0.03	-	-	-
Wood and Bamboo Products	-	0.01	0.02	0.01
Furniture and Fixtures	-	0.36	0.32	0.21
Paper, Pulp and Print	0.21	-	-	-
Pulp, Paper and Paper Products	-	0.18	0.18	0.13
Printing and Related Support Activities	-	0.07	0.08	0.22
Chemical Material	0.84	0.57	0.63	0.36
Chemical Products	0.89	1.42	1.56	1.57
Petroleum and Coal Products	0.86	0.77	0.48	0.19
Rubber Products	0.52	0.70	0.52	0.75
Plastic Products	1.12	0.57	0.60	0.37
Non-Metallic Mineral Products	0.11	0.25	0.23	0.21
Basic Metal	0.32	0.35	0.20	0.16
Fabricated Metal Products	0.25	0.27	0.27	0.16
Machinery and Equipment and Repairing	0.55	0.83	0.67	0.59
Electric and Electronic Machinery	2.41	2.39	-	-
Computer, Communication, and Video and Radio Electronic Products	-	-	1.76	2.91
Electronic Parts and Components	-	-	3.05	2.83
Electrical Machinery, Supplies and Equipment and Repairing	-	-	1.35	1.03
Transport Equipment and Repairing	1.01	1.30	1.14	1.20
Precision, Optical, Medical Equipment, Watches and Clocks	0.68	1.41	2.40	3.22
Other Industrial Products	0.35	0.53	0.72	0.68
Manufacturing Industry Total	0.94	1.06	1.26	1.33

Notes) *This figure is of the food industry.

**This figure is of the beverage and tobacco industry.

Source) Appendix Table 5

Table 5: R&D-Total Revenue and -Operating Revenue Ratios from Commercial Census Data 2001 (%)

	to Total Revenue	to Operating Revenue
Food and Beverages	0.47	0.50
Tobacco	0.40	0.42
Textiles Mills	0.65	0.67
Apparel, Clothing Accessories and Other Textile Products	0.32	0.32
Leather, Fur and Allied Products	1.27	1.36
Wood and Bamboo Products	0.05	0.05
Furniture and Fixtures	0.30	0.31
Pulp, Paper and Paper Products	0.29	0.30
Printing and Related Support Activities	0.30	0.30
Chemical Material	0.79	0.82
Chemical Products	1.73	1.77
Petroleum and Coal Products	0.59	0.60
Rubber Products	1.23	1.27
Plastic Products	0.74	0.76
Non-Metallic Mineral Products	0.52	0.56
Basic Metal	0.33	0.34
Fabricated Metal Products	0.25	0.25
Machinery and Equipment and Repairing	1.10	1.12
Computer, Communication, and Video and Radio Electronic Products	2.35	2.48
Electronic Parts and Components	4.79	5.04
Electrical Machinery, Supplies and Equipment and Repairing	1.32	1.38
Transport Equipment and Repairing	2.62	2.71
Precision, Optical, Medical Equipment, Watches and Clocks	3.52	3.67
Other Industrial Products	1.02	1.06
Manufacturing Industry Total	1.82	1.89

Source) DGBAS, The Report on Industry, Commerce and Service Census, Taiwan-Fuchien Area, ROC (2001)

Table 6: S&T Staff as Ratios of Total Employment (%)

