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ECONOMIC STRUCTURAL CHANGES OF MALAYSIA USING INTERNATIONAL INPUT-OUTPUT ANALYSIS

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The international Input-Output table can be used to clarify the international inter-dependence of various sectors of a country. Furthermore, the international I-O analysis can be used to determine the international trade linkages between industries of different countries. Based on the 1975 international I-O table, the technical coefficient of Malaysian industries for 1985 was determined by using RAS method. The changes in the economic structure of Malaysia between 1975 and 1985 is then determined. The technical coefficients for 1985 is used to determine the dependence and linkages for industries in malaysia. It was found that machinery, fish canning, and chemical industries have the strongest forward or backward linkages in Malaysia. Malaysian industries depend on the final demand of Japan at the rate of 2.3%. Malaysian economy has rapidly changing for the last ten years, especially in textile, chemical, and transport equipment industries.

1. BACKGROUND AND OBJECTIVES

The relationship between the economic and trade structure of a country can be clarified by using the International Input-Output table. We can determine the internal mutual dependence between countries with this table. For example, the additional final demand of a country will directly or indirectly affect the economic activities of the whole country.

In either cases, the occurrence of the final demand of a particular country will effect the economies of other countries. That is to say, the final demand of a certain country, through the network of international trade, is closely related, directly or indirectly to the economies of other countries.

There are various studies concerning the economic structure and it's relation with international trade in the past. Kaneko Y.[4] analyzed the international I-O table of Japan, United States, and Asean Countries for 1975. He compared the economic linkages and the international degree of dependence of these countries. F.Harrigan and et.al.[3] estimated the inter-regional flow between Scotland and the rest of the United Kingdom. The methods applied and evaluated here are, Location Quotient Method, Commodity Balance Technique, Moses Technique, and Tibet Method. Out of these methods, they concluded that Moses Technique and Tibet Method were considered to be reliable.

T.J.Barnes[6] reviewed three famous trade theories. They are the Hecksher-Ohlin-Samuelson trade theory, Emmanuel's theory of unequal exchange, and the Straffan trade theory. After examining the three trade theories with respect to their value theories, the Straffan trade theory seems to be the most consistent. D.Campisi and A La Bella[2] discussed the relationship between economic growth and transportation supply in a multiregional multisectoral system. Based on a dynamic type of an I-O model, the relationship between the irreducibility of matrix U (input matrix of rectangular system) and existence of a balanced growth solution was determined.

Considering the advantage and shortage of the analyses mentioned above, the objectives of this paper are summarized as follows:
(1) To determine and confirm the international linkage of the economy of Malaysia.
(2) To estimate the economic structural changes of Malaysia for a decade between 1975 and 1985 based on trade between Malaysia and Japan.

For this purpose, the International I-O table for 1975 was used to determine the first objective. the second objective was determined by updating the 1985 technical coefficients of Malaysia by using RAS method. The coefficients of the final demand and value added were used to forecast each component of the final demand and value added. The problem faced in up-

dating the technical coefficients matrix for Malaysian industries were the lack of data, emerging of new industries, and the closing of some of the old industries. In this study, it is assumed that there was constant economic growth of other countries.

2. METHODOLOGY

The whole process of the study is shown in Figure 1.

This study is based on the 1975 international I-O table which consists of 56 industry sectors. Using the technical coefficients for Malaysia and Japan the linkages and the international dependence for both countries were obtained.

Based on the value added coefficients for 1975 and the GDP (Gross Domestic Product) by sector for 1985, through the aggregation adjustment, the value added for 1985 is obtained. Then, the total input which is equal to the total output is obtained. The total for the intermediate input and intermediate demand is obtained from the total input, total export, and the final demand by using the aggregation adjustment method.

The technical coefficients for 1985 were obtained by using the 1975 technical coefficients, total intermediate input and total intermediate demand through the RAS method.

