

FORESTRY ECONOMICS AND DEVELOPMENT

IN MALAYSIA

by

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I certify that this thesis is my own composition.

Raj Kumar

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TO MY PARENTS

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A B S T R A C T

The study attempts to fill a gap in Malaysian forestry economics, an area relatively less probed compared to the other important primary commodities of Malaysia.

The core of the thesis are two econometric studies. The first concerns estimating supply and demand elasticities of the three main Malaysian wood products - sawlogs, sawnwood and plywood. Demand is split up into export and home demand to understand better the separate economic forces at work. Dynamic aspects, not previously considered, are incorporated in the model. Forecasts are made up to 1985 on the basis of these estimates. The model is applied to data covering the whole of the country as well as of each individual region - Peninsular Malaysia, Sarawak and Sabah, to examine elasticity variations and aggregation biases. For Sabah and Sarawak, this is the first rigorous econometric analysis of wood products.

The other econometric investigation is of estimating employment demand elasticities and the speeds of labour adjustment of wood-based industries in comparison with those in rubber and the oil palm sectors. Employment implications arising out of changes in output, as well as exports and home consumption are estimated. This involves both linear and non-linear estimation, the latter a novelty in studies of less developed countries.

To understand better the implications of these two econometric investigations, the study also examines the role of Malaysia in the world hardwood trade and the economic, political and social influences at work in Malaysian forestry.

CHAPTER ONE

INTRODUCTION - FORESTRY AND THE MALAYSIAN
ECONOMYSection 1.1: Forestry - Definition and Economic Characteristics

Forests are one of the world's natural resources which include all those that originate from biological, chemical or geological processes. Physically speaking, exhaustible resources are those not capable of being replenished, such as petroleum and tin, while renewable (or replenishable) resources can be reproduced or replaced such as trees, fish, solar energy and wild life. The consumption pattern of renewable resources, such as forests, is flow in character, while those of exhaustible resources is like a stock, where the inventory diminishes with use. However, economically speaking, a renewable resource could sometimes take on a stock character. For instance, trees, that are felled once for all, and not replanted, with the land going to other uses, could in some sense be regarded as a stock resource. Another example is the over-exploitation of some species of animals making them extinct.

Our interest is in forestry which can be broadly defined as the art and science of managing forests. Management covers all those activities related to planning, production, distribution and replenishment of forest products, principally wood. The scientific aspect of forestry is physico-biological in character, covering such areas as classification of species, mensuration, silviculture and all those factors that influence the growth and maintenance of trees. The physico-biologist is concerned with ecological aspects like the relationship of the forests to their surroundings - the effect on climate, on soil, on water-flow, on plants and animals. His focus is on the technical aspects of the forest science to enhance knowledge on the natural attributes of forests.

The economist's interest is in the art of managing forests - i. e. the optimal allocation of scarce resources (in this case, forest land), both over space and time to maximise total net benefit to society. At

one level he deals with allocating resources like land, labour and capital to forestry, vis a vis alternative uses like agriculture. At the next level is the allocation process within forestry like deciding whether to produce only saw logs, or extend to downstream industries like sawmilling and wood panelling. At the third level, the economist is involved in the choice of techniques for a particular activity like logging or sawmilling. Should it be labour intensive or capital intensive? Here he would also be interested in the timing of the harvest, i. e. when to market. In other areas the economist will be more concerned with cost, price and welfare implications than pure technical aspects. Nevertheless, biological factors like yield and growth rate of trees would influence the economic calculus. So would environmental effects. More specifically, the interest is in economic efficiency given the aim to maximise the value of benefits produced by the given stock of forest resources in the most optimal way.

There are certain economic characteristics in forestry that are in some sense sui generis in nature. These are:

1. The tree is simultaneously both the capital plant and the finished product. This means that it is physically impossible to separate the product (wood) from the production plant. This has implications in terms of identifying the capital investment, costing and planning of investment.
2. The gestation period of forestry is longer than other replenishable production processes, and marked with a higher degree of risk and uncertainty than in extractive and manufacturing industries. Tropical forests could take from 40 to 150 years to mature. This means that the forest owner cannot expect to have a regular flow of income from the same wood-lot. Within certain limits, the production period is elastic in the sense that there is no clearly defined age of maturity or fixed date of marketing, unlike other renewable resources like wheat.
3. Usable wood is something very different from a standard product.

It may be difficult to find two logs, particularly from the tropical species, exactly similar as industrial standardised products. This has repercussions in terms of techniques of production and grading, both of which affect cost and prices of the product.

4. The elasticity of substitution, firstly among wood products, and secondly, with other non-wood products is unusually higher than for any other primary commodity. Sawnwood, plywood and fibre board compete with each other and are almost interchangeable despite differences in production processes, and most of them face competition from steel, plastics, aluminium and fibreglass.
5. The multiple-use character of forest lands gives rise to problems of defining the underlying production functions and of allocating the area to the different uses. Besides producing commercial wood, other uses of forests include recreation, wild-life preservation, water-shed protection, climate amelioration and overall environmental preservation. A large proportion of these benefits are non-marketed, making quantitative analysis of cost and benefits an onerous task. The jointness of the supply of output, some of it in the nature of a public good, complicates economic analysis.

Singly, none of these characteristics can be considered special in itself, but the fact that they occur together to a much greater degree than in other industries makes forestry complex in terms of economic analysis.

The scope of forest economics is therefore wide. Our broad objective is to focus attention on some selected major issues in Malaysian forestry, and evaluate their economic implications. Forests and forest industries are components of the general economy, influencing and are influenced by other sectors. They have an important role to play in the economic development of Malaysia, like the other major primary commodities, rubber, oil palm, tin and petroleum. To appreciate this role, it would be useful to introduce Malaysia, and consider its economic performance, problems and government strategies.

Section 1.2: The Malaysian Economy, its Problems and
 Government Policies.