	1991	1996	2001	2005
Food and Beverages	-	-	1.6	0.9
Tobacco	-	3.6	4.9	2.6
Textiles Mills	1.7	1.2	0.9	0.6
Apparel, Clothing Accessories and Other Textile Products	0.1	0.4	0.4	0.3
Leather, Fur and Allied Products	0.7	0.7	2.2	4.2
Wood and Bamboo Products	-	0.0	0.2	0.0
Furniture and Fixtures	-	0.7	0.6	0.5
Pulp, Paper and Paper Products	-	0.5	0.6	0.2
Printing and Related Support Activities	-	0.2	0.2	0.2
Chemical Material	3.8	3.4	2.8	2.7
Chemical Products	3.4	4.7	4.2	3.8
Petroleum and Coal Products	4.1	2.9	2.2	3.2
Rubber Products	2.4	2.2	1.2	1.6
Plastic Products	1.4	1.3	0.7	0.6
Non-Metallic Mineral Products	0.6	1.0	0.6	0.5
Basic Metal	0.5	2.3	0.8	0.6
Fabricated Metal Products	0.8	0.9	0.6	0.3
Machinery and Equipment and Repairing	1.2	1.9	1.9	1.4
Computer, Communication, and Video and Radio Electronic Products	-	-	11.3	12.8
Electronic Parts and Components	-	-	7.1	8.2
Electrical Machinery, Supplies and Equipment and Repairing	-	-	5.2	2.7
Transport Equipment and Repairing	2.9	3.8	3.7	3.5
Precision, Optical, Medical Equipment, Watches and Clocks	1.5	4.3	8.3	9.9
Other Industrial Products	0.9	1.4	1.7	1.4
Manufacturing Industry Total	2.1	2.9	3.4	3.5

Source) Appendix Table 6

Table 7: Correlation between 4- & 8-Firm Concentration Ratios and R&D-Sales Ratios

	1991		1996		2001		2006		1991		1996		2001		2006	
	CR4	R&D-Sales	CR4	R&D-Sales	CR4	R&D-Sales	CR4	R&D-Sales*	CR8	R&D-Sales	CR8	R&D-Sales	CR8	R&D-Sales	CR8	R&D-Sales*
Food and Beverage	5.10	-	5.86	0.42	9.43	0.39	7.43	0.28	9.01	-	10.17	0.42	14.76	0.39	12.94	0.28
Textiles	22.85	0.55	29.37	0.28	35.00	0.29	80.52	0.30	32.11	0.55	40.54	0.28	47.25	0.29	88.12	0.30
Apparel	5.15	0.24	8.66	0.25	17.57	0.18	46.18	0.12	8.01	0.24	14.82	0.25	25.24	0.18	62.69	0.12
Tannery and Leather Goods	2.82	0.45	9.33	0.43	15.20	0.94	18.19	1.49	5.08	0.45	15.16	0.43	25.55	0.94	27.85	1.49
Plywood, Wooden, Bamboo, Ratan Products	7.46	0.03	13.94	0.37	11.64	0.34	10.39	0.22	13.03	0.03	23.28	0.37	20.32	0.34	13.12	0.22
Paper and Pulp	24.78	-	25.73	0.18	26.98	0.18	29.87	0.13	33.00	-	33.80	0.18	33.61	0.18	37.18	0.13
Printing	-	-	-	0.07	6.38	0.08	5.66	0.22	-	-	-	0.07	8.39	0.08	7.79	0.22
Chemicals	6.91	1.73	3.87	1.99	5.59	2.19	6.56	1.94	9.67	1.73	6.64	1.99	8.69	2.19	9.84	1.94
Petrochemical Products	17.18	0.86	23.20	0.77	43.96	0.48	63.07	0.19	22.87	0.86	29.45	0.77	50.52	0.48	69.33	0.19
Rubber Products	25.21	0.52	22.44	0.70	25.36	0.52	34.59	0.75	36.57	0.52	32.66	0.70	34.57	0.52	43.99	0.75
Plastics Processing	20.13	1.12	14.71	0.57	15.44	0.60	21.55	0.37	23.39	1.12	17.61	0.57	19.36	0.60	25.11	0.37
Non-Metallic Mineral Products	19.97	0.11	17.71	0.25	24.13	0.23	24.39	0.21	27.12	0.11	23.26	0.25	30.80	0.23	32.17	0.21
Iron and Steel	5.55	0.32	22.86	0.35	25.44	0.20	23.52	0.16	8.06	0.32	27.74	0.35	31.89	0.20	32.02	0.16
Fabricated Metal Products	9.68	0.25	9.18	0.27	10.63	0.27	9.36	0.16	16.08	0.25	15.98	0.27	18.07	0.27	13.73	0.16
Machinery	3.18	0.55	5.22	0.83	4.75	0.67	3.86	0.59	5.13	0.55	7.39	0.83	7.03	0.67	6.04	0.59
Precision Machinery	-	0.68	-	1.41	31.56	2.40	11.48	3.22	-	0.68	-	1.41	41.00	2.40	18.65	3.22
Computer and Peripheral	7.42	-	19.52	-	27.87	1.76	186.90	2.91	11.79	-	29.80	-	42.36	1.76	258.86	2.91
Electronic and Electrical	15.38	-	16.64	-	25.85	4.40	27.22	3.86	24.30	-	26.47	-	39.25	4.40	39.39	3.86
Motor Vehicles and Equipment	26.05	1.01	30.84	1.30	30.98	1.14	27.54	1.20	38.86	1.01	45.46	1.30	41.07	1.14	39.39	1.20
Correlation Coefficient	0.19		-0.15		0.13		0.27		0.13		-0.14		0.23		0.32	
Standard Deviation	8.28	0.44	8.27	0.50	10.78	1.06	41.10	1.15	11.14	0.44	10.91	0.50	13.10	1.06	55.01	1.15

