COMMUNICATION I
An Inter-industry Analysis of the West Malaysian Economy

ABDUL AZIZ ABDUL RAHMAN
Department of Economics,
Faculty of Economics and Management,
Universiti Pertanian Malaysia,
43400 Serdang, Selangor Darul Ehsan, Malaysia

ABSTRACT
This paper analyses the structural interrelationship of the West Malaysian economy based on the 1982 inter-industry table. Four types of direct interdependence are examined, namely, industrial share of final demand and primary input components, input requirement and intermediate transactions of industries. The study indicates that a substantial proportion of private consumption in the economy comprises expenditure on food and services. The fixed capital formation structure is dominated by the construction and motor vehicle industries while the export mix is dominated by the petroleum products, rubber processing and oils and fats industries. In general, the non-agro-based manufacturing industries are the major purchasers of imported inputs whereas the agricultural and service industries are the major users of primary inputs. The analysis of structure of intermediate transactions indicates that there are only a few industries that possess extensive technological linkages with the rest of the economy. The majority of high-linkage industries comprise those that are involved in the processing of imported inputs for domestic or export markets such as chemical fertilizers, plastic products and other metal products.

INTRODUCTION
The development of inter-industry models commenced in 1936 with Leontief's empirical model of the United States economy. Subsequent accumulation of statistical material in the inter-industry framework led to the development of alternative analytical techniques and there is now a wide variety of inter-industry models in use. The foremost advantage of the inter-industry approach of analysis is its stress on industrial relationships and interdependence, showing empirically how "everything depends
upon everything else."

This paper analyses the inter-industry relations in the West Malaysian economy, with specific reference to direct structural interdependence. It will serve as a useful source of information on economic relations in West Malaysia and provides some guidelines for national development planning.

INTER-INDUSTRY TABLE

An inter-industry table is a two-way transactions matrix of the national economy. The entries in the table are all in money values. Within the table, each industry has a row and a column attributed to it. The size of the table may vary depending upon the degree of detail incorporated in it.

The rows of the table show the disposal of the output of each industry: sales of commodities to other industries to be utilised in the current productive process and sales to final demand, comprising government and private consumption, stocks, capital formation and exports.

The columns show the sources of the inputs utilised by each industry to produce its output: intermediate inputs purchased from domestic industries and primary inputs. The primary inputs comprise value added (the sum total of wage and non-wage factor payments) and imported inputs. As the input column includes profits, total inputs used in the industry always equal the value of total output.

The value of all the purchases made by an industry for each dollar's worth of output may be made by dividing each input value by the corresponding total output. The resulting values are known as input-output coefficients, and the table of input-output coefficients is termed the technology matrix.

DATA

The primary source of data for this study is the 1970 input-output table for West Malaysia published by the Department of Statistics (1975). Several adjustments have been made to the basic table, including the disaggregation of agricultural sectors into constituent crop industries and the estimation of land development works by the agricultural contractor services subsector. This table is then updated to 1982 by the use of the bi-proportional rating, or RAS method.

The RAS method proportionally adjust row and column totals to agree with some predetermined values. The proportions are expressed as the vectors "r" and "s", being termed row and column multipliers respectively. The predetermined values are those of final demands, primary inputs, sectoral outputs and, therefrom, the values of the row and column total vectors. The updated coefficient matrix, A', is related to the base year matrix, A₀, by the relation:

\[ A_1 = RA_0 S \]

The estimates of final demands, primary inputs and sectoral outputs for 1982 were derived from the National Accounts worksheets of the Department of Statistics. To conform to the industrial classification scheme adopted in this study, some adjustments were necessary. Also, for a number of industries, indices of volume of output and prices were applied to the industrial output for 1970 in order to derive the output levels for 1982.

RESULTS

Four types of direct relations will be examined: industrial share of final demand components and primary inputs, direct input requirements and intermediate transactions of industries.

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1. This study covers West (or Peninsular) Malaysia only. This is largely because sufficient inter-industry data for analysing structural interdependence are not available for East Malaysia (that is Sabah and Sarawak).

2. For an explicit exposition of the direct, indirect and total interdependence see, for example, Miernyk (1957) and Chenery and Clark (1959).

3. "RAS" is a shorthand way of describing a technique which involves prorating the row and column coefficients of an inter-industry table to equal to some known marginal totals. The RAS is not the only method of updating the inter-industry matrix: for a discussion of alternative techniques, see Tilanus (1966).

4. For details of the theoretical scheme and analytical framework underlying the RAS method, see, for example, Bacharach (1970) and Stone, Bates and Bacharach (1974).
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Industrial Share of Final Demand
Approximately 51% of government consumption comprised expenditure on public administration and defence. In addition, about 38% and 11% of government consumption were expended on social services and other community services respectively.

