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9 Export Structure and Exchange Rate Variation in Taiwan: A Comparison with Japan and the United States

Pochih Chen, Chi Schive, and Cheng Chung Chu

9.1 Introduction

Although Taiwan switched to a flexible exchange rate system in 1979, the New Taiwan (NT) dollar/U.S. dollar exchange rate remained virtually fixed under the Central Bank's firm control until 1985. During this time the macroeconomics situation in Taiwan changed drastically. For instance, Taiwan's trade surplus increased rapidly in the early 1980s, with the trade surplus to GNP ratio increasing from 0.05 percent in 1980 to 17.87 percent in 1985. However, the government made no concrete or immediate efforts to reduce the ever-growing macroeconomic disequilibrium. The major macro policy during this period was large-scale intervention in the monetary market in order to sterilize the effect of the trade surplus on money supply. Nevertheless, the sterilization policy not only restricted the automatic mechanism for reducing the trade surplus through more domestic expenditure and a higher inflation rate, but also aggravated the trade imbalance via less domestic credit creation (Chen 1985). Due partly to the inactive policies in the early 1980s but most importantly to U.S. pressure on Taiwan to reduce its bilateral trade surplus with the United States, the burden of adjustment became formidable for Taiwan after 1985.

This paper analyzes the impact on Taiwan's export structure of the sharply appreciated local currency over the past five to six years, with special reference to Japan and the United States, Taiwan's two major trading partners. Before

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analyzing the changes in commodity structure after 1985, in the next section we will offer some background information about Taiwan's trade surplus and exchange rate appreciation in the 1980s. Then in sections 9.3 and 9.4 we will examine the changes in factor intensities and other characteristics of Taiwan's exports. Finally, we will compare the composition of exports from Taiwan, Japan, and the United States with various measures of commodity characteristics. Some inferences can then be drawn about how and at what speed Taiwan's production and export structure will adjust as it approaches the per capita GNP level of a developed country.

9.2 Trade Surplus and Exchange Rate Appreciation

Taiwan's economy was hit by a huge trade surplus in the 1980s—the trade surplus to GDP ratio reached nearly 20 percent in 1986. Since 1985, international pressure on Taiwan to reduce its trade surplus has become so intense that Taiwan has had to rapidly appreciate its currency against the U.S. dollar. The exchange rate appreciated from about 40 NT dollars per U.S. dollar to 26 NT dollars per U.S. dollar between 1985 and 1989. As a result, the rate of appreciation of the NT dollar in the second half of the 1980s was higher than that of most currencies in the world. Table 9.1 shows the price indices of some major currencies in terms of NT dollars. As all indices are set equal to 100 for March 1992, if the NT dollar has appreciated against a certain currency since a specific period, the index of that currency for that period is greater than 100. Conversely an index less than 100 in a period implies that the NT dollar has

Table 9.1 Price Indices of Major Currencies in Terms of the NT Dollar

Year	U.S. Dollar	British Pound Sterling	Deutsche Mark	French Franc	Japanese Yen	Korean Won
1980	140.85	192.65	119.10	173.74	92.26	165.42
1981	148.02	163.17	108.43	144.20	89.51	163.76
1982	156.13	146.06	108.11	129.54	88.34	161.59
1983	157.54	132.00	95.38	105.47	90.21	153.48
1984	154.41	103.61	81.16	89.72	81.77	144.63
1985	155.90	129.54	104.49	115.32	103.39	135.72
1986	138.86	117.60	117.42	120.13	116.05	124.93
1987	111.63	120.18	115.80	115.97	119.27	109.20
1988	110.14	115.04	102.62	101.53	116.46	124.78
1989	102.51	94.68	99.45	98.47	93.80	116.90
1990	106.19	117.69	116.90	115.97	103.80	114.87
1991	100.86	108.15	108.82	107.88	106.09	102.74
1992	100.00	100.00	100.00	100.00	100.00	100.00

Sources: *International Financial Statistics* (Washington, D.C.: IMF, various issues); *Financial Statistics Monthly: The Republic of China* (Taipei: Ministry of Finance, various issues).

Notes: Data refer to the end of each period. Prices in March 1992 are set equal to 100.

depreciated against that currency since that period. As shown in table 9.1, since 1980 the NT dollar has appreciated against all currencies except the Japanese yen.

In addition to the rapid appreciation of the NT dollar, wage rates in Taiwan also rose rapidly in the 1980s due both to the promulgation of the Labor Law in 1983, which tended to raise concern for labor welfare, and to the booming economy, particularly the service sector, in the second half of the 1980s. Consequently, unit labor costs in Taiwan's manufacturing sector as measured in U.S. dollars increased much faster than such costs for all of Taiwan's major competitors, with Japan the only probable exception (see table 9.2). One clear implication is that the international competitiveness of Taiwan's traditional, usually labor-intensive, export products had to have worsened sharply in that period. In order to maintain the same market position as before, Taiwan has had to promptly switch exports from traditional labor-intensive products to those with which Taiwan can rebuild an international comparative, or competitive, advantage.¹

The pressure for structural change in Taiwan's exports after 1985 was further reinforced by two structural factors, namely the decline of domestic investment after 1980 and the falling share of the manufacturing sector in GDP. Although the appreciation of the NT dollar was caused mainly by Taiwan's huge trade surplus, the surplus before 1985 was not solely the result of the strong international competitiveness of Taiwan's products. Instead, insufficient domestic investment also had a role to play (Chen 1989; Schive 1991).