Malaysia, lying in the tropical zone of Southeast Asia, is generally divided into two parts - Peninsular Malaysia (P. M.) or West Malaysia (formerly known as the Federation of Malaya) and East Malaysia, comprising the Borneo states, Sarawak and Sabah (formerly known as British North Borneo). The two wings are separated by between 800 and 1,500 kilometres of the South China Sea. Peninsular Malaysia, comprising 11 states, forged a union with Sarawak, Sabah and Singapore in 1963 with a federal system of government. Although prior to 1963, the different units were run separately, they all have a common British colonial heritage. Peninsular Malaysia itself became independent in 1957, while Singapore gained independence in 1965 when it was expelled from Malaysia after friction between the federal government in Kuala Lumpur and the Singapore state administration. Sabah and Sarawak have never achieved independent status except within the context of Malaysia. The various stages in the political formation of present-day Malaysia have created a country marked with heterogeneity in culture and races, economic and social development and political maturity, that have given rise to problems that are unique compared to that of other less developed countries in Asia. A summary of the major historical and political developments, and the main economic indications are in Appendix 1A.

From an economic perspective, Malaysia can be classified as an open economy, with an Export/Gross National Product ratio that has varied between 35 and 60 percent since 1960; and prior to 1960, sometimes greater than 60% (see Table 1.1). The export mix, listed in Table 1.2, comprises mainly primary commodities, with manufactured products, mostly processed primary products, taking between 10 and 20% of the total. The import basket comprises predominantly consumer goods and capital items. Malaysia could be described to be in the process of evolving from a British colonial economic structure (commonly described as the classical export system), dominated by a thin specialisation of a few primary commodities, mainly rubber and tin, to one of an industrialized country, with manufacturing and domestic processing of raw materials playing a leading role.

Malaysia's economic growth is highly dependent on world demand conditions, while on the supply side it is very sensitive to the availability of human and capital resources to exploit and process its raw materials. Given the upswings and downswings of the world business cycle, Malaysia is potentially susceptible to a degree of economic instability that is greater than countries which are less open and more balanced structurally. This is accentuated by two other factors - a high degree of market concentration of its exports and the nature of the elasticity of demand and supply of primary commodities. The United States, Western Europe (principally the European Economic Community, E. E. C.) and Japan have been absorbing 60% of all its exports, with Singapore taking another 15 to 20% which eventually end up in the Organization of Economic and Commercial Development (O. E. C. D.) countries. For its major imports, like machinery and other manufactured goods, it is also dependent on these markets, besides oil from the Middle-east. The demand of its primary commodities is price and income elastic while the supply, price inelastic, at least in the short-run. The elasticity of substitution of its major commodities, rubber, oil palm and timber, is high. The export proceeds have therefore exhibited a fluctuating pattern, and one can expect the instability to be transmitted to the rest of the economy, although some studies have not found evidence to support this.¹

Nevertheless, the specialization on a few commodities has been a Robertsonian "engine of growth," giving the country a standard of living among the highest in Asia. Except for the post-1973 period, the growth has taken place under relative internal price stability. This is despite the fact that its terms of trade have been falling since 1965, a common feature of most less developed countries (Table 1.1). Its balance of payments position has however been healthy showing consistent but varying surpluses since 1970. This to some extent has promoted a very stable currency, a rare feature in less developed economies.

1. See Macbean (1966) and Ariff (1972).

MALAYSIA: MAIN ECONOMIC INDICATORS (1960 - 1978)

Year	G.N.P. at market prices (M\$ mil.)	Share of Exports in G.N.P. (percent)	Economic Growth(%) Real in brackets	Per Capita Income (M\$)	Retail Price Index (P.M.) 1967: 100	Terms of Trade (PM) 1970:100	Exchange Rate US\$ = M\$
1960	6 019	60.4	-	820	92.3	n.a.	3.06
1961	6 681	48.5	10.0 (n.a.)	798	92.2	109	3.05
1962	7 048	46.3	5.0 (n.a.)	815	92.3	108	3.05
1963	7 513	44.3	10.0 (n.a.)	843	95.2	106	3.05
1964	7 960	42.5	6.0 (n.a.)	869	94.8	107	3.05
1965	8 776	43.1	10.0 (n.a.)	954	94.7	114	3.06
1966	9 344	41.2	6.0 (n.a.)	990	96.0	107	3.08
1967	9 704	38.4	4.0 (n.a.)	997	100.0	100	3.07
1968	10 190	40.5	5.0 (n.a.)	1 025	99.8	91	3.08
1969	10 978	46.0	8.0 (n.a.)	1 081	99.4	103	3.09
1970	12 155	42.5	11.0 (n.a.)	1 169	101.3	100	3.08
1971	12 501	40.1	3.0 (n.a.)	1 202	102.9	86	2.90
1972	13 641	35.6	9.0 (9.7)	1 240	106.5	79	2.81
1973	17 443	42.3	29.8 (10.5)	1 543	109.4	87	2.45
1974	21 234	48.0	21.7 (7.7)	1 829	119.7	83	2.31
1975	21 684	42.6	1.2 (2.2)	1 822	127.1	68	2.58
1976	26 914	49.9	24.8 (10.5)	2 200	133.4	80	2.54
1977	30 851	52.0	14.4 (7.6)	2 297	138.1	92	2.36
1978*	35 652	51.0	11.4 (7.2)	2 490	n.a.	90	2.33

* Estimates

n.a. - not available

Sources: Department of Statistics: Annual Bulletin of Statistics, 1968 - 1977
 Ministry of Finance : Economic Report, 1974 - 1979
 Bank Negara : Quarterly Economic Bulletin, 1976 - 1979

Despite the impressive economic record, the trade-biased economy has produced lopsided growth characterized by a dualistic structure with a slow-growing subsistence sector coexisting with the dynamic export sector. As a result, there are sharp regional disparities and income inequalities that are a growing threat to civil order and stability of the country.² In comparison to other similar less developed economies, the "economic dualism" is not especially large, but it assumes a more sensitive dimension, as there is a strong correlation of the dualism with racial differences. Due to historical factors, (explained in Appendix 1A) the Malays and other indigenous groups, (collectively referred to as bumiputras) were not keen to work on commercial sectors, owing to cultural and social reasons. They have therefore been predominantly confined to the low productivity occupations in the largely subsistence sector. The more energetic and ambitious immigrant population, especially the Chinese, have meanwhile, concentrated themselves in the export and commercial sectors.