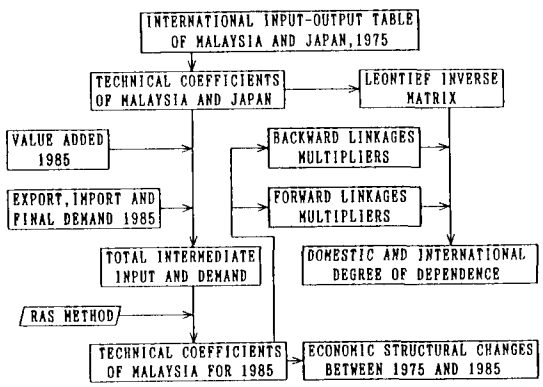

Figure 1 Flow Chart of the Study

2.1 Characteristics of the International I-O table

The international I-O table for Malaysia and Japan is illustrated in Table 1. The input structure of the industries of two countries are shown in those columns of Table 1. In Malaysia column, A^{MM} shows the inputs of Malaysia's industries for the goods and services produced in Malaysia. Matrix A^{JM} shows the input of industries in Malaysia for the outputs of industries in Japan. The same applies to the Japan's column. The output structure of the products of Malaysia and Japan are shown in the row of the table. Final demands of Malaysia and Japan for the products of Malaysia are F^{MM} and F^{MJ} respectively.

Table 1 International I-O Table

A^{MM}	A^{MJ}	F^{MM}	F^{MJ}	E^{M}	S^{M}	X^{M}
A^{JM}	A^{JM}	F^{JM}	F^{JJ}	E^{J}	S^{J}	X^{J}

2.2 International Degree of Dependence

The occurrence of the final demand of a country affects the industrial production of the whole country through the network of the technical structure. In order to fulfill this additional demand, it has to import import from other countries when the production level of the country in not enough. The induced production amount, through the international relationship of industries is called the ultimate degree of dependence.

Suppose, there are three countries A, B, and C, the production level of an industry j of country A is in dependence to the final demand for products j in countries A, B, and C, i.e. fj^{A}, fj^{B}, and fj^{C}, respectively. Therefore the ultimate international degree of dependence is shown in the following equation.

$$Kj^{A} = Kj^{AA} + Kj^{AB} + Kj^{AC} \quad \text{----- (1)}$$

Kj^{RS} can be formulated as below:

$$Kj^{AB} = \sum_{i=1}^{n} bij^{AA} x fj^{A}/Xj^{A} \quad \text{----- (2)}$$

$$Kj^{AB} = \sum_{i=1}^{n} bij^{AB} x fj^{B}/Xj^{A} \quad \text{----- (3)}$$

In the above equation, bij^{RS} are the components of the Leontief inverse matrix. fj^{S} is the final demand of goods j of country S, and Xj^{R} is the total output of sector j of country R. Here,

$$bij^{RS} = (I-A)^{-1}, \quad A = (aij^{RS}) \quad \text{---(4)}$$

2.3 Linkage Study

The backward linkages and forward linkages multipliers are used to examine the impact of an individual sector upon it's total output.

The backward linkages is aim to measure the potential stimulus to other activities from investment in any sector j. The direct and indirect stimuli given to the economy can be measured by comparing the average stimulus created by sector j with the overall average. Therefore the back-

ward linkages multipliers is formulated as equation (5).

$$B(j) = \sum_{i=1}^{n} b_{ij} / \sum_{j=1}^{n} \sum_{i=1}^{n} b_{ij} \quad --(5)$$

where b_{ij} denotes the i,jth element of the Leontief inverse and n is the number of sectors. The numerator denotes the average stimulus imparted for other sectors by a unit's worth of demand for sector j and the denominator denotes the average stimulus for the whole economy when all final demands increase by unity. Therefore if B(j)>1, then investments in sector j will yield above average backward linkages, while the opposite is true when B(j)<1.

The forward linkages multipliers can be written as follows:

$$D(i) = \sum_{j=1}^{n} b_{ij} / \sum_{i=1}^{n} \sum_{j=1}^{n} b_{ij} \quad ---(6)$$

where the numerator shows the total impact on sector i when final demand of all sectors increases by unity. If this impact is large, it suggests that increased investment in sector i would induce output increases in all using sectors. If D(i)>1 ,then it implies that a certain sector has a high forward linkages, while the opposite is true when D(i)<1.