Since Taiwan is a comparatively open economy, with trade playing an ever-increasing role, the growth rate of GNP and that of exports are usually highly correlated. Even in economically bad years, both indicators have shown the same direction. For example, Taiwan's exports and GNP both grew minimally in 1981 and 1985, as shown in table 9.3. Moreover, a sharp decline in the growth of Taiwan's domestic investment in early 1980s can be detected from table 9.3. The growth rate of gross fixed capital formation in real terms was almost zero between 1981 and 1986, while the growth rate before 1981 averaged about 10 percent. Even without detailed discussion of the sources of Taiwan's trade surplus, data from table 9.3 are probably sufficient to show that the international competitiveness of Taiwan's products was not at its peak in 1985. After 1986, the policy aimed at reducing the trade surplus via exchange rate appreciation put intense pressure on Taiwan's trade sector to adjust.

In addition to the rapid appreciation of the NT dollar, the overexpanded nature of the manufacturing sector compared to that in most developed countries also accentuated the need for structural change in Taiwan after 1985. Kuznets pointed out more than three decades ago that the share of different sectors in

1. Three other papers tackle the same issue from different aspects, including upgrading export products, introducing more automated machinery and equipment, and making outward investment. See Schive (1991, 1992a, 1992b).

Table 9.2 Unit Labor Cost in U.S. Dollars: 1980–91 (1982=100)

Year	Taiwan	Japan	Korea	United States	United Kingdom	France	West Germany	Netherlands	Canada	Denmark	Belgium	Norway	Sweden	Italy
1980	87	107	104	87	118	125	124	127	83	126	155	110	130	117
1981	97	114	100	94	112	109	104	103	89	108	126	105	120	103
1982	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1983	97	103	94	98	86	93	95	92	99	93	86	93	84	99
1984	108	99	90	96	77	87	86	77	91	87	79	85	81	89
1985	112	97	88	97	77	88	85	76	88	90	81	86	85	88
1986	127	142	83	97	91	117	120	104	91	128	110	110	109	116
1987	160	157	91	94	103	138	156	130	99	167	129	132	130	138
1988	170	173	112	92	112	138	160	130	111	170	126	141	141	140
1989	192	161	153	93	106	128	150	119	123	160	122	130	146	143
1990	199	—	160	—	—	—	—	—	—	—	—	—	—	—
1991	200	—	163	—	—	—	—	—	—	—	—	—	—	—

Sources: *Monthly Labor Review* (Washington, D.C.: Department of Labor, Bureau of Labor Statistics, August 1991); *Monthly Bulletin of Earnings and Productivity Statistics* (Taipei: Directorate-General of Budget, Accounting and Statistics [DGBAS], Executive Yuan, April 1992).

Table 9.3 Growth Rate of Taiwanese GNP, Trade, and Capital Formation (%)

Year	GNP	Exports of Goods and Services	Imports of Goods and Services	Gross Fixed Capital Formation
1980	24.31	23.03	33.57	35.88
1981	18.51	14.13	7.43	8.24
1982	6.85	-1.80	-10.90	-1.10
1983	9.96	13.14	7.41	-3.34
1984	11.43	21.23	8.24	2.56
1985	5.29	0.88	-8.46	-7.27
1986	16.33	29.73	20.29	10.96
1987	12.41	34.66	44.67	19.83
1988	9.01	13.02	41.99	16.90
1989	10.70	9.29	5.22	17.99
1990	9.02	1.37	4.69	10.78
1991	11.60	13.33	14.89	10.82

Source: *Quarterly National Economic Trends Taiwan Area: The Republic of China* (Taipei: DGBAS, Executive Yuan, February 1992).

an economy changes over time as the economy moves through different stages of development, a phenomenon also known as the Clark hypothesis. The experiences of many developed countries indicates that the share of manufacturing sector in GDP increases in the early development stage, then decreases in later stages. The turning point seems to be around the per capita GDP level of \$5,000 (U.S.; 1985 prices), and the highest level of manufacturing in the major Western countries is about 40 percent of GDP (Chen and Lee 1988).

When Taiwan's per capita GNP was around \$5,000 (U.S.) in 1987, the manufacturing sector share of GDP was also around 40 percent. The share of Taiwan's manufacturing sector in GDP has followed the same general pattern over time as other developed economies have experienced. In 1986 Taiwan reached a record share for manufacturing in GDP of 39.70 percent, but this share fell to only 34 percent in 1991. Since the declining ratio means that the manufacturing sector grew much more slowly than the whole economy, certain industries in the manufacturing sector must have encountered mounting pressure and difficulties requiring change. How the manufacturing sector has responded to these challenges should be a major concern.

