PART 1: Chapter 4 Industrialization of Asian NIEs and Their Economic Interdependency with Asia-Pacific Region: 1 Growth Patterns and Structural Changes in the Asian NIEs: A Comparative Study Based on Asian International I-O Tables

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Chapter 4

Industrialization of Asian NIEs and Their Economic Interdependency with Asia-Pacific Region

Paper 1

Growth Patterns and Structural Changes in the Asian NIEs: A Comparative Study Based on Asian International I-O Tables

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1. Introduction

One of the highlights of recent economic history is the remarkable economic growth of Asian NIEs (Hong Kong, Korea, Taiwan and Singapore) in the 1970s. According to many theoretical and empirical studies, adopting "outward-looking" policies to promote their exports of labor-intensive manufacturing goods largely contributed to such rapid economic growth. As a result, many developing countries are now seeking the same strategy. For example, most ASEAN-4 countries dismantled their inward-looking (protectionistic) regulations in the 1980s and succeeded in accelerating their economic growth rates. Some South Asian countries such as India has just started such structural adjustment in the early 1990s.

This sort of economic growth has accompanied drastic changes in each nation's industrial structure. The share of the manufacturing sector in the GDP has rapidly expanded while that of the agricultural sector has contracted. Moreover, capital-intensive industries also has become more competitive. As a result, business chances have been extended not only to the labor-intensive export-oriented industries, but also to other types of industries.

The economic interdependence among the Asian countries also drastically changed. In other words, the roles of NIEs in the regional economy have become more and more important although those of developed countries, such as the EC, the USA, and Japan, are still dominant. These impacts diffused through the channels of their trade and investment. For example, the direct investment from Taiwan to Thailand drastically increased from 36 to 868 million dollars during 1986 – 1989.

Needless to say, these topics have been discussed in many books and articles. However, since internationally comparable (official) I–O tables have not been available on a time series basis until recently, the scope and validity of empirical analysis have been limited. With this in mind, using Asian International I–O tables for 1975 and 1985, this paper will

clarify: (1) how the export-oriented economic structures of NIEs changed, (2) how their input structures changed, and (3) how their impacts on the Asian regional economy changed during this period.

While international I-O tables will be utilized for (3), the uniformly classified and evaluated in U.S. dollars national I–O tables will be utilized for (1) and (2). (These national tables were reproduced from the international I–O tables.) The availability of these uniformly classified and evaluated national I–O tables is one of the valuable by-products derived from the compilation of international I–O tables.

2. Still Export-Oriented Economic Structures?

As previously mentioned, export expansion of labor-intensive manufacturing goods largely contributed to the rapid economic growth of Singapore, Taiwan and Korea in the 1970s. However, it is often pointed out that the roles of such light industries gradually become less important in NIEs. With this in mind, we will clarify how their export-oriented economic structures changed during 1975 – 1985.

2.1 Methodology

In the framework of I–O analysis, the output vector (X) can be broken down as follows:

$$X = R^dF^d + R^dE$$

where R^d, F^d, and E are a domestic Leontief inverse matrix, a domestic final demand vector, and an export vector, respectively. The first term can be interpreted as the output induced by the domestic final demand while the second term can be interpreted as the output induced by exports. Thus, when the second term is larger than the first term, such an economy can be considered export-oriented.

2.2 Some Empirical Results

Singapore: The number of export-oriented manufacturing sectors increased from seven to eleven during this period. In particular, light industries (food, beverages, and tobacco; textile and leather products; wooden products) increased their shares more than 20%. In contrast, some of heavy and chemical industries (petroleum and its products; rubber products; nonmetallic mineral products; metal products) decreased their shares (Table 1 and Figure 1).

Korea: Textile and leather products and rubber products were export-oriented throughout this period. Moreover, their shares increased more than 10%. Metal products became an export-oriented sector by increasing its share. In contrast, other manufacturing products decreased their share from 54.6% to 49.0%. Thus, the number of export-oriented sectors did not change. Among the non-export-oriented sectors, however, transport equipment increased its share from 24.3% to 37.8% (Table 1 and Figure 3).

Taiwan: Six sectors (textile and leather products; wooden products; chemical products; metal products; machinery; and other manufacturing goods) were export-oriented in 1985. In this sense, Taiwan is more export-oriented than Korea (Table 1 and Figure 2).