Source) Table 1, Table 4

Note) *The figures of R&D-Sales in 2006 are taken from 2005 data in Table 4.

Appendix Table 1: Sales of Top 4 and Top 8 Firms

	Sales (million NT\$)			
	1991 Top 4	1996 Top 4	2001 Top 4	2006 Top 4
Food and Beverage	23,632	34,781	44,583	36,454
Textiles	81,078	115,183	137,142	261,214
Apparel	9,431	10,649	18,823	32,856
Footwear	13,078	24,354	20,374	14,156
Tannery and Leather Goods	4,070	7,353	7,932	7,987
Plywood, Wooden, Bamboo, Ratan Products	4,814	6,031	3,157	2,316
Paper and Pulp	34,204	41,927	42,897	57,955
Printing	-	-	4,796	4,844
Chemicals	32,046	28,340	50,559	118,055
Petrochemical Products	43,793	78,837	237,357	788,870
Rubber Products	12,628	16,057	17,720	29,858
Plastics Processing	53,302	55,038	52,640	74,742
Non-Metallic Mineral Products	34,861	41,906	48,391	63,563
Iron and Steel	20,217	126,719	152,785	353,452
Fabricated Metal Products	27,681	37,388	43,913	54,096
Machinery	8,690	22,327	22,595	29,158
Precision Machinery	-	-	23,136	12,893
Computer and Peripheral	28,971	156,230	333,042	1,907,943
Electronic and Electrical	84,058	173,671	415,345	909,329
Motor Vehicles and Equipment	95,572	150,938	138,522	155,802
	1991 Top 8	1996 Top 8	2001 Top 8	2006 Top 8
Food and Beverage	41,777	60,304	69,767	63,517
Textiles	113,911	159,011	185,130	285,877
Apparel	14,659	18,214	27,046	44,603
Footwear	16,987	27,300	22,171	15,642
Tannery and Leather Goods	7,345	11,949	13,333	12,228
Plywood, Wooden, Bamboo, Ratan Products	8,407	10,073	5,513	2,925
Paper and Pulp	45,550	55,091	53,438	72,144
Printing	-	-	6,306	6,669
Chemicals	44,885	48,555	78,626	177,065
Petrochemical Products	58,300	100,062	272,744	867,131
Rubber Products	18,320	23,365	24,150	37,966
Plastics Processing	61,946	65,896	66,006	87,094
Non-Metallic Mineral Products	47,358	55,047	61,772	83,829
Iron and Steel	29,394	153,814	191,521	481,209
Fabricated Metal Products	45,974	65,095	74,637	79,354
Machinery	14,015	31,582	33,419	45,644
Precision Machinery	-	-	30,053	20,950
Computer and Peripheral	46,073	238,536	506,145	2,642,592
Electronic and Electrical	132,846	276,196	630,550	1,315,886
Motor Vehicles and Equipment	142,600	222,465	183,649	222,886

Source) CCIS, The Largest Corporations in Taiwan (1992, 1997, 2002, 2007)