2.4 Structural Changes in an Economy

The structural changes in an economy can be determined by the changes in the technical coefficients between two periods of time. It is usually determined by the difference and ratio of the technical coefficients of the two given periods. In this case, the structural difference for the Malaysian economy is the difference and ratio of the technical coefficients of 1975 and 1985.

2.5 Structural Changes of Production.

For long term prediction of the structural changes of the production, changes of the technical coefficient plays the most important role since other indicators or data, such as value added, final demand, and trade amounts of import and export are usually easy to obtain from the national statistics.

There are various methods to up-date the technical coefficient of input-output table. they are the Frator Method, Lagrange Multiplier Method, Average Increment Ratio Method , and RAS Method. Out of these, the RAS Method proposed by Richard Stone and his colleagues (1962) is the most reliable and popular worldwide. Therefore the RAS Method is applied in the paper.

RAS Method can up-date the technical coefficient for an arbitrary year using the coefficient in the past, up-date intermediate demand and input by the industrial sector.

3. CASE STUDY

3.1 Data Source

The data comes mainly from the following sources:

(1) Asean I-O tables for 1975
(2) Malaysia Year Book Statics
(3) Japan Year Book Statics reports (1) and (2)

From the above sources, the available data are the value added, total export and import, and the final demand. The 1985 I-O table for Malaysia was compiled by using the above data.

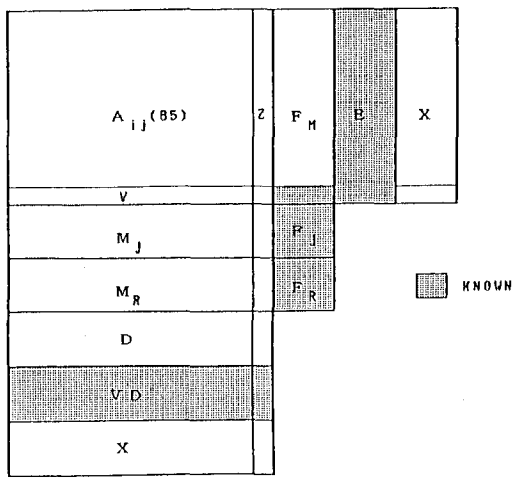

Figure 2 General Feature of I-O Table

3.2 Estimation of the Intermediate Input and Demand for 1985

The intermediate input and the intermediate demand was estimated using the data in the shaded area of Figure 2, with the assumption that the coefficients below are constant.

$$v_j^{75} = VA_j^{75} / X_j^{75} \quad ---(7)$$
$$f_i^{75} = F_i^{M75} / F_i^{M75} \quad ---(8)$$
$$t_j^{75} = D_j^{75} / (M^J{}_j^{75} + M^R{}_j^{75}) \quad ---(9)$$

where, v_j, f_i, and t_j are the value added coefficients, final demand coefficients, and duty and tax coefficients respectively. The equation to determine the intermediate input and intermediate demand are shown in equations (10) and (11) respectively.

$$V = X - VA - MJ - MR - T \quad ---(10)$$
$$Z = X - FM - E \quad ---(11)$$

In the above two equations;

V: total intermediate input
VA: value added
MJ: import from Japan

MR: import from the rest of the world
T: import duties and import sales tax
E: total export
FM: final demand for Malaysia
X: total input equal to total output

The flowcharts for equation (10) and (11) are shown in Figure 3 and 4, respectively.