Table 1 Manufacturing Output Shares Induced by Exports

(percentage)

	Singapore		Taiwan		Korea	
	1975	1985	1975	1985	1975	1985
Food, Bev. & Tobacco	33.3	53.5		18.2	7.4	6.8
Text. & Leather Prod.	34.7	78.4		81.4	59.7	73.3
Wooden Prod.	36.8	58.1		74.8	48.3	21.0
Pulp & Paper Prod.	58.3	60.5		39.0	24.8	25.8
Chemical Prod.	75.6	77.9		69.8	34.3	40.3
Petro. & Its Prod.	89.7	86.5		49.3	26.6	35.2
Rubber Prod.	71.9	55.3		-	58.7	71.4
Nonmetallic Min. Prod.	38.5	21.2		38.1	22.6	18.9
Metal Prod.	65.0	55.9		58.9	45.8	57.4
Machinery	64.4	86.3		75.5	42.0	44.2
Transport Equipment	36.8	62.6		38.7	24.3	37.8
Other Manufac. Prod.	64.7	78.3		83.0	54.6	49.0

Figure 1 Output Shares Induced by Exports: Singapore's Manufacture

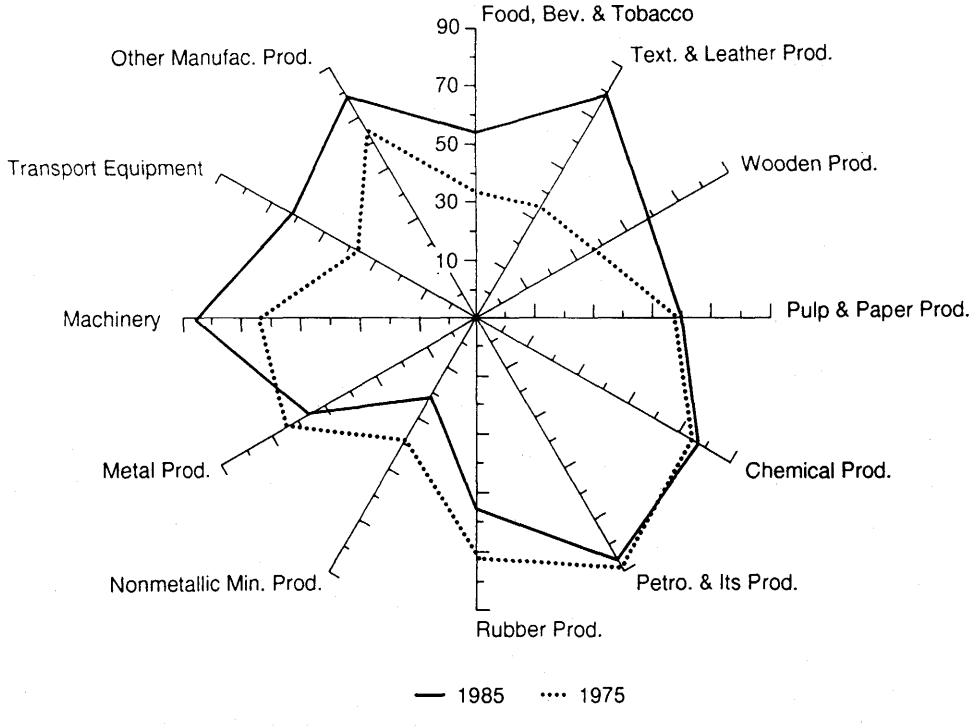


Figure 2 Output Shares Induced by Exports: Taiwan's Manufacture

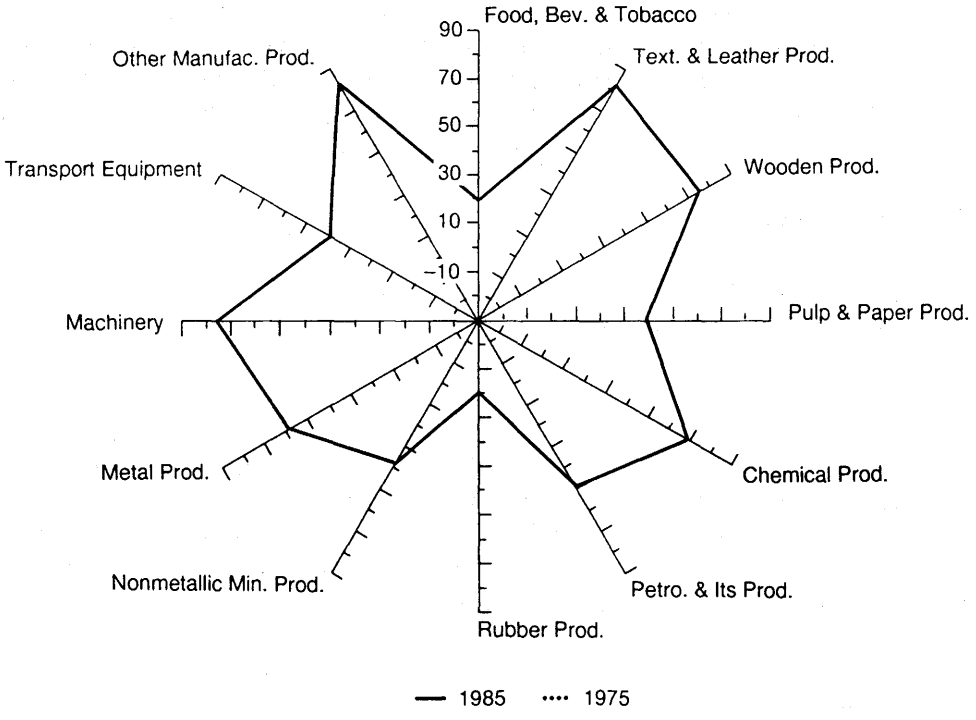
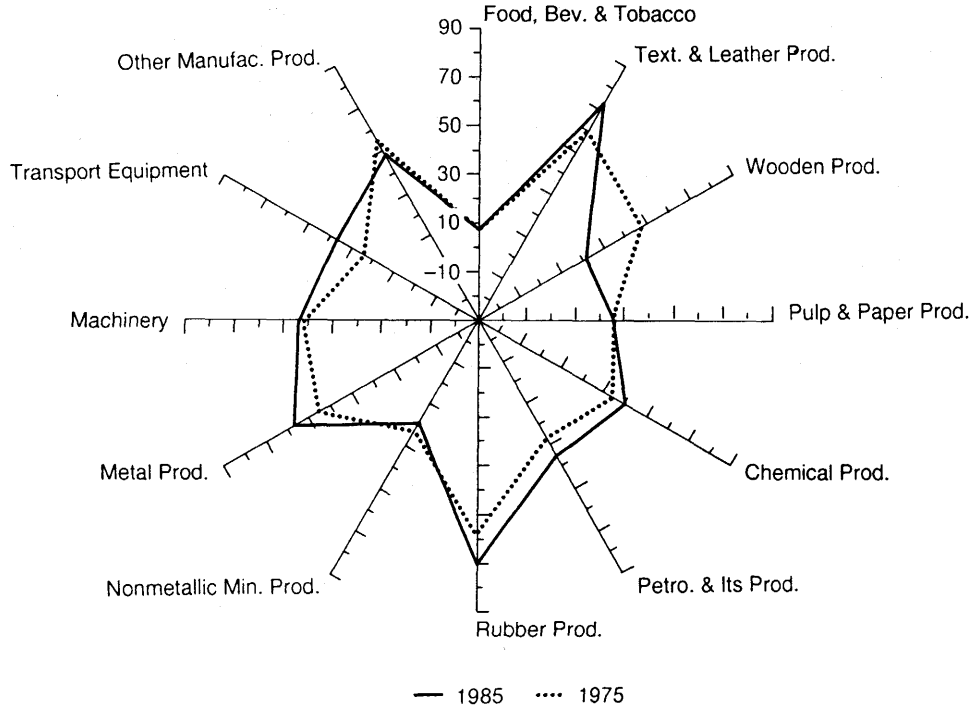


Figure 3 Output Shares Induced by Exports: Korea's Manufacture



3. Towards the Japanese-Type Input Structure?

As previously mentioned, the economic growth has accompanied drastic changes in each nation's industrial structure. As a result, the business chances have been extended not only to the labor-intensive export-oriented industries but also to other types of industries. In other words, their input structures are getting more complicated. With this in mind, we will clarify how their input structures changed during 1975 – 1985.

3.1. Methodology

In order to clarify whether or not the input structure of industry i is similar to that of Japan, the following index (s_i) will be used:

$$s_i = \sum \left| a_{.i}^K - a_{.i}^J \right| / 0.5 \sum (a_{.i}^K + a_{.i}^J)$$