9.3 Changes in the Factor Intensities of Taiwan's Exports

With the significant rise in Taiwan's labor costs, standard trade theory asserts that Taiwan's international comparative advantage and trade structure should change. However, there are some difficulties involved in measuring structural changes in trade. First, the production factors actually used are more than just capital and labor. A relative decline of labor-intensive products in total trade, thus, may not imply a relative increase in capital-intensive products in total

trade. Moreover, trade data are generally classified by commodity or by industry. It is by no means an easy job to examine changes in trade structure in relation to changes in comparative advantages.

Fortunately, a recent study sponsored by the Ministry of Finance (Chen, Schive, and Wu 1991) on the reclassification of tradable commodities provides relevant data and classification criteria to analyze the commodity structure of trade in Taiwan and other countries as well. An input-output table for 1986 and other statistics for Taiwan were used to identify the characteristics of each industry. The characteristics of each commodity in the H.S. classification are then assumed to remain unchanged across different countries for country comparative studies.²

Table 9.4 classifies Taiwan's exports according to the factor/input intensities of commodities. The degree of labor intensity of each product was measured by the ratio of domestic labor expenditures embodied in the product to the total domestic factor income that the product contains. Then all industries were divided into three groups—high, medium, and low—according to the level of this measure. The results from table 9.4 show that the share of highly labor-intensive commodities in total trade declined from 47.03 percent in 1986 to 40.10 percent in 1991. In contrast, the share in total trade of commodities with low labor intensities increased from 14.89 percent in 1987 to 21.17 percent in 1991. The direction of the structural change in trade seems to be in line with that expected, but the speed of adjustment may be considered only moderate.

The indicator for capital intensity was measured by the ratio of total domestic capital to labor used directly and indirectly in the production. Note then that the ranking of industries by this measure may not equal the reverse of the ranking according to labor intensity just discussed. The ratio of products with high capital intensities in Taiwan's total exports increased from 22.35 percent in 1987 to 29.81 percent in 1991, and that with low capital intensities dropped from 27.72 percent in 1986 to 19.21 percent in 1991. The directions and speeds of adjustment were similar to those for labor intensities.

When commodities were reclassified by the degree of human capital intensity, the speed of adjustment in trade structure seems to be faster than in the previous two cases. Human capital intensity is measured by the ratio of workers with a college degree or higher educational attainment relative to the total direct and indirect employment of an industry. Table 9.4 shows that the proportion of products with a high degree of human capital intensity in Taiwan's exports increased from 18.37 percent in 1986 to 27.23 percent in 1991, while the proportion of low human-capital-intensity products declined from 47.94 percent in 1986 to 34.26 percent in 1991. The direction of adjustment is consis-

2. The "H.S. classification" refers to the Harmonized Commodity Description and Coding System of the Customs Cooperation Council. We are fully aware that factor intensity may change in different countries. Nevertheless, the reclassification of tradable commodities following each country's own standard would complicate the country comparison to an almost unmanageable degree. Further discussion on this point is addressed in section 9.5 of this paper.

Table 9.4 **Export Structure of Taiwan by Input Intensities, 1985–91 (%)**

Year	Degree of Labor Intensity			Degree of Capital Intensity			Degree of Human Capital Intensity			Degree of Energy Intensity		
	High	Mid	Low	High	Mid	Low	High	Mid	Low	High	Mid	Low
1985	45.93	35.60	18.47	24.48	48.70	26.83	18.75	33.62	47.63	14.14	46.89	38.97
1986	47.03	36.93	16.05	22.91	49.37	27.72	18.37	33.68	47.94	11.82	46.55	41.62
1987	47.93	37.18	14.89	22.35	50.52	27.13	19.30	35.30	45.40	10.84	45.39	43.77
1988	46.27	36.79	16.94	23.49	51.50	25.01	22.55	36.92	40.53	12.37	48.05	44.56
1989	43.44	37.75	18.80	26.59	50.73	22.66	24.25	38.10	37.65	13.07	45.29	41.64
1990	41.02	38.30	20.68	28.95	50.54	20.51	26.73	38.57	34.70	13.78	45.37	40.85
1991	40.10	38.73	21.17	29.81	50.96	19.21	27.23	38.51	34.26	13.89	45.74	40.37

Source: Calculated from tapes of trade statistics of Taiwan (Taipei: Ministry of Finance).

Note: For definitions of measures, see text (also, Chen, Schive, and Wu 1991).

tent again with what one may expect, but the faster adjustment in this classification is of particular interest. More discussions on this point will be presented later.

Commodities were further classified by energy intensity, with the result that the ratios of products with different energy intensities changed only slightly despite significant changes in energy prices during the period of observation. Part of this result is due to the fact that many energy goods are tradable, so that the relative opportunity cost of energy faced by Taiwan and other countries is stable despite wide fluctuations in oil price. Consequently, the main factor determining the international comparative advantage of energy-intensive products would be differences in the efficiency of energy use in different countries rather than the relative factor cost of the countries involved (Caves, Frankel, and Jones 1990, 185–87). It also implies that a relative increase of wage rates or labor costs may not change the comparative advantage of energy-intensive products significantly.

