Productivity Growth and Industrial Structure: The Case of Taiwan

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September 1999

Paper to be presented
At the Pacific Economic Outlook
Specialist meetings,
September, 1999,
In Osaka, Japan

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1. Introduction

Many changes have occurred in Asia in the last few years. Before the East Asian financial crisis took most people by surprise, the discussion was mainly about how and why the first-tiered East Asian NICs and the second-tiered Southeast Asian economies achieved fast growth. People were occupied with the task of explaining the "miracle". There was the debate between the free-market neoclassical school and the revisionist school. The former stresses the role of free market in fostering fast growth, while the latter emphasizes the role of public polices. The influential World Bank study (1993), which represents the neoclassical view, has also attracted numerous responses and criticism. The debate, of course, is still ongoing.

Paul Krugman (1994) ignites another smaller round of argument, when he argued in *Foreign Affairs,* that "Asian growth, like that of the Soviet Union in its high-growth era, seems to be driven by extraordinary growth in inputs like labor and capital rather than by gains in efficiency" (p.70). This kind of growth, of course, cannot continue indefinitely[1].

He mainly relied on total factor productivity figures to back his story, and he cited empirical studies like Young (1994) and Kim and Lau (1994) which indeed showed below average performance for the East Asian economies in terms of total factor productivity growth. However, many pointed out that Young's results are rather mixed in that it showed Egypt

[1] However, after the Asian financial crisis broke out, Krugman did not join those who blame the crisis on "Asian crony capitalism". Instead, he was in agreement with people like J.E. Stiglitz and J. Sachs, who see the crisis as one of liquidity crunch rather than one of solvency. That is, he did not use the crisis as a supporting evidence for his earlier argument. See Krugman (1998).

and Botswana at the top and Switzerland at the bottom of the ranking of the countries' TFP growth. Since most would find the situation of Switzerland much more desirable than that of Botswana, the results are neither realistic nor convincing.

On the other hand, there are many other studies, which have opposite results. The famous World Bank (1993: Chapter 1) study is an example. It found that the East Asian high-performance economies indeed had significant productivity growth in the last few decades.

This paper will look at the record of productivity growth in Taiwan in the last two decades, and examine the structural change in the industrial sector and assess the relation between the two. Some policy issues will also be discussed.

2. Industrial Structure

2.1 The share of industry in GDP.

We will first examine the composition of the gross domestic product by sectors, which is listed in Table 1a and represented in Figure 1. Table 1b, on the other hand, lists the composition of employment by sectors. The graph in Figure 1 clearly shows that industrialization in Taiwan progressed continuously in the 1950s and 1960s. The extent of industrialization then proceeded more slowly from the mid-1970s to the late 1980s, reaching a plateau.

Then the share of industry in GDP began to decline after 1986. That was the time when the economy began its tremendous transformation. That

is, the New Taiwan dollar appreciated 40% against the US dollar, the wage level rose significantly, and the government started implementing trade liberalization in earnest after 1986.

The shifting pattern of GDP's composition among the primary, secondary and tertiary sectors in Taiwan, of course, pretty much resembles that of the more advanced countries. The share of the manufacturing sector in Taiwan's GDP is 27% in 1997, which is higher than the average for the advanced economies. It probably also reflects the fact that Taiwan's niche in the international market still lies in its manufacturing capabilities. The changes in the employment composition, as shown in Table 1b, run pretty much parallel to those of the GDP.

2.2 The distribution of value-added in manufacturing sectors.

Table 2 lists the distribution of the value-added among the twenty-one two-digit manufacturing industries from 1971 to 1997. We can see that two industries played the leading role in different times. The textile industry was the leading sector until its position was taken over by the electrical and electronic machinery sector in the mid-1980s. The share of the textile industry declined from 20% in 1971 to 6.4% in 1997. The electrical and electronic machinery sector now generates over one quarter of the value-added of Taiwan's manufacturing sector. Each of the two sectors was also the leading export industry at its time.

The pattern of the structural change among the manufacturing sector is easy to identify. The share of more labor-intensive industries began to decline after the mid-1980s or even earlier. That includes the food, apparel, leather products, furniture, and miscellaneous products.

On the other hand, the share of more capital-intensive and technology-intensive industries began to increase at the same time. The same pattern of change also occurred in the export side. The share of heavy industrial goods in total exports increased from 46% in 1990 to 63% in 1997. While the share of non-heavy industries declined from 50% in 1990 to 35% in 1997. The weight of intermediate goods in total exports, relative to the final and capital goods, also increased from 36% in 1988 to 59% in 1997.

All these patterns of changes are somewhat expected. For as the extent of industrialization deepens and the wage level increases, it could be foreseen that Taiwan's industry would try to upgrade its product mix and its technology level while it continues its learning of the advanced technology.

The question of course is whether the pattern of changes in terms of productivity growth matches up with those mentioned above. To address this question, we now turn to examine the changes in Taiwan's productivity growth in the last two decades.

3. Changes in Productivity

3.1 The conventional method

The method of measuring total factor productivity is well known. The analysis is about the determination of the contribution of labor and capital to the growth of output, with that part of growth still unaccounted for being referred to as technical progress or total factor productivity. The conventional way to measure total factor productivity is as follows:

(1) $\lambda = y - sk - (1-s)n,$

where *y*, *k*, and *n* is percentage rates of growth in output, capital and labor respectively, *s* is the share of capital in total factor payments.

It is a common practice to use the share of output accruing to capital and labor as weights, assuming constant return to scale and competitive equilibrium. This practice, of course, has been criticized sometimes[2]. It would be obvious that these two assumptions, constant return to scale and prevalence of competitive equilibrium, may not hold in most of the occasions.

In the past, many studies of total factor productivity in the industrialized economies have found the unexplained part unusually large, sometimes even of the magnitude of one-half. Some people then try to devise new measures such as introducing additional inputs to account for the unexplained part of growth. In principle, it is possible to account eventually for all the residual part of growth in this way, but this procedure have been criticized as being arbitrary and flawed. Some additional variables suggested include materials, R&D outlays and economies of scale, among others. The rationales for including each variable is usually not well spelled out. Most importantly, the interaction effects between the additional variables and capital outlay could be significant; thus making the estimate procedure flawed and results unreliable.

In principle, it is very difficult to separate the effects on output growth of an increase in input (such as capital) from that of an increase in " knowledge" or new technology (the source of higher productivity). New

[2] For reference, see Denison (1967) and Nelson (1981).

technology usually requires investments in capital stock or labor to embody it. And the introduction of new machinery and equipment requires new knowledge (in the form of worker skills and engineering know-how) to function. East Asian firms borrowed foreign technology and invested heavily in new capital goods, but they also had to invest in their own human and organizational capabilities to make what they borrowed work in the marketplace.

It is difficult to distinguish between an increase in capital or labor (a movement along a production function) and an increase in knowledge (a shift of the production functions), regardless which sophisticated econometric model you use. Some have argued that this is one of the reasons why the productivity estimates obtained by various analysts have been widely different[3]. As mentioned above, estimates by Young (1994) and Kim and Lau (1994) showed little productivity growth in East Asia, while the World Bank (1993) and many others find the opposite.

Besides these conceptual problems with the total factor productivity analysis, there are plenty of the usual measurement problems. The measurement of "real" output over time involves price deflation and quality-change problems. The measurement of input over time also has similar problems: the changing skill-mix of the labor force, quality change in the machinery and equipment used, and the changing utilization of the labor force and of the existing capital stock. What inputs to be included in the total input concept also present problems. The quality of data collected is always suspect, especially in less developed countries.

Despite all these difficulties and problems, total factor productivity analysis has become very popular. Even though the analysis addresses an

[3] See for example Amsden et al. (*World Development*, April 1994).

important issue, we should always take care when we try to interpret the results. With all these precautions, we now turn to the estimates of Taiwan's total factor productivity from 1978 to 1997.

3.2 Estimates of total factor productivity in Taiwan, 1978-97

Table 4 and 5 list the indices of total factor productivity of the industry and service sectors and the twenty manufacturing sub-sectors, 1978-1996, respectively. Total factor productivity is as defined in equation (1) above. Here the total input includes the capital and labor inputs. Other additional factors such as energy and R&D outlays were not included. At the bottom of each column lists the average annual rate of change for two periods, 1978-88 and 1989-96; that is, the period before and after liberalization.

For industry sectors, the overall rate of change did not differ very much for the two periods. However, for the service sectors, the rate of change was significantly higher for the second period, and it is so for all service sub-sectors. It is also a period of fast growth for the service sectors as well.

From Table 5 we can see that the overall rate of change of total factor productivity remains more or less unchanged over the two periods, but the variations are significant across the manufacturing sub-sectors. Only the most prosperous sectors, like the all-important electrical and electronic products, shows significant higher total factor productivity growth rates in the second period than in the first period. For many of the relatively labor-intensive sectors, such as apparels and miscellaneous products, total factor productivity turned negative in the second period, the period in which they contracted in absolute terms.