In terms of wealth distribution, foreigners still own the major share capital in limited companies - about 55% in 1975 compared to 63% in 1970. The shares of the Malays, Chinese and Indians respectively in 1975 were 7.8%, 28% and 1%. (Appendix 7A (v)).

The Malaysian government has adhered to a philosophy of free-enterprise, but with the state intervening where it considers necessary to alleviate economic and social problems. It has used planning as a means of implementing its development programmes. So far, there have been five 5-Year Plans, the first two solely for Peninsular Malaysia. The Plans formally lay down the basic objectives of the government, give reviews and forecasts of the development programmes and the financial allocation to the major sectors. The estimates are highly aggregative, with no indication of the basis of the forecasts.

2. There were race riots in May 1969 that resulted not only in a change of leadership, but a more vigorous emphasis on distribution policies.

The presentation at times appears like a party manifesto. At the heart of the last two plans has been the so-called "New Economic Policy," whose aim is to achieve national unity, a major problem in the plural society.³

In a nutshell, the major policy aims expressed in the various development plans have been:

- a. to diversify the economy by reducing dependence on the rubber-tin specialization;
- b. to eradicate poverty by providing opportunities for greater labour participation for a new breed of young and educated people, as well as reducing underemployment both in rural and urban areas;
- c. to uplift economically the bumiputras, and to increase their commercial participation so as to eliminate the identification of ethnic groups along occupational lines;
- d. to achieve a more balanced distribution of wealth by ensuring that bumiputras would hold about 30% of the ownership of all wealth by 1990.

The approach is almost eclectic, and the strategy an act of economic modernization and at the same time, of social engineering. In current economic jargon, it could be viewed as an effort to achieve redistribution with growth.⁴

3. This policy arose directly after the 1969 race riots, and the aim is to alleviate poverty, particularly among Malays.
4. See Chenery and Ahluwalia (1974) on the foundations of this strategy, which uses the familiar Harrod-Domar growth model in an economy that is segmented into several sectors, and examines the economic linkages among these sectors. The strategy appears to be a justification of government intervention to solve the problems of income distribution and dualism. For discussions on other development strategies see Nurkse (1953), Lewis (1955), Myrdal (1968), and Bauer (1971).

There have been mixed views regarding Malaysia's post independent economic performance. The government view is that the transformation of Malaysia's social and economic framework will take about a generation to achieve. Nevertheless, the general performance, it reckons, has been favourable "despite the uncertainties of the international economic situation and developments beyond the nation's control."⁵

As far as the economic growth rate is concerned, it has been very impressive as figures in Table 1.1 show - averaging 9.7% between 1960-1977, compared to the 8% achieved between 1947-60. In other words, the shift from colonial status to one of political independence has not affected the general character of economic growth, although Malaysia still continues to be highly dependent on world demand conditions. Concomitant with this economic growth, the per capita income too has risen by about 6% per annum between 1960 and 1977, an increase that has outpaced the rate of inflation, which has been remarkably low.

Industrialization is part of the government's efforts to substitute imports and to promote exports, and at the same time, to create jobs. Unlike many less developed countries like India, Pakistan, and Brazil, industrialization was not motivated by the need to curtail imports in the face of severe balance of payments difficulties, nor was it promoted by inward looking policies like excessive import taxes and quotas as the experience of some countries had been. Hoffmann (1973), Lo (1972) and Kasper (1974) in their respective studies confirm that the import-substitution objective of manufacturing industries of consumer goods has been largely achieved, and so has been to meet the needs of domestic demand expansion. For exports, this has been quite impressive in wood products, clothing, food processing, tobacco products and non-electrical machinery. The costs of achieving industrialization has however been large - a high level of subsidy with

5. Third Malaysia Plan, 1976-1980, p. 11.

a bias towards capital intensity.

On the rural front, the focus has been on land development and modernisation of agriculture. This is being achieved more through direct government involvement rather than from being a spontaneous private interest responsive to market incentives as it largely had been during the pre-colonial days. Wafa (1975) and Wan (1976) both question the high cost of achieving the objective of increasing bumiputra participation in commercial agriculture.

Section 1.3: The Forestry Economy of Malaysia

The Forestry sector could be analytically divided into three broad categories:

1. Primary, which covers the production and management of commercial forests including logging.
2. Secondary, which covers the processing sector and wood-based industries like sawnwood, veneer, plywood and particle board.
3. Tertiary, which covers aspects like research, grading, marketing and export of forest produce.

All the above are commercially oriented activities, and represent a production cycle beginning from the production of the raw material, its processing, and eventual distribution.

We could add another category covering areas like recreation, environmental and wild-life protection. However, we will not consider in depth this category for three reasons. Firstly, the issues involve physical and biological factors that could best be handled by the forester or a botanist. Secondly, for a less developed country, recreation and aesthetic pleasure of forests, though important, are not of immediate concern compared to the commercial aspects to

generate income. Lastly, the problem of quantification is an immense one, given the lack of knowledge on this subject. In any case, the government has set aside protective forests for this purpose. In other words, our focus will be on commercial avenues in forestry.