A substantial proportion of private consumption expenditure was incurred on services comprising trade, transportation and communication, house rentals and personal services. The expenditure on trade, particularly on hotel and restaurant services, accounted for 19% of total private consumption while that on house rentals accounted for 13%. Private consumption of transportation and personal services were much smaller, in the order of 7% and 5% respectively of the total expenditure.

The next largest expenditure by consumers in 1982 was on food. The livestock, meat and dairy products, grain mills and other food industries each accounted for over 3% of total private consumption. The bakeries and other processed food industries also recorded a relative share of total private consumption of over 1% each.

The fixed capital formation structure was evidently dominated by the construction industry. It contributed 64% to the total value of capital goods produced in the economy. The motor vehicles and non-electric machinery industries, with relative shares of 8.2% and 1.1% respectively, were two other industries that contributed significantly to gross fixed capital formation.

With respect of fixed capital formation in agriculture, the smallholder sector's contribution was slightly larger than that of the estate sector. For instance, in the case of rubber, the smallholder sector had a share of 2.6% while the estate sector had a share of only 1.4%. The relatively low level of capital formation in the rubber estate sector was primarily due to the decline in the rate of new and re-planting in the sector coupled with the conversion of numerous rubber estates to oil palm cultivation.

By 1982 the petroleum products industry had overtaken rubber processing and oils and fats (chiefly palm oil) whose relative shares were 19% and 18% respectively. The basic metals industry, another traditional export industry, contributed only 12% to the gross export receipts.

Industrial Share of Primary Inputs
In general, the non-agrobased manufacturing industries were the major users of imported inputs. Of the top ten industries in terms of relative share of imports, four, namely, motor vehicles, petroleum products, basic metals and other metal products, belonged to the non-agrobased manufacturing category. By and large, the agricultural industries were insignificant users of imported inputs except for padi and rubber estates.

The government sectors of public administration and social services together accounted for almost one third of the total wages generated in the economy. In comparison, the proportionate contributions to total labour payments by agricultural industries were insignificant except for rubber estates, rubber smallholdings and livestock. It should be noted that despite the diminishing importance of the rubber sector in the export structure, it still remained significant in terms of capacity to employ labour.

The agricultural industries, however, proved to be the major generators of non-wage factor payments, (other value added), in the economy. Of the top ten industries in terms of value added generation four — rubber smallholdings, padi, oil palm estates and livestock — consisted of agricultural industries. Much of the non-wage value added generated in these industries comprised depreciation charges associated with plantation and land development. Other industries which were important from the viewpoint of value added generation include trade, dwellings and transport and communication.

Direct Input Requirements
The agricultural industries, by definition primary industries, had comparatively large aggregative primary input requirements. For each industry the wage and non-wage factor requirements together constituted four-fifths or more of total primary input requirements. Like-
wise, the service industries were also more dependent on primary inputs compared to intermediate, or non-primary, inputs. Except for personal services and other services, the primary input requirements of the service industries constituted more than three-fifths of unit value of production.

Employing the relative size of wage coefficient as a proxy for labour intensity, it was found that only four manufacturing industries could categorically be classified as being relatively labour intensive. These consisted of sawmills, furniture, paper products and industrial chemicals. In these industries, the wage coefficients were larger than the non-wage value added coefficients. Other labour intensive industries include education, personal services and public administration.

The comparatively high intermediate input coefficients of manufacturing industries such as meat and dairy products and canning of fruits characterised one activity typical of a developing economy, namely, primary processing of local raw materials for export. These industries required a high level of domestic (intermediate) compared to imported inputs. Concomitantly, they showed a strong orientation for export as reflected by their prominent shares in the export mix.

On the other hand, the relatively high import relative to intermediate input coefficients recorded by industries like wearing apparel and plastic products characterised another activity prevalent in a developing economy, namely, processing of imported inputs for domestic or export market. For these industries the import requirements constituted one-third or more of unit value of production. Also, in the case of industries such as animal feed and other metal products, the low degree of processing on imported inputs was reflected to an extent by their low wage and non-wage factor input coefficients.

The average merchandise (intermediate plus import) input coefficient of manufacturing industries in 1982 was found to be 0.62. In addition, the average intermediate input coefficient (0.41) of manufacturing industries was also greater than the imported input coefficient (0.23). In comparison, the average merchandise input and intermediate input coefficients for manufacturing industries in 1970 were significantly greater at 0.70 and 0.48 respectively. These observations, inter alia, indicate that the industries involved in the processing of domestic resources for exports had expanded less rapidly compared with other manufacturing industries over 1970–1982.

Intermediate Transactions

The structural interdependence between industries may also be examined by analysing the contribution of each industry to total supply and demand.