For the sake of reference, Table 6 and 7 list indices of labor productivity of the industry sectors and manufacturing sub-sectors, 1976-1997, respectively[4]. We can see that the effects of transformation are more notable in this case than that of TFP. In most of the labor-intensive sectors, labor productivity growth turned negative in the second period, while their output also contracted.

3.3 Patterns and Correlation of Changes

To discern a pattern of changes from these productivity figures, we can compare these different indices together. Thus, in Table 8, 9 and 10, there list the various productivity and production indices of the industry and service sectors, the manufacturing industry, and the manufacturing sub-sectors, 1978-1997, respectively. We also calculated the correlation coefficients of the various productivity and production indices of the manufacturing sub-sectors, 1978-1996, and put the results in Table 11.

From Table 11, we can see that three of the four variables listed are consistently highly correlated. That is, for these manufacturing sub-sectors, the change in the share of value-added, the average growth rate of labor productivity, and the average growth rate of production output are highly correlated; they tend to move in the same directions. If an industry is growing faster than the average, then its share, of course, also increases, but its labor productivity goes up as well. If an industry is contracting, and then its share declines so does its labor productivity.

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[4] Labor productivity index is derived by dividing real GDP index by labor input index. The latter is measured by man-hour times number of employed and equi-employed. See DGBAS (1998b).

This pattern of changes among the manufacturing industries can be interpreted as evidence of the Verdoorn effects. That is, the faster the output level increases, the more rapidly learning takes place, and the growth of the labor productivity also accelerates. Does the effect work in a reverse direction? It is likely that as output growth slows or even turns negative, output level contracts faster than the labor force, and the capital investment turns negative as well, thus rendering negative growth in labor productivity. This is not Verdoorn effect in reverse though.

From Table 11, we can also notice that the average growth rate of the total factor productivity is not highly correlated with the other three variables. The correlation coefficients tell us that less than forty percent of the variations between the total factor productivity and the other three variables are correlated.

This is not a rigorous statistical test. It, however, does confirm our suspicion about the reliability of the total factor productivity estimates. It shows that most likely the differences in the level of total factor productivity cannot be explained by differences in the level of output growth. For the fastest sector like the electrical and electronic products, it indeed does exhibit the highest level of total factor productivity growth especially in the second period. The overall pattern between total factor productivity and output growth, nonetheless, is not clear. If total factor productivity can represent technical change, then the results show that technological progress may not be stimulated by output growth or vice versa. This will be very difficult to interpret.

Nonetheless, the level of total factor productivity of Taiwan's manufacturing sectors obtained from this study is quite presentable by itself. If we compare it with those of other countries, the level of total factor productivity of Taiwan's whole manufacturing sector, averaging 2.3% from

1979-96, is satisfactory. The level of the TFP of the OECD countries averages 0.9% for the same period[5]. If we grant the estimate acceptable, it shows that Taiwan's manufacturing industry does have agreeable level of technological progress, unlike what Krugman claimed.

3.4 Some evidence of qualitative change

As mentioned above, changes in the product mix and the skill mix of the labor force, and the embodiment of technical change in capital and labor, all will reduce the reliability of the total factor productivity estimates. The level of total factor productivity of Taiwan's manufacturing industry shown above does indicate acceptable level of technical progress, as we would predict based on our casual empirical observation. The fact that its variations are not highly correlated with those of the other growth variables hence indicates some data problems.

It will not be easy to disentangle these complicated changes in the relevant data; however, it is possible to have a sense of qualitative change, especially in the second period, by looking at some relevant statistics.

Table 12 lists the changing product mix of Taiwan's exports from 1982 to 1997. It shows that the share of capital-intensive products, technology-intensive products, and high-tech products in Taiwan's exports has all increased in this period. It indicates industrial upgrading indeed has been taking place in this round of industrial transformation. Besides reflecting the shifting weight of the various manufacturing sub-sectors, it also indicates that the product mix in a given industry is changing as well.

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[5] See OECD (1997).

3.5 Policy issues

The role of industrial policy has had its effects. For example, the two leading sectors, textiles and the electric and electronic product sector, had been the governments target industries in its time. The government used infant industry policy to promote the textile sector in the early 1950s. And it also helped to promote the textile sector's exports after the domestic market became saturated in the early 1960s. Even though the textile industry has seen its importance declined in recent years in Taiwan, the government still provides R&D funds to help it to upgrade its technology and design level. The government also set up a semi-public Textile Productivity Research Center for this purpose.

As for the all-important electric and electronic sectors, the role of industrial policy is also prominent. The government set up the semi-public research organization, Industrial Technology Research Institute (ITRI), the forerunner of Taiwan's semiconductor industry in the mid-1970s. Two spin-offs from the ITRI, Taiwan Semiconductor Manufacturing Co. and United Microelectronics Corp., have become the two leading semiconductor firms in Taiwan.

The government continued to push upgrading every step of the way since then. The policy for subsidizing R&D and sponsoring cooperative research should have helped to promote technological progress in Taiwan's high-tech industries.

There are indications that Taiwan's technological effort has made some progress. Not only that its high-tech industries are thriving and capturing not so insignificant shares in the global market. But various indicators used

by the international rating agency (to rate country's competitiveness) have shown that Taiwan has made significant progress in various areas. For example, Henderson (1999: 352) shows that Taiwanese firms hold more than twice of the number of patterns held by Korean firms in the USA.

The effects of all these industrial policy measures are evident in the growth record of Taiwan's high-tech industries. Though detailed studies will be needed to verify these tentative hypotheses.

4. Conclusion

Taiwan's industrial structure has been changing swiftly over the last few decades. The transformation from a dominantly agricultural society to an industrialized one took place in the 1950s and 1960s. The light industries grew rapidly from the late 1960s to mid-1980s, and then began to grow much more slowly or even contract or simply moved offshore since the late 1980s. The heavy industries emerged slowly in the late 1960s, then picked up speed in the 1970s, and took over the dominant position in the 1980s.

The high-tech industries was in its infancy in the 1970s, then began to grow quickly in the 1980s and became the dominant industry in the 1990s. The decline of labor-intensive industries and the increasing dominance of the high-tech industries took place at an extremely fast pace after the liberalization in the late 1980s and especially so in the 1990s. The speed of transformation of Taiwan's industrial structure quickens in the 1990s.

The composition of Taiwan's export pretty much reflects this structural change in the production side.

Some like Krugman (1994), citing negligible total factor productivity estimates from Young (1994) and others has argued that East Asian NICs achieved little technical progress in their so-called miracle growth. This study, using the conventional method of measurement, found respectable rates of total factor productivity for Taiwan's industrial sectors from 1978 to 1996. Other studies such as World Bank (1993) have obtained similar results. Since Taiwan has successfully transformed itself into an economy that relies heavily on high-tech industries, it is difficult to reconcile this fact with the indictment of no technical progress.

As expected from our understanding of the Verdoorn effects, the growth of the output level and labor productivity of Taiwan's manufacturing industries has been found to be highly correlated during this period under study. As output grows faster, learning then takes place more rapidly, and the growth of the labor productivity also accelerates.

However, when we examine the relationship between the total factor productivity and other growth variables, the correlation seems much weaker and the pattern of changes less clear-cut. It is possible that the usual problems with data and the inherent difficulties in distinguishing between an increase in capital or labor (a movement along a production function) and an increase in knowledge (a shift in a production function), have led to this result. Nonetheless, the overall level of total factor productivity obtained in this study shows that Taiwan has indeed experienced acceptable rate of technical progress during this period.

The role of policy must have had some influence. Because the industrial policy was responsible for setting up the forerunner of Taiwan's semiconductor industry in the 1970s, and for pushing upgrading every step of the way since then. The policy for subsidizing R&D and sponsoring cooperative research, of course, should have helped as well. The effects of

all these industrial policy measures are evident in the growth record of Taiwan's high-tech industries. Though detailed studies will be needed to verify these tentative hypotheses.