Appendix Table 2: Gross Output

	Gross Output at Current Prices (million NT\$)				
	1991	1996	2001	2005	2006
Food and Beverage	463,586	593,036	472,793	487,749	490,922
Textiles	354,767	392,229	391,845	325,406	324,417
Apparel	183,028	122,921	107,138	79,882	71,154
Footwear	-	-	-	-	-
Tannery and Leather Goods	144,551	78,807	52,187	46,979	43,913
Plywood, Wooden, Bamboo, Ratan Products	64,525	43,268	27,131	22,283	22,297
Paper and Pulp	138,044	162,980	158,980	196,089	194,015
Printing	54,650	71,166	75,174	88,468	85,654
Chemicals	464,026	731,455	904,786	1,634,453	1,799,930
Petrochemical Products	254,957	339,752	539,917	1,059,483	1,250,811
Rubber Products	50,096	71,548	69,864	83,659	86,311
Plastics Processing	264,801	374,098	340,888	360,796	346,873
Non-Metallic Mineral Products	174,594	236,635	200,530	253,020	260,621
Iron and Steel	364,590	554,423	600,645	1,230,487	1,502,650
Fabricated Metal Products	285,846	407,401	413,015	541,770	577,973
Machinery	273,090	427,466	475,292	716,570	755,228
Precision Machinery	53,788	56,371	73,297	104,316	112,356
Computer and Peripheral	390,673	800,447	1,194,834	1,015,379	1,020,848
Electronic and Electrical	546,684	1,043,384	1,606,559	2,866,920	3,340,380
Motor Vehicles and Equipment	366,944	489,390	447,156	676,858	565,805

Source) National Statistics, ROC (Taiwan), Gross Output by Kind of Activity (93SNA)

(<http://eng.stat.gov.tw/ct.asp?xItem=14621andctNode=3567>)

Appendix Table 3: Total Revenue

	Total Revenue (million NT\$)		
	1991	1996	2001
Food and Beverage	358,717	510,896	451,801
Textiles	384,445	402,929	410,942
Apparel	97,604	154,433	155,316
Footwear	-	-	-
Tannery and Leather Goods	75,677	74,064	98,540
Plywood, Wooden, Bamboo, Ratan Products	66,397	57,626	38,967
Paper and Pulp	140,915	181,518	176,699
Printing	55,588	86,320	91,237
Chemicals	460,042	714,097	1,001,571
Petrochemical Products	276,818	362,457	452,669
Rubber Products	69,819	79,566	80,038
Plastics Processing	338,158	429,616	409,646
Non-Metallic Mineral Products	189,482	270,147	246,199
Iron and Steel	362,751	553,398	527,999
Fabricated Metal Products	323,452	488,303	496,156
Machinery	264,048	422,594	616,058
Precision Machinery	55,706	67,410	126,110
Computer and Peripheral	421,509	911,095	1,902,836
Electronic and Electrical	571,180	1,223,633	2,195,501
Motor Vehicles and Equipment	397,341	499,243	513,081

Source) DGBAS, The Report on Industry, Commerce and Service Census, Taiwan-Fuchien Area, ROC (1991, 1996, 2001)

Appendix Table 4: Operating Revenue

	Operating Revenue (million NT\$)		
	1991	1996	2001
Food and Beverage	344,969	484,452	425,870
Textiles	374,189	389,269	396,089
Apparel	96,133	152,269	151,704
Footwear	-	-	-
Tannery and Leather Goods	74,691	72,004	92,195
Plywood, Wooden, Bamboo, Ratan Products	65,610	56,862	38,467
Paper and Pulp	137,582	176,435	172,937
Printing	55,020	85,463	90,257
Chemicals	438,787	682,301	964,357
Petrochemical Products	271,050	350,806	447,660
Rubber Products	68,358	77,866	77,950
Plastics Processing	333,198	421,434	397,646
Non-Metallic Mineral Products	182,787	260,893	231,326
Iron and Steel	354,569	542,959	514,013
Fabricated Metal Products	320,730	483,032	488,872
Machinery	260,709	417,568	603,182
Precision Machinery	54,872	65,959	121,009
Computer and Peripheral	409,686	882,369	1,808,050
Electronic and Electrical	557,000	1,184,471	2,087,431
Motor Vehicles and Equipment	388,429	485,627	495,664

