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# LINKAGES AND IMPORTS OF MALAYSIA, 1978-1987: AN INPUT-OUTPUT APPROACH

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**ABSTRACT**

*This article examines the inter-sectoral linkages and imports of Malaysia using the input-output approach. The method employed here will be similar to the work of Achay a and Hazari (1973), where they differentiated between total and domestic linkages. A hypothesis is put forward, .stating that there will be low rank correlation between the total and domestic linkages if the import requirements are relatively high. The results of the analysis suggest a distinct characteristic between the industries generating backward and forward linkages respectively. This study found that there is a high correlation between the total and net forward linkage, suggesting the low import requirements for those industries generating forward linkage. These are in contrast with the results found for those industries generating backward linkage, where the correlation between the total and net backward linkage is lower. This suggests that the import requirements for those indutries generating backward linkage are higher than* those *industries generating forward linkage.*

**ABSTRAK**

*Artikel ini mengkaji hubungan rantaian inter-sektor dan import Malaysia dengan menggunakan pendekatan input-output. Kaedah yang digunakan dalam kajian ini menyamai kaedah yang digunakan seperti mana dalam kajian Acharya dan Hazari (1973), di mana mereka membezakan antara rantaian total dengan rantaian dornestik. Hipotesis yang dikemukakan adalah akan wujudnya korelasi pangkat yang rendah di antara rantaian total dengan rantaian domestik sekiranya keperluan import adalah secara relatifnya tinggi. Keputusan kajian mendapati terdapat perbezaan ciri antara industri yang*

*menjana rantaian ke belakang dengan industri yang menjana rantaian ke depan. Kajian ini mendapati wujudnya korelasi yang tinggi antara rantaian ke depan total dengan rantaian ke depan bersih. Ini mengimplikasikan keperluan import yang rendah bagi industri yang menjana rantaian ke depan. Keputusan kajian adalah sebaliknya bagi industri yang menjana rantaian ke belakang, di mana korelasi antara rantaian ke belakang total dengan rantaian ke belakang bersih adalah rendah. Ini mengimplikasikan keperluan import untuk industri yang menjana rantaian ke belakang adalah lebih tinggi berbanding industri yang menjana rantaian ke depan.*

## INTRODUCTION

It has always been the goal of Malaysia's industrial policy to improve the inter-industry linkages of our economic sectors. Even until now, in our most recent 8th Malaysia Plan (2001-2005), further improvement of inter-sectoral linkages will be emphasized. In line with this goal, one of our industrial policy thrusts in the Third Outline Perspective Plan (2001-2010) is to strengthen the local production of capital/investment and intermediate goods, so as to reduce import intensity and dependency on such goods. This is important to maintain a healthy balance of payment. Also, in 1998, after being shaken by the Asian financial crisis, the National Economic Recovery Plan (NERP) has an agenda to speed up the development of backward linkage especially for non resource-based industries. This is to ensure the local sourcing of inputs. However, Malaysia still has a long way to go before materializing those goals, as illustrated in the following brief overview of Malaysia's situation with regard to imports.

The structure of the Malaysian import has changed tremendously from 1978 to 1987 (the period of this study) as depicted by the Table 1.

From Table 1, one can notice that since 1981, Malaysia has been a very open economy. This is shown by the ratio of export and import over GDP. Since then, this ratio has been consistently above one, indicating that a one percent increase in GDP can generate more than one percent of trade volume - where trade volume here refers to export plus import. This ratio in general has increased steadily over the years, implying that Malaysia is slowly integrating its economy with the rest of the world.

**Table 1**

Openness of the Malaysian Economy, 1975 - 1998

| Year | Export/GDP[1] (%) | Import/GDP (%) | (X+M)/GDP[2] (%) |
|---|---|---|---|
| 1975 | 41.3 | 35.9 | 77.2 |
| 1976 | 45.3 | 34.6 | 79.9 |
| 1977 | 44.8 | 36.9 | 81.7 |
| 1978 | 49.1 | 43.5 | 92.5 |
| 1979 | 45.4 | 46.9 | 92.4 |
| 1980 | 43.2 | 48.4 | 91.7 |
| 1981 | 47.1 | 53.0 | 100.2 |
| 1982 | 49.2 | 57.0 | 106.2 |
| 1983 | 52.0 | 58.4 | 110.5 |
| 1984 | 54.9 | 57.7 | 112.7 |
| 1985 | 55.8 | 52.6 | 108.4 |
| 1986 | 64.9 | 50.8 | 115.7 |
| 1987 | 67.9 | 52.6 | 120.5 |
| 1988 | 69.0 | 57.5 | 126.5 |
| 1989 | 74.6 | 66.6 | 141.2 |
| 1990 | 79.6 | 75.6 | 155.2 |
| 1991 | 84.5 | 88.7 | 173.2 |
| 1992 | 82.3 | 81.4 | 163.7 |
| 1993 | 86.7 | 86.3 | 173.0 |
| 1994 | 99.7 | 103.9 | 203.6 |
| 1995 | 107.1 | 115.0 | 222.1 |
| 1996 | 105.7 | 110.7 | 216.4 |
| 1997 | 102.0 | 88.2 | 190.2 |
| 1998 | 102.8 | 88.3 | 191.1 |