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Table 1a. Gross Domestic Product by Sectors, 1952-1997

Unit: %

Period	Agriculture	Industry	(Manufacturing)	Service	Total
1952	32.2	19.7	12.9	48.1	100.0
1955	29.1	23.2	15.6	47.7	100.0
1956	27.5	24.4	16.6	48.1	100.0
1957	27.3	25.3	17.4	47.4	100.0
1958	26.8	24.8	16.8	48.4	100.0
1959	26.4	27.1	19.4	46.6	100.0
1960	28.5	26.9	19.1	44.6	100.0
1961	27.4	26.6	18.9	46.0	100.0
1962	25.0	28.2	19.9	46.8	100.0
1963	23.2	29.9	22.0	46.8	100.0
1964	24.5	30.4	22.9	45.1	100.0
1965	23.6	30.2	22.3	46.2	100.0
1966	22.5	30.5	22.5	46.9	100.0
1967	20.6	33.0	24.9	46.4	100.0
1968	19.0	34.4	26.5	46.5	100.0
1969	15.9	36.9	29.1	47.3	100.0
1970	15.5	36.8	29.2	47.7	100.0
1971	13.1	38.9	31.5	48.0	100.0
1972	12.2	41.6	34.3	46.2	100.0
1973	12.1	43.8	36.8	44.1	100.0
1974	12.4	40.7	32.8	46.9	100.0
1975	12.7	39.9	30.9	47.4	100.0
1976	11.4	43.2	33.8	45.5	100.0
1977	10.6	44.0	34.2	45.4	100.0
1978	9.4	45.2	35.6	45.4	100.0
1979	8.6	45.3	35.9	46.1	100.0
1980	7.7	45.7	36.0	46.6	100.0
1981	7.3	45.5	35.6	47.2	100.0
1982	7.7	44.3	35.2	48.0	100.0
1983	7.3	45.0	35.9	47.7	100.0
1984	6.3	46.2	37.5	47.5	100.0
1985	5.8	46.3	37.6	47.9	100.0
1986	5.6	47.1	39.4	47.3	100.0
1987	5.3	46.7	38.9	48.0	100.0
1988	5.0	44.8	37.2	50.1	100.0
1989	4.9	42.3	34.6	52.8	100.0
1990	4.2	41.2	33.3	54.6	100.0
1991	3.8	41.1	33.3	55.1	100.0
1992	3.6	39.9	31.7	56.5	100.0
1993	3.7	39.0	30.5	57.3	100.0
1994	3.6	37.3	29.0	59.2	100.0
1995	3.6	36.3	28.1	60.2	100.0
1996	3.3	35.5	27.9	61.2	100.0
1997	2.7	34.9	27.7	62.4	100.0

Source: Taiwan Statistical Data Book, various years.

Table 2. Distribution of Manufacturing Value - Added , 1971-1997

Period	Food	Tobacco[1]	Textile mill products	Wearing apparel & accessories	Leather & fur products	Wood & bamboo products[2]	Furniture & fixtures	Pulp, paper & paper products[3]	Printing processings	Chemical materials	Chemical products
1971	10.07	2.76	20.09	2.76	0.38	4.32	-	3.29	-	5.43	3.32
1972	8.87	2.52	19.81	2.38	0.37	3.93	-	3.32	-	5.52	2.86
1973	8.58	2.49	18.26	2.21	0.37	3.57	-	3.17	-	5.99	2.43
1974	9.27	2.64	18.85	2.18	0.29	2.45	-	2.45	-	6.06	2.26
1975	9.15	2.79	21.51	2.00	0.35	2.88	-	2.60	-	6.84	2.36
1976	9.14	1.42	15.18	2.21	1.76	3.77	-	3.08	-	4.49	3.59
1977	8.68	1.40	14.40	2.08	1.86	3.55	-	3.01	-	5.08	3.54
1978	7.19	1.24	14.68	2.16	1.89	3.95	-	3.11	-	5.25	3.22
1979	7.36	1.22	13.56	2.23	2.13	3.19	-	3.54	-	6.00	3.16
1980	6.69	1.16	14.28	2.57	1.89	2.65	-	3.50	-	6.16	2.71
1981	7.08	1.29	12.81	3.47	1.11	3.74	-	3.88	-	8.02	1.87
1982	7.09	1.39	12.12	3.49	1.60	3.66	-	3.84	-	7.79	2.02
1983	8.33	0.35	11.90	3.61	2.07	2.86	1.64	1.93	1.53	5.91	1.94
1984	7.73	0.33	11.66	3.63	2.14	2.59	1.60	1.77	1.67	6.32	1.92
1985	8.13	0.31	11.31	3.81	2.37	2.62	1.69	1.87	1.67	6.70	2.06
1986	7.10	0.28	10.64	3.54	2.54	2.57	1.76	1.96	1.56	6.92	2.08
1987	6.74	0.22	10.03	3.27	2.31	2.30	1.88	1.90	1.46	6.35	2.15
1988	6.62	0.22	8.70	2.62	2.12	1.93	1.76	1.93	1.40	6.38	2.27
1989	6.22	0.22	8.76	2.54	2.00	1.52	1.72	1.96	1.45	6.47	2.26
1990	6.57	0.22	8.58	2.14	1.83	1.11	1.50	2.06	1.52	6.98	2.45
1991	6.37	0.21	8.61	1.95	1.65	1.08	1.49	2.06	1.49	7.28	2.47
1992	6.45	0.20	8.30	1.59	1.27	0.90	1.40	2.10	1.64	7.93	2.60
1993	6.41	0.18	7.62	1.35	1.07	0.76	1.28	1.98	1.65	8.18	2.69
1994	6.35	0.18	7.62	1.07	0.97	0.54	1.10	1.93	1.50	9.39	2.81
1995	6.14	0.16	6.94	0.96	0.79	0.40	0.92	1.92	1.40	9.49	2.83
1996	5.95	0.15	6.69	0.98	0.74	0.35	0.86	1.86	1.36	9.83	2.92
1997	5.04	0.14	6.41	0.88	0.64	0.33	0.82	1.79	1.30	9.61	2.91

Source: Industrial Production Statistics Monthly, various years.

Notes: 1. The data of 1971-1982 includes beverage.

2. The data of 1971-1982 includes furniture.

3. The data of 1971-1982 includes printing.

Table 2. Continued

Unit: %

Period	Petroleum & coal products	Rubber products	Plastic products	Non-metallic mineral products	Basic metal	Fabricated metal produccts	Machinery & equipment	Electrical & electronic machinery	Transport equipment	Precision instruments	Miscellaneous industrial products
1971	5.35	1.73	7.69	3.97	6.20	1.06	4.20	11.78	4.30	0.08	1.22
1972	5.24	1.68	2.51	3.78	5.88	1.10	3.80	15.43	4.78	0.10	1.15
1973	5.41	1.69	7.19	3.53	5.96	1.04	3.42	18.64	4.56	0.21	1.26
1974	5.20	1.67	6.25	3.90	5.79	1.05	3.36	19.18	5.21	0.25	1.60
1975	4.91	1.31	7.40	3.70	5.31	1.11	3.05	16.51	4.71	0.30	1.21
1976	9.08	2.27	6.81	4.63	3.95	6.20	4.45	9.55	4.39	0.77	3.18
1977	9.01	2.04	5.71	4.76	4.29	6.53	4.34	10.01	5.47	1.03	3.12
1978	8.96	1.85	6.07	4.21	4.73	5.96	3.90	11.82	5.51	1.04	3.17
1979	8.23	1.90	6.56	4.25	5.12	5.42	4.17	11.74	5.99	0.89	3.24
1980	7.99	1.94	6.43	4.33	5.15	5.67	3.96	12.39	6.55	0.86	3.03
1981	6.96	1.58	8.11	3.96	6.39	5.12	3.70	9.89	5.87	1.15	4.00
1982	6.88	1.75	8.33	4.06	6.69	4.88	3.33	9.78	5.50	1.24	4.56
1983	6.12	1.60	7.50	4.15	7.09	4.98	3.89	11.62	6.36	1.35	3.27
1984	5.48	1.49	8.03	3.88	6.70	5.04	3.71	13.58	6.20	1.22	3.31
1985	5.32	1.56	8.24	3.97	6.71	5.24	3.73	12.68	5.75	1.12	3.14
1986	4.56	1.48	8.67	3.63	6.73	5.15	3.86	14.08	6.00	1.12	3.77
1987	4.87	1.44	8.83	3.46	6.51	5.05	4.09	15.73	6.63	1.16	3.62
1988	5.10	1.46	8.96	3.47	7.04	5.30	4.49	16.57	6.52	1.28	3.86
1989	5.37	1.48	8.41	3.66	7.41	5.38	4.37	16.69	7.21	1.25	3.65
1990	4.80	1.58	7.78	3.78	7.64	5.52	4.75	17.29	7.10	1.29	3.51
1991	4.52	1.53	7.42	3.82	7.72	5.74	4.89	17.77	7.36	1.27	3.30
1992	4.46	1.51	6.71	3.96	8.37	5.73	4.93	17.94	7.75	1.23	3.03
1993	5.09	1.36	6.21	4.16	9.01	5.46	5.02	19.17	7.54	1.12	2.69
1994	4.67	1.24	6.06	4.07	8.97	5.42	4.94	20.62	7.21	1.07	2.27
1995	5.46	1.21	5.28	3.87	8.67	5.42	4.84	23.15	7.13	0.99	2.03
1996	5.83	1.17	5.37	3.52	8.74	5.19	4.80	24.33	6.58	0.90	1.88
1997	5.59	1.09	5.12	3.30	9.62	5.02	4.76	26.80	6.25	0.81	1.77