Source) DGBAS, The Report on Industry, Commerce and Service Census, Taiwan-Fuchien Area, ROC (1991, 1996, 2001)

Appendix Table 5: R&D-Sales Ratios from Science and Technology Indicators (R&D Expenditures/Sales Ratios, %)

	1986	1991	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Food and Beverages	0.48*	0.43*	0.42	0.43	0.45	0.42	0.39	0.39	0.38	0.35	0.33	0.28
Tobacco	0.23**	0.13**	0.45	0.38	0.40	0.54	0.51	0.74	0.52	0.43	0.36	0.32
Textiles Mills	0.16	0.55	0.28	0.32	0.39	0.39	0.35	0.29	0.27	0.29	0.36	0.30
Apparel , Clothing Accessories and Other Textile Products	0.12	0.24	0.25	0.30	0.17	0.15	0.15	0.18	0.17	0.13	0.11	0.12
Leather, Fur and Allied Products	0.24	0.45	0.43	0.61	0.79	0.93	1.11	0.94	1.30	1.34	1.45	1.49
Wood, Bamboo Products and Non-metal Furniture	0.11	0.03	-	-	-	-	-	-	-	-	-	-
Wood and Bamboo Products	-	-	0.01	0.08	0.16	0.02	0.03	0.02	0.03	0.08	0.01	0.01
Furniture and Fixtures	-	-	0.36	0.58	0.50	0.68	0.30	0.32	0.30	0.26	0.20	0.21
Paper, Pulp and Print	0.16	0.21	-	-	-	-	-	-	-	-	-	-
Pulp, Paper and Paper Products	-	-	0.18	0.29	0.24	0.40	0.14	0.18	0.18	0.11	0.14	0.13
Printing and Related Support Activities	-	-	0.07	0.10	0.24	0.23	0.18	0.08	0.09	0.14	0.14	0.22
Chemical Material	1.07	0.84	0.57	0.75	0.64	0.92	0.56	0.63	0.47	0.37	0.28	0.36
Chemical Products	0.80	0.89	1.42	1.47	1.45	1.67	1.55	1.56	1.51	1.42	1.62	1.57
Petroleum and Coal Products	0.41	0.86	0.77	1.11	1.17	0.01	0.44	0.48	0.43	0.31	0.28	0.19
Rubber Products	0.51	0.52	0.70	0.94	1.24	0.91	0.58	0.52	0.70	0.64	0.75	0.75
Plastic Products	0.72	1.12	0.57	0.78	1.00	0.91	0.59	0.60	0.57	0.54	0.41	0.37
Non-Metallic Mineral Products	0.27	0.11	0.25	0.44	0.29	0.32	0.28	0.23	0.34	0.23	0.20	0.21
Basic Metal	0.29	0.32	0.35	0.26	0.21	0.19	0.17	0.20	0.21	0.16	0.16	0.16
Fabricated Metal Products	0.36	0.25	0.27	0.43	0.45	0.39	0.24	0.27	0.20	0.14	0.15	0.16
Machinery and Equipment and Repairing	0.86	0.55	0.83	0.79	0.70	0.69	0.62	0.67	0.77	0.73	0.61	0.59
Electric and Electronic Machinery	0.65	2.41	2.39	2.39	-	-	-	-	-	-	-	-
Computer, Communication, and Video and Radio Electronic Products	-	-	-	-	2.20	2.06	1.69	1.76	2.03	2.37	2.85	2.91
Electronic Parts and Components	-	-	-	-	3.21	2.95	2.42	3.05	2.98	2.64	2.47	2.83
Electrical Machinery, Supplies and Equipment and Repairing	-	-	-	-	1.18	1.19	1.36	1.35	1.19	1.21	0.98	1.03
Transport Equipment and Repairing	0.48	1.01	1.30	1.82	1.66	1.79	1.43	1.14	1.14	1.21	1.27	1.20
Precision, Optical, Medical Equipment, Watches and Clocks	0.48	0.68	1.41	1.75	1.85	1.31	1.54	2.40	2.68	2.97	2.64	3.22
Other Industrial Products	0.74	0.35	0.53	0.73	0.80	0.67	0.52	0.72	0.74	0.69	0.69	0.68
Manufacturing Industry Total	0.47	0.94	1.06	1.16	1.26	1.26	1.14	1.26	1.30	1.28	1.24	1.33

Notes) *This figure is of the food industry.