Source : Ministry of Finance, Economic Report, various issues.

As for the ratio of export over GDP and import over GDP, it is obvious that since the early 1980s, both the export and import constitute over 50% of the GDP. These figures are not accidental. This increasing degree of openness of our Malaysian economy coincide with our export-oriented strategy which began in the late 1960s with the enactment of the 1968 Investment Incentives Act.[3]

Another concern is with the composition of imports that has undergone substantial changes. Imports are being decomposed into 3 major components, namely, consumption goods, investment goods and intermediate goods.

Consumption goods refer to all goods which are generally in finished form and which are not used in the production process, but are utilized directly to satisfy final demand. These goods include food (such as rice and refined sugar) and consumer durables for household use (such as motor vehicles, television, radio sets, refrigerators and fans). Investment goods (or sometimes also termed as capital goods) refer to finished goods used for investment purposes, such as plant and machinery (including excavators, bulldozers, rolling mills, tractors). Intermediate goods refer to unfinished and semi-finished goods used for the production of other goods, including products that have to undergo further processing, assembling and transformation.

**Table 2**
Percentage of Consumption, Investment and Intermediate Goods to Total Import

| Year | Percentage to total import (%) | | |
|---|---|---|---|
| | Consumption goods | Investment goods | Intermediate goods |
| 1975 | 22.2 | 31.7 | 41.3 |
| 1976 | 21.1 | 31.5 | 43.6 |
| 1977 | 21.5 | 30.9 | 44.9 |
| 1978 | 22.2 | 29.6 | 45.8 |
| 1979 | 19.8 | 29.9 | 48.1 |
| 1980 | 18.2 | 30.0 | 50.1 |
| 1981 | 19.3 | 28.2 | 51.0 |
| 1982 | 18.6 | 31.1 | 48.8 |
| 1983 | 18.2 | 31.9 | 48.4 |
| 1984 | 18.6 | 32.8 | 47.5 |
| 1985 | 20.3 | 31.1 | 47.7 |
| 1986 | 21.1 | 28.8 | 49.2 |
| 1987 | 20.2 | 28.6 | 50.2 |
| 1988 | 19.6 | 29.6 | 49.8 |
| 1989 | 17.9 | 34.2 | 46.8 |
| 1990 | 16.4 | 37.5 | 45.4 |
| 1991 | 17.0 | 39.7 | 42.8 |
| 1992 | 17.0 | 41.6 | 40.8 |
| 1993 | 16.2 | 40.6 | 42.7 |
| 1994 | 16.2 | 40.5 | 42.7 |
| 1995 | 14.2 | 40.5 | 44.7 |
| 1996 | 14.2 | 40.0 | 45.2 |
| 1997 | 14.3 | 42.3 | 42.7 |
| 1998 | 13.6 | 38.3 | 47.4 |

Source: Bank Negara Malaysia, Quarterly Economic Bulletin, various issues.

A look at Table 2 confirms that the intermediate goods are the major component of imports. From 1975 - 1998, intermediate goods constitute over 40% of total imports. This high intermediate goods import is in line with the economic phase that Malaysia was going through - the export-expansion phase in the 1970s and the heavy-industry phase in the 1980s.

As for the investment goods component, in the 1990s, the percentage is around 40%, implying the imports of relatively increasing investment goods, in line with the emphasis on more highly-sophisticated industries, e.g., the information technology (IT) industry which needs large amount of investment goods.

As for consumption goods, this component of imports is generally in a declining trend. This may imply that Malaysia now is capable of producing more consumer goods, instead of relying on import of such goods.