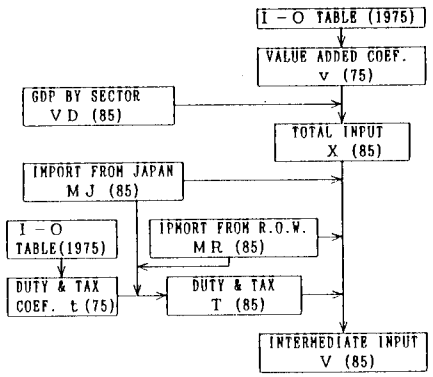

Figure 3 Determination of Intermediate Input

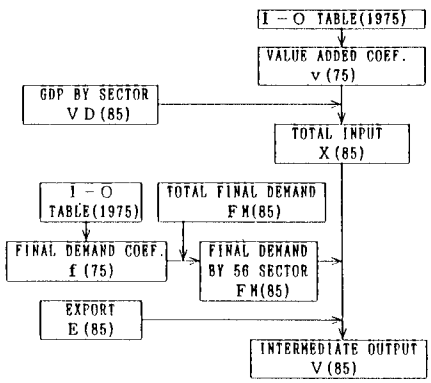

Figure 4 Determination of Intermediate Output

3.3 Updating the I-O table

The RAS method was employed when updating the 1975 I-O table. The RAS technique is a biproportional matrix adjustment of rows and columns of an existing matrix in an iterative manner such that it sums simultaneously to predetermined row and column totals. Given a base year (in this case 1975) technical coefficients matrix A, and the vectors of total intermediate year input v and total intermediate demand z, the diagonal scalar matrices R and S are constructed, to find the technical coefficients A^{85} (1985). The algorithms of the technique are described in the following equations.

$$A^{85} = R \times A \times S$$

such that $(A^{85}xX^{85})I = X^{85}xI = Z$

and $(A^{85}xX^{85})^{T}I = X^{85}xI = V$

where X^{85} is the total output for the estimated year and I is an identity matrix.

4. RESULTS AND DISCUSSION

4.1 International Degree of Dependence

The degree of dependence of Malaysia product towards the final demand of Malaysia is shown in Figure 5. The highest is for the wholesale industry (2.89), follows by services (2.52), commercial services (1.85), construction (1.29), and oil and drinks (1.10). It can be said that the domestic dependence of Malaysia is great.

The international dependence of the final demand do Malaysia towards the products of Japan is even smaller. The highest is for the machinery (6.9%), follows by fishery (2.3%),and rubber products (1.8%). (please see Figure 6) The ultimate degree of dependence for the products of Japan toward the final demand of Malaysia is quite small.

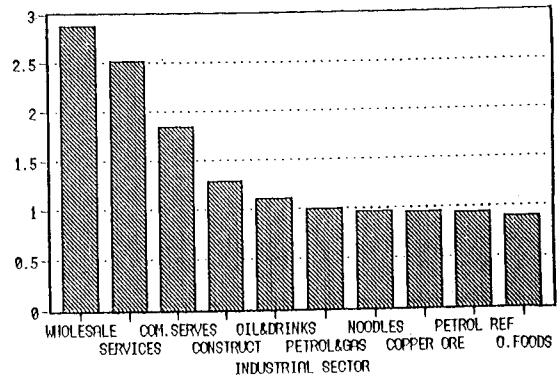

Figure 5 Dependence Degree of Malaysia Products Toward Final Demand of Malaysia

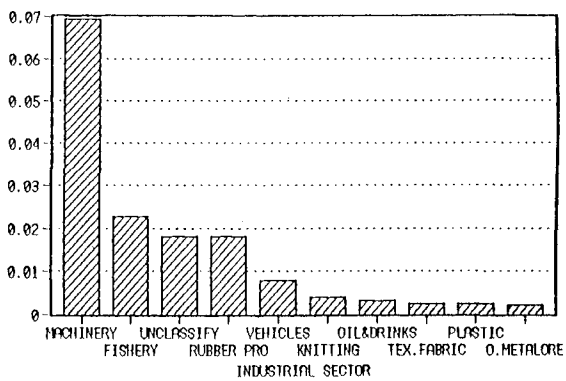

Figure 6 Dependence Degree of Malaysia Products Toward Final Demand of Japan

4.2 Backward Linkages and Forward Linkages

For a less developed country to be industrialized, it is very important to invest in specific sectors with backward linkages and forward linkages that are relative high. That is to say, the value of the backward or forward linkages that are greater than one.