9.4 Other Forms of Structural Change in Taiwan's Exports

Chen, Schive, and Wu (1991) have also applied other criteria to classify trade commodities. Table 9.5 regroups Taiwan's exports into ten categories according to the stages of fabrication or the use of commodities applied in a World Bank study (Balassa 1981). The results shown in table 9.5 indicate further the rapid structural adjustment of Taiwan's exports in the late 1980s.

The shares of primary products and processed food declined steadily as would be expected. Among the categories with increasing shares in Taiwan's exports, type B intermediate products, which are those intermediate products readily usable as final products, replaced consumer nondurable goods as the largest category in Taiwan's exports. The share of type B intermediate products was only 25.98 percent in 1986, but increased sharply to 36.97 percent in 1991. The decline of consumer nondurable goods is even more striking. The share of this category dropped from 35.34 percent in 1986 to 22 percent in 1991. The primary reason behind this drastic change is the change in the relative labor costs between Taiwan and its competing countries explained earlier (table 9.2). However, it is also worth noting that rapid outward investment since 1986 from Taiwan to neighboring countries with low labor costs was another factor behind this drastic change (Schive 1991). Many Taiwanese multinational firms are now importing intermediate products and capital goods from Taiwan to produce final products in neighboring countries. The shares of both intermediate products and capital goods in Taiwan's exports increased while that of consumer goods, both durables and nondurables, declined. Moreover, the share of the U.S. market held by Taiwan's exports decreased from nearly 48 percent in 1986 to 28 percent in 1991, while the share of Taiwanese exports going to neighboring developing countries as well as the share of U.S. imports from these countries have been increasing rapidly to fill the gap (Schive 1992a).

Table 9.5 Export Structure of Taiwan by Industry and Use, 1985–91 (%)

Year	Agriculture, Forestry, Livestock, and Hunting Products	Processed Food	Beverage and Tobacco Preparation	Energy and Minerals	Construction Materials	Intermediate Products		Consumer Nondurable Goods	Consumer Durable Goods	Machinery	Transportation Equipment
						A	B				
1985	1.57	4.28	0.04	0.03	0.55	8.66	26.76	35.54	10.34	10.30	1.71
1986	1.67	4.69	0.03	0.06	0.44	7.40	25.98	35.34	11.68	10.84	1.86
1987	1.40	4.51	0.03	0.11	0.35	6.86	26.51	33.29	11.93	13.14	1.86
1988	1.60	3.73	0.04	0.07	0.35	8.74	27.69	29.67	11.20	15.36	1.54
1989	0.96	3.57	0.03	0.06	0.29	8.98	31.02	27.42	10.30	15.47	1.89
1990	0.84	3.51	0.03	0.05	0.22	9.47	34.92	23.67	8.87	16.31	2.11
1991	0.91	3.63	0.05	0.04	0.23	9.44	36.97	22.00	8.51	16.10	2.12

Source: See table 9.4.

Note: Intermediate products A is defined as products used in the manufacturing process of other intermediate products. Intermediate products B refers to those products which can be used directly in the manufacturing process of final products.

Because outward investment may slow down in the future but not reverse, the resulting impact on the domestic economy is likely to be permanent. In addition, since Taiwan's total exports in U.S. dollars almost doubled from 1986 to 1991, all categories of exports grew during that period. Thus, the structural change in Taiwan's export coincided with a rather high export growth rate and was not attributable to the shrinking of certain categories. A clear implication is that the significant changes in trade structure in the second half of the 1980s were less attributable to Taiwan's short-term business cycle than to long-term structural changes.

The increasing share of producer goods in Taiwan's exports may be regarded as an indication of the upgrading of Taiwan's economy. The rapidly rising shares of less labor-intensive, highly capital-intensive, or highly human-capital-intensive goods also has similar implications. A more traditional and easier way to identify whether there has been industrial upgrading is to look at the share of heavy and chemical industries or the share of high-tech products in total exports. According to table 9.6, the share of heavy and chemical industries in Taiwan's exports increased from 35.63 percent in 1986 to 46.71 percent in 1991. The share of high-tech products jumped from 27.56 percent in 1986 to 36.23 percent in 1991. Both measures indicate a roughly 10 percentage point increase over the short period of five years. Therefore, Taiwan's export structure did change significantly regardless of which indicator is used to measure the change.