Table 3. Production Indices of the Manufacturing Sectors, 1970-1997

	Food	Tobacco[1]	Textile mill products	Wearing apparel & accessories	Leather & fur products	Wood & bamboo products[2]	Furniture & fixtures	Pulp, paper & paper products[3]	Printing processings	Chemical materials[4]	Chemical products
1970	12.30	10.40	39.80	16.60	45.60	24.30	42.00	19.50	11.40	16.00	-
1971	8.50	8.60	36.80	19.80	10.60	44.70	38.10	22.70	11.50	36.40	-
1972	8.10	11.80	20.70	5.70	17.50	11.50	-	23.60	-	24.60	5.60
1973	13.90	16.80	8.70	9.30	20.10	7.10	-	12.60	-	27.50	-0.20
1974	1.70	-0.30	-2.80	-7.20	-27.90	-33.10	-	-27.20	-	-4.90	-12.40
1975	6.70	13.90	23.10	-1.10	32.30	22.40	-	14.30	-	21.90	13.00
1976	21.40	12.00	12.90	57.70	32.90	28.20	-	19.00	-	34.10	15.10
1977	7.68	11.35	7.46	6.79	19.83	6.72	-	10.65	-	28.09	11.79
1978	2.75	10.20	26.51	28.77	25.97	38.02	-	28.35	-	28.20	12.91
1979	8.25	3.93	-2.35	9.17	19.32	-14.59	-	20.20	-	20.78	3.74
1980	-3.49	1.31	11.83	22.48	-5.85	-11.84	-	5.04	-	9.13	-9.17
1981	1.23	1.87	0.46	16.46	-11.90	15.17	-	-2.49	-	4.81	-5.87
1982	0.97	8.28	-4.60	1.58	44.47	-1.55	-	-0.08	-	-2.04	8.74
1983	7.46	6.20	6.56	-3.13	41.44	5.92	13.91	6.39	-2.84	16.02	10.79
1984	4.24	7.42	10.15	13.23	16.24	1.73	9.20	3.08	22.60	20.35	11.42
1985	7.90	-3.93	-0.53	7.64	13.57	3.63	8.43	8.20	2.34	8.61	9.88
1986	0.70	3.16	8.48	7.02	23.56	13.33	20.23	21.07	7.74	19.02	16.25
1987	5.39	-11.85	4.72	2.63	0.88	-0.76	18.67	7.69	3.57	1.96	14.81
1988	1.82	1.36	-10.17	-16.95	-4.99	-13.23	-2.87	4.88	-0.21	4.21	9.44
1989	-3.50	5.01	3.80	0.02	-2.59	-15.82	4.88	4.85	13.71	3.22	5.09
1990	5.77	-2.78	-2.33	-16.11	-8.85	-28.95	-16.41	5.35	1.37	8.41	6.80
1991	4.19	5.39	8.00	-2.06	-2.72	3.23	6.25	7.40	1.83	12.75	7.15
1992	4.24	-2.61	0.01	-15.00	-20.61	-14.29	-0.47	5.12	11.59	14.20	8.45
1993	2.23	-4.65	-5.55	-12.95	-13.28	-17.83	-10.48	-2.58	3.92	6.56	6.57
1994	5.49	1.50	5.53	-16.40	-4.15	-20.02	-6.40	2.96	-1.98	19.28	10.89
1995	0.86	-4.38	-4.84	-6.35	-15.35	-22.01	-12.32	3.58	-2.82	5.57	5.23
1996	-1.01	-3.02	-2.73	4.37	-4.06	-11.00	-4.76	-0.86	-0.31	5.87	5.43
1997	-8.13	1.38	3.94	-2.47	-6.59	0.87	3.60	4.40	3.71	5.95	8.14
Ave. 1970-1978	9.23	10.53	19.24	15.15	19.66	16.65	33.04	13.72	10.94	23.54	19.17
Ave. 1979-1988	3.45	1.78	2.46	6.01	13.67	-0.22	5.48	7.40	5.59	10.29	7.00
Ave. 1989-1997	1.13	-0.46	0.65	-7.44	-8.69	-13.98	-4.01	3.36	3.45	9.09	7.08
Ave. 1970-1997	4.56	3.87	7.27	4.63	8.41	0.78	16.12	8.13	7.58	14.16	12.77

Source: Industrical Production Statistics Monthly, various years.

Notes: 1. The data of 1971-1982 includes beverage; 2. The data of 1971-1982 includes furniture.

3. The data of 1971-1982 includes printing; 4. The Data of 1970-1971 includes chemical products

5.The Data of 1970-1971 includes plastic products.

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Table 3. Continued

Unit: %

	Petroleum & coal products	Rubber products[5]	Plastic products	Non-metallic mineral products	Basic metal	Fabricated metal produccts	Machinery & equipment	Electrical & electronic machinery	Transport equipment	Precision instruments	Miscellaneous industrial products
1970	19.80	19.50	-	10.60	22.10	18.00	25.80	32.10	12.30	-	63.10
1971	9.60	44.50	-	14.20	16.00	23.20	22.90	36.40	24.40	-	33.90
1972	19.80	18.90	19.70	16.70	16.50	26.90	10.70	60.60	36.50	65.60	15.40
1973	21.60	18.90	12.90	10.20	19.20	11.60	6.20	42.30	12.30	144.60	28.90
1974	-9.70	-7.20	-18.30	3.80	-8.60	-5.30	-7.60	-3.20	7.70	10.90	19.90
1975	1.80	-15.30	27.80	2.30	-0.90	14.10	-2.20	-7.10	-2.60	31.00	-18.10
1976	38.10	33.90	31.80	26.30	29.90	28.20	31.20	28.70	33.00	178.60	67.80
1977	12.50	2.25	-4.89	16.52	22.79	19.36	10.61	18.82	41.31	51.71	11.11
1978	23.45	12.33	31.82	9.88	36.82	13.28	11.46	46.56	25.07	25.51	25.87
1979	-3.00	8.35	14.31	6.58	14.45	-3.90	13.09	4.94	14.79	-10.33	8.15
1980	3.20	8.40	4.05	8.21	6.82	11.08	0.82	12.04	16.12	3.41	-0.82
1981	-4.98	-0.93	11.83	0.49	-1.56	2.00	9.84	10.46	5.00	19.07	9.52
1982	-0.30	11.45	3.57	3.30	5.42	-3.91	-9.07	-0.30	-5.50	8.70	15.02
1983	14.00	20.39	14.57	9.06	19.50	16.82	8.88	30.96	12.20	23.38	14.47
1984	0.79	4.43	20.42	5.05	6.19	13.79	7.22	31.46	9.58	1.55	10.71
1985	-0.45	7.17	5.23	4.87	2.76	6.64	2.99	-4.26	-4.85	-6.04	-4.84
1986	-1.27	9.88	21.30	5.46	15.58	13.34	19.41	28.06	20.23	15.84	27.61
1987	18.83	7.64	13.17	6.00	7.46	8.75	17.80	24.03	22.80	14.92	11.01
1988	8.41	5.02	5.07	3.90	11.97	8.78	13.59	9.20	1.95	14.54	4.88
1989	8.53	5.12	-2.18	8.95	7.78	4.79	2.40	3.96	14.90	6.88	-6.82
1990	-10.95	5.95	-8.08	3.17	3.34	1.54	6.01	2.88	-2.37	-1.50	-5.00
1991	1.31	3.97	1.95	8.13	8.96	12.52	10.91	10.90	11.26	4.22	1.16
1992	2.01	3.23	-3.99	5.14	10.99	4.85	5.81	5.14	8.89	2.06	-2.52
1993	17.70	-9.54	-5.41	7.55	10.64	-4.40	2.76	10.26	-0.63	-8.54	-11.92
1994	-2.92	-2.15	1.22	6.27	6.52	6.07	4.59	12.68	1.90	1.61	-10.03
1995	22.12	2.04	-8.92	-0.70	1.04	4.48	2.51	17.24	3.36	-3.01	-7.21
1996	8.89	-0.87	3.83	-7.18	2.84	-2.21	1.19	7.42	-5.78	-7.58	-5.51
1997	4.12	0.84	3.36	1.61	19.38	5.04	7.49	19.43	2.98	-2.69	1.74
Ave. 1970-1978	15.22	14.20	21.44	12.28	17.09	16.59	12.12	28.35	21.11	72.56	27.54
Ave. 1979-1988	3.52	8.18	11.35	5.29	8.86	7.34	8.46	14.66	9.23	8.50	9.57
Ave. 1989-1997	5.65	0.95	-2.02	3.66	7.94	3.63	4.85	9.99	3.83	-0.95	-5.12
Ave. 1970-1997	7.96	7.79	12.77	7.01	11.21	9.12	8.48	17.56	11.31	22.48	10.62

Table 4. Indices of Total Factor Productivity -- Industry and Service Sectors, 1978-1996

