CHAPTER 6

AN EMPIRICAL STUDY ON A RESOURCE-RICH COUNTRY - MALAYSIA: THROUGH LINKAGE AMONG INDUSTRIES

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I. Introduction

The issue of linkage among industries was first discussed by Albert Hirschman (1958). Since then, this subject has been well discussed in the literature, with concentration on formulating various indices to measure the magnitude of linkage. However, to date there has been little theoretical and empirical work done to establish the importance of linkage in economic development. The very few efforts in this field include the argument for "dual industrial growth" based on the experiences of Korea and Taiwan [Ohno and Imaoka, 1986], and the "theoretical rationale of industrial policies" [Ito, 1988]. In proposing "dual industrial growth", Ohno and Imaoka have claimed that not only labour intensive industries have contributed to the rapid growth of Korea and Taiwan but capital intensive ones too. In addition, backward linkages were established between the two industries.

Originally, Hirschman proposed the sum of forward and backward linkage as a criteria for investment allocation. However, after reviewing the Japanese industrial policies, Ito derived a new theoretical criteria for the rationale of industrial policies, that is, industries which enjoy economy of scale and which generate supporting industries via linkage effects should be targetted for industrial policies.

Malaysia, being an industrialising country, should strengthen the linkage among her industries to facilitate further industrialisation efforts. Concurrently, Malaysia is also known for her abundantly endowed natural resources; tin, petroleum, wood, or other tropical products. It is true that in the beginning of 1970s, exports of traditional primary commodities composed roughly 70-80 per cent out of her total exports. However, their share in exports has been declining sharply to less than 50 per cent in 1989. In fact, manufactured exports have replaced primary commodities as the top foreign exchange earner ever before 1989.

The development above does not necessarily mean that Malaysia has already depleted her natural resources, because resource-based manufactured exports (which contain natural resources), albeit electric/electronic machinery or textile/clothing have assumed the key positions in the manufactured exports profile. Therefore, empirical studies are needed to investigate how natural resources in an economy can be measured and to determine whether Malaysia is still abundantly endowed with natural resources or vice versa. Furthermore, the effect of a change in the export structure on domestic industrial structure needs to be observed along with the possibility of strengthening the linkage among industries (which may support further industrialisation process) in Malaysia. These abovementioned questions, however, are of empirical concern.

Henceforth, this chapter will present an empirical study of the Malaysian economy, particularly in areas concerning linkage among primary and manufacturing industries. In Section II, a pilot study will be done to measure how much each country in the Pacific-rim, including Malaysia, is endowed with natural resources. Subsequently, estimates of the factor contents embodied in the Malaysian exports and imports using conventional formulae proposed by Leontief and Leamer will be calculated. Backward and forward linkages indices will be calculated in Section III for the years, 1970, 1975, 1978 and 1983. Lastly, the concluding section will provide a summary of the results together with some proposals for future research work.

II. Factor Endowment Embodied in Exports and Imports of Malaysia

It is not an easy task to estimate natural resources as well as the amount of capital and labour in each country. Basically the wide range of natural resources makes it difficult to aggregate them into one common scale; some are depletable like mineral ores while the others are not. In this section, we will conduct a pilot study to estimate the quantity of natural resources in Malaysia, with the help of input-output tables. The following subsection adopts a method to estimate the endowment of natural resources in several Pacific-rim countries including Malaysia, while the next subsection concentrates on the estimation of conventional factor contents embodied in the Malaysian exports and imports.

Natural Resources

Since there is no single variable to represent the quantity of natural resources in each country, Tatemoto (1975) proposes the "product of some specific industries which use natural resources intensively" as a proxy. For example, most of the agriculture industry

use land to cultivate their agricultural products and forestry industry uses wood for their products, while in the mining industry, mineral ores or petroleum are extracted. We may call the former (land or wood) as undepletable or reproducible, while the latter (mineral ores), as depletable or unreproducible.