where $\sum$ denotes the column-wise summing operation, $a_{.i}$ is an input coefficient of sector i, and superscripts K and J are respectively the country considered and Japan. If this index is close to zero, the concerned industry's input structure is similar to that of Japan.[1] By using this index, it is possible to test whether or not the input structures of NIEs are becoming closer to the Japanese-type "full set" structure.

3.2 Some Empirical Results

3.2.1 Similarity of Technology

The similarity of "technology" can be measured by using competitive-type input coefficients.[2] The results are summarized in Table 2 and Figures 4 to 6.

According to this, all twelve Taiwanese sectors are indicating less than 0.5 level in 1985. Thus, from the viewpoint of technological similarity, the Taiwanese industrial structure seems to be very close to the Japanese one. On the other hand, eight sectors in Korea and six sectors in Singapore are indicating less than 0.5 level in 1985. Thus, from the viewpoint of technological similarity, Korea's industrial structure also seems to be close to Japan's.

Taiwan's input coefficients are not available for 1975. Therefore, the direction of the changes in technological similarity can be examined only for Singapore and Korea. According to the results, all twelve sectors in Singapore and four sectors in Korea revealed greater than 0.5 level in 1975. This suggests an extremely rapid technological catching-up process in Singapore during this period.

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[1] For further detailes, see Watanabe [1970].

[2] Needless to say, the concept of "technology" defined like this is fairly broad because many commodities are included in each aggregated sector.