These increasing figures imply that the Malaysian imports remain large, owing to overdependence on imported goods, especially the investment and intermediate goods. According to Jomo (1990), although one cannot doubt that our industrial structure has improved, our sectors remain import-dependent, with the manufacturing sectors in particular.

Quoting Jomo,

> *"Malaysia's rather shallow industrial structure and high import propensities suggest many possibilities for more import-substitution industrialization. While considerable industrial development has taken place, the potential for further import-substitution remains neglected though imports grew rapidly until the mid-1980s and the economy's industrial structure remained shallow. Meanwhile, export-oriented industrial production has so far failed to develop strong and extensive industrial linkages or to develop a far more integrated national economic structure."*
>
> (Jomo, 1990)

we can say that these large import content, in turn, implies that our domestic inter-sectoral linkages are weak. Thus, it is crucial to determine the significance of the role of imports in the Malaysian domestic productive sectors, so that the domestic linkages or spread effects can be maximized for induced development.

In this connection, it is important to calculate the domestic linkages[4] only, so as to exclude the effects of imports on the inter-sectoral linkages

(i.e. total linkages). From the perusal of related literature in this area of linkages, it has been hypothesized that if there is high import intensity, then there will be low ranking correlation (i.e., the correlation between rankings calculated using the domestic inverse and the total inverse).[5]

Based on the above analysis, the main objective of this study is to look at the difference between the domestic and total sectoral linkages (i.e., excluding and including the imports element respectively) within the period of 1978 - 1987 (according to the availability of the Malaysian Input-Output Table). It tries to determine if imports play a significant part in the inter-sectoral linkages in the Malaysian economy. More specifically, it tries to analyze whether the strength of backward and forward linkages of certain sectors are due to the domestic sectors' own real ability to create linkages or if it is just due to the imports utilization effect.

The specific objective of this study is to calculate the correlation between the sectoral rankings (by the 2 types of total and domestic linkages), so as to see if there is any significant differences, thus determining if the findings will substantiate the chosen hypothesis.

**Related Works on Linkages and Imports**

Riedel (1976) provides an index ($\Sigma a^*_{ij}$) of the total dependence of a given sector j on inputs from other sectors. The index is, in this sense, an indicator of potential linkage of a given sector. However this index indicates the actual existing linkages in the economy if and only if all intermediate inputs are produced and supplied domestically. If a significant proportion of intermediate inputs is imported, then this index will be an erroneous measure of existing linkages. In an open economy that imports intermediate inputs, Riedel introduced the following index of linkages (direct and indirect) for the jth sector :

$$\sum_i d^*_{ij} \quad \text{where} \quad d_{ij} = (I - d_{ij})^{-1}$$

$$d_{ij} = a_{ij} - m_{ij}$$

and $m_{ij}$ = per unit imported input requirement

So, it is obvious that in countries with import-dependent industrial structure, $a^*_{ij}$ and $d^*_{ij}$ can diverge significantly (i.e. there may be significant sectoral rank reversals).

Jones (1976), noted another problem arising in the Chenery and Watanabe's ( 1958) linkage measurement, that is, the inclusion of imported as well as domestic intermediate inputs. An industry would have high backward and low forward linkages if the inputs are domestically available and the outputs are wholly exported, and vice versa. Thus, the measurement of linkages (direct or indirect) must be derived using only the domestic flow matrix ($F_d$), instead of the total flow matrix ($F_{d+m}$). World and domestic (introduced by Yotopoulos and Nugent, 1973) may differ solely because of the stage of development, so that the gap represents import substitution potential. In a conclusion, Jones noted that when measuring potential long-run linkages ex-ante, one should utilize a flow matrix incorporating domestic intermediates, plus those imported intermediates that are domestically producible within the time frame being analyzed (i.e., which are not based on resources that the economy does not possess and which do not require a level of technology that is infeasible within the period). But, if one is using an end-of-period table to measure linkages ex-post, then only the domestic flows are relevant, since induced import substitution will have taken place (i.e., domestic linkages should be used in an ex-post study, where domestic linkages will differ with comparative advantage, so that relative sectoral linkages vary across countries and nation-specific linkages indicators are required for ex-post work). Thus, the ex-post evaluations of linkages (for analytical purposes) are different from policy-oriented, ex-ante evaluations.[6]