In input-output tables, the concept of undepletable (depletable) natural resources can be represented as the quantity of agricultural (mining) products contained in the final demand of each industry. In other words, suppose that the first and the second industry are agriculture/forestry/fishery and mining respectively, and that a matrix $\{b_{ij}\}$ is the Leontief inverse of the input-output coefficients, then the quantities of undepletable and depletable natural resources contained in one unit of the jth final product are estimated as b_{1j} and b_{2j} respectively. When one unit of automobile in final consumption is increased, certain amount of demand for parts, steel or tyre will be generated directly. But the effect does not stop here. The parts, steel or tyre industries are in turn induced to demand for other related parts, iron ores or natural rubber, which generate another round of demand. Ultimately, b_{1j} and b_{2j} will take into account these direct and indirect effects of one unit increase in automobile consumption. Though not discussed in detail, it is reported that industries in West Malaysia which have relatively higher b_{1j} coefficients are food processing, wood product, or rubber product, while metal product industries tend to record a higher b_{2j} coefficients.[1]

Now we can use these $\{b_{ij}\}$s for the estimation of natural resources embodied in exports and imports. Suppose e_j (m_j) is a vector of export (import) ratio of the jth industry, then the undepletable and depletable natural resources embodied in exports (imports), NR_{ue} (NR_{um}) and NR_{de} (NR_{dm}) respectively are defined as;

$$
\begin{aligned}
NR_{ue} &= \Sigma b_{1j} * e_j, \\
NR_{de} &= \Sigma b_{2j} * e_j, \\
NR_{um} &= \Sigma b_{1j} * m_j, \text{ and} \\
NR_{dm} &= \Sigma b_{2j} * m_j.
\end{aligned}
$$

NR_{ue} (NR_{de}) and NR_{um} (NR_{dm}) estimate how much undepletable (depletable) natural resources are embodied in one unit of export, and one unit of import respectively. We assume here that it represents the amount of domestic natural resources needed if each country employs her technology to substitute for imports.

Using the ASEAN-IO Table for 1975 which links each input-output table of eight Pacific-rim countries through exports and imports, four formulae are applied to derive

Table 1. Note that the effects of any change in each country's final demand will be diffused directly or indirectly to other countries via the intermediate transactions of exports and imports among all eight countries. This is one of the properties of international input-output table of this sort, although this is not essential in estimating natural resources.

Each figure in Table 1 represents natural resources embodied in exports or imports in terms of US$. For example, for her undepletable natural resources, West Malaysia exports US$981 out of US$1000 worth, and on the other hand, imports US$553 out of US$1000. For depletable natural resources (including Petroleum/Natural Gas, Metallic Ore, and Non-metallic Ore), West Malaysia exports US$597 and imports US$320 out of US$3000 each. In total, out of US$4000, West Malaysia exports US$1577 and imports US$872 in 1975. Compared to other countries, West Malaysia, Indonesia and Philippines export their natural resources relatively more. Among them, Philippines and Indonesia export more of their depletable natural resources, while West Malaysia and Thailand export more of their undepletable natural resources. Though Japan and US both are net importers of natural resources, the natural resource contents in the exports and imports of Japan is comparatively low. The Japanese trade structure derived here is almost similar to the findings of Tatemoto in 1965.

Though there are some limitations in the measurement of natural resources, we can see a general characteristics of the ASEAN countries; relatively more natural resources are embodied in their exports, with West Malaysia exporting more of her undepletable natural resources.

Factor Contents

One of the most famous empirical work on the factor abundance theory is the Leontief Paradox. Following the Hecksher-Ohlin theorem, Leontief attempted to estimate factor abundance of the US economy, based on the US trade statistics in 1947. He used the concept of factor (capital and labour) contents embodied in exports and imports; the quantity of each factor used directly or indirectly to produce one unit of export and import. Paradoxically, he concluded that US in 1947 was relatively more abundant with labour than capital. Subsequently many discussions have centered around this paradox, which later contributed to the development of the theory of international economics.