Table 2 Similarity of Technologies in Manufacturing Sector

	Singapore		Taiwan		Korea	
	1975	1985	1975	1985	1975	1985
Food, Bev. & Tobacco	0.66	0.76	0.33		0.59	0.57
Text. & Leather Prod.	0.62	0.57	0.42		0.36	0.41
Wooden Prod.	0.90	0.66	0.33		0.44	0.30
Pulp & Paper Prod.	0.58	0.27	0.24		0.33	0.27
Chemical Prod.	0.74	0.32	0.41		0.40	0.22
Petro. & Its Prod.	0.62	1.56	0.42		0.12	0.36
Rubber Prod.	1.58	0.99	0.49		0.69	0.65
Nonmetallic Min. Prod.	0.79	0.42	0.45		0.52	0.39
Metal Prod.	0.64	0.52	0.11		0.29	0.21
Machinery	0.70	0.44	0.29		0.29	0.27
Transport Equipment	1.14	0.45	0.40		0.42	0.78
Other Manufac. Prod.	1.08	0.24	0.33		0.51	0.59

Figure 4 Similarity of Technologies: Singapore

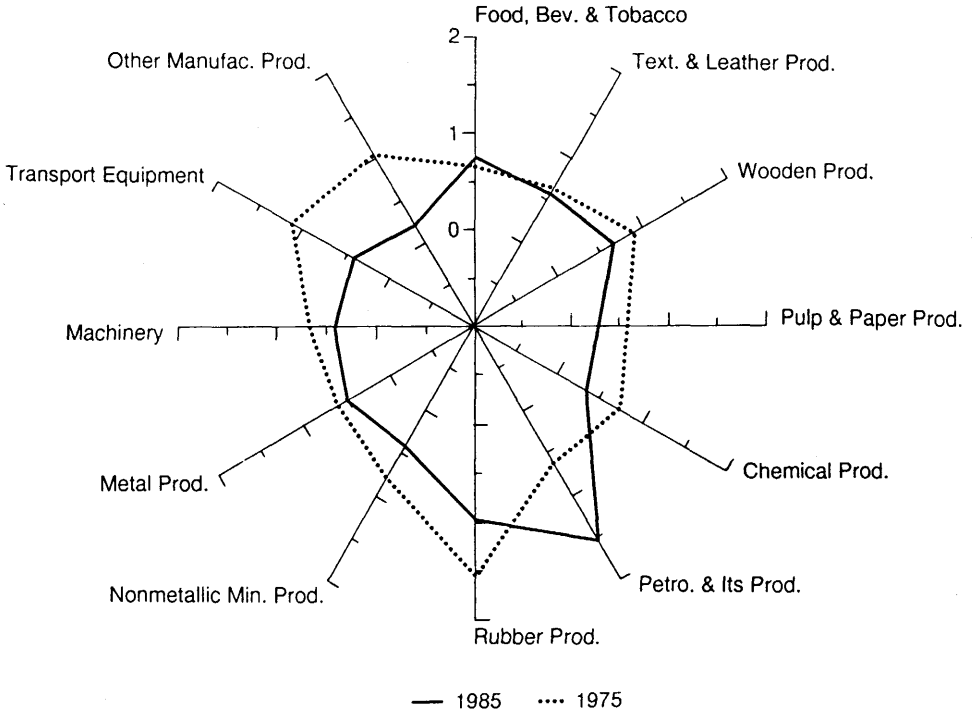


Figure 5 Similarity of Technologies: Taiwan

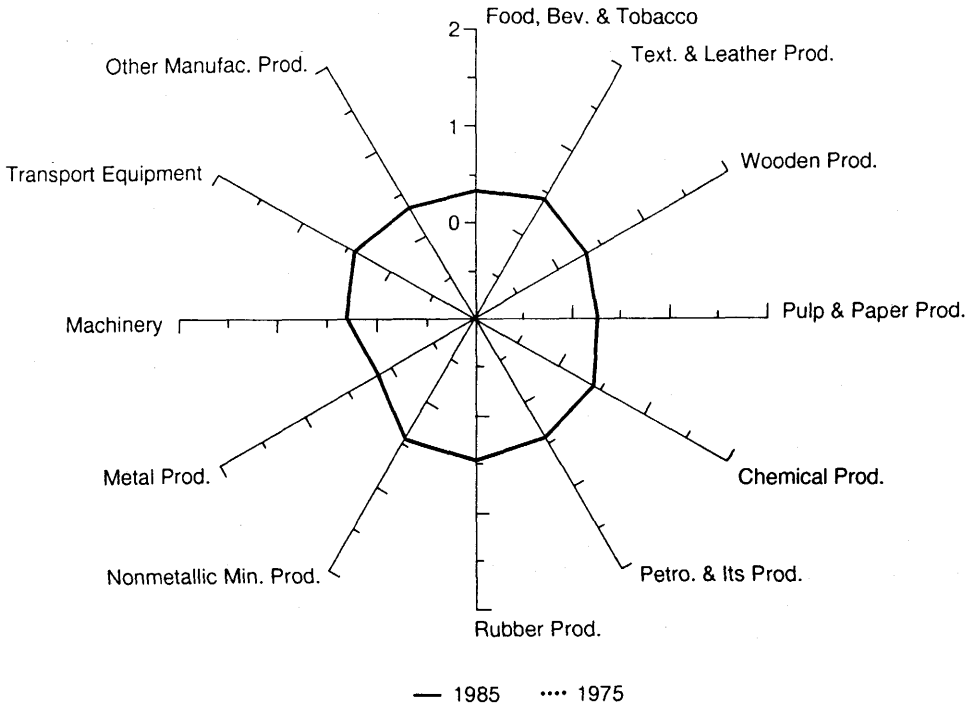
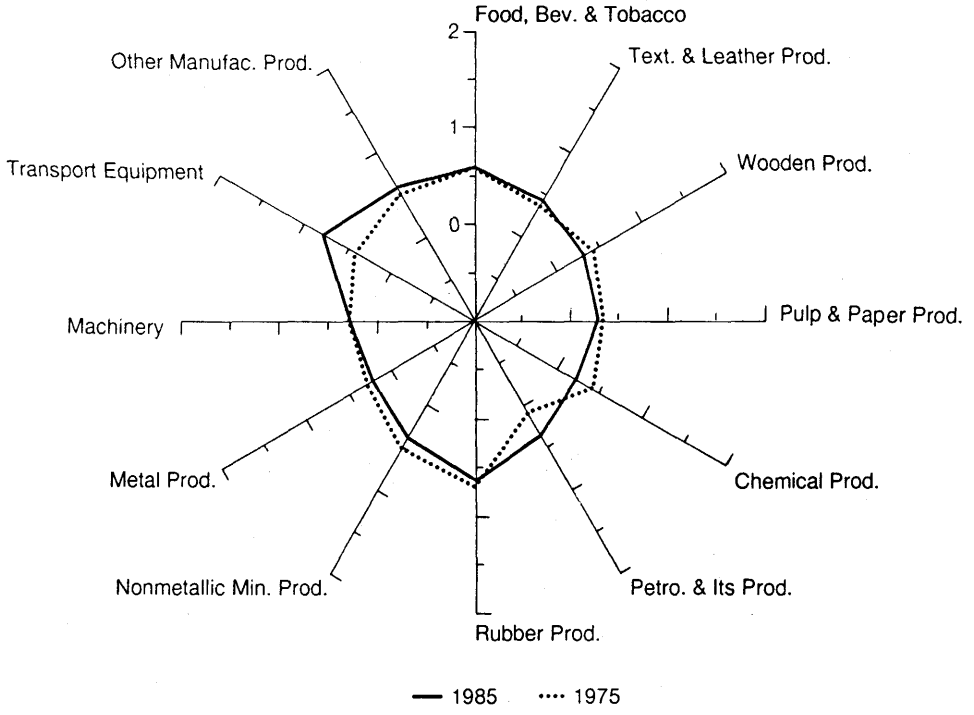


Figure 6 Similarity of Technologies: Korea



3.2.2 Similarity of Domestic Input Structure

The similarity of domestic input structure (i.e., local content structure) can be measured by using non-competitive-type input coefficients. The results are summarized in Table 3 and Figures 7 to 9. According to this, nine sectors in Taiwan and seven sectors in Korea are indicating less than 0.5 level in 1985. Thus, from the viewpoint