Similar to Yotoupolos and Nugent's world and domestic linkages are Acharya and Hazari's (A&H) (1973) gross and net linkages, where gross linkages are defined on the inverse of the Leontief technology matrix $(I-A)^{-1}$ or the total inverse, while the net linkages are on the domestic inverse. They argued that for economies which are dependent on intermediate and capital goods imports, the domestic inverse may be more appropriate in measuring the (net) linkages, thus identifying the sources of induced economic development (whether induced by the domestic sectors or by imports). A&H refer the linkages computed on $(I-A)^{-1}$ as gross linkages and those computed on the inverse net of imports, $(I-A+m)^{-1}$ as net linkages. If, in a country, a substantial difference between these net and gross linkages persists over time for some sectors, then

this will be grounds of argument to use the net rather than gross linkages in sector-ranking, so as to maximize induced development. A&H tested their hypothesis that a country with the highest average import intensity will display the greatest divergence of industry rankings on the linkage criteria. Their results, derived from Indian and Pakistan data shows that the concepts of gross and net linkages (computed via total and domestic inverse respectively) will imply very different ranking of sectors. Thus, there will be a serious limitation if one is to use the gross linkages as a form of investment criterion.

Bulmer-Thomas (1978), also gave a similar suggestion like that of A&H and McGilvray. A balance equation given by Bulmer-Thomas is:

$$Q = Aq + f + e - m$$

where q is a vector of gross output, or $q = (I-A)^{-1}(f+e-m)$ where A is the input-output matrix, f is a vector of home final demand, whose ith element shows total purchases of the ith commodity, e is a vector of exports and m is a vector of imports, all of which are assumed to be competitive. A competitive import can be defined as a commodity which is a close substitute for one domestically produced, while a non-competitive import is one for which there is no domestic counterpart.[7] Bulmer-Thomas's index of linkage, $L_{Tj}$ is a mesure of potential rather than existing linkages, because it is based on the input-output matrix. It would only be a measure of existing linkages if all inputs are supplied domestically. Such a measure can be supplied by the domestic input-output matrix (DIOM). So, Bulmer-Thomas redefined his balance equation as :

$$q = A_{Dq} + f_D + e \text{ where } A_D \text{ is the DIOM or,}$$

$$q = (I-A_d)\text{-}1\ (f_D + e) \text{ where } f_D \text{ is a vector of domestic demand,}$$

where the ith element shows purchases of the ith commodity from domestic sources only.

To further note the importance of this notion of existing/net/domestic linkages (terms used in different works), a recent study by Clements and Rossi (C&R) (1991), shown that linkage estimates only measure the domestic linkages. In their work, the I-O coefficients used to compute the linkage estimates do not include the imported inputs used to produce a sector's output. So then, similarly, the final demand vector does not incorporate final demand imports. According to C&R, their results are

best suited for an ex-post analysis of linkages, that is, an analysis of which sectors have had the greatest actual linkages (given the current level of dependence on imports). This is in contrast to an analysis of what linkages might be if all inputs were supplied domestically (potential linkages). C&R, having a similar opinion to Jones, A&H and Bulmer-Thomas, noted that, for relatively open economies, there can be a great difference in the linkage ranking of sectors, depending on whether imports are included or not.

Still another work using a similar approach (the domestic linkage), is the work by Yuji Kubo (1985). Kubo compares the patterns of intermediate inputs use, the levels of overall and domestic industrial linkages, and the role of imported intermediate goods in production among 9 countries. Kubo uses 2 ways to calculate his index of linkage (L). First, he uses the I-O matrices inclusive of imported intermediates, thus the resulting L will capture the extent of interindustrial relations implied by the underlying intermediate input technology. The linkage index thus calculated reflects the overall linkages. Second, he uses the I-O matrices exclusive of imported components, so, the L will show the extent of linkages emanating from domestic industrial base alone. The linkage index thus calculated brings out the domestic linkages. The significant result of this study is that countries like Korea and Taiwan achieved a linkage level nearly comparable to that of a more developed country like Japan, by relying heavily on imported intermediates (these can be seen through the relatively large differences between the overall and domestic linkage measures). On the other hand, there is only a small difference between the domestic and overall linkages in the case of Japan, implying that Japan has strong domestic industrial linkages and low import dependence.

As for the literature of linkages regarding Malaysia, one can refer to Abdul Aziz Abdul Rahman (1987, 1988 and 1991). Most of his works are to determine the key sectors of Malaysian industries using the input-output approach. The methodology used involved ranking the sectors according to their backward and forward linkages, after which the average of these 2 linkages will be taken to determine the overall ranking of the sectors. However, for the works on Malaysian linkages, there is yet to be a study done based on the methodology of Acharya and Hazari (1973). Although we realized that, this methodology might be made obsolete by the emergence of newer techniques, this study is done

nevertheless, in order to fill in the gap mentioned, in the literature of Malaysian linkages studies.