The forestry sector, since the 1970's has been contributing about 5% of the Gross Domestic Product, compared to less than 3% in 1960, and negligibly prior to independence. This means that the sector's progress is relatively a post-independence phenomenon, unlike rubber, oil palm and tin, Malaysia's other major exports, which were nurtured during the colonial rule. The reason for the little interest shown by the British in Malaysian wood was that British and European hardwood requirements were then adequately met by imports from North America and Colonies in Africa, of which had advantage in transport costs over countries of Southeast Asia. Demand from other countries in the region like Japan and South Korea was small before the last world war.

To the extent that the computation of the G. D. P. is based only on items that are actually traded, the contribution of the forestry sector is underestimated. The intangible benefits like recreation, aesthetic pleasure and environmental preservation, are non marketed and are difficult to quantify, and therefore do not enter into National Income Calculations. If these were quantifiable and incorporated into G. D. P. calculations, the contribution of the forestry sector would be even more.

In 1960, sawlogs, sawnwood and plywood contributed about 5% of the total export earnings, and in 1973, their contribution was about a quarter of export proceeds (Table 1.2). In 1976, the three products took 19% of the earnings compared to the shares of rubber, which fell from 55% in 1960 to 23% in 1976, while that of tin fell from 14% to 11% during the same period. The export capacity of the forest products even took the government economic planners by surprise. The First Malaysia Plan (1965-70) underestimated the export volume of sawlogs in 1970 by 122%, and that of sawn timber, 43%. This implied that in 1970 alone, the export proceeds from these

SHARES OF SELECTED COMMODITIES IN TOTAL VALUE OF MALAYSIAN EXPORTS
(1960 - 1976 - % of total export value)

Year	Total Exports M\$ '000	Rubber	Oil Palm	Tin	Petroleum	Sawlogs	Sawnwood	Plywood	Others*
1960	3 634	55.1	1.7	14.0	4.0	3.3	2.1	neg	19.8
1961	3 238	48.4	1.9	17.1	3.3	4.2	1.6	neg	23.5
1962	3 260	45.3	2.0	19.0	3.3	5.0	1.5	neg	23.8
1963	3 330	44.3	2.1	19.3	2.7	6.2	2.0	neg	23.5
1964	3 382	41.3	2.4	21.5	2.5	6.1	2.7	0.1	23.4
1965	3 783	38.6	2.8	23.0	2.3	7.0	2.6	0.1	23.6
1966	3 846	38.3	3.1	20.6	2.7	10.0	2.1	0.1	22.9
1967	3 724	34.2	3.1	20.3	3.3	12.8	2.9	0.4	23.0
1968	4 123	32.8	3.0	20.1	4.2	13.3	3.6	0.6	22.3
1969	5 051	40.2	3.0	18.6	3.3	12.0	3.4	0.5	19.0
1970	5 163	33.4	5.1	19.6	3.9	12.5	4.0	0.9	20.5
1971	5 017	29.1	7.6	18.1	7.8	12.8	3.9	1.2	19.5
1972	4 854	26.7	7.5	19.0	4.6	12.2	5.9	1.7	22.3
1973	7 372	34.0	6.3	12.2	3.6	13.4	7.8	2.1	20.5
1974	10 195	28.3	10.6	14.9	6.7	10.1	5.0	0.9	23.4
1975	9 231	21.9	14.3	13.1	9.2	7.3	4.8	1.0	28.4
1976	13 443	23.2	9.0	11.4	13.0	10.9	6.6	1.4	24.5
1977	14 911	22.7	12.0	11.4	13.5	10.2	5.3	1.3	23.6
1960- 1976 Average		33.4	5.0	17.4	5.2	9.4	3.8	0.7	23.1

Source: As Table 1.1
* mainly manufactured goods, pepper, copra and pineapples
neg - negligible, i.e. below 0.1 percent.

TABLE 1.2

two items were underestimated by over M\$ 400 million, a sizeable sum in Treasury budgeting. This lends support to the notion that the knowledge of the forest sector has lagged behind its rising significance. Rubber, oil palm and tin, on the other hand, have been subject to careful planning and monitoring. Manufactured woods products contribution to the total value of Malaysian manufactured products increased from 7% in 1967 to 12% in 1978.

Table 1.3 below shows the net foreign exchange earnings from all forest products, that is, the difference between export earnings and import expenditure for these products.

Table 1.3

Net Foreign Exchange Earnings of Forest Products
(1966 - 1977 - ^{million} Malaysian dollars)

Selected Years:	1966	1970	1975	1977	Increase 1966-77
Peninsular Malaysia	68.38	231.11	398.38	740.66	983%
Sarawak	107.27	197.34	116.25	342.54	219%
Sabah	254.54	393.45	577.75	1,263.81	396%
MALAYSIA	430.19	821.91	1092.38	2,326.98	441%

Source: Food and Agricultural Organization (F. A. O.): Yearbook of Forest Products, 1966-77, Rome, p.370-373.

As can be seen above, between 1966 and 1977, the net foreign exchange earnings have increased by over 400%. Most of this has been due to the expansion of manufacturing capacity that promoted exports and substituted imports. This has an important economic implication in terms of financing forestry projects. The various

annual reports of the Forest Department suggest that for nearly all states, the revenue which the government obtained from royalties, and other duties from forest products has always exceeded expenditure in terms of wages and salaries, afforestation and silviculture and research. For Malaysia as a whole, only M\$ 55.5 million or 0.3% of the total development expenditure has been earmarked for forestry during the period 1975-1980, with PM taking 83%, Sarawak, 12% and Sabah, 5%. For Peninsular Malaysia, this would be less than 10% of the total revenue collection. Thus, the funds required to manage the forestry sector are generated within the sector itself. Unlike the experience of some countries, like the United Kingdom, other sectors of the economy do not need to subsidise forestry, (at least if past trends continue), but rather, as the findings of a Food and Agricultural Organization (F. A. O. 1970-1975) suggest, returns from forestry would provide some of the capital required for agricultural development for the period 1981-1985.