of domestic input structure, the Taiwanese industrial structure is closer to Japan's. However, the differences are only in food processing and miscellaneous manufacturing. In contrast, the local content of Singapore is quite different, because only one sector is indicating less than 0.5 level.

Since Taiwan's data are not available for 1975, the direction of the changes in similarity of domestic input structure can be examined only for Singapore and Korea. According to the results, all twelve sectors in Singapore and eight sectors in Korea revealed greater than 0.5 level in 1975. This suggests a rapid catching-up process in Korea during this period.

Table 3 Similarity of Local Content Structure

	Singapore		Taiwan		Korea	
	1975	1985	1975	1985	1975	1985
Food, Bev. & Tobacco	0.74	0.90		0.34	0.71	0.60
Text. & Leather Prod.	0.83	1.03		0.47	0.32	0.40
Wooden Prod.	0.71	0.51		0.41	0.79	0.44
Pulp & Paper Prod.	1.07	0.74		0.22	0.55	0.23
Chemical Prod.	1.02	0.54		0.39	0.57	0.41
Petro. & Its Prod.	1.43	0.55		1.29	0.79	0.85
Rubber Prod.	1.39	1.00		0.63	0.72	0.71
Nonmetallic Min. Prod.	0.80	0.43		0.49	0.48	0.35
Metal Prod.	1.46	0.91		0.23	0.34	0.17
Machinery	0.85	0.98		0.44	0.52	0.35
Transport Equipment	1.34	0.58		0.61	0.56	0.79
Other Manufac. Prod.	1.17	0.69		0.40	0.49	0.62