9.5 A Comparison between Taiwan, Japan, and the United States

As expected, Taiwan's export structure has been changing rapidly to resemble that of a developed country. Yet it is not clear whether the export structures of developed countries are indeed consistent with what has been gener-

Table 9.6 Share of Heavy and Chemical and High-Tech Products in Taiwanese Exports, 1985-91 (%)

Year	Heavy Chemical Industries Products	Non-Heavy Chemical Industries Products	High-Tech Products	Non-High-Tech Products
1985	36.47	63.53	27.03	72.97
1986	35.63	64.37	27.56	72.44
1987	37.89	62.11	30.03	69.97
1988	42.84	57.16	33.70	66.30
1989	44.53	55.47	33.92	66.08
1990	46.67	53.33	35.87	64.13
1991	46.71	53.29	36.23	63.77

Source: See table 9.4.

ally assumed. Moreover, in order to better understand how fast the Taiwanese economic structure has been changing, some information about the current state of the trade structure of developed countries is useful as a reference point for Taiwan. The same classifications used before were applied to calculate the export structures of Japan and the United States. Two minor points should be mentioned. First, because both countries changed their system of commodity classification recently, only data for recent years was analyzed. Second, because the criteria for commodity classification were taken directly from those developed for Taiwan, the results may not correctly reflect the actual export structures of Japan and the United States. Nevertheless, the results turn out to be consistent with both the theory and what has been found before.

Table 9.7 shows the export structures of Japan and the United States by input intensities. The export structure of Japan in table 9.7 was stable over the last four years. Relative to Japan, exports of the United States were more inclined to high labor-intensity, low capital-intensity, and low human-capital-intensity products, yet the gaps between the United States and Japan were much smaller than those between Taiwan and Japan or between Taiwan and the United States. Moreover, the gaps between the United States and Japan and those between Taiwan and the two developed countries have been shrinking in the last few years.

The share of high labor-intensity products in Taiwan's exports in 1991 was 40.10 percent, which was 1.4 percentage points higher than the U.S. level, but the U.S. share was 7.3 percentage points higher than the Japanese level. From this point of view, the export structure of the United States seems to be closer to Taiwan's than to Japan's. However, the share of low labor-intensity products in Taiwan was only 21.17 percent in 1991, while the same figure in the United

Table 9.7 Export Structure of the United States and Japan by Input Intensities, 1988-91 (%)

Year	Degree of Labor Intensity			Degree of Capital Intensity			Degree of Human Capital Intensity			Degree of Energy Intensity		
	High	Middle	Low	High	Middle	Low	High	Middle	Low	High	Middle	Low
<i>United States</i>												
1989	41.01	25.26	33.74	38.31	39.26	22.43	63.09	16.88	20.03	15.13	41.72	43.15
1990	39.51	26.08	34.41	38.80	41.35	19.86	62.66	17.43	19.90	14.43	44.44	41.13
1991	38.68	26.02	35.29	39.84	41.61	18.55	63.54	17.46	18.99	14.42	45.77	38.91
<i>Japan</i>												
1988	30.40	29.11	40.50	45.36	40.49	14.15	64.13	30.65	5.22	13.26	49.43	37.31
1989	31.06	29.40	39.54	44.50	41.92	13.58	64.10	30.79	5.11	12.99	49.79	37.23
1990	30.87	29.85	39.28	44.22	42.04	13.74	64.14	30.52	5.34	12.26	49.93	37.81
1991	31.34	29.91	38.75	43.45	42.56	13.99	63.91	30.77	5.33	12.04	49.40	38.56

Source: Calculated from the tapes of trade statistics of the United States and Japan.

Note: For definitions, see discussion in the text, section 9.3 (also, Chen, Schive, and Wu 1991).

Table 9.8 Export Structure of the United States and Japan by Industry and Use, 1988–91 (%)

Year	Agriculture, Forestry, Livestock and Hunting Products	Processed Food	Beverage and Tobacco Preparation	Energy and Minerals	Construction Materials	Intermediate Products		Consumer Nondurable Goods	Consumer Durable Goods	Machinery	Transportation Equipment
						A	B				
<i>United States</i>											
1989	8.04	4.15	1.31	2.02	0.13	16.60	29.10	6.48	7.54	15.13	9.50
1990	6.92	4.08	1.62	1.90	0.15	15.87	30.25	7.37	5.72	15.52	10.61
1991	5.85	4.25	1.43	1.80	0.15	15.79	30.12	7.72	5.66	15.71	11.54
<i>Japan</i>											
1988	0.10	0.60	0.05	0.15	0.16	10.82	28.33	3.74	8.04	25.18	22.83
1989	0.10	0.55	0.05	0.16	0.17	10.81	29.44	3.59	7.47	25.58	22.09
1990	0.10	0.51	0.06	0.12	0.16	10.10	29.52	3.91	7.53	25.55	22.45
1991	0.10	0.48	0.07	0.13	0.17	9.78	29.68	3.92	7.22	26.32	22.12

Source: See table 9.7.

Note: See table 9.5 for definitions of intermediate products.

States was 35.29 percent, much closer to the 38.75 percent share in Japan. Similar results also can be found in the classifications by capital intensity. Taiwan and United States were closer in low capital-intensity products while Japan and the United States were closer in high capital-intensity products. As implied, the comparative advantage of Taiwan was concentrated slightly more in products with medium degrees of labor or capital intensity.