Figure 7 and 8 show the comparison of high forward linkages and high backward linkages respectively. It can be seen that the forward linkages for chemical and construction industries increased rapidly from 1975 to 1985. Whereas, the forward linkages for rubber product and wholesale industries decline in 1985. On the other hand, the backward linkages for machinery, textile, and petroleum refinery industry have increased.

After comparing the backward and forward linkages for 1975 and 1985, canfish, chemical, and textile industry seem to be one who may be promising industries for investment.

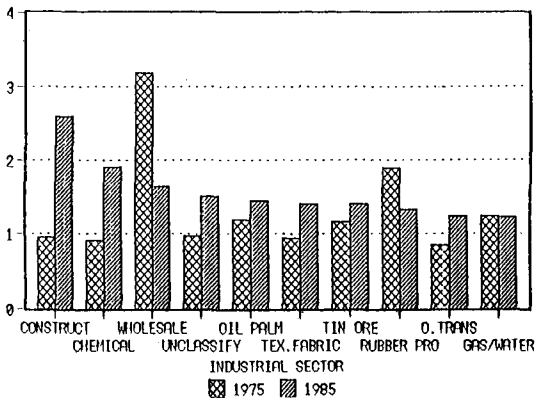

Figure 7 Comparison of High Forward Linkages for 1985 and1975

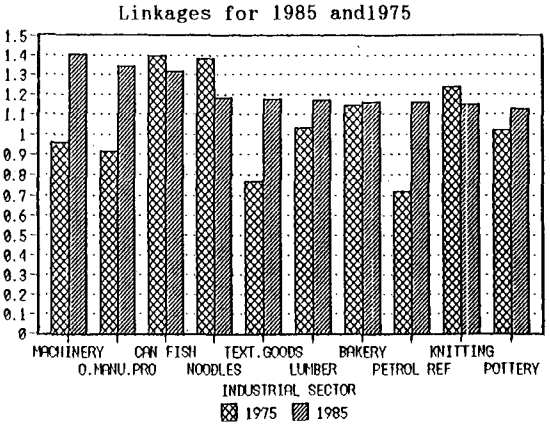

Figure 8 Comparison of High Backward Linkages for 1985 and 1975

4.3 Change in Economic Structure

The changes in the economic structure of Malaysia can be explained by the changes in the value added, total export, and total import between 1975 and 1985 is shown in Table 2.

In the value added column, the most of the value added of the industries are increasing in value, especially the manufacturing industries. Some examples of these industries are textile fabrics, leather products, chemical industry and transport equipment. This shows that gross domestic product (GDP) of Malaysia has increased in the last ten years. The industrial sectors that are declining in value at only cassava and other metal industries.

In the export and import column, agricultural industries import more goods but the export is declining. For example, import of oil palm, cassava, and livestock are increasing while their export is decreasing. In the manufacturing industries, the difference in export for petroleum refinery, lumber, wood product, machinery, and vehicles between 1975 and 1985 are large (about ten times), whereas their import are slightly increasing. In the mining industries, petrol and gas become export in 1985 even though they were imported in 1975, while only other metals and non metals are declining a little bit in their export.

Table 2 Comparison of Industrial Structure for 1975 and 1985
(unit; million US$)