**This figure is of the beverage and tobacco industry.

Source) NSC, Indicators of Science and Technology, Taiwan (every year)

Appendix Table 6: S&T Staff as Ratios of Total Employment from Science and Technology Indicators (S&T Manpower/Employment Ratios, %)

	1991	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Food and Beverages	-	-	1.7	1.8	2.3	1.9	1.6	1.7	1.4	0.9	0.9
Tobacco	-	3.6	3.3	4.0	4.9	2.3	4.9	4.9	4.2	2.7	2.6
Textiles Mills	1.7	1.2	1.3	1.4	1.3	1.3	0.9	0.8	0.9	0.6	0.6
Apparel, Clothing Accessories and Other Textile Products	0.1	0.4	0.5	0.5	0.4	0.5	0.4	0.3	0.4	0.3	0.3
Leather, Fur and Allied Products	0.7	0.7	0.5	1.3	1.9	2.4	2.2	2.6	3.6	3.2	4.2
Wood and Bamboo Products	-	0.0	0.2	0.3	0.2	0.3	0.2	0.1	0.1	0.0	0.0
Furniture and Fixtures	-	0.7	1.1	0.8	1.0	0.7	0.6	0.6	0.6	0.3	0.5
Pulp, Paper and Paper Products	-	0.5	0.8	2.1	1.5	0.7	0.6	0.5	0.3	0.3	0.2
Printing and Related Support Activities	-	0.2	0.2	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Chemical Material	3.8	3.4	3.7	3.5	3.2	3.1	2.8	2.8	2.5	2.6	2.7
Chemical Products	3.4	4.7	5.2	4.9	4.8	4.4	4.2	4.4	4.2	3.7	3.8
Petroleum and Coal Products	4.1	2.9	2.4	1.5	3.5	2.6	2.2	2.3	2.6	2.8	3.2
Rubber Products	2.4	2.2	2.1	2.0	2.7	1.6	1.2	1.7	1.6	1.4	1.6
Plastic Products	1.4	1.3	1.5	1.4	1.3	1.1	0.7	0.6	0.7	0.6	0.6
Non-Metallic Mineral Products	0.6	1.0	1.0	0.8	1.0	1.0	0.6	0.9	0.6	0.5	0.5
Basic Metal	0.5	2.3	1.3	1.2	0.9	0.7	0.8	0.8	0.6	0.6	0.6
Fabricated Metal Products	0.8	0.9	1.4	1.0	1.3	0.8	0.6	0.5	0.4	0.3	0.3
Machinery and Equipment and Repairing	1.2	1.9	2.1	2.0	1.8	1.9	1.9	2.1	1.8	1.4	1.4
Computer, Communication, and Video and Radio Electronic Products	-	-	-	-	-	-	11.3	13.0	13.2	12.1	12.8
Electronic Parts and Components	-	-	-	-	-	-	7.1	7.8	9.3	7.4	8.2
Electrical Machinery, Supplies and Equipment and Repairing	-	-	-	-	-	-	5.2	4.2	3.4	2.8	2.7
Transport Equipment and Repairing	2.9	3.8	5.5	3.9	4.6	3.7	3.7	3.8	3.8	3.3	3.5
Precision, Optical, Medical Equipment, Watches and Clocks	1.5	4.3	7.4	4.8	4.4	5.8	8.3	10.0	10.0	8.9	9.9
Other Industrial Products	0.9	1.4	2.1	2.5	1.7	1.4	1.7	1.8	1.7	1.5	1.4
Manufacturing Industry Total	2.1	2.9	3.3	3.1	3.3	3.4	3.4	3.7	3.8	3.3	3.5