Although, Leamer (1980) proposes a slightly different index, but the factor contents approach in maintained. He tried to prove that the statistics Leontief used in his studies

Table1

Natural Resources Embodied in Exports and Imports
Eight Pacific-rim Countries, 1975

	Country		Undepletable (per $1000)	Depletable* (per $3000)	Total (per $4000)
1.	Indonesia	exports	582	1926	2508
		imports	584	792	1376
2.	West Malaysia	exports	981	597	1577
		imports	553	320	872
3.	Philippines	exports	389	934	1283
		imports	233	170	403
4.	Singapore	exports	316	312	628
		imports	371	152	523
5.	Thailand	exports	380	407	788
		imports	246	275	522
6.	Japan	exports	71	55	126
		imports	242	142	384
7.	Korea	exports	131	551	682
		imports	223	243	466
8.	U.S.A.	exports	309	379	689
		imports	415	568	983

Note: * - the sum of the estimates for Petroleum/Natural Gas, Metallic Ore, and Non-metallic Ore.

Source: Yokoyama - Itoga (1985), compiled from Institute of Developing Economies, *International Input-Output Tables for ASEAN Countries, 1975*, Asian Economic Press, Tokyo, 1982.

have not indicated any paradox. It has been pointed out that the ratio Leontief applied in his study is limited and is only relevant in the case of a two goods and two factors economy. Though the capital-labour ratio is conventionally used in an economy with two goods and two factors, it is not directly applicable to a real economy which entails many goods and many factors. Leamer has instead proposed a more general concept of net exports rather than a ratio, in accordance with the Hecksher-Ohlin-Vanek theorem.

If we denote K_e (K_m) and L_e (L_m) as capital and labour embodied in exports (imports) respectively, then net exports of capital and labour embodied in exports and imports will be,

$$K_e - K_m, \text{ and}$$
$$L_e - L_m$$

respectively. Notice that we can easily increase the number of factors as many as possible, for example, $(M_e - M_m)$ for the third production factor, M. In a special case of two by two, the capital-labour ratio $(K_e/L_e, K_m/L_m)$ in Leontief study can be derived. Applying this general index, Leamer proves that the necessary and sufficient conditions for a country to be relatively more abundant with capital than labour are;

(a) $K_e - K_m > 0, L_e - L_m < 0$
(b) $K_e - K_m > 0, L_e - L_m > 0, (K_e - K_m) / (L_e - L_m) > (K_c/L_c)$
(c) $K_e - K_m < 0, L_e - L_m < 0, (K_e - K_m) / (L_e - L_m) < (K_c/L_c)$,

where K_c and L_c are capital and labour embodied in domestic consumption respectively.

We will estimate the factor contents for West Malaysia in 1970 and 1975 using these two indices as adopted by both Leontief and Leamer; as shown in Table 2.[2]

The Leontief and Leamer Indices in Table 2 show that West Malaysia is relatively more abundant with labour than with capital. It should be noted that this result is coincidental. There is possibility that each of this result may yield contradictory conclusion, as in the case of US in 1947.

For both years under study the capital-labour ratio embodied in exports is less than that embodied in imports, thus, the Leontief Index is observed to be less than unity. This proves that the factor contents of exports from West Malaysia are relatively less capital intensive compared to those imports from the world. Therefore, West Malaysia is

revealed to be relatively more endowed with labour compared to the world.