These two measures of direct interdependence were computed for each industry. The individual industries were in turn ranked, following Chenery and Clark (1959), in a four-way classification of industries. The ranking was based on whether the industrial shares in total supply and demand are above/below the corresponding economy-wide averages.

Thirty-four out of a total number of sixty industries sold two-thirds or more of their outputs directly to final demand, mainly to private consumption and export sectors. Further, twenty of these industries comprised manufacturing industries.

The significance of agricultural industries as major suppliers of inputs for agro-based manufacturing industries was reflected by the fact that they sold over two-thirds of their outputs to intermediate demand.

On the other hand, the service industries, with an average of 20%, sold proportionately less of their products to other industries. Likewise, the manufacturing industries as a whole recorded a relatively low average intermediate demand proportion of 27%. This indicated that in general the manufacturing activity was still strongly oriented towards the final markets, especially for consumer and non-durable goods.

The industries included under Category II and Category III were characterised by high (direct) backward linkage values. Accordingly,
they depended heavily on other domestic industries for their inputs. Changes in their level of activity would concomitantly generate greater repercussions on the economy than those included in either Category I or Category IV. Category II industries, which also had high (direct) forward linkage values, comprised predominantly non-agrobased manufacturing industries. On the other hand, Category III industries, which were characterised by low forward linkage indices, consisted largely of agrobased manufacturing industries.

Taking an overall measure of direct interdependence, the industries in Category II, with comparatively high backward and forward indices, would possess the most extensive structural linkages in the economy. A total of nine industries fell under this category, seven of which were non-agrobased manufacturing industries. Almost invariably, the latter industries comprised those that processed imported inputs for domestic or export market such as chemical fertilisers, paints and plastic products.

At the other extreme, industries in Category IV, with low backward and forward linkage values, would be relatively independent of other industries for both their inputs and outputs. A large number of service industries including trade, education and health belonged to this group.

CONCLUSIONS
The application of inter-industry analyses for examining the structural interrelationships of the national economy has been widely described. A useful feature of an inter-industry model is that it measures, explains and compares the degree of interdependence among the various sectors of the economy.

This paper has analysed the inter-industry relations in the West Malaysian economy. Four types of direct interdependence were examined: industrial share of total final demand and total primary inputs, input requirements and intermediate transactions of industries. The basic data for this study were provided by the 1982 input-output table for West Malaysia.

The study indicated that a substantial proportion of private consumption in 1982 comprised expenditure on services and food. These two items together accounted for approximately one-third of total private consumption expenditure. The government consumption expenditure, on the other hand, was confined only to three sectors — public administration, social services and other services.

The fixed capital formation structure of the economy was dominated by the construction and motor vehicle industries whose respective shares were 64% and 8%. The level of capital formation in plantation and land development was predominant in rubber and oil palm industries, with the smallholder sector generally recording a greater level of investment compared to the estate sector. In terms of exports, it was found that by 1982, the petroleum products industry had surpassed the traditional export industries of rubber processing, oils and fats (palm oil) and basic metals (tin) industries to become the most important export earner for West Malaysia.

Generally, the non-agrobased manufacturing industries were the major purchasers of imported inputs. In contrast, the agricultural industries were insignificant users of imported inputs except for padi and rubber estates. The service industries together contributed almost one-third to the total wages generated in the economy while the agricultural industries together accounted for approximately one-fifth of the gross non-wage factor payments.

The agricultural and service industries generally utilised high levels of primary compared with non-primary, or intermediate, inputs. In comparison, a number of industries like meat and dairy products and canning of fruits utilised proportionately more of intermediate than primary inputs. Almost invariably, these industries comprised resource-based manufacturing industries whose production were oriented towards exports. In the case of assembly industries like wearing apparel and plastic products the imported input requirements were substantially greater than the intermediate input requirements.

The analysis of structure of intermediate transactions indicated that there were only a few industries that had extensive technological linkages with the rest of the economy. The majority of these strategic industries were
involved in the processing of imported inputs for domestic or export market such as chemical fertilizers, plastic products and other metal products. Accordingly, any changes in their level of productive activity would generate extensive repercussions on the economy.

Some comments are necessary concerning the shortcomings associated with this study. Obviously, the usefulness and validity of the results presented above are limited by the realism of the inter-industry model employed. For instance, the model is based on current flows, and it assumes fixed technological coefficients. This static model is open to questioning because it ignores the possibility of factor substitution. It also ignores several other difficulties involved in adopting a static inter-industry framework as a basis for analysing problems of structural interdependence. From a different viewpoint, the measures of industrial inter-relationships are also bound by the particular industrial classification scheme adopted in the basic inter-industry table and price changes.

REFERENCES


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