Source) Appendix Table 6a, Appendix Table 6b

Appendix Table 6a: S&T Staff/Employment Ratios

	1991	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Food and Beverages	1816*	1950*	1,969	2,045	2,548	2,022	1,713	1,815	1,551	1,002	981
Tobacco	173**	95	81	79	87	41	85	75	61	40	38
Textiles Mills	2,814	1,864	1,974	2,122	2,073	1,937	1,343	1,128	1,208	808	733
Apparel, Clothing Accessories and Other Textile Products	175	432	516	501	390	386	327	228	286	173	204
Leather, Fur and Allied Products	795	405	294	650	921	1,150	906	990	1,350	1,178	1,484
Wood, Bamboo Products and Non-metal Furniture	95	-	-	-	-	-	-	-	-	-	-
Wood and Bamboo Products	-	4	51	84	63	73	39	16	29	5	2
Furniture and Fixtures	-	334	513	379	438	296	237	214	191	104	136
Paper, Pulp and Print	724	-	-	-	-	-	-	-	-	-	-
Pulp, Paper and Paper Products	-	321	502	1,231	871	409	325	256	151	180	135
Printing and Related Support Activities	-	102	120	232	183	134	125	121	131	90	135
Chemical Material	2,414	2,258	2,393	2,343	2,398	2,359	2,094	2,030	1,763	1,853	1,942
Chemical Products	1,892	2,995	3,173	2,981	3,061	2,890	2,671	2,781	2,655	2,438	2,472
Petroleum and Coal Products	664	506	414	247	558	428	355	347	388	426	493
Rubber Products	758	730	697	706	924	553	414	549	522	491	547
Plastic Products	2,261	2,199	2,548	2,198	2,154	1,786	1,074	901	1,083	981	955
Non-Metallic Mineral Products	588	995	940	699	827	887	468	720	448	379	364
Basic Metal	457	2,333	1,371	1,281	931	743	754	812	625	606	606
Fabricated Metal Products	1,486	1,819	2,932	2,182	2,802	1,653	1,184	982	785	726	752
Machinery and Equipment and Repairing	2,135	3,870	4,624	4,362	4,090	4,288	4,075	4,529	4,041	3,383	3,638
Electric and Electronic Machinery	24,760	38,441	40,628	41,107	45,316	52,431	-	-	-	-	-
Computer, Communication, and Video and Radio Electronic Products	-	-	-	-	-	-	24,294	29,082	29,863	27,748	28,836
Electronic Parts and Components	-	-	-	-	-	-	20,930	22,813	28,157	25,267	29,297
Electrical Machinery, Supplies and Equipment and Repairing	-	-	-	-	-	-	7,042	5,404	4,308	3,620	3,493
Transport Equipment and Repairing	3,829	5,361	7,944	5,554	6,426	5,074	4,787	4,592	4,746	4,300	4,609
Precision, Optical, Medical Equipment, Watches and Clocks	618	1,419	2,499	1,700	1,503	1,969	2,763	3,307	3,529	3,182	3,471
Other Industrial Products	1,053	1,187	1,655	1,877	1,275	993	1,167	1,143	1,080	1,007	932
Manufacturing Industry Total	49,505	69,618	77,838	74,560	79,836	82,501	79,170	84,836	88,951	79,988	86,257

Notes) *This figure is of the food industry.

**This figure is of the beverage and tobacco industry.

Source) NSC, Indicators of Science and Technology, Taiwan (every year)