Table 2
Factor Contents Embodied in Exports and Imports
West Malaysia, 1970 and 1975

Year	1970		1975	
Factor (A)	K	L	K	L
(1) Leontief Index				
a. Embodied in Exports (A_e)	4.690	1.050	7.310	1.160
b. Embodied in Imports (A_m)	3.670	0.645	7.040	1.060
c. Capital-Labour Ratio $(K_e/L_e)/(K_m/L_m)$	(4.46/5.67) < 1		(6.28/6.64) < 1	
d. Relatively Abundant in	Labour		Labour	
(2) Leamer Index				
a. Embodied in Net Exports $(A_e - A_m)$	+1.00	+4.10	+0.27	+0.10
b. Embodied in Consumption (A_c)	10.00	1.740	18.90	2.410
c. (K/L) ratio of (a) and (b) $\frac{(K_e - K_m)}{(L_e - L_m)} \quad \frac{K_c}{L_c}$	2.53 < 5.74		2.59 < 7.85	
d. Relatively Abundant in	Labour		Labour	

Note:
K: Capital in billion Ringgit - in 1970 constant prices.
L: Labour in million of persons.
Source: Yokoyama, (1989).

The Leamer's Index has also revealed similar conclusion for West Malaysia. The figures for both years (1970 and 1975) correspond to case (b) above, though case (b) is one of the conditions for a country to be capital abundant. The figures in Table 2 are just the opposite to case (b), meaning that this country is relatively labour abundant. Since

West Malaysia enjoys a trade surplus, the net exports of capital and labour are positive (in this sense the figures in Table 2 correspond to case (b)) for each year. But the (net) capital-labour ratio in excess of her imports of capital and labour from the world is less than the capital-labour ratio in domestic consumption. This means that the world (West Malaysia) is importing (exporting) relatively less capital per one unit of labour than domestic consumption in West Malaysia. Therefore, West Malaysia is considered as being relatively more abundant with labour than the world.

One of the contributions by Leamer is the flexibility in increasing the number of primary factors using the necessary and sufficient conditions above. We may disaggregate our labour into skilled or unskilled labour, or add another factor of production such as natural resources or intermediate inputs.

Following the preceding subsection, we will estimate the third production factor, that is, natural resources, by applying the above formula. Table 3 gathers the results of the rank of the factor abundance in West Malaysia. To obtain the figures for Table 3, we first compare two factors pair-wisely and then arrange them in order of their relative abundance, following the law of transitivity. For both the years (1970 and 1975), West Malaysia is found to have had abundant natural resources, labour and capital in descending order.

Table 3
Relative Abundance of Factors Embodied in Exports and Imports
West Malaysia, 1970 and 1975

	1970			1975		
Leontief Index	R	L	K	R	L	K
Leamer Index	R	L	K	R	L	K

Note: The further to the left, the more abundant with R - Natural Resources or L - Labour or K - Capital.
Source: Yokoyama, (1989).

III. Interindustry Linkages in Malaysia

The first empirical study since Hirschman linkage hypothesis is a paper prepared by Chenery and Watanabe (1958). They investigated the linkage structure among four

developed countries. They interpreted Hirschman's concept of forward and backward linkage as follows,

$$FL_i = (1/X_i)\ \Sigma_j X_{ij} = \Sigma_j a_{ij},$$
$$BL_j = (1/X_j)\ \Sigma_i X_{ij} = \Sigma_i a_{ij}$$

where FL_i (BL_j) is the forward (backward) linkage index for the i(j)th industry, while X_i, X_{ij} and a_{ij} are the gross output for the ith industry, the intermediate input from the ith to the jth industry, and the input-output coefficient respectively.[3]

Based on these indices, similarities among the four countries were observed. The selected 29 industries are then categorised into four types of productive sectors. They are (I) Intermediate Primary Production, (II) Intermediate Manufacture, (III) Final Manufacture, and (IV) Final Primary Production as summarised in Table 4.

These indices represent the direct linkage effect, that is, how much supply (demand) to (from) the other industries out of (in producing) one unit of its own gross output. Yotopoulus and Nugent (1973) extended these indices into the "total linkage" effect by adding indirect linkage effects;

$$FL_i^* = \Sigma_j b_{ij},$$
$$BL_j^* = \Sigma_i b_{ij}.$$

where the matrix $\{b_{ij}\}$ is the Leontief inverse. FL_i^* shows how much demand is generated in the ith industry if each final demand of all the industries is increased marginally by one unit. On the other hand, BL_j^* indicates how much demand is generated in total to the other industries if the final demand of the jth industry is increased marginally by one unit.