Figure 7 Similarity of Local Content Structure: Singapore

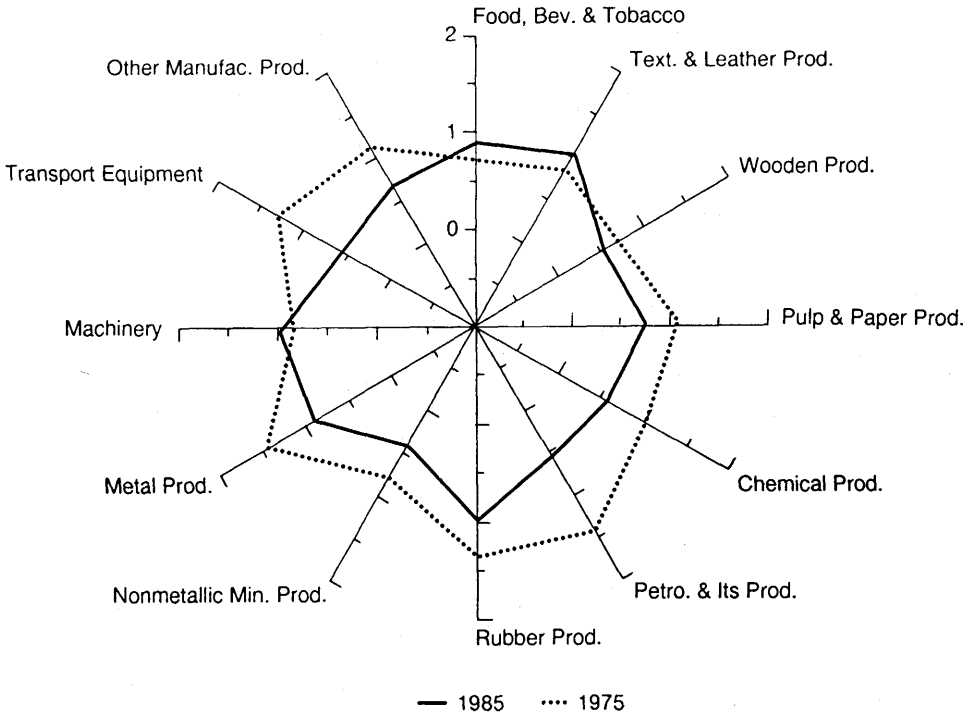


Figure 8 Similarity of Local Content Structure: Taiwan

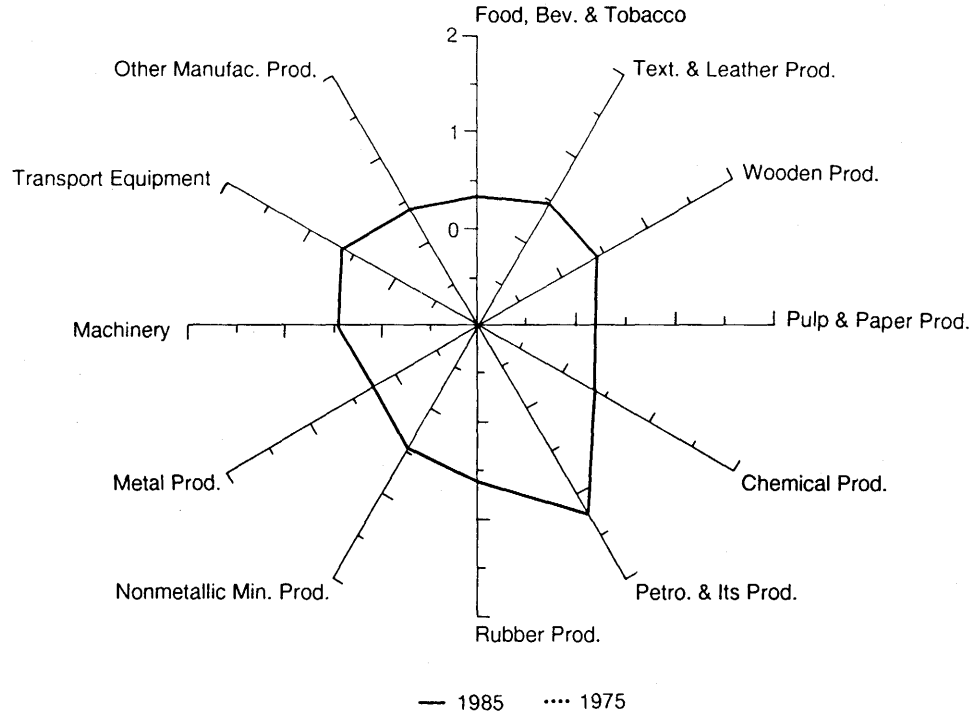
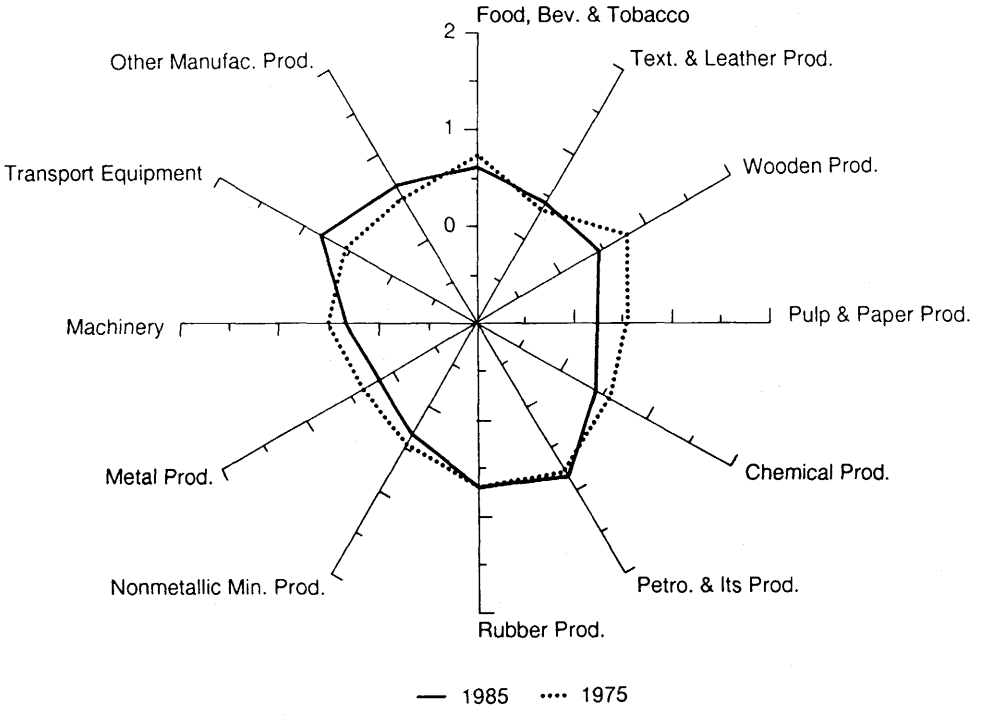