Year	Industry & services		Industry		Mining & quarrying		Manufacturing		Electricity, gas & water		Construction	
	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change
1978	76.01	-	79.98	-	49.17	-	75.54	-	98.59	-	93.91	-
1979	76.37	0.47	78.98	-1.25	47.62	-3.16	75.89	0.46	95.03	-3.61	89.85	-4.32
1980	77.59	1.59	80.61	2.06	48.32	1.47	78.70	3.70	89.18	-6.16	90.40	0.61
1981	79.89	2.97	82.91	2.85	49.69	2.83	83.59	6.22	79.91	-10.39	84.76	-6.25
1982	76.80	-3.87	80.37	-3.07	49.56	-0.25	81.81	-2.14	74.32	-7.00	81.22	-4.18
1983	77.79	1.29	82.51	2.67	54.73	10.42	84.72	3.56	76.83	3.38	79.85	-1.69
1984	81.35	4.58	85.30	3.38	58.36	6.62	87.42	3.18	78.84	2.61	83.58	4.67
1985	81.68	0.40	85.68	0.44	65.39	12.05	87.42	0.00	83.65	6.11	83.28	-0.35
1986	84.75	3.76	90.55	5.69	68.19	4.29	92.32	5.61	82.85	-0.95	88.52	6.29
1987	88.77	4.74	94.08	3.90	71.02	4.15	95.33	3.26	86.61	4.53	92.16	4.11
1988	90.70	2.17	94.45	0.39	75.44	6.22	94.73	-0.63	90.13	4.06	95.43	3.55
1989	94.70	4.41	95.30	0.90	84.46	11.95	95.10	0.39	92.26	2.36	97.59	2.26
1990	97.00	2.42	96.01	0.74	94.78	12.22	95.32	0.23	96.22	4.29	100.80	3.30
1991	100.00	3.10	100.00	4.16	100.00	5.51	100.00	4.91	100.00	3.93	100.00	-0.80
1992	102.32	2.32	100.80	0.80	107.25	7.25	100.64	0.64	101.27	1.27	102.24	2.24
1993	104.56	2.19	102.37	1.57	112.86	5.24	102.62	1.97	107.39	6.04	102.58	0.33
1994	107.22	2.54	103.40	1.01	116.01	2.79	105.34	2.65	109.99	2.42	96.55	-5.88
1995	110.58	3.13	106.89	3.37	130.69	12.65	109.88	4.31	114.24	3.86	95.52	-1.07
1996	113.56	2.69	109.97	2.88	132.24	1.18	112.32	2.22	116.92	2.35	97.97	2.57
Average annual rate of change												
1979-1988		1.81		1.71		4.47		2.32		-0.74		0.24
1989-1996		2.85		1.93		7.35		2.17		3.32		0.37
1979-1996		2.27		1.80		5.75		2.25		1.06		0.30

Source: The Trends in Multifactor Productivity Taiwan Area, various years.

Note: Multifactor Productivity is defined as output per combined unit of capital and labor only.

Table 4. Continued

Base: 1991 = 100

Year	Services		Commerce		Transport, storage & communication		Financing, insurance real estate & business service		Commnuity, social & peraonal service	
	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change
1978	71.83	-	68.16	-	77.74	-	86.02	-	63.73	-
1979	73.71	2.63	67.02	-1.67	76.89	-1.10	108.29	25.90	59.27	-7.00
1980	74.18	0.63	65.53	-2.23	80.46	4.65	110.82	2.34	60.76	2.52
1981	76.47	3.09	65.80	0.42	83.26	3.48	118.78	7.18	62.77	3.30
1982	72.91	-4.65	63.31	-3.79	83.71	0.54	104.32	-12.17	61.32	-2.30
1983	72.43	-0.66	65.04	2.73	85.20	1.79	89.75	-13.97	65.95	7.55
1984	76.79	6.03	70.28	8.06	87.79	3.03	92.18	2.71	71.20	7.96
1985	77.11	0.41	71.72	2.04	86.94	-0.96	88.68	-3.80	74.58	4.75
1986	77.99	1.14	74.78	4.28	87.12	0.21	84.07	-5.20	75.94	1.83
1987	82.58	5.88	80.12	7.14	90.09	3.40	90.53	7.69	79.05	4.09
1988	86.49	4.74	83.69	4.45	91.30	1.34	97.60	7.81	82.38	4.21
1989	94.15	8.85	88.77	6.07	93.94	2.90	111.70	14.45	87.71	6.47
1990	98.19	4.29	95.75	7.87	96.19	2.39	106.79	-4.40	91.88	4.75
1991	100.00	1.85	100.00	4.43	100.00	3.96	100.00	-6.36	100.00	8.84
1992	103.68	3.68	105.11	5.11	104.47	4.47	98.72	-1.28	104.43	4.43
1993	106.43	2.65	110.04	4.69	107.01	2.43	95.10	-3.66	107.24	2.69
1994	110.52	3.85	111.39	1.23	109.23	2.08	101.14	6.35	112.78	5.17
1995	113.69	2.86	115.53	3.72	115.70	5.92	97.66	-3.44	117.26	3.97
1996	116.69	2.64	117.45	1.66	120.02	3.74	97.36	-0.30	121.62	3.72
Average annual rate of change										
1979-1988		1.92		2.14		1.64		1.85		2.69
1989-1996		3.83		4.35		3.49		0.17		5.00
1979-1996		2.77		3.12		2.46		1.10		3.72

Table 5. Indices of Total Factor Productivity -- Manufacturing Sub-Sectors, 1978-1996

	Manufacturing		Food manufacturing		Tobacco manufacturing		Textile mill products		Apparel & textile products	
Year	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change
1978	75.54	-	83.73	-	91.71	-	63.76	-	90.33	-
1979	75.89	0.46	88.41	5.59	96.33	5.04	61.51	-3.52	93.55	3.57
1980	78.70	3.70	88.70	0.34	91.12	-5.41	74.14	20.53	108.71	16.20
1981	83.59	6.22	89.04	0.38	90.49	-0.70	87.45	17.95	111.13	2.22
1982	81.81	-2.14	91.28	2.52	106.33	17.51	82.51	-5.65	116.47	4.81
1983	84.72	3.56	100.80	10.43	120.20	13.04	80.59	-2.33	114.67	-1.55
1984	87.42	3.18	101.75	0.94	113.38	-5.67	84.78	5.21	120.94	5.47
1985	87.42	0.00	106.58	4.75	110.54	-2.50	85.86	1.28	109.09	-9.80
1986	92.32	5.61	104.75	-1.72	103.72	-6.17	97.27	13.28	112.40	3.03
1987	95.33	3.26	107.66	2.78	115.62	11.47	97.77	0.52	112.16	-0.21
1988	94.73	-0.63	105.33	-2.17	100.93	-12.70	87.76	-10.24	100.93	-10.02
1989	95.10	0.39	98.49	-6.49	105.75	4.78	92.70	5.63	101.13	0.21
1990	95.32	0.23	99.83	1.35	102.50	-3.07	93.99	1.39	98.79	-2.31
1991	100.00	4.91	100.00	0.17	100.00	-2.44	100.00	6.40	100.00	1.22
1992	100.64	0.64	104.39	4.39	103.60	3.60	99.36	-0.64	96.68	-3.32
1993	102.62	1.97	105.25	0.83	117.10	13.03	94.50	-4.88	92.19	-4.65
1994	105.34	2.65	108.76	3.34	120.17	2.62	97.69	3.38	76.81	-16.68
1995	109.88	4.31	110.84	1.91	137.50	14.42	94.47	-3.30	75.36	-1.88
1996	112.32	2.22	113.15	2.08	124.45	-9.49	92.65	-1.92	81.06	7.56
Average annual rate of change										
1979-1988		2.32		2.38		1.39		3.70		1.37
1989-1996		2.17		0.95		2.93		0.76		-2.48
1979-1996		2.25		1.75		2.07		2.39		-0.34

Source: The Trends in Multifactor Productivity Taiwan Area, various years.

Note: Multifactor Productivity is defined as output per combined unit of capital and labor only.

Table 5. Continued

Year	Leather, fur & related products		Wood, bamboo, furniture & fixtures products		Pulp & paper products; printing & related products		Chemical & related products		Petroleum & coal products	
	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change
1978	80.21	-	55.00	-	108.57	-	50.95	-	194.88	-
1979	94.46	17.77	50.63	-7.95	123.65	13.89	57.89	13.62	191.97	-1.49
1980	90.81	-3.86	42.67	-15.71	128.93	4.27	62.27	7.57	181.58	-5.41
1981	98.97	8.99	60.59	41.98	162.80	26.27	67.46	8.33	178.43	-1.74
1982	103.64	4.72	56.04	-7.51	145.33	-10.73	69.52	3.05	154.93	-13.17
1983	101.70	-1.88	58.61	4.60	139.19	-4.22	75.90	9.18	149.97	-3.20
1984	107.52	5.73	65.23	11.29	140.04	0.61	82.44	8.62	145.27	-3.13
1985	113.68	5.72	72.41	11.02	134.81	-3.73	86.06	4.40	135.22	-6.92
1986	119.19	4.85	90.00	24.28	146.60	8.74	97.78	13.62	109.00	-19.39
1987	109.79	-7.88	98.34	9.27	136.38	-6.97	96.48	-1.33	125.31	14.96
1988	99.67	-9.22	96.41	-1.96	126.05	-7.57	95.99	-0.51	118.08	-5.77
1989	99.84	0.17	98.19	1.85	117.90	-6.47	93.87	-2.21	111.73	-5.38
1990	99.23	-0.60	89.03	-9.33	107.34	-8.95	94.71	0.89	98.21	-12.10
1991	100.00	0.77	100.00	12.32	100.00	-6.84	100.00	5.59	100.00	1.82
1992	85.73	-14.27	102.93	2.93	94.14	-5.86	101.39	1.39	89.90	-10.10
1993	83.12	-3.04	101.25	-1.63	86.64	-7.97	105.25	3.80	87.06	-3.15
1994	81.18	-2.34	91.17	-9.96	83.12	-4.06	113.26	7.61	99.30	14.06
1995	74.02	-8.83	81.26	-10.87	84.58	1.75	114.43	1.03	111.47	12.25
1996	82.20	11.06	81.06	-0.24	81.12	-4.09	118.92	3.92	118.66	6.45
Average annual rate of change										
1979-1988		2.49		6.93		2.05		6.65		-4.53
1989-1996		-2.13		-1.87		-5.31		2.75		0.48
1979-1996		0.44		3.02		-1.22		4.92		-2.30