Yotopoulus-Nugent estimates these "total linkage" indices for developed as well as developing countries. They discovered similarities among these two groups of country, albeit higher linkage effects of developed countries vis-a-vis developing ones.

Following this attempt, further improvements have been proposed to consider the share of each final demand [Laumas, 1976], to introduce imported intermediates [Riedel, 1976], and to omit the own change of final demand [Jones, 1976]. Yotopoulus and Nugent (1976) took these into consideration and reestimated these indices. Despite modification, no significant differences were found.

Since the interpretation of FL_i^* is difficult and there is some suspicion if it differs from the original meanings of the forward linkage as postulated by Hirschman, further discussions have been carried out. Some of them included the introduction of an output coefficient with value added ratio [Bulmer-Thomas, 1982] and exogenisation of the ith industry [Cella, 1984, 1986]. However, there are hardly any empirical studies to support these discussions.

A few empirical studies have been done for developing economies, including Sauthanam-Patil (1972), Song (1977), or Furukawa (1986). Both Sauthanam-Patil and Song reported similar conclusion as in the studies by Chenery-Watanabe and Yotopoulus-Nugent. In contrast, Furukawa discovered that among developed countries (Japan and US), Asian NICs (Korea and Singapore) and ASEAN countries, there are differences. In terms of the backward linkages, the indices of Korea and Singapore are almost similar to those of Japan and US, although their forward linkages are far below the level of developed countries. ASEAN countries are reported to have lower backward linkages, but similar level of forward linkages with Korea and Singapore. For Malaysia, Rahman (1987, 1988) has estimated these indices in an attempt to evaluate different scenario on policy targets.

We will confine ourselves to estimate two different types of the linkages, FL (BL) and FL* (BL*), for a long-run review.

There are two types of Input-Output Tables available since 1970; the tables for West (Peninsular) Malaysia for 1970 and 1975, and the tables for Malaysia for 1978 and 1983. The 1975 table was a joint effort of IDE and the Faculty of Economics and Administration, University of Malaya. The others were published by the Department of Statistics, Malaysia. In the latter input-output tables for 1978 and 1983, commodity taxes were not taken into account. Therefore some discrepancy among the tables may exist. In addition, the period marked a change of relative prices. Hence, careful consideration is needed when comparing figures intertemporally. Nevertheless, these figures will reflect some characteristics of the Malaysian economy in each of the years. Furthermore, it will provide a basis for understanding the long-run properties.

In Table 5, Industrial Categorisation by Chenery-Watanabe is given for 1970, 1975, 1978 and 1983. Some characteristics of the Malaysian manufacturing industries can be pointed out to compare the structural changes experienced since 1970.

One of the most important characteristics in these tables is the increment in the number of industries categorised as Intermediate Manufacture (II). Note that the types

of industries are divided based on their average forward and backward linkages (FL and BL) respectively. In 1983, the Malaysian manufacturing industries were relatively more balanced towards the high linkage industry (II), compared to the skewed structure of linkages in 1970, where most of industries were focused around the lowest linkage type (IV).

Table 4
Types of Productive Sector

	Final	Intermediate
Manufacturing	**III. Final Manufacture** Apparel Shipbuilding Leather and Leather Prod. Processed Foods Grain Mill Products Transport Equipment Machinery Lumber and Wood Products Non-metallic Mineral Prod. Industry n.e.c.	**II. Intermediate Manufacture** Iron and Steel Paper and Products Petroleum Products Non-ferrous Metals Chemicals Coal Products Rubber Products Textiles Printing and Publishing
Primary Production	**IV. Final Primary Production** A Commodities Fishing B Services Transport Trade Services	**I. Intermediate Primary Production** Agriculture and Forestry Coal Mining Primary Metal Mining Petroleum and Natural Gas Non-metallic Minerals Electric Power

Source: Chenery - Watanabe (1958) p. 493.