## METHODOLOGY

From the literature review, one can notice that there are several ways to determine total and domestic linkages in order to bring out the significance of the role imports play in the linkages measurement. This present study will be based largely on the work by A &H. However, a few minor modifications will be made in order to strengthen this work. The main aim of this part is to see if the findings substantiate the hypothesis suggested by A&H (that there will be low rank correlation between the total and domestic linkages if the import requirements are relatively high).

### Sources of Data

This work will use the 3 available I-O tables for the whole of Malaysia , that is year 1978, 1983 and 1987.[8]

### Analytical Framework

Mainly based on the technique used by A &H, first we will get the total inverse matrix for each of the respective input-output table year, i.e., 1978, 1983 and 1987. These total inverse matrices are computed from the transaction tables of both domestic **and** imported commodities[9] for each respective year. By denoting the structural matrices, derived from the transaction tables of both domestic **and** imported commodities, as A, the total inverse matrix calculated from A is then $(I-A)^{-1}$. Thus, as our first step, it is to compute:

$(I-A)_{78}^{-1}$
$(I-A)_{83}^{-1}$

and $(I-A)_{87}^{-1}$ where the A matrices of year 1983 and 1987 are undeflated matrices. To avoid confusion, linkages computed from the domestic inverse will be called domestic linkages and those calculated from total inverse will be called total linkages.

After getting those 3 total inverse matrices, our next step is to calculate the domestic inverse. By domestic inverse, we mean the inverse matrices calculated from the structural[10] matrices containing only the domestic element, i.e., without the import element.

By denoting these structural matrices as $\tilde{A}$ , our second step here is to calculate the following domestic inverse matrices, for each respective year:

$$(I - \tilde{A})_{78}^{-1}$$
$$(I - \tilde{A})_{83}^{-1}$$

and $(I - \tilde{A})_{87}^{-1}$ where the $\tilde{A}$ matrices of year 1983 and 1987 are undeflated matrices.Our third step is to calculate the backward and forward linkage from both types of inverse matrices (for each respective year), that is to get the following indices:

For year 1978 : $U_j, \hat{U}_j, U_i, \hat{U}_i$

For year 1983 : $U_j, \hat{U}_j, U_i, \hat{U}_i$

For year 1987 : $U_j, \hat{U}_j, U_i, \hat{U}_i$

For sector ranking purposes, this study employs the Rasmussen's indices of backward (BL) and forward linkages (FL) (the $U_j$ and $U_i$). These Rasmussen's indices are used because they include both the direct and indirect effects of linkages. The $U_j$ and $U_i$ are termed by Rasmussen as the Index of Power of Dispersion and the Index of Sensitivity of Dispersion.

Gross @Total BL, $U_j = [(1/n)K_{.j}] / [(1/n^2) \sum_{j=1}^{n} K_{.j}]$

where $K_{.j} = \sum_{i=1}^{n} K_{ij}$ is the sum of the column elements of the total inverse, which indicates the direct and indirect increase in supply of all sectors needed to sustain a unit increase in final demand of jth sector.

Net @ Domestic BL, $\hat{U}_j = [(1/n)\overline{K}.j] / [(1/n^2) \sum_{j=1}^{n} \overline{K}_{.j}]$

where $\overline{K}_{.j} = \sum_{i=1}^{n} \overline{K}ij$ is the sum of the column elements of the domestic inverse, which indicates the direct and indirect increase in domestic output of all sectors needed to sustain a unit increase in final demand of jth sector.

Similarly,

$$\text{Gross @ Total FL, } U_i = [(1/n)K_{i.}]/[(1/n^2)\sum_{i=1}^{n} K_{i.}]$$

where $K_{i.} = \sum_{j=1}^{n} K_{ij}$ is the sum of row elements of the total inverse, which indicates the direct and indirect increase in supply of ith sector needed to sustain a unit increase in final demand of all sectors.

$$\text{Net @ Domestic FL, } \hat{U}_i = [1/n)\overline{K}_{i.}]/[(1/n_2)\sum_{i=1}^{n} \overline{K}_{i.}]$$

where $\overline{K}_{i.} = \sum_{j=1}^{n} \overline{K}_{ij}$ is the sum row elements of the domestic inverse, which indicates the direct and indirect increase in domestic output of the ith sector needed to sustain a unit increase in final demand of all sectors.