The differences among countries in the shares of commodities as classified by human capital intensity are striking. In 1991 the shares of highly human-capital-intensive products in exports were 63.54 and 63.91 percent in the United States and Japan, respectively, while the same measure was only 27.23 percent in Taiwan. Thus, the export structure of Taiwan is still far behind Japan and the United States, while Japan and the United States are similar to each other in their trade structures. As for the shares of low human-capital-intensity products, the 1991 figures for Taiwan, the United States, and Japan are 34.26, 18.99, and 5.33 percent, respectively. Japan seems to concentrate much more on products with a medium-degree of human capital intensity than does the United States.

The shares of products by energy intensities did not differ much among these three countries. This result is interesting but the reasons for it are not yet clear. It is possible that energy and energy-related product prices do not play a major role in determining international comparative advantage for energy-intensive products. The argument of Caves, Frankel, and Jones (1990) applies well in this case.

The results presented in table 9.8 show that the United States enjoyed comparative advantage in primary products, processed food, beverage and tobacco, energy and minerals, intermediate products, and consumer nondurable goods over Japan, while Japan performed better in machinery and transportation equipment. In comparison with its share of Japanese and U.S. exports, consumer nondurable goods was the largest export category in Taiwan recently, although this share has been declining very rapidly. Even so, the share was still 22 percent in 1991, compared with 7.72 and 3.92 percent in the United States and Japan, respectively. The share of machinery in Taiwan's exports was already slightly higher than that of the United States in 1991.

The export shares of heavy and chemical industries and high-tech products shown in tables 9.6 and 9.9 indicate again that the export structure of the United States is between Taiwan's and Japan's, but much closer to Japan's. The shares of heavy and chemical industries in 1991 were 85.76, 65.71, and 46.71 percent in Japan, the United States, and Taiwan, respectively. The shares of high-tech products in these three countries in 1991 were 70.14, 54.39, and 36.23 percent, respectively. Thus, Taiwan still has a long way to go to achieve an export structure similar to that of Japan or the United States.

Before concluding this section, it is worthwhile to point out that the analysis presented here may be affected by the fact that the United States has a richer natural resource endowment so that its export shares of primary products and

Table 9.9 Share of Heavy and Chemical and High-Tech Products in U.S. and Japanese Exports, 1988–91 (%)

Year	Heavy Chemical Industries Products	Non-Heavy Chemical Enterprises Products	High-Tech Products	Non-High-Tech Products
<i>United States</i>				
1989	63.17	36.83	52.39	47.61
1990	64.77	35.23	53.52	46.48
1991	65.71	34.29	54.39	45.61
<i>Japan</i>				
1988	86.27	13.73	70.72	29.58
1989	86.42	13.58	70.64	29.36
1990	85.87	14.13	70.54	29.46
1991	85.76	14.24	70.14	29.86

Source: See table 9.7.

other natural-resource-intensive products are higher. If comparisons are made on the basis of manufacturing goods only, with processed foods also excluded, then the export structure of the United States may be similar to that of Japan. However, Japan's export structure would probably still be slightly ahead of that of the United States according to some measures such as human capital. The use of Taiwan's production characteristics in this study is another factor that should be considered a source of bias.

9.6 Concluding Remarks

Using different factor intensities and other measures to reclassify export data, this paper showed that the export structure of Taiwan has been changing rapidly toward that of a developed country in the last few years. This paper also found that the export structure of the United States generally lies between the structures of Taiwan and Japan, but much closer to Japan's. However, the gaps between Taiwan and Japan and between Taiwan and the United States are still significant for many product categories. Therefore it is still too early to predict when Taiwan can achieve an export structure similar to that of Japan or the United States.

An interesting question is whether, since Japan is a major competitor of Taiwan's in high-tech and human-capital-intensive products in the international market, the greater strength of the Japanese yen relative to the NT dollar in the mid-1980s was a factor in the structural change of Taiwan's exports.³ The answer is probably yes, but the degree of the yen's impact should not be exaggerated. First, even though the rise of the yen pushed Taiwan's real effective ex-

3. This question was raised at the conference.

change rate down in 1986 (Schive 1992a) and thereby helped to boost exports by 30 percent that year, structural changes in Taiwan's exports did not take place until 1987. Thus, even if a very strong yen in 1985 and 1986 did facilitate Taiwan's export of high-end products, it also helped promote Taiwan's exports in general, so that the effect on overall trade structure, at least in the short run, was not significant. Moreover, the expansion of exports of Taiwan's intermediate and capital goods beginning in 1987 was, to a significant extent, directly attributable to Taiwan's active outward investment that began that year and was therefore mostly unrelated to the yen's value. It may be fair then to conclude that Taiwan's export structure probably would not have changed as quickly as it did had the Japanese yen not appreciated to its present level, but that the value of the yen was not a decisive factor in the change.

Another interesting finding of this paper is that the speed of adjustment in Taiwan as well as the gaps among Taiwan, Japan, and the United States are significant when exports were classified by human capital intensity. This result implies that human capital may play a key role in determining international comparative advantage between semideveloped and developed countries. If this proposition is true, human-capital-intensive industries should be targeted for Taiwan's future development. An adequate supply of human capital will be vital to Taiwan's success in the later stages of economic development.