In 1983, with the exception of a few industries, most of the industries indicated in Table 5.b.2 follows Chenery-Watanabe categorisation in Table 4. For example, Food Processing industry has increased its forward linkage. This industry still occupies the largest share in value added out of the 18 manufacturing industries covered in this study,

despite its declining share. Most of the industries in the group (II) (including Food Processing) contains natural resources. Henceforth, these resource-based industries have implicitly contributed to the strengthening of the linkage of industries since 1970. Another peculiar but important industry indicated in Table 5 is Machinery and Electric Machinery. This group of industries is categorised as the Final Primary Production in group (IV), where both forward and backward linkages are lower than the average. Despite their rapid growth, they have had little linkages with other industries. They can be called as enclave. Textile, another foot-loose industry, has been included into group (II), where forward and backward linkages are higher than the average.

Table 5.a.1.
Industrial Categorisation by Chenery – Watanabe
West Malaysia, 1970

	Final	Intermediate
	III. Final Manufacture	**II. Intermediate Manufacture**
Manufacturing	2. Food Processing	5. Textile
	8. Wooden Product	7. Lumber
	10. Rubber Product	14. Metal
	IV. Final Primary Production	**I. Intermediate Primary Production**
	3. Beverage	1. Primary
	4. Tobacco	9. Paper, Printing
Primary	6. Apparel, Leather	11. Chemical
Production	12. Petroleum Product	13. Non Metal Product
	17. Elect. Machinery	15. Metal Product
	18. Transport Equipment	16. Machinery
	19. Other Manufacturers	20. Tertiary

Source: See Appendix

Table 6.a and 6.b represent the direct and indirect linkages, that is, FL_i^* and BL_j^*, (Yotopoulos-Nugent) for West Malaysia for 1970 and 1975, and for Malaysia for 1978 and 1983 respectively.

It can be observed that (1) the average linkages are steadily increasing, (2) Primary

industry records an exceptionally high forward linkage, (3) both forward and backward linkages of Food Processing and Textile are high and continue to increase, (4) Machinery and Electric Machinery remain in the group of lower linkages and (5) main resource based industries have higher linkages, with the exception of Metal industry which has indicated a declining backward linkage since its peak in 1970.

Table 5.a.2
Industrial Categorisation by Chenery – Watanabe
West Malaysia, 1975

	Final	Intermediate
	III. Final Manufacture	**II. Intermediate Manufacture**
	2. Food Process	5. Textile
	4. Tobacco	7. Lumber
Manufacturing	6. Apparel, Leather	12. Petroleum Product
	8. Wooden Product	13. Non Metal Product
	10. Rubber Product	14. Metal
	IV. Final Primary Production	**I. Intermediate Primary Production**
	3. Beverage	1. Primary
Primary	15. Metal Product	9. Paper, Printing
Production	16. Machinery	11. Chemical
	17. Elect. Machinery	
	18. Transport Equipment	
	19. Oather Manufacturers	
	20. Tertiary	

Table 5.b.1
Industrial Categorisation by Chenery-Watanabe, Malaysia, 1978

	Final	Intermediate
	III. Final Manufacture	**II. Intermediate Manufacture**
	2. Food Process	5. Textile
Manufacturing	6. Apparel, Leather	12. Petroleum Product
	7. Lumber	13. Non Metal Product
	8. Wooden Product	14. Metal
	10. Rubber Product	15. Metal Product
	IV. Final Primary Production	**I. Intermediate Primary Production**
	3. Beverage	1. Primary
Primary	4. Tobacco	9. Paper, Printing
Production	16. Machinery	11. Chemical
	17. Elect. Machinery	18. Transport Equipment
	19. Other Manufacturers	
	20. Tertiary	