After calculating these indices for each of the I-O table year, the sectors will be ranked in descending order by way of each of these indices. By doing so, we can calculate the correlation of those rankings to see if there is any significant differences in the sectoral rankings between the 2 types of linkages (i.e., total and domestic). Thus, for each respective year, we will calculate the correlation between the rankings[11] of :

(i) $U_j$ and $\hat{U}_j$

(ii) $U_i$ and $\hat{U}_i$

using the Spearman rank correlation method. The Spearman rank correlation coefficient is,

$$r_s = 1 - 6[\Sigma d_i^2 / n(n^2-1)]$$

where $d_i$ is the difference in the ranks assigned to the two different total and domestic linkages indices of the ith sector, and n is the number of sectors ranked.

The reason for getting the $r_s$ between (i) $U_j$ and $\hat{U}_j$ (ii) $U_i$ and $\hat{U}_i$, is to see whether the hypothesis by A&H is substantiated or not. From their hypothesis, if that correlation is low, then a nation is import-dependent and if that correlation is high, then it is less import-dependent.

This correlation analysis is just to measure the strength of degree of linear association between 2 variables. The 2 variables are treated sym-

metrically, where there is no distinction between dependent or independent variables.[12]

In this study, the $r_s$ will be considered as[13]:

(i) weak, if $0 \leq r_s \leq 0.4$

(ii) medium-strong, if $0.4 < r_s \leq 0.7$

(iii) strong, if $0.7 < r_s \leq 1$

## RESULTS AND ANALYSIS

### Domestic and Total Linkages

From our methodology section, the first most important result that we want to obtain is the correlation (using Spearman rank correlation) between the total and domestic linkages. Table 3 is what we have obtained:

**Table 3**
Spearman Rank Correlation coefficients Between Total and Domestic Linkages[14]

| Year | $r_s$ between $U_j$ and $\hat{U}_j$ | $r_s$ between $U_i$ and $\hat{U}_i$ |
|---|---|---|
| 1978 | 0.6353 | 0.8812 |
| 1983 | 0.6452 | 0.9066 |
| 1987 | 0.6847 | 0.8931 |

The $r_s$ here denotes the Spearman rank correlation. If we study the $r_s$ of the total and domestic backward linkages carefully, i.e., the $r_s$ between $U_j$ and $\hat{U}_j$, for all the three years, they are consistently around the figure 0.6. Thus, they can be considered as medium-strong correlation (as defined in our methodology section).

On the other hand, the $r_s$ of the total and domestic forward linkages, i.e., the $r_s$ between $U_i$ and $\hat{U}_i$, for all the three years, are relatively higher. They hover around the figure 0.88, 0.91 and 0.89 respectively. Thus, from our methodology section, these $r_s$ are considered to be very strong ($r_s > 0.7$). According to the hypothesis put forward by Acharya and Hazari (1973), if the $r_s$ between total and domestic linkages (be it back-

ward linkage or forward linkage) is high, then relatively, the economy for that particular year is less-dependent on imports.

From Table 3, we can see that the rs between $U_j$ and $\hat{U}_j$ are medium-strong as compared to those of the forward linkage generating sectors. This implies that the imports requirements of these sectors 15 are relatively higher. Thus, we may say that, these sectors in general, generate backward linkages; these sectors generate growth in other sectors by demanding their outputs. But, for these backward-linking sectors, they import more inputs relatively as compared to those forward-linking sectors.

A high rs between $U_i$ and $\hat{U}_i$ implies that the imports of the sectors[16] are are relatively low. We may say that these sectors relatively depend less on imports to produce their outputs. Whatever output that they supply to other domestic sectors, they do not depend much on imports. From Table 3, we can see that generally, the $r_s$ between $U_i$ and $\hat{U}_i$ is relatively higher than the rs between $U_j$ and $\hat{U}_j$, for each respective years.

The figures from Table 3 suggest that our backward-linking sectors depend more on imports, if compared to the forward-linking sectors. In an economy, those sectors that can generate more backward linkages are held in greater importance. In our Malaysian economy, most of our important sectors are also those that can induce growth in other input-supplying sectors. These important sectors include sectors like Electrical Machinery (sector 35 from the input-output table), Motor Vehicle (36), Other Transport (37) and Other Manufacturing Product (38). These sectors are those engaged in modern technology. But since our Malaysian industrial structure is shallow[17], these sectors have to depend on imports for their inputs.