Table 5. Continued

Year	Rubber products		Non-metallic mineral products		Primary metal industries		Fabricated metal products		Machinery except electrical equipment	
	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change
1978	63.03	-	70.67	-	78.99	-	76.82	-	53.46	-
1979	65.83	4.44	66.94	-5.28	83.86	6.15	72.44	-5.70	55.18	3.22
1980	72.45	10.05	71.66	7.04	75.80	-9.61	82.21	13.50	55.21	0.05
1981	95.75	32.17	78.86	10.05	69.10	-8.83	81.22	-1.21	68.24	23.60
1982	98.98	3.37	73.26	-7.09	70.46	1.97	70.61	-13.06	62.95	-7.75
1983	101.72	2.77	77.08	5.21	80.60	14.38	72.49	2.66	70.80	12.47
1984	98.83	-2.84	76.95	-0.16	86.71	7.58	74.65	2.98	70.38	-0.58
1985	100.63	1.82	77.34	0.50	85.84	-1.00	77.54	3.88	73.27	4.10
1986	97.13	-3.84	78.17	1.08	94.37	9.93	83.05	7.10	80.11	9.34
1987	99.46	2.40	81.14	3.79	93.04	-1.40	81.27	-2.14	86.89	8.46
1988	95.55	-3.94	86.07	6.08	95.50	2.64	85.50	5.20	94.72	9.01
1989	88.87	-6.99	90.00	4.56	93.62	-1.97	87.53	2.37	90.51	-4.44
1990	97.51	9.72	96.51	7.23	94.99	1.47	90.15	3.00	92.21	1.88
1991	100.00	2.56	100.00	3.62	100.00	5.27	100.00	10.92	100.00	8.45
1992	103.74	3.74	102.47	2.47	101.67	1.67	103.16	3.16	103.68	3.68
1993	98.46	-5.08	108.11	5.51	108.60	6.82	99.24	-3.80	108.15	4.31
1994	96.31	-2.18	109.26	1.07	107.92	-0.63	99.13	-0.12	107.79	-0.34
1995	96.72	0.42	111.53	2.07	103.94	-3.69	102.04	2.94	111.49	3.43
1996	93.53	-3.29	106.83	-4.21	103.95	0.00	98.62	-3.36	116.09	4.13
Average annual rate of change										
1979-1988		4.68		2.12		2.18		1.32		6.19
1989-1996		-0.14		2.79		1.12		1.89		2.64
1979-1996		2.54		2.42		1.71		1.57		4.61

Table 5. Continued

Base: 1991 = 100

Year	Electrical electronic equipment		Transportation equipment		Precision equipment		Misc. manufacturing industries	
	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change	Index	Annual rate of change
1978	62.57	-	63.91	-	87.26	-	125.39	-
1979	57.44	-8.20	62.76	-1.79	80.96	-7.23	111.06	-11.43
1980	60.11	4.65	67.44	7.45	76.06	-6.04	109.66	-1.26
1981	56.88	-5.38	73.28	8.66	91.32	20.05	100.62	-8.24
1982	57.42	0.96	75.62	2.79	106.26	16.36	96.92	-3.67
1983	62.13	8.20	74.55	-1.02	126.09	18.67	98.46	1.59
1984	67.87	9.23	75.15	0.80	110.93	-12.02	102.76	4.37
1985	66.52	-1.98	68.96	-8.24	105.42	-4.97	102.19	-0.55
1986	76.55	15.07	74.15	7.52	105.98	0.53	111.05	8.67
1987	83.15	8.63	82.81	11.68	107.65	1.58	115.79	4.27
1988	88.75	6.73	84.67	2.24	114.67	6.53	118.67	2.49
1989	91.28	2.86	94.32	11.40	118.29	3.15	111.62	-5.94
1990	92.07	0.86	95.75	1.51	107.76	-8.90	102.06	-8.56
1991	100.00	8.62	100.00	4.44	100.00	-7.20	100.00	-2.02
1992	99.60	-0.40	99.89	-0.11	101.90	1.90	97.14	-2.86
1993	106.69	7.11	96.78	-3.11	103.12	1.20	96.60	-0.55
1994	112.66	5.60	94.38	-2.48	104.40	1.24	87.30	-9.63
1995	127.10	12.82	96.15	1.87	101.54	-2.74	88.21	1.05
1996	132.31	4.10	88.96	-7.48	99.30	-2.21	90.08	2.12
Average annual rate of change								
1979-1988		3.79		3.02		3.34		-0.38
1989-1996		5.20		0.76		-1.69		-3.30
1979-1996		4.42		2.01		1.11		-1.68

Table 6. Indices of Labor Productivity -- Industry Sectors, 1976-1997

Based period: 1991

Year	Industry	Mining	Manufacturing	Electricity, gas & water
Ave.1976	43.83	66.43	43.55	40.25
Ave.1977	46.07	69.85	45.84	43.15
Ave.1978	52.80	75.83	52.76	49.54
Ave.1979	53.88	77.35	53.77	51.67
Ave.1980	54.47	78.80	54.78	53.65
Ave.1981	57.94	75.03	58.35	54.32
Ave.1982	58.31	71.92	58.78	50.92
Ave. 1983	62.71	79.92	63.25	54.42
Ave.1984	62.47	85.34	63.09	57.43
Ave.1985	64.11	85.24	64.52	63.30
Ave.1986	68.65	86.31	69.26	70.13
Ave.1987	73.28	92.06	73.90	78.24
Ave.1988	77.43	102.92	77.78	84.11
Ave.1989	84.51	106.44	84.87	88.52
Ave.1990	91.24	106.78	91.26	93.62
Ave.1991	100.00	100.00	100.00	100.00
Ave.1992	104.01	99.80	103.80	107.21
Ave.1993	107.90	99.25	107.16	117.21
Ave.1994	112.20	105.52	111.15	127.89
Ave.1995	120.05	111.71	118.72	139.88
Ave.1996	126.61	115.89	124.85	150.87
Ave.1997	134.57	124.61	132.83	162.06
Average annual rate of change				
1977-1988	2.80	3.04	2.85	3.66
1989-1997	6.35	2.41	6.12	8.66
1977-1997	4.32	2.77	4.25	5.80

Source: Yearbook of Earnings and Productivity Statistics, various years.

Notes: 1. Employees include the employees on payrolls of Employees Earning, survay and contracted workers which work outside the factories and paid by piece-rate.