Table 5.b.2
Industrial Categorisation by Chenery -Watanaba, Malaysia, 1983

	Final	Intermediate
	III. Final Manufacture	**II. Intermediate Manufacture**
	3. Beverage	2. Food Process
	6. Apparel, Leather	5. Textile
Manufacturing	8. Wooden Product	7. Lumber
	10. Rubber Product	12. Petroleum Product
	20. Tertiary	13. Non Metal Product
	14. Metal	15. Metal Product
	IV. Final Primary Production	**I. Intermediate Primary Production**
Primary	4. Tobacco	1. Primary
Production	16. Machinery	9. Paper, Printing
	17. Elect. Machinery	11. Chemical
	19. Other Manufacturer	18. Transport Equipment

Table 6.a
Interindustry Linkages, West Malaysia, 1970 and 1975

No.	Industry	Forward Linkage		Backward Linkage	
		1970	1975	1970	1975
1.	Primary	3.69	4.62	1.17	1.22
2.	Food Process	1.33	1.58	1.78	1.82
3.	Beverage	1.01	1.10	1.26	1.38
4.	Tobacco	1.00	1.12	1.21	1.73
5.	Textile	1.33	1.76	1.54	1.72
6.	Apparel	1.04	1.10	1.22	1.87
7.	Wood	1.40	1.28	1.71	1.63
8.	Furniture	1.04	1.10	1.74	1.80
9.	Paper, Printing	1.28	1.49	1.40	1.58
10.	Rubber	1.11	1.13	1.78	1.84
11.	Chemical	1.29	1.95	1.40	1.51
12.	Petroleum Product	1.10	1.58	1.06	1.64
13.	Non Metallic Product	1.14	1.15	1.35	1.66
14.	Basic Metal Product	1.15	1.71	1.84	1.77
15.	Metal Product	1.12	1.14	1.39	1.68
16.	Machinery	1.18	1.23	1.26	1.19
17.	Elect. Machinery	1.02	1.22	1.32	1.54
18.	Transport Equipment	1.01	1.18	1.12	1.37
19.	Other Manu. Product	1.15	1.11	1.41	1.20
20.	Tertiary	3.93	3.01	1.37	1.42
	Total	1.43	1.58	1.43	1.58

Source: See Appendix

Table 6.b
Interindustry Linkages, Malaysia, 1978 and 1983

No.	Industry	Forward Linkage		Backward Linkage	
		1978	1983	1978	1983
1.	Primary	4.45	4.15	1.29	1.35
2.	Food Process	1.77	1.98	1.94	2.27
3.	Beverage	1.04	1.03	1.17	1.81
4.	Tobacco	1.16	1.10	1.62	1.54
5.	Textile	1.81	1.76	1.78	1.81
6.	Apparel	1.03	1.04	1.85	1.90
7.	Wood	1.47	1.46	1.87	1.89
8.	Furniture	1.02	1.02	1.99	2.01
9.	Paper, Printing	1.61	1.57	1.55	1.59
10.	Rubber	1.10	1.12	1.75	1.82
11.	Chemical	1.96	2.04	1.47	1.55
12.	Petroleum Product	1.47	1.63	1.87	1.76
13.	Non Metallic Product	1.25	1.31	1.68	1.69
14.	Basic Metal Product	1.79	1.93	1.71	1.65
15.	Metal Product	1.16	1.18	1.74	1.76
16.	Machinery	1.28	1.27	1.21	1.16
17.	Elect. Machinery	1.50	1.39	1.59	1.56
18.	Transport Equipment	1.52	1.57	1.53	1.50
19.	Other Manu. Product	1.20	1.12	1.49	1.34
20.	Tertiary	3.70	4.02	1.64	1.72
	Total	1.66	1.68	1.66	1.68