Appendix Table 6b: Total Employment

	Employment (persons)													
	1981	1986	1991	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Food and Beverages	117,165	131,626	122,366	120,498	115,889	110,667	109,114	107,477	104,193	105,092	107,604	107,591	108,322	109,734
Tobacco	4,418	3,864	4,574	2,655	2,424	1,980	1,760	1,811	1,722	1,525	1,465	1,468	1,466	1,440
Textiles Mills	221,604	214,253	168,395	154,798	154,489	154,010	154,242	154,214	141,893	135,076	130,486	128,983	121,853	116,588
Apparel, Clothing Accessories and Other Textile Products	190,069	233,956	144,627	106,405	101,141	96,257	89,784	84,271	76,136	70,253	67,565	64,421	59,508	56,260
Leather, Fur and Allied Products	157,805	222,319	120,926	58,341	54,162	50,049	48,617	47,345	41,681	38,419	37,387	37,184	35,347	33,972
Wood and Bamboo Products	71,683	78,180	55,024	31,226	29,734	27,549	26,791	25,640	24,161	22,055	21,921	22,161	22,101	20,259
Furniture and Fixtures	54,471	72,357	58,981	48,763	47,793	45,053	43,993	42,455	36,921	34,071	32,375	31,010	29,434	28,886
Pulp, Paper and Paper Products	48,679	59,750	60,440	63,770	61,385	59,660	59,037	57,818	55,044	53,821	55,740	57,124	57,723	59,453
Printing and Related Support Activities	26,777	42,457	51,347	53,751	54,448	55,456	58,968	59,661	58,800	58,602	59,311	59,368	59,125	61,648
Chemical Material	52,715	59,500	63,351	65,929	65,554	66,558	75,211	75,991	73,532	71,634	71,767	72,633	72,404	73,509
Chemical Products	41,516	50,543	55,110	63,364	61,609	60,812	63,798	65,245	63,643	63,218	63,876	65,394	65,737	66,053
Petroleum and Coal Products	10,643	14,807	16,379	17,484	16,924	16,160	16,159	16,188	15,874	15,275	14,720	15,105	15,409	15,258
Rubber Products	22,897	28,310	31,449	32,987	33,646	34,638	34,341	34,169	33,135	32,497	33,157	34,200	33,698	33,553
Plastic Products	125,490	166,476	160,259	164,853	165,595	161,879	162,014	161,305	151,734	150,213	152,236	157,364	155,494	154,582
Non-Metallic Mineral Products	103,080	109,818	99,022	96,372	93,365	88,713	85,750	85,382	78,875	77,431	77,592	77,764	78,105	79,074
Basic Metal	70,299	81,270	89,677	103,490	105,824	105,083	102,421	104,022	99,966	97,471	98,969	100,735	102,762	105,401
Fabricated Metal Products	101,255	155,896	178,879	204,683	212,710	215,194	215,445	212,965	199,876	198,272	208,288	217,701	217,481	218,977
Machinery and Equipment and Repairing	114,184	137,353	174,344	207,767	216,593	221,779	222,381	224,417	219,466	219,679	228,206	241,465	252,814	260,699
Computer, Communication, and Video and Radio Electronic Products	109,095	143,525	150,663	163,586	175,759	190,095	198,544	217,863	214,224	223,370	226,320	228,977	225,045	228,449
Electronic Parts and Components	67,214	148,682	152,825	197,305	218,197	238,095	252,258	292,241	293,879	292,727	304,102	340,262	356,318	377,685
Electrical Machinery, Supplies and Equipment and Repairing	138,175	144,537	150,294	148,101	148,546	143,552	142,363	146,517	134,617	127,830	128,374	128,720	128,027	126,806
Transport Equipment and Repairing	108,001	127,758	132,281	141,202	143,476	143,895	140,841	137,785	128,348	120,374	124,652	129,442	132,110	130,353
Precision, Optical, Medical Equipment, Watches and Clocks	25,303	36,284	40,603	33,335	33,770	35,219	33,874	33,949	33,465	33,066	35,383	35,765	35,126	34,911
Other Industrial Products	95,259	150,536	117,285	82,962	78,985	74,801	73,176	72,343	67,116	65,058	64,104	65,269	64,493	64,141
Manufacturing Industry Total	2,077,797	2,614,057	2,399,101	2,363,627	2,392,018	2,397,154	2,410,882	2,461,074	2,348,301	2,307,029	2,345,600	2,420,106	2,429,902	2,457,691

(Source) DGBAS, Macro Economics Database, National Statistics website (<http://61.60.106.82/pxweb/Dialog/statfile1L.asp>)