Figure 9 Similarity of Local Content Structure: Korea



4. NIEs Became More Important for ASEAN-4?

As previously mentioned, the roles of NIEs in the Asian regional economy have also become more and more important although those of developed countries, such as the EC, the USA and Japan, are still dominant. With this in mind, we will clarify how their impacts on ASEAN-4 changed during this period.

4.1 Methodology

In the framework of the international I–O model, it is possible to break down the output vector of country k as follows:

$$X_k = R_k F_1 + \ldots + R_k F_n$$

where R_k denotes the portion of international Leontief inverse matrix corresponding to country k and F_k denotes the final demand vector of country i. Thus, for example, the impacts of NIEs on the ASEAN-4 countries can be assessed by using this breakdown.

4.2 Some Empirical Results

The ASEAN-4 countries' outputs induced by final demands of Singapore, Taiwan and Korea were compared with those induced by Japan and the USA. The results are summarized in Table 4 and Figure 10.

Table 4 Contribution Ratios of Final Demand to Production

(a) 1975

(percentage)

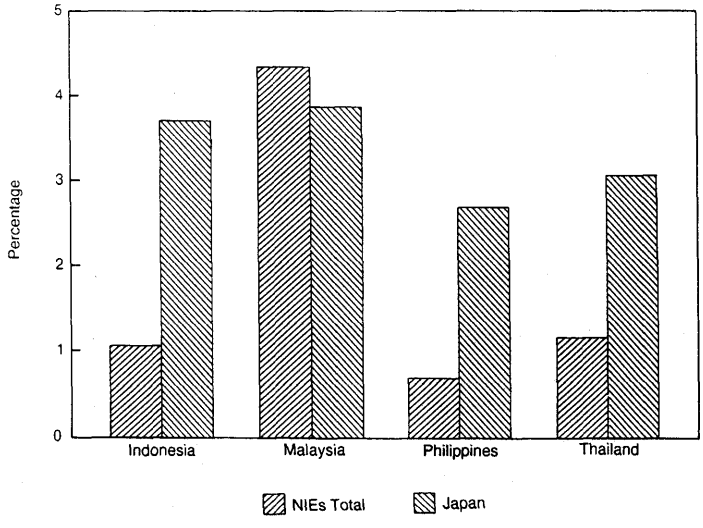
		Singapore	Taiwan	Korea	Japan	USA
Indonesia	Manuf.	0.59	–	0.13	2.52	2.25
	Total	0.54	–	0.41	6.03	5.02
Malaysia	Manuf.	2.38	–	0.95	3.36	11.34
	Total	1.68	–	0.68	2.46	7.38
Philippines	Manuf.	0.15	–	0.13	4.16	5.31
	Total	0.09	–	0.12	3.97	3.15
Thailand	Manuf.	0.49	–	0.16	3.58	1.99
	Total	0.37	–	0.18	2.89	1.23

(b) 1985

(percentage)