Now, this is where the discrepancy and doubt creeps in. If a sector depends much on imports for its inputs, then how can it act as a backward-linking sector in an economy? How can, for example, sector A which is very much import-dependent, act as a catalyst to sector B's growth of output (where ultimately this sector B's output will be supplied to sector A as input)?

One of the explanations is that perhaps the sectors import things like robotics, latest machineries or higher-quality intermediate inputs. On

the other hand, these sectors may be generating backward linkage by enabling other domestic sectors to supply them with intermediate inputs that are less technologically demanding. For example, in our national car production sector, we may be importing the vehicles' engines, but this car production sector also stimulates other sectors into providing it with other parts of a car, such as the body frames, tyres, seats, dashboards, cushions and the like.

Having said all these, is there any nexus between intersectoral linkages and trade liberalization? As we all know, as the process of trade liberalization deepens, our economy will become more and more integrated with the global economy. We can see this integration from our increasing proportion of trade (imports plus exports) to GDP.[18] Trade liberalization will result mainly in import liberalization. Now, if a sector can import more, what will happen to its backward and forward-generating effect to other domestic sectors in the economy? Intuitively, higher imports of a certain good may imply that our country does not have the comparative advantage in the production of that certain good or it may also imply that the price of that certain good is cheaper internationally if compared with the domestic price (thus, enabling imports). Trade liberalization suggests that a nation should specialize in its most efficient production and export the goods that intensively uses its abundant factor, while importing goods that the nation does not possess any comparative advantage. In Malaysia's case, it is quite obvious that we are no strong contenders in the high-technology sectors as compared to other developed countries like the United States and Japan.

From the results in Table 3, it can be seen that the forward-linking sectors are relatively less-reliant on imports and the backward-linking sectors are relatively more-dependent on imports. This may mean that our backward-linking sectors are not doing very well in enabling other domestic sectors to produce higher-technology inputs. But, we must not forget one thing-that is our endowment factor. Malaysia is not so well-endowed with capital, but we do have a large pool of labour and abundant natural resources. So, as the process of liberalization accelerates, there will be an influx of imports. Our producers may choose to obtain imported inputs instead of domestically-produced inputs. This is because the cost of producing something which one does not have comparative advantage is higher, compared with the imported inputs which are produced by nations that have comparative advantage.

Then, how can we explain the relatively import-independent forward-linking sectors? From this study, our leading forward-linking sectors which are import-independent include mostly the resource-based sectors and the trade sector. For all the three years studied, the trade sector has been consistently the most important forward-linking sector and also the most import-independent sector. This is indeed in line with our nation's trade strategy in that period (1978-1987), which emphasizes on the growth of export-oriented sectors. Our resource-based sectors have high net forward linkage for all the 3 years studied. For example, we take one of the resource-based sectors, Petrol Mining (Sector 7). It can act as a catalyst to the establishment of many other petrol-based industries, thus generating forward linkage in the economy.

As for our important forward-linking resource-based sectors, it is quite easy to see why they relatively depend less on imports. It may be mainly because they are resource-based sectors, such as petroleum, rubber, oil and fats and agriculture. Our nation is relatively abundant with these natural resources, so there is no need to import them. These sectors provide their resource-based outputs as inputs to other domestic sectors and also as exports to other nations. But, as we integrate more and more into world economy, our forward-linking sectors will probably face some problems with their exports. This is because the importing countries, especially the developed countries may impose higher tariffs on our processed commodities exports - tariff escalation, i.e., the tariffs imposed will be higher if the degree of fabrication or processing of our exports are higher. In recent years, there has been an increasing number of cases of non-tariff barriers imposed by the developed nations on the developing nations. These trade barriers may adversely impede growth in those developing countries as their sectors depend much on a favourable world trade environment.

## POLICY IMPLICATIONS AND CONCLUSION

From the results, this study will suggest some policy implications. Governments can put more emphasis on the development of those forward-linking resource-based sectors, such as Other Agriculture (Sector 1), Forestry (5), Petrol Mining (7), Oil and Fats (10) and Petrol Product (25). Government can strengthen the industrial cluster of these resource-based sectors by introducing more incentives and tax exemptions in order to attract more investments into these sectors. More processed outputs

from these sectors should be exported to ensure more added value in our exports, thus improving our balance of payment. These sectors may then further spur the growth of small and medium size industries.