IND. SECTOR & No. / YEAR	VALUE ADDED 1975	VALUE ADDED 1985	IMPORT 1975	IMPORT 1985	EXPORT 1975	EXPORT 1985
2 CASSAVA	8	5	1	2	0	0
5 OIL PALM	334	1,379	8	18	1	1
9 LIVESTOCK	140	566	11	18	2	1
11 FISHERY	186	767	4	10	17	105
12 PETROL & GAS	-	-	-	-	-	4,430
14 TIN ORE	267	1,599	8	19	1	664
17 BAKERY	317	365	12	23	418	52
20 CAN FISH	4	14	47	72	40	53
21 OIL & DRINKS	169	674	47	77	82	308
24 TEXT. FABRIC	13	190	5	13	19	67
25 KNITTING	10	186	3	8	17	60
26 TEXT. GOODS	44	236	14	64	38	131
28 LEATHER	8	177	3	12	2	8
29 LUMBER	122	368	7	15	178	813
30 WOOD PRODUCT	65	275	7	20	70	512
33 CHEMICAL	15	646	8	29	12	40
36 PETROL REF.	82	358	266	402	45	396
41 IRON & STEEL	55	328	13	27	10	34
43 OTHER METALS	238	170	67	108	630	504
45 MACHINERY	50	360	33	97	73	593
46 VEHICLES	133	673	64	233	223	1,814
52 CONSTRUCTION	173	1,502	56	297	0	0

4.4 Change in Production Structure

By using the RAS method, up dated input coefficients were determined, which indicates the production structure of Malaysia for 1985. Input coefficient of

construction towards most of the other industries has increased, which affects the growth of the construction sectors. The main cause may be the investment of production by other industries. Input coefficient of the drinks and beverages industries has decreased. This shows that the increased capacity of production of these industries has compensated by the imported goods not by the domestic products. The reason why the input coefficient of textile and fabrics and knitting industries have increased is the simultaneous growth of the industry in this field has tightened the mutual independence which means the inter-industry transaction.

5. CONCLUSION

The approach proposed here to determine the international degree of dependence, the forward linkages of industry, and the comparative analysis of the production structure turned out to be successful. The conclusions from the results obtained from the results can be summarized as follows.

1. From the linkage study of the industry, it was found that the construction industry and fertilizers and pesticides industry have the strongest forward linkages compare with the other domestic industrial sectors. On the other hand, the strongest backward linkages was found in canning, preserving and processing of fish industry, and the second was the noodle industry.

The four of the industries mentioned above are the key industries to be developed which are expected to stimulate the production of other industries through the linkage of production procedure.

2. Regarding the ultimate dependence degree of Malaysia product, final demand of Japan will affect the production level of machinery industry in Malaysia the most.

The degree of 0.07 indicates that if the final demand of 100 mil. US dollars will cause the product of 7 mil. Us dollars for the machinery industry in Malaysia. The second highest degree of dependence is fishery industry. The total, the production amount of industry in Malaysia is depended on the final demand of Japan at the rate of 2.3%.

3. Economic structure in Malaysia has rapidly changing for the last ten years. Manufacturing industries, especially textile fabrics, leather products, chemical fertilizer, and transport equipment have been growing at the rate of more than ten times between 1975 and 1985. With regard to export, tin ore mining, lumber and wooden products, vehicles and machinery has increased. especially, petroleum and its refinery has drastically changed their position. that is, petroleum was completely import in 1975, but however it has become to be exported in 1985 because it was found in the Siam Bay and developed recently.

Despite the increasing amount of textile production, the import of textile goods has increased significantly. It may reflect the growth of income level in Malaysia. The same situation can be observed for the machinery sectors. Due to the growth of vehicle industry, the export of engine has increased.

4. By using RAs method, updated input coefficient was determined which indicates the production structure of Malaysia for 1985. Input coefficient of construction toward most of the other industries has increased which affects the growth of construction sector mentioned above. It may be caused by the investment of the industry related to drinks and beverages has decreased. It means that increased capacity of production of these industry has compensated by the imported goods not by the domestic products. The reason why textile and fabrics industrial coefficient and knitting industry have increased their input are that the simultaneous growth of the industry in the field has tightened the mutual independence which means the inter-industry transaction.

As the insight mentioned above, the tools to determine the changes of economy is very useful and can be transferred to other countries if those countries have the I-O table and the trade matrix. However, the lack of data which is required to carry out the proposed procedure may be more popular among developing countries such as Indonesia and the Philippines. In line with this, more powerful tool to determine the economic structure in the future is expected to be developed.

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