Source: See Appendix

IV. Concluding Remarks

The Malaysian economy is currently experiencing rapid transformation in her industrial structure. The industrialisation process in Malaysia differs from other Newly Industrialising Countries, because Malaysia is still heavily endowed with natural resources. This is one of the reasons why the Industrial Master Plan (1986) has deliberately highlighted resource based as well as nonresource based industries as its strategic industries in the longer run. Some of the industries were specified as leading industries, where linkages among them were emphasised. Further, since the late 1980's, supporting or small/medium scale industries manufacturing parts or intermediate products of final products are gradually developing. The expansion of these supporting industries is expected to strengthen the industrial structure of the Malaysian economy.

This chapter attempts to analyse the structure of resources in Malaysia alongside with the linkages established amongst the industries. This will serve as a basis for further discussion. Using the input-output tables available, we can review Malaysia's transformation in her resource and linkage structures. Main findings in this chapter for 1970 and 1975 are (1) (West) Malaysia like Indonesia is revealed to have been relatively more richly endowed with natural resources compared to other Pacific-rim countries, and (2) based on the factor contents used by Leontief and Leamer, (West) Malaysia is observed to be relatively more abundant with natural resources, labour and capital in this order as compared with the world. Based on the linkages obtained for 1970, 1975, 1978, and 1983, it is evident that (3) primary industries are supplying a lot to manufacturing industries; thus creating high forward linkages, (4) food processing industry still plays an important role in terms of share contribution to manufacturing sector and linkage, and (5) most of the resource based and textile industries are categorised as having the highest linkage, while machinery (including electric machinery) industries are among the groups having the lowest linkage.

Much remains to be done, though. More theoretical investigations should be done on the concept of natural resources as well as forward/backward linkages. We have employed the simplest approach to estimate the above mentioned issues in this chapter. The discussions in the literature cited will help further investigations to some extent. Sectoral classifications should be examined in more detail, especially for determination of the primary and resource based industries. Nevertheless, more accurate and consistent data series are required to facilitate further analysis.

Notes:

(1) Detailed information as well as some other discussions for this section can be found in Yokoyama (1985).
(2) More details is discussed in Yokoyama (1989), as well as the results for Japan, Korea and Taiwan.
(3) This section is based on a part found in Yokoyama (1990).

Appendix

Following are main the sources of data, while Table A-1 is the Industrial Classification used in the text.

Sources of Data

Input-Output Tables

Department of Statistics, *Input-Output Tables for Peninsular Malaysia, 1970*, Kuala Lumpur, 1975.

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Table A-1
Industrial Classification*

No.	Industry	1970		1975	
		I-O Table	Survey	I-O Table	Survey
1.	Primary	1-7		1-6	
2.	Food Process	8-14	3-22	17-33	1-24
3.	Beverage	15	23-25	34	25-27
4.	Tobacoo	16	26	35	28
5.	Textile	17	27	36-38	29-38
6.	Apparel, Leather	18	28-30,44-45	39-42	39-42
7.	Lumber	19	31-36	43	43-48
8.	Wooden Product	20	37-38	44-46	49
9.	Paper, Printing	21	40-43	47-50	50-53
10.	Rubber Product	26-27	1-2,46	59-61	64-68
11.	Chemical	22-24,28	47-57	51-57,62	54-61,69
12.	Petroleum Product.	25	58	58	62-63
13.	Non Metal Product	29-31	59-65	63-67	70-77
14.	Metal	32	66-68	68-70	78-81
15.	Metal Product	33	39,69-75	71-72	82-88
16.	Machinery	34	76-79	73-77	89-94
17.	Elect. Machinery	35	80-83	78-79	95-101
18.	Transport Equipment	36-37	84-89	80-85	102-107
19.	Other Manufacturers	38	90-95	86-88	108-113
20.	Tertiary	39-60		89-105	

Note: * - Classification of I-O table for the years 1978 and 1983 is the same as those for 1970.

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