2. Output is calculated by industrial production indexes.

3. Due to change in based period used by the publisher, the output of 1976-1983 is calculated on the link idnex.

Table 7. Indices of Labor Productivity -- Manufacturing Sub-Sectors, 1976-1997

Year	Manufacturing	Food manufacturinig	Tobacco manufacturing	Textile mill products	Wearing apparel & accessory manufacturing	Leather, fur & related products	Wood & bamboo products	Furniture & fixture products	Pulp & paper products
Ave.1976	43.39	62.12	80.00	35.59	71.37	44.46	85.37	-	47.18
Ave.1977	45.67	62.37	88.15	37.94	70.58	41.51	85.19	-	49.03
Ave.1978	52.57	65.37	90.84	47.24	85.13	47.48	109.37	-	59.02
Ave.1979	53.57	69.77	88.41	45.64	92.90	54.13	94.51	-	69.75
Ave.1980	54.57	63.85	88.96	52.58	112.05	46.50	88.50	-	71.06
Ave.1981	58.35	70.43	98.68	57.82	118.74	41.89	103.89	-	68.95
Ave.1982	58.78	70.44	120.66	55.89	108.97	56.96	102.91	56.23	63.65
Ave.1983	63.25	78.69	124.81	57.94	105.04	69.94	102.71	64.15	64.05
Ave.1984	63.09	73.96	121.49	60.65	105.36	75.31	99.50	62.35	62.03
Ave.1985	64.52	79.53	123.12	59.16	106.55	81.31	114.45	65.43	63.85
Ave.1986	69.26	80.20	127.84	64.92	108.83	89.71	120.05	71.95	73.73
Ave.1987	73.90	84.19	117.42	70.16	112.15	88.31	114.54	82.14	75.71
Ave.1988	77.78	90.89	126.55	65.77	98.70	85.49	101.81	85.83	78.94
Ave.1989	84.87	89.14	129.99	75.83	107.82	94.48	95.01	95.92	86.66
Ave.1990	91.26	93.78	108.52	88.45	99.39	99.95	85.51	90.95	94.10
Ave.1991	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Ave.1992	103.80	102.15	92.56	103.21	92.46	85.97	102.56	99.95	102.06
Ave.1993	107.16	103.85	95.26	100.69	83.75	79.46	101.56	91.69	98.07
Ave.1994	111.15	108.42	94.00	103.67	70.60	78.81	86.74	85.71	99.78
Ave.1995	118.72	111.61	112.15	103.36	71.32	73.19	76.87	81.33	101.17
Ave.1996	124.85	115.26	95.44	104.27	76.90	79.12	75.12	80.16	102.66
Ave.1997	132.83	109.85	96.88	108.83	75.20	73.03	78.30	80.78	107.70
Average annual rate of change									
1977-1988	2.87	2.40	3.88	2.52	2.28	3.42	1.37	0.04	2.65
1989-1997	6.12	2.11	-3.30	4.78	-2.61	-1.38	-2.61	-0.56	3.20
1977-1997	4.26	2.27	0.80	3.49	0.18	1.36	-0.34	-0.22	2.88

Source: Yearbook of Earnings and Productivity Statistics, various years.

Notes: 1. Employees include the employees on payrolls of Employees Earning, survay and contracted workers which work outside the factories and paid by piece-rate.

2. Output is calculated by industrial production indexes.

3. Due to change in based period used by the publisher, the output of 1976-1983 is calculated on the link index.

4. The data of Tobacco manufacturing in 1976-1982 includes beverage.

5.The data of wood & bamboo products in 1976-1982 includes non-metallic furniture.

6. The data of pulp & paper products in 1976-1982 includes printing and publishing.

Table 7. Continued

Year	Printing & related products	Chemical materials manufacturing	Chemical products	Petroleum & coal products	Rubber products	Plastic products	Non-metallic mineral products	Primary metal industries	Fabricated metal products
Ave.1976	-	25.96	48.43	78.31	50.58	39.20	47.97	39.10	88.04
Ave.1977	-	32.38	50.51	88.18	47.15	32.18	50.81	49.20	87.22
Ave.1978	-	35.86	51.30	105.14	43.31	41.68	52.97	55.90	90.60
Ave.1979	-	40.34	51.60	104.78	47.63	46.92	53.66	59.47	77.00
Ave.1980	-	41.55	42.11	109.82	47.69	44.87	54.21	56.22	78.89
Ave.1981	-	48.47	49.69	108.91	50.98	48.48	54.73	53.92	80.30
Ave.1982	94.87	49.97	49.71	96.50	56.07	48.50	55.81	56.10	74.32
Ave.1983	86.93	59.88	54.54	101.19	62.03	54.45	59.88	70.12	74.96
Ave.1984	94.97	61.75	58.03	99.96	63.61	55.21	60.54	68.34	73.61
Ave.1985	99.16	66.05	63.11	96.50	68.04	55.98	65.06	69.44	75.81
Ave.1986	96.49	76.58	69.98	96.18	67.82	62.72	66.91	76.68	77.45
Ave.1987	94.26	74.81	78.11	109.48	74.44	70.48	70.17	78.74	79.01
Ave.1988	91.47	76.23	81.67	107.91	74.29	77.41	74.47	83.59	83.91
Ave.1989	97.82	81.44	82.96	105.84	77.76	86.55	84.82	85.81	86.87
Ave.1990	99.15	88.72	91.33	90.63	93.43	94.30	91.95	92.42	89.89
Ave.1991	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Ave.1992	107.93	111.61	105.65	97.74	106.01	99.54	102.06	98.32	101.61
Ave.1993	108.18	118.41	106.05	109.52	99.36	99.71	105.71	100.99	95.01
Ave.1994	100.47	138.45	114.03	107.98	97.31	100.50	107.03	104.49	95.22
Ave.1995	101.40	146.17	119.00	128.88	102.30	95.54	112.99	105.74	100.89
Ave.1996	99.87	153.12	126.27	143.09	105.43	103.81	112.23	109.40	99.45
Ave.1997	99.10	161.79	138.69	160.79	102.67	107.07	117.59	126.47	99.43
Average annual rate of change									
1977-1988	3.69	4.19	2.77	2.47	1.98	3.18	2.21	3.71	-0.34
1989-1997	0.85	9.51	6.34	5.88	3.15	3.30	4.79	4.76	1.72
1977-1997	2.47	6.47	4.30	3.93	2.48	3.23	3.32	4.16	0.54

Table 7. Continued

Base period: 1991

Year	Machinery, equipment manufacturing & reparing	Electrical and electronic machinery	Transport equipment manufacturing & reparing	Precision instruments	Misc. industrial product manufacturing
Ave.1976	54.42	23.88	34.83	51.72	44.69
Ave.1977	52.67	26.39	45.51	68.34	50.72
Ave.1978	59.55	32.84	45.96	67.82	60.22
Ave.1979	65.84	32.53	46.69	64.80	62.89
Ave.1980	61.10	34.40	52.98	63.61	60.84
Ave.1981	65.84	41.10	56.65	73.41	65.10
Ave.1982	62.19	46.64	56.98	90.71	65.02
Ave.1983	66.93	51.33	60.79	108.03	67.73
Ave.1984	69.42	53.70	62.27	86.01	62.63
Ave.1985	72.63	55.08	56.66	75.14	61.38
Ave.1986	77.68	61.95	64.63	77.02	67.77
Ave.1987	82.44	69.27	73.14	79.75	70.58
Ave.1988	89.22	75.40	76.06	89.63	79.71
Ave.1989	88.41	82.02	88.60	98.47	83.74
Ave.1990	92.08	88.85	89.67	98.91	93.22
Ave.1991	100.00	100.00	100.00	100.00	100.00
Ave.1992	101.61	103.15	104.07	108.81	102.15
Ave.1993	99.83	113.26	101.68	115.61	101.69
Ave.1994	103.75	122.36	101.30	119.60	95.28
Ave.1995	107.77	140.02	106.37	116.53	95.07
Ave.1996	112.57	151.89	104.97	115.38	97.26
Ave.1997	115.68	170.50	108.46	112.11	101.87
Average annual rate of change					
1977-1988	2.90	4.29	3.44	3.16	2.92
1989-1997	2.94	10.57	3.60	2.50	2.46
1977-1997	2.92	6.98	3.51	2.88	2.72

Table 8. Productivity and Production Indices for the industry and Service Sectors, 1978-1997

	Changes in share of GDP	Average annual rate of changes in labor productivity	Average annual rate of changes in multifactor productivity
Agriculture	-6.70	-	-
Industry	-10.30	4.35	1.80
Service	17.00	-	2.77

Sources: The first column of data comes from Table 1; the second from Table 6;
and the third from Table 4.

Table 9. Productivity and Production Indices (II) -- Manufacturing Industry, 1978-1997

Unit: %

Year	Labor Productivity of Manufacturing	Multifactor Productivity of Manufacturing	Manufacturing Production
Ave.1978	52.57	75.54	44.26
Ave.1979	53.57	75.89	46.78
Ave.1980	54.57	78.70	49.68
Ave.1981	58.35	83.59	51.51
Ave.1982	58.78	81.81	51.93
Ave.1983	63.25	84.72	59.10
Ave.1984	63.09	87.42	66.45
Ave.1985	64.52	87.42	68.14
Ave.1986	69.26	92.32	78.56
Ave.1987	73.90	95.33	87.27
Ave.1988	77.78	94.73	90.42
Ave.1989	84.87	95.10	93.71
Ave.1990	91.26	95.32	93.02
Ave.1991	100.00	100.00	100.00
Ave.1992	103.80	100.64	103.95
Ave.1993	107.16	102.62	106.38
Ave.1994	111.15	105.34	112.60
Ave.1995	118.72	109.88	117.62
Ave.1996	124.85	112.32	120.44
Ave.1997	132.83		129.91

Sources: The first column of data comes from Table 7; the second from Table 5;
and the third from *Industrial Production Statistics Monthly* , various issues.