Highly human-capital-intensive industries have been developing quite well in Taiwan recently. Table 9.10 classifies Taiwan's manufacturing sector by capital intensity and human capital intensity. The production indices of these industry groups with high, middle, and low capital intensities have shown only minor differences. Roughly speaking, between 1971 and 1986, industries with low capital intensity grew at about the same rate as those with high capital intensity, but the former lagged behind in the second half of the 1980s. Although the growth rate in the second half of the 1980s was relatively high for industries with high capital intensity, industries with high human capital intensities grew at an even higher rate. Moreover, industries with low human capital content recorded a negative growth rate between 1986 and 1991. Therefore, changes in the production structure in Taiwan were similar to those in the export structure, and human capital seems to be the dominant factor in Taiwan's international competitiveness.

In view of both the theoretical arguments and empirical findings, human-capital-intensive products are also likely to be the products with which advanced countries may have comparative advantage. Although advanced countries are usually more affluent in capital, human capital, and technology, the degree of international mobility of human capital seems to be lower than that of capital and technology. Consequently, capital-intensive products may be easier to transplant and produce in less-developed countries than human-capital-intensive products. Therefore, human capital would be the dominant factor in determining a country's comparative advantage. Further study along this line is clearly warranted.

Table 9.10 Industrial Production Indices by Capital and Human Capital Intensities: Taiwan, 1971–91 (1986 = 100)

Year	Capital Intensity			Human Capital Intensity		
	High	Medium	Low	High	Medium	Low
1971	17.23	19.69	16.95	17.57	13.86	22.10
1972	21.89	25.19	18.81	21.19	17.49	26.54
1973	25.97	29.10	23.12	25.25	21.19	31.09
1974	24.56	24.68	19.74	22.92	17.51	27.69
1975	25.89	26.35	24.06	22.87	21.62	31.69
1976	40.98	36.49	35.17	32.20	34.43	46.15
1977	46.67	40.86	39.99	38.24	40.93	48.43
1978	55.74	50.85	49.55	47.14	51.38	57.85
1979	58.88	55.35	50.85	51.08	53.56	60.24
1980	63.05	55.16	54.28	52.78	57.15	62.68
1981	69.35	67.27	59.16	66.14	62.71	65.72
1982	69.73	67.09	59.60	63.74	62.87	68.99
1983	79.74	75.26	71.25	76.47	73.66	75.22
1984	85.08	84.11	83.92	84.15	84.68	84.28
1985	89.92	87.41	82.49	86.51	84.94	87.65
1986	100.00	100.00	100.00	100.00	100.00	100.00
1987	109.12	111.70	112.29	113.92	112.56	106.53
1988	115.70	116.65	113.90	122.95	120.00	102.37
1989	108.58	120.63	116.34	120.94	124.08	100.55
1990	123.49	119.11	107.87	135.33	118.93	92.52
1991	132.53	127.19	117.32	145.19	131.38	96.97

Source: *Strategies for the Development of Manufacturing Sector* (Taipei: Taiwan Institute for Economic Research, 1992).

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Comment Rachel McCulloch

From 1980 until 1985, the Central Bank of Taiwan maintained a fixed exchange rate between the NT dollar and the U.S. dollar despite a soaring trade surplus and a politically troublesome bilateral trade imbalance with the United States. In 1985, Taiwan yielded to U.S. pressure to allow the NT dollar to appreciate as a means of reducing the large bilateral imbalance. This paper analyzes changes in Taiwan's export structure during the subsequent period.

Post-1985 changes in Taiwan's exports reflect the rise in the value of the NT dollar relative to the currencies of most of its trading partners (although not Japan), as well as the rapid increase in NT dollar wage rates that began early in the 1980s when Taiwan moved into an era of tight labor markets. Over the period 1980–88, the rise in the value of the NT dollar and in NT dollar wage rates together produced a larger rise in unit labor costs (measured in U.S. dollars) than was experienced by any of Taiwan's trade competitors, including even Japan. However, a third potent agent of change is not mentioned by the authors: U.S. trade policy, which in 1985 shifted abruptly from a largely laissez-faire approach to an active stance emphasizing reduction of bilateral trade imbalances.

Using an input-output table for 1986, Chen, Schive, and Chu classify Taiwan's exports into broad groups according to their production characteristics: labor intensity, capital intensity, and human capital intensity. As one might expect given the rapidly rising unit labor costs, the share of high labor-intensity products in Taiwan's exports fell from 47 percent in 1986 to 40 percent in 1991, while the share of exports with low labor intensities rose from 15 percent to 21 percent over the same period. The authors term the speed of adjustment "only moderate," implicitly raising the interesting question of how to judge the speed of adjustment to changing circumstances. In fact, Taiwan's exports of some high labor-intensity products, apparel in particular, had been constrained by trade policies abroad to levels below those justified by comparative advantage alone. Thus, one hidden effect of the rapidly rising unit labor costs was to reduce the inconsistency between the constrained export levels and domestic costs of production.