Since forestry is a state matter, all revenue derived from the forest lands by the governments forms an important source for financing the recurrent and development expenditure of the states. For Sabah, more than half of the state revenue comes from forestry while for Sarawak, the figure is about 20%. Within PM itself, the poorer states like Trengganu and Kelantan, the revenue impact from forestry is greater as they have very few other income sources like mining and rubber which the richer west coast states possess.

Section 1.4: Past Studies on the Economic Aspects of
 Malaysian Forestry

The literature on economic studies of forestry in Malaysia is meagre compared to that of Malaysia's other important primary commodities like rubber, tin and oil palm. This is because the forestry sector became important only from the 1960's. The biggest

work on Malaysian forestry has come from the Food and Agricultural Organization, covering the period 1970-1975, with the presentation of 9 technical reports and about 40 working papers. Three of the reports involve calculating a forest inventory for Peninsular Malaysia and Sarawak, giving projections of the areas logged and estimated future supplies. This aspect will be considered in Chapter 3. The study also delved into the commercial and technical aspects of the various wood-based industries including logging, sawnwood and plywood. It was mainly interested in recovery rates, technical lay-out of mills to minimise cost, and the location of wood-based industries. This information is analysed in Chapter 4, but broadly it is concerned with ways of breaking bottle-necks in supply as well as ways to achieve technical and economic efficiency.

There are three other contributions of the study. The first concerns the economic viability of developing quick growing pine pulpwood in Peninsular Malaysia. Nearly all of Malaysian pulp is at present imported from temperate countries, principally from Canada, Scandinavia and Australia. Using various cost-revenue-yield combinations, the study said that it was possible to achieve an internal rate of return of between seven and ten percent over 36 years from a 45000 acre (18,200 hectares) pine scheme. As far as employment needs went, it estimated a figure of 1,400 persons for a full year from the pine scheme or about one person to 32 acres compared to the 1976 figure of one person to 15 acres which we have estimated (see Chapter 7). The study emphasised that the employment of a larger number of persons than estimated would reduce the financial return of the plantation.

The second contribution is the estimation of forecasts of domestic consumption of plywood and sawnwood. The methodology and the forecasts are considered in depth in Chapter 6. The final aspect is a proposed economic model for the years 1975-1995 for Peninsular Malaysia based on how to achieve efficient programme of conversion of forested land to agriculture. Also included are ways to manage permanent forests with a cutting cycle of 40 years as opposed

to the present of 70. A cutting cycle or rotation can be defined as the period of time between the formation of a forest and when it is finally cut over. The F. A. O. proposed strategy assumes an important role of the state in terms of investment of forest lands, industries and re-locating wood-based plants.

There are several short-comings of the study. First of all, the various parts of the study, done by different people, has produced a voluminous work of over 5,000 pages that is lacking in any kind of unity for a sector analysis. Some reports purely pieced together data, and put forward projections that were often tinkered with. The basis of the trend projections is not explained. Sabah is totally ignored, and Peninsular Malaysia and Sarawak are treated as if they were separate countries. The forestry sector is almost treated in isolation from the major goals of the economy. Conversion of forest land from forestry to agriculture was accepted as a fait accompli. The approach is patchy and programmatic, lacking in any rigorous theoretical underpinnings. The study covered a very wide ground, but treatment of each subject is shallow. Its greatest use lies however, in its organisation of statistics of forest inventories, and checking on what data were available and how the data base can be extended. As such, we reckon, the report is useful as a starting point of exploring Malaysian forestry rather than a reliable analysis for making firm policy decisions.

The next piece of work on Malaysian forestry, by Radzuan Rahman (1975, 1976) is more selective. This research is restricted to Peninsular Malaysia, and considers three main aspects - the economic efficiency of the plywood and sawnwood mills, the future domestic consumption demand of sawnwood and plywood and investment appraisal of selected industries in the agricultural and forestry sector. Using results of a survey of 18 sawmills and 5 plywood mills in the state of Johore, Radzuan shows the economic inefficiency of the wood processing industry, which is the result of excess capacity and the failure to achieve economies of scale. While his efforts to quantify

the economic inefficiency of Malaysian processing industries are innovative, one could question his results on two counts - i. e. whether the cost data collected from the survey ^{are} accurate or representative enough (there is only one data point), and whether the mills selected in Johore state are reflective of the situation in other areas of the country. Regarding the forecasting of domestic demand for sawnwood and plywood, he uses the econometric technique testing out various functional forms, which we would examine in Chapter 6. The third part of his thesis attempts an investment appraisal of four industries - rubber, oil palm, plywood and saw milling. Using the Cost-Benefit technique, and considering only foreign-exchange and employment effects, he ranks the industries according to the objective that is to be maximised. Any investment appraisal is very sensitive to the kind of figures used for cost and prices of the various items. Cost and price figures in the study are in most cases projected in a rather ad hoc fashion (like increases of 2% per year or \$5 per year) for any firm economic reasoning. Any small errors in the cost-revenue figures could thus upset the cost-benefit ratio from which his policy arguments are based.

Another study is of Luqman (1978) who used the econometric technique to assess the demand for Malaysian sawnwood and plywood in the European Economic Community, and his main conclusion is that a lot would depend on Malaysia maintaining its credibility as a reliable and long-term supplier of quality timber. We would also examine this study in Chapter 6.

These three are the only major economic analyses of forestry in Malaysia. The others are non-academic papers presented by civil servants and business men at various conferences emphasising some of the problems of the industry like the availability of log supplies for domestic processing, marketing, quality control and general inefficiencies in the industry. A collection of these is contained in National Timber Congress (1976, 1979).

The field of forestry economics in Malaysia will therefore

appear to be relatively less trodden. As pointed out earlier, there are a host of economic aspects where research is needed, and to achieve any depth, one can only pick out a few of the important issues for rigorous examination, given the constraints of time and resources.

Section 1.5: Economic Issues of Malaysian Forestry in Malaysia, and the Contribution of the Present Study

We will spell out the main economic issues facing Malaysian forestry, and indicate the objectives and contributions made by this study.

An equilibrium between different uses of land which has evolved in most temperate zones, has yet to be established in most parts of Malaysia. Land here is an important political and economic instrument, particularly when existing government policy is to promote rural development and uplift a politically powerful indigenous group. As such, as would be made clearer in subsequent chapters, the conversion of forestry land to other uses, particularly agriculture, has been uncoordinated and ad hoc in nature. The policy to open up as much land as possible, and at the same time derive revenue from logs in view of high prices, has resulted in a harvesting rate of 400,000 hectares per year in the last 15 years, three times more than the rate feasible in terms of coping with conversion to agriculture or afforestation. Thousands of hectares of cleared land are therefore left barren and exposed to soil erosion, until either conversion or afforestation took place. Furthermore the rate of regeneration has been only about 10% of the desired level.

This rapid clearing of forests has given rise to fears that Malaysia will almost exhaust its primeval forest base by 1990. The most critical problem facing forestry in the rest of the century, therefore, would be a shortage of supply, which has repercussions on several fronts. First of all, the huge foreign exchange proceeds which the industry earns may be considerably reduced, and to the extent that

these proceeds subsidise other major development projects, it could constrain the momentum of economic growth, unless, of course, increased earnings from other sectors make up the shortfall.

Malaysia, in the last 15 years has seen the development of its wood-based industries, principally the high-capital absorbing integrated plants. A shortage of logs may hit these industries, unless imports from neighbouring Indonesia and Papua New Guinea are able to fill in the vacuum. This, besides increasing costs of production, would affect the competitive position of Malaysian industries, which have grown under the circumstances of a readily available cheap supply of logs. These will inevitably have repercussions on employment.

On the demand side, the foreign exchange earning capacity of wood products is subject to fluctuations in business conditions abroad. At the same time wood faces a continuing threat of competition from substitutes. An important question is whether forestry in Malaysia can continue to be a viable industry in the long-run, or would the industry fade out once the wood supply base disappears.

These are some of the salient issues we would be considering. Specifically, there are at least three major contributions of the thesis to knowledge of Malaysian forestry. First of all, all previous attempts at examining economic aspects of Malaysian forestry have limited the study to one particular region of Malaysia, principally Peninsular Malaysia. The present attempt would have a nation-wide focus, integrating Peninsula Malaysia, Sabah and Sarawak, thus coming out with policy guidelines that are more useful in national perspective. The three regions form an integral part of one country, and treating each region in isolation from the other is not appropriate given that Malaysia as a unit has already existed for 16 years. Such an integration would involve collating information from the three regions. Some of it has already been done, for instance in production and export figures. A large part of it is still scattered in various publications, particularly concerning employment, home consumption

of products, manufacturing, and income and expenditure. Piecing together the data from the regions, and probing into the deficiencies, have been tedious, given that the three regions grew up as separate civil service units. Even to the present day, they are quite independent of one another although steps are under way to coordinate policy. We feel that organising the data, estimating and interpreting the various economic aspects of forestry on a country-wide basis is a step forward towards finding ways of solving the problems of Malaysian forestry.

The other two major contributions of the study are not only useful for Malaysian forestry, but have methodological implications elsewhere for both forestry and other commodities. The first one concerns an econometric estimation of the supply and demand of three major forest products - sawlogs, sawnwood and plywood, which earn over 80% of the foreign exchange of the sector in Malaysia. Previous studies have ignored evaluating supply responses in forestry, considering only on forecasting domestic consumption for Peninsular Malaysia of sawnwood and plywood. We would extend this to cover supply and export demand as well. A novelty would be to test the model, formulated on the basis of economic theory, for not only data for the whole of Malaysia, but for each of the individual regions as well. This will enable us to see if there are regional variations as well as the extent of the aggregation biases. Dynamic aspects, not previously considered in Malaysian studies, will also be incorporated in the model. For Sabah and Sarawak, at least, it will be the first attempt at a rigorous econometric investigation of supply and demand aspects of forestry. The estimates of the price elasticities of supply and demand, the income elasticities of export and home demand, and the cross-price elasticities of three wood products (sawnwood, plywood and particle-board) will be used to work out forecasts as well as point out implications for guiding investment decisions. Linked to this study is a survey of the literature of econometric forestry models. We believe that this is the first time

that major studies in forestry since the last war have been brought together for critical analysis. This would reveal the state of econometric applications in world forestry.

The other area concerns an important issue in Malaysian development - namely the job promotion capacity of the major wood-based industries. For the first time, the employment aspect of **Malaysian** forestry will be subject to detailed quantitative analysis, together with rubber and oil palm as a basis of comparison. Three aspects of employment would be measured. The first is the elasticity of employment with respect to changes in output, export and home demand, and the speed of labour adjustment. This would involve both linear and non-linear estimation of employment functions, with non-linear estimation quite unusual in studies of less developed countries. The results can aid investment decisions in terms of job planning. The second concerns measuring the degree of employment stability over time in relation to output, exports and home demand for forestry, rubber and oil palm. The third part will involve evaluating the implicit costs of providing jobs in forestry in terms of capital and land intensity, and comparing these estimates with agro-based industries. Rubber and oil palm are specifically chosen because they are the most immediate competitors to forestry in terms of land.

Jointly, the analysis of these aspects will enable us to get notions of the economic potential of forestry to earn foreign exchange and meet domestic needs, as well as to absorb new labour. These two aspects will thus be the core of the thesis. To understand their implications we will consider the importance of Malaysia in the world wood trade, the Malaysian wood supply base and its processing industries. Broadly, the procedure of analysis would be as follows:

In Chapter Two, we will examine Malaysia's role in the world hardwood trade, the degree of market concentration of exporters and importers and price developments. This is to provide an international perspective to forestry.