This study has been carried out with the main objective of finding out our Malaysian intersectoral linkages and imports, that is whether the sectors depend on imports as their inputs. Attempts are made to link the results obtained from this study to the recent issues of trade liberalization. The methodology used is largely based on the work by Acharya and Hazari (1973). This study thus, wishes to justify the need to fill in the gap of the literature on Malaysian linkages studies by using this methodology.

The main results obtained from this study suggests that in general the sectors do not depend much on imports in their production, implying the existence of the necessary linkages generation that is needed for the growth of an economy. These results are however, governed by how the Spearman correlation rank coefficients, $r_s$, are interpreted. However, from other results obtained from this study, certain sectors such as Electrical Machinery, Motor Vehicle, Other Transport and Other Manufacturing Product, do depend heavily on imports as their inputs. This can have serious implication to our economy, where if we depend too much on imports, especially in this era of rapid liberalization, sectoral growth may be impeded, thus rendering those sectors handicapped without the ability to generate linkages to the domestic economy.

Without a doubt, there are shortcomings in this study. First and foremost is that the three input-output table used as the study's main data is not the most recent ones. There has been a lapse of 13 years since the last published input-output table (1987). Thus, the results obtained may not be able to represent the current situation of our economy. Thus, it is suggested that our Statistics Department take the necessary steps so as to update the input-output table. It is expected that if this study is to use more recent input-output tables, then, a higher $r_s$ between total and domestic backward linkages would be registered.[19] This higher $r_s$ would then imply that our backward linkage-generating sectors would be less-dependent on import materials or technology. Taking into considerations the recent economic developments in the 1990s, Malaysia has experienced a change in its economic structure. More emphasis now are being given to the information and communications technology (ICT) sector, productivity-driven and resource-based industrial sectors. The

manufacturing sectors now are gearing up towards the enhancement of competitiveness and economic resilience.[20] These changes are critically-important especially in the recent economical and political uncertainties in the international scene.[21] Thus, we would expect that with these structural changes, our economic sectors would not have to depend heavily on imports. Too much dependence on imports would come at a high price as Malaysia is a very open economy.

This study only uses one type of methodology - based on the methodology used by Acharya and Hazari in 1973. It is suggested that this study be replicated using a more recent technique, so that the results obtained can be compared and further validated. Future studies can also compare the linkages and imports between Malaysia and other countries.

## ENDNOTES

1. In a literature review done by Lutz & Singer, (1994), it is found that the World Bank uses the ratio of exports to GDP as an indicator of increased openness or outward orientation, where the usefulness of the proxy is that is provides directly available and broadly reliable quantitative data.

2. As used by Drabek & Laird (1997) in their World Trade Organization working paper, where they termed this ratio as "trade openness" or "trade intensity". The values of GDP, export and import are all in constant prices and, a consistent price deflator is used, where applicable.

3. Jomo, K.S., 1990

4. Acharya & Hazari,1973

5. Acharya & Hazari (1973), Bulmer-Thomas (1978), Yuji Kubo (1985).

6. Cella, 1984

7. O' Connor and Henry, 1975

8. The latest Input-Output table for the whole of Malaysia is only until 1987. The author regrets any irrelevancy of this work with today's current situation.

9. for example, the transaction table of both domestic AND imported commodities for the year 1978 is - " Table 2.1 : Input-Output Table of Domestic and Imported Commodities at Basic Values, 1978, Commodity x Commodity (Thousand Ringgit)" - pg 69

10. these structural matrices are calculated from the transaction tables of domestic commodities, for e.g., from Table 2.2 - " Input-Output Table of Domestic Commodities at Basic Values, 1978, Commodity x Commodity" - pg 77

11. Note that, here, we do not deflate the 1983 and 1987 tables into 1978 prices because we are comparing the correlation of the relevant linkages only.

12. Gujarati, 1995

13. The following range is modified and adjusted from Gujarati (1995), Lind et al. (2000) and Mendenhall et al. (1993).

14. Data and calculations may be obtained from the authors.

15. The sectors here are referred to those backward-linking sectors.

16. The sectors here are referred to those forward-linking sectors.

17. Jomo (1990)

18. Refer to Table 1 in this current study.

19. Instead of the figures 0.6353, 0.6452 and 0.6847 that are obtained in this current study.

20. 8th Malaysia Plan 2001-2005

21. The uncertainties of a looming Iraq-US war in this recent time of writing (October 2002).

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