Table10. Productivity and Production Indices(III) -- Manufacturing Sub-Sectors, 1978-1997

Manufacturing Sectors	Changes in share of Manufacturing Value	Average annual rate of changes in		
		labor productivity	multifactor productivity*	industrial production
Food	-2.15	2.37	1.75	2.37
Tobacco	-1.10	0.44	2.07	1.19
Textile mill products	-8.27	3.54	2.39	2.84
Wearing apparel & accessories	-1.28	0.23	-0.34	1.10
Leather & fur products	-1.25	1.58	0.44	4.23
Wood & bamboo products	-3.62	-0.34	3.02	-4.50
Furniture & fixtures	-3.13	-0.22	-	2.83
Pulp, paper & paper products	-1.32	2.93	-1.22	6.63
Printing processings	-1.81	0.70	-	5.76
Chemical materials	4.36	6.47	4.92	10.64
Chemical products	-0.31	4.41	-	7.33
Petroleum & coal products	-3.37	3.63	-2.30	5.47
Rubber products	-0.76	2.78	2.54	5.14
Plastic products	-0.95	3.74	-	6.36
Non-metallic mineral products	-0.91	3.34	2.42	4.79
Basic metal	4.89	3.86	1.71	9.85
Fabricated metal products	-0.94	0.61	1.57	5.97
Machinery & equipment	0.86	3.15	4.61	6.99
Electrical & electronic machinery	14.98	7.21	4.42	14.15
Transport equipment	0.74	3.15	2.01	7.60
Precision instruments	-0.23	2.19	1.11	5.10
Miscellaneous industrial products	-1.40	2.56	-1.68	3.77

*The data of average annual rate of changes in multifactor productivity refers to 1979-1996.

Sources: The first column of data comes from Table 2; the second from Table 7;
and the third from Table 5; the fourth from Table 3.

Table 11. Correlation Coefficients of Various Rates of Change of the Manufacturing Subsectors, 1978-1997

Changes in share of manufacturing value			
Average annual rate of changes in labor productivity	0.6264		
Average annual rate of changes in multifactor productivity	0.3760	0.3864	
Average annual rate of changes in industrial production	0.7618	0.8124	0.2612
	Changes in share of manufacturing value	Average annual rate of changes in labor productivity	Average annual rate of changes in multifactor productivity

Source: The correlation coefficients are calculated using data from Table 10.

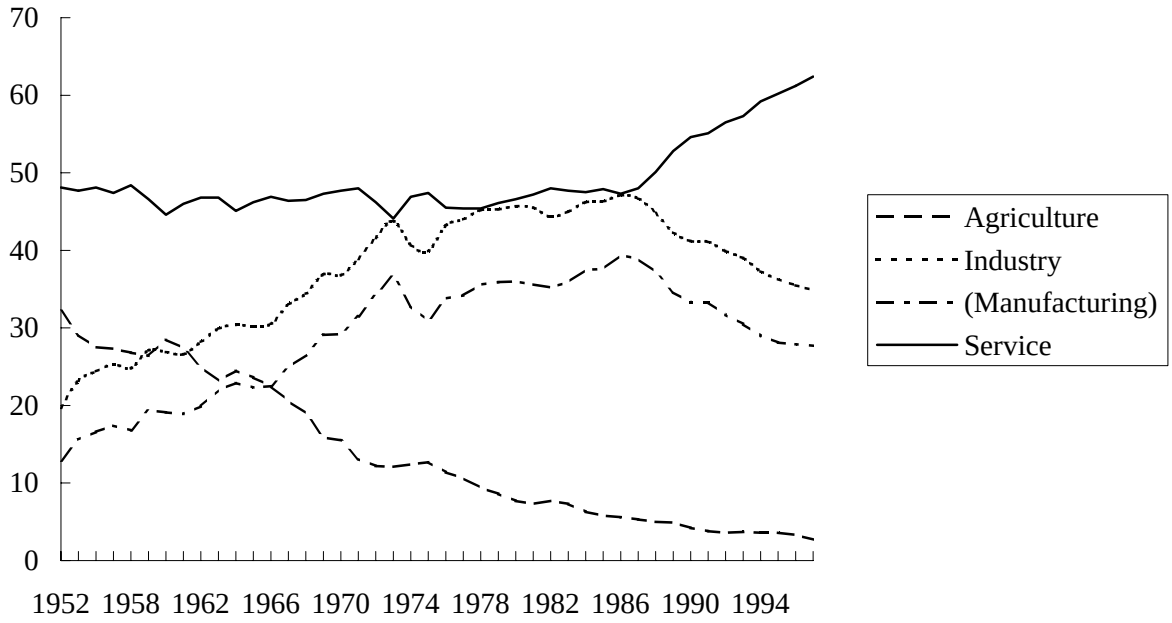
Table 12. Classification of Taiwan's Exports by Factor Intensity, 1982-1997

Unit: %

Period	Total	Degree of Labor Intensity			Degree of Capital Intensity			Degree of Technology Intensity		
		High	Mid	Low	High	Mid	Low	High	Mid	Low
1982	100.0	47.2	30.8	21.9	26.9	45.4	27.6	18.3	32.6	49.1
1983	100.0	46.6	34.3	19.0	24.5	46.6	28.9	18.2	33.4	48.4
1984	100.0	47.0	35.4	17.5	23.0	48.7	28.3	18.3	34.0	47.7
1985	100.0	45.9	35.6	18.5	24.5	48.7	26.8	18.8	33.6	47.6
1986	100.0	47.0	36.9	16.0	22.9	49.4	27.7	18.4	33.7	47.9
1987	100.0	47.9	37.2	14.9	22.4	50.5	27.1	19.4	35.2	45.4
1988	100.0	46.3	36.8	16.9	23.5	51.5	25.0	22.6	36.9	40.6
1989	100.0	43.4	37.8	18.8	26.6	50.7	22.7	24.2	38.1	37.7
1990	100.0	41.0	38.3	20.7	28.9	50.5	20.5	26.7	38.6	34.7
1991	100.0	40.1	38.8	21.2	29.8	51.0	19.2	27.2	38.5	34.3
1992	100.0	39.2	40.3	20.5	29.3	53.0	17.7	29.5	38.5	32.0
1993	100.0	38.9	41.2	19.9	28.9	54.8	16.3	31.4	40.3	28.3
1994	100.0	38.7	39.8	21.5	31.0	55.0	14.0	32.5	42.0	25.6
1995	100.0	36.4	40.6	23.0	31.9	56.5	11.6	36.5	41.4	22.0
1996	100.0	33.9	43.6	22.5	31.8	57.4	10.8	39.7	38.9	21.4
1997	100.0	34.9	43.1	22.1	30.3	60.6	9.1	39.7	41.1	19.2

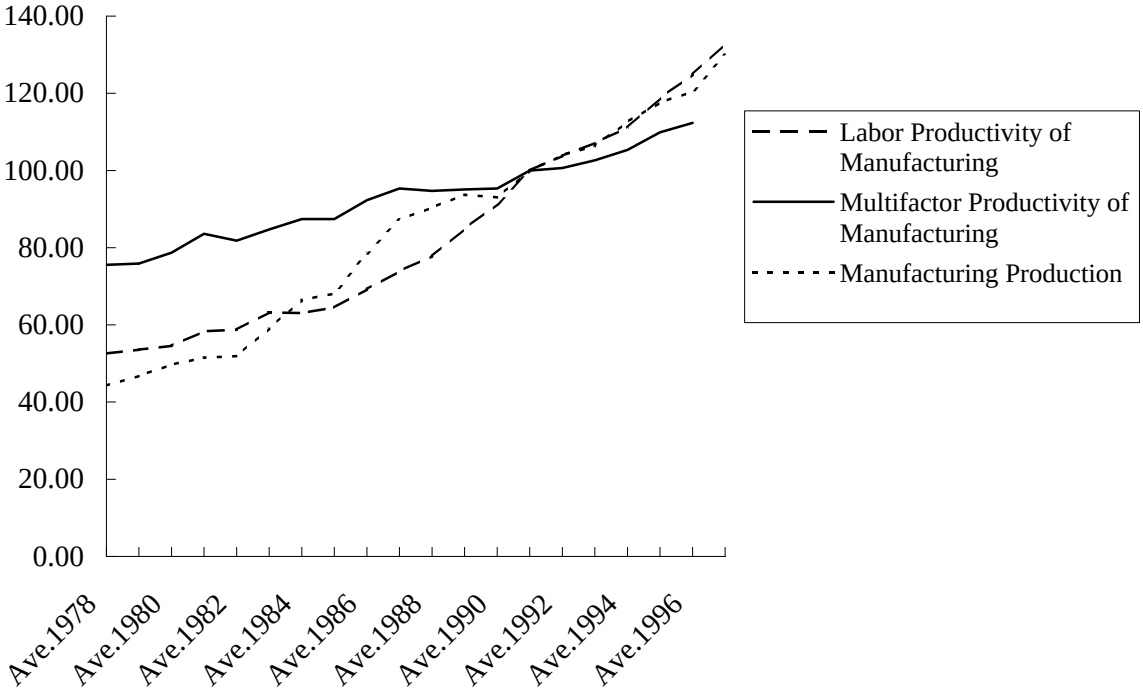
Source: Monthly Statistics of Exports and Imports, various issues.

Figure 1. Gross Domestic Product by Sector, 1952-1997



Source: Table 9.

Figure 2. Productivity and Production Indices of the Manufacturing Industry, 1978-1997



Source: Table 9.