Other likely changes in the manufacturing sector to reduce the impact of increased labor costs cannot be assessed from the methodology used by the authors. Because they rely on a single year's input-output structure, the adjustment measured includes only the part achieved through changes in export mix, not the part achieved through changes in the way any given product was manufactured. Therefore, to the extent firms economized on labor through increased mechanization of production, the authors' approach understates the true response. Problems of interpretation also arise in the case of direct investment in neighboring (presumably lower-wage) countries, because intermediate products previously used in domestic production of exports may now become exports to subsidiaries abroad. Such export increases do not represent new demand for domestic output. Finally, even in the absence of changing unit labor costs, quantitative trade restrictions such as voluntary export restraints are likely to induce upgrading of the restricted exports over time, which often also means changes in the production characteristics of these exports.

The authors go on to compare Taiwan's export structure with those of Japan and the United States. They find Taiwan's export structure has become more like that of these two highly developed countries, with the United States lying between Taiwan and Japan, but closer to Japan, on most dimensions of export structure. The authors conclude their comparison with the observation that "Taiwan still has a long way to go to achieve an export structure similar to that of Japan or the United States." This statement seems to imply that all wealthy countries can be expected to have similar export structures. Should Taiwan's success, or lack of success, in economic development be judged on the basis of its export structure? In fact, rich countries with similar levels of GDP per capita differ widely in the structure of their merchandise exports. As the authors note, the United States is more abundant than Japan in land and natural resources, an element of comparative advantage reflected in the two countries' very different extent of primary-commodity exports. A more interesting comparison is of Japan and Germany. Like Japan, Germany has small primary exports and very large manufactured exports, but the composition of Germany's manufactured exports is quite different from that of Japan. While machinery and transport equipment accounted for two-thirds of Japan's 1990 exports, this category made up less than one-half of German exports.

The aggregate data presented by Chen, Schive, and Chu hint at a fascinating story to be told at the industry level. The authors' discussion focuses entirely on broad commodity groups, yielding such information as that "heavy and chemical industries" generated 86 percent of exports from Japan in 1991 but only 47 percent of Taiwan's exports, and that "type B intermediate products, which are those intermediate products readily usable as final products" have replaced "consumer nondurable goods" as Taiwan's biggest export category. Apparel and semiconductors are never mentioned. Augmenting the analysis of broad trends with some detail on the commodity composition of Taiwan's exports, or even case studies of adjustment by individual firms, could provide a more complete picture of the nation's recent economic transformation.

Comment Shin-ichi Fukuda

This paper gives very interesting information about the Taiwanese economy in the 1980s. Focusing on export structure, the authors describe the drastic structural change that took place in the Taiwanese economy around 1985. Such analysis is very important because Taiwan achieved remarkable economic growth in the 1980s. Although the paper is clearly written, I have four comments.

My first comment is on the comparison of the export structures of Taiwan, Japan, and the United States. The authors show that the export structure of the United States lies between those of Taiwan and Japan. However, this result seems strange to me because I can find no reason for the export structure of the United States to be less developed than that of Japan. Furthermore, the export to GNP ratio in Taiwan is more than 50 percent, while the export to GNP ratios in Japan and the United States are less than 20 percent. This implies that the role of exports in Taiwan is not simply comparable to that in Japan or the United States.

My second comment is on the data sample. The paper focuses on the sample period of the 1980s, especially the late 1980s. I agree that this was the most noteworthy period for Taiwanese economic growth. However, in general, ten years or five years is too short a span over which to discuss economic development. For such a short period, it is difficult to distinguish economic growth from business cycles. For example, the authors stress the very rapid structural change after 1985. However it is possible that this change reflects the temporary boom of business cycles in the Taiwanese economy.

My third comment is on the factors that caused structural change in the Taiwanese economy after 1985. As the authors stress, the main force behind the structural change was the drastic appreciation of the NT dollar after 1985. This appreciation made labor in Taiwan more expensive and led to a less labor-intensive and more capital-intensive industry structure. However, in my view, another important factor was the drastic appreciation of the Japanese yen. As we can see in table 9.1, the appreciation of the Japanese yen was even more drastic than that of the NT dollar. Since Japan is one of Taiwan's main competitors in the less labor-intensive and more capital-intensive industries, it is quite possible that appreciation of the Japanese yen accelerated structural change in Taiwan.

My final comment is on the trade balance in the Taiwanese economy. I am quite interested in how this was affected by the structural change in the late 1980s. If we look at data on the Taiwanese trade balance, we find a surplus throughout the 1980s. However the total trade balance of Taiwan was decreasing in the late 1980s because of the rapid increase in imports after 1985. According to a standard theory of the stages of economic development, the trade

balance is deficit in the first stage, becomes surplus in the second stage, and goes back to deficit in the third stage. It is usually said that Japan with its large trade surplus is in the second stage and the United States with its large trade deficit is in the third stage. Is it then appropriate to say that the recently decreasing trade surplus in Taiwan can be interpreted as foretelling the end of Taiwan's second stage of economic development?