This is followed by an analysis of the Malaysian forest supply base in Chapter 3. In the same chapter, the effects of the market structure on forest management will be considered, particularly in relation to the economic, political and social implications of wood disposal policies.

Chapter Four concerns the analysis of the logging, sawnwood, plywood and other wood-based industries, and the areas covered include competition, investment, capacity constraints and costing.

The first four chapters therefore provide a background for the quantitative analysis of supply and demand, as well as employment implications of forestry in Malaysia's development. Chapter 5 focuses on the methodological implications of the econometric technique, the data and the problems of computation.

From then on we move to the core of the thesis. Chapter 6 deals with an econometric investigation of supply and demand of Malaysian products, while Chapter 7 concerns the employment implications of forestry, details of which were presented earlier.

In the final chapter, Chapter 8, we will examine the main findings of the study and comment on the overall policy implications. The limitations of the study, possible extensions and new areas of future research, as well as the kind and quality of data necessary will also be pointed out.

CHAPTER 2

MALAYSIA AND THE WORLD HARDWOOD TRADE

Section 2.1: Developments in the Character of World Hardwood Trade

Broadly, wood is classified into two main groups - broad-leaved (Angiospermae) or commonly referred as hardwood, and coniferous (Gymnospermae) or softwood. The distinction is not made on the quality of wood, but rather it is a biological division of classes of trees with softwoods having needleshaped leaves and bearing seeds on cones, while hardwood trees produce seeds enclosed in a case. Most of the tropical wood is hardwood in character, and our focus will be on hardwoods for this is where Malaysia's main interest lies.¹ Nevertheless it will be useful to make references to features of the softwood trade for comparative purposes. In some areas like construction, furniture and packaging, softwood and hardwood are competitors, although most of Malaysia's species traded, like ramin and keruing, are mainly used for panelling, furniture and joinery in the market for high quality products.

A major characteristic of the world trade is the diversity in products and species with various grades and specifications. Some important wood-based products are sawlogs (sometimes referred to as roundwood), sawnwood (also called lumber), panels (veneer, plywood, particle board, fibreboard), pulp, paper and paperboard. Malaysia's world wood trade lies predominantly in three commodities, sawlogs, sawnwood and plywood, although other products like veneer, mouldings and particle board are becoming important. As such our concern will be on these three products. Appendix 2A lists the species, uses and substitutes of Malaysian wood products. The wide range of products and substitutes indicate that technology has an important role in wood trade.

1 There has been no recent indepth study on the world hardwood trade, and most information is patchy. Some useful insights are, however, provided by Toulumine Corporation (1971), Wassink (1973), Timber Trades Journal (1973), Takeuchi (1974), Erfruth and Rusche (1976) and Erfruth (1979).

A major feature of hardwood supplies in trade has been a rapid shift of source of supply. The impetus of the tropical hardwood trade was received after the Second World War when reconstruction and rapid economic development created demand for tropical hardwood. By then, a large part of the forests in the western countries, especially in Southern Europe, had been cut down to make way for agriculture, industry and infrastructure. Before the war, temperate hardwood species like the oak and beech, especially from the United States and Canada, catered to the excess demand in Europe. The dwindling supplies and the rising price of North American hardwood resulted in the tropical species penetrating the markets of Europe and Japan. Most of them came from West Africa like the okume and the utile, as well as the luan from the Philippines. The Sarawak species, ramin, too made inroads there. Most of the trade was conducted by the British and the French from their respective colonies.

The exploitation of the species from West Africa was not matched by sufficient regeneration. As a result of dwindling supplies, many African species were outpriced in the markets, especially in the late sixties. It was then that Malaysian species like the keruing, meranti and ramin penetrated more firmly the market. Previously it was cheaper for the Europeans to import from Africa in view of its relative proximity. There is a fear that the West African experience will be repeated in Malaysia, and perhaps new species from the unexploited Central Africa, parts of South America and Papua New Guinea may take over. The rapid erosion of the primeval forests, followed by insufficient regeneration, have produced rapid changes in species traded as well as their supply areas. Although taste could be a factor, economic reasons like availability of supplies, price and promotion are more important in producing a shifting and unstable hardwood trade. Supply sources are however more stable in softwood trade - North America, the Soviet Union and Scandinavia.

F. A. O. figures show that Asia, Africa and South America account for about 75% of the world hardwood forests, although the three continents have only 53 percent of all the world's forests. South America,

HARDWOOD SAWLOGS: WORLD PRODUCTION AND EXPORTS, AND MALAYSIA'S SHARE OF EXPORTS
(1946 - 1976)

Year	Output ('000 cu m)	Annual Change(%)	Exports ('000 cu m)	Annual Change(%)	Malaysia's share of Exports (%)
1946	113 700	-	1 310	-	negligible
1950	110 500	* -2.8	3 300	* 151.9	5.0
1955	112 100	+ 1.0	6 620	+ 100.6	9.0
1960	149 000	3.3	12 300	85.8	17.0
1961	160 000	7.4	14 300	16.3	18.1
1962	163 000	1.9	14 600	2.1	20.2
1963	173 000	6.1	17 900	22.6	20.4
1964	178 000	2.9	19 900	11.2	20.3
1965	180 000	1.1	21 200	6.5	22.6
1966	181 841	1.0	23 786	12.2	27.0
1967	187 691	3.2	25 227	6.1	28.1
1968	193 461	3.1	30 162	19.6	27.3
1969	201 648	4.1	35 050	16.2	25.0
1970	208 801	3.5	38 756	10.6	23.0
1971	211 480	1.3	40 701	5.1	21.6
1972	220 757	4.4	42 822	5.2	21.3
1973	239 716	8.6	52 406	22.4	19.3
1974	228 223	-4.8	45 172	-13.8	21.1
1975	208 560	-8.6	35 182	-20.6	23.3
1976	225 905	8.3	44 719	22.7	27.2
	1960-76 average			1960-76 average	1960-76 average
		2.7		8.5	22.5

Sources: F.A.O.: Yearbook of Forest Products, Rome, various issues 1946-1977.
Department of Statistics, Malaysia: Annual Bulletin of Statistics, various issues.
Bank Negara: Quarterly Economic Bulletin, various issues.
Ministry of Finance, Malaysia: Economic Report, various issues.

* 1946 - 55 + 1950 - 55 @ 1955-60

TABIE 2.1

HARDWOOD SAWWOOD, WORLD OUTPUT AND EXPORTS, AND MALAYSIA'S SHARE IN EXPORTS
(1946 - 1976)

Year	Output ('000cu m)	Annual Change(%)	Exports ('000cu m)	Annual Change(%)	Malaysia's share of world exports (%)
1946	46 150	-	1 300	-	2.5
1950	47 540	12.8 ^a	3 210	146.9 ^a	6.4
1955	58 010	22.0 ^b	3 580	11.5 ^b	9.6
1960	71 600	23.4 ^c	4 400	22.9 ^c	13.0
1961	73 400	2.5	4 300	-2.2	10.5
1962	74 500	1.5	4 300	0.0	11.2
1963	78 400	5.2	4 500	4.7	12.7
1964	81 200	3.6	5 300	17.8	13.7
1965	82 100	1.1	5 500	3.8	13.6
1966	83 918	2.2	5 821	5.8	12.2
1967	85 374	1.7	5 707	-2.0	15.0
1968	87 416	2.4	6 340	11.1	17.6
1969	93 215	6.6	6 897	8.8	17.9
1970	92 525	-0.7	7 185	4.2	19.7
1971	94 011	1.6	7 234	0.7	18.6
1972	95 504	1.6	8 398	16.1	21.4
1973	97 118	1.7	10 613	26.4	21.0
1974	94 784	-2.4	8 956	-15.6	22.3
1975	91 719	-3.2	7 993	-10.8	23.6
1976	97 751	6.6	10 887	36.2	28.1
	Average (1960-76)		Average (1960-76)		Average (1960-76)
	2.0		6.6		17.0

Sources: As at Table 2.1

TABLE 2.2

a - 1946-50

b - 1950-55

c - 1955-60

PLYWOOD : WORLD OUTPUT AND EXPORTS, AND MALAYSIA'S SHARE OF WORLD EXPORTS
(1946 - 1976)

Year	Output ('000 cu m)	Annual Change (%)	Exports ('000 cu m)	Annual Change (%)	Malaysia's share of World Exports (%)
1946	3 100	-	335	-	0.0
1950	6 170	9.9 ^a	400	22.4 ^a	0.0
1955	10 990	7.8 ^b	1 000	14.3.9 ^b	0.0
1960	15 400	40.1 ^c	1 500	50.0 ^c	0.1
1961	16 500	7.1	1 500	0.0	0.1
1962	18 200	10.3	1 700	13.3	0.2
1963	20 100	10.4	1 900	11.8	0.1
1964	22 300	10.9	2 360	24.2	0.3
1965	24 300	9.0	2 540	7.6	0.4
1966	25 577	5.3	2 781	9.5	0.5
1967	26 559	3.8	3 031	8.6	1.0
1968	29 884	12.5	3 832	26.8	2.0
1969	30 839	3.2	4 191	9.4	2.6
1970	32 959	6.9	4 477	6.8	3.2
1971	36 595	11.0	4 901	9.5	4.0
1972	39 835	8.9	5 733	17.0	4.7
1973	42 278	6.1	6 498	13.3	5.8
1974	36 150	-14.4	4 923	-24.2	4.4
1975	34 130	-5.6	5 185	5.3	4.8
1976	38 609	13.1	5 995	15.6	7.1
		Average 1960-76		Average 1960-76	Average 1960-76
		6.4		9.1	2.5

a - 1946-50

b - 1950-55

c - 1955-60

Sources: As at Table 2.1

TABLE 2.3

which has 57% of the world hardwood stock only produces about 15% of the world hardwood log production whereas Asia, which has only a quarter of the stocks, currently produces over 40% of the world output.

Africa is responsible for a quarter of the world production. Malaysia on its own produces 2.6% of the world hardwood logs. (The reason for South America's low share is taken up in the subsequent section).

Since the last War, there have been increases in both the sawlog and sawnwood output. Between 1960-76, sawlog output rose by about 2.7 percent per annum (Table 2.1), while for sawnwood, the corresponding figure is 2% (Table 2.2). These increases are in line with world population growth - about 2.5% per annum since 1960. The growth rates of exports have been higher - 8.5% for sawlogs and 6.6% for sawnwood.

In volume terms, the amount traded in broadleaved sawlogs is about twice that of coniferous logs, but in the case of sawnwood, the picture is the reverse - the volume of softwood traded is about 5 times that of hardwood, mainly due to a lack of processing facilities in tropical countries. However, exports as a percentage of production have risen. In 1946, only 3% of all hardsawn wood produced was exported, but this doubled in 1960, and almost doubled again in 1976, when it was about 11% of all production. For sawlogs, the export participation is increasing, 1% in 1946, 8% in 1960 and 20% in 1976 while corresponding figures for softwood logs are 9%, 2% and 5%. The export participation of soft sawnwood too has risen from 8% in 1946 to 15% in 1960 and 17% in 1976. The processing of hardwood logs, although very impressive in respect of Malaysia, is rather modest when all the tropical log producers are taken together. Given a continuous supply of logs, the processing facilities in these countries are likely to increase. Already new processing centres like South Korea, Singapore, Taiwan and Malaysia have widened the trade participation of hard sawnwood and plywood.

We can summarise the current world hardwood trade as follows:

- I) MAJOR EXPORTERS: a) Sawlogs: Indonesia, Malaysia, the