		Singapore	Taiwan	Korea	Japan	USA
Indonesia	Manuf.	0.7	0.15	0.21	3.7	3.53
	Total	0.38	0.2	0.34	6.9	4.62
Malaysia	Manuf.	3.2	0.45	0.68	3.86	11.41
	Total	2.04	0.48	1.39	6.78	7.56
Philippines	Manuf.	0.16	0.22	0.31	2.68	9.07
	Total	0.11	0.17	0.22	2.68	6.06
Thailand	Manuf.	0.57	0.35	0.23	3.05	5.91
	Total	0.38	0.23	0.22	1.98	3.61

Figure 10 Impacts on Manufacture in ASEAN-4, 1985



Indonesia: The total output share induced by the final demand of Singapore decreased from 0.54% to 0.38% during this period. However, if we look at the manufacturing output share rather than the total output share, the share increased from 0.59% to 0.70%. Similarly, the total output share induced by the final demand of Korea decreased from 0.41% to 0.34% during this period. However, the manufacturing output share increased from 0.13% to 0.21%. Since the Taiwanese data are not available for 1975, it is not possible to examine whether or not the share increased. However, among the three economies, the impact was smallest in 1985.

Malaysia: The total output share induced by the final demand of Singapore increased from 1.68% to 2.04% during this period. The manufacturing output share was larger and also increased from 2.38% to 3.29%. Similarly, the total output share induced by the final demand of Korea increased from 0.41% to 0.34% during this period. However, the manufacturing output share decreased from 0.95% to 0.68%. Among the three economies, the impact of Taiwan was smallest.

Philippines: The total output share induced by the final demand of Singapore increased from 0.09% to 0.11% during this period. The manufacturing output share was larger and also increased from 0.15% to 0.16%. Similarly, the total output share induced by the final demand of Korea increased from 0.12% to 0.22% during this period. The manufacturing output share also increased from 0.13% to 0.31%. Among the three economies, the impact of Taiwan was larger than that of Singapore but smaller than that of Korea.

Thailand: The total output share induced by the final demand of Singapore increased from 0.37% to 0.38% during this period. The manufacturing output share was larger and also increased from 0.49% to 0.57%. Similarly, the total output share induced by the final demand of Korea increased from 0.12% to 0.22% during this period. The manufacturing output share also increased from 0.13% to 0.23%. Among the three economies, the impact of Taiwan was larger than that of Korea but smaller than that of Singapore.

In summation, although the impact of each NIEs on ASEAN-4 is still smaller than that of the U.S. or Japan, it has been increasing. In particular, the contribution ratios to manufacturing output in Malaysia were remarkable in 1985. The total impact of these three NIEs (4.42%) became larger than that of Japan (3.86%).

5. Summary and Conclusion

First, we examined how the export-oriented economic structures of Singapore, Taiwan and Korea changed during 1975 – 1985 by breaking down the outputs into those induced by domestic final demand and those induced by the exports. According to the empirical results, Singapore was the most export-oriented among the three economies. Except nonmetallic mineral products, all of the manufacturing sectors were export-oriented in 1985. Korea was shown to be the least export-oriented although transport equipment increased its share during this period.

Second, we examined whether or not their input structures are approaching to the Japanese type structures by using the index of similarity. According to the empirical results, from the viewpoint of technological similarity, the Taiwanese input structure was shown to be very similar to Japan's. On the other hand, eight sectors in Korea and six sectors in Singapore were shown to be similar in 1985. However, judging from the direction of the

changes, as extremely rapid technological catching-up process was found in Singapore during this period.

The similarity of domestic input structures was also measured by using non-competitive-type input coefficients. According to the empirical results, the structure of Taiwan was closest to that of Japan. However, the difference between Taiwan and Korea was only in light industries, such as food processing and other (miscellaneous) manufacturing goods. In contrast, the structure of Singapore was shown to be quite different.

Finally, the impacts of these economies on ASEAN-4 were examined by using the contribution ratios of final demand to production. According to the empirical results, Singapore's contribution ratios of final demand to manufacturing production in Indonesia, Malaysia, the Philippines and Thailand increased during this period. Korea's contribution ratios of final demand to manufacturing production in Indonesia, the Philippines and Thailand also increased during this period. However, the contribution ratio to manufacturing output in Malaysia decreased because of the sharp increase in Singapore and Japan. Except Thailand, Taiwan's contribution was relatively small. In summation, although the impact of each NIEs on ASEAN-4 is still smaller than that of the U.S. or Japan, it has been increasing. In particular, the contribution ratio to manufacturing output in Malaysia was remarkable in 1985. The total impact of these three NIEs became larger than that of Japan.[3]

References

T. Watanabe [1970], *Suryo Keizai Bunseki* (Quantitative Economic Analysis), Keiso Shobo.

Institute of Developing Economies [1992], *Asian International Input-Output Table, 1985*, Institute of Developing Economies.

[3] I would record here my acknowledgments to Mr. Takao Sano, Councilor, I.D.E., for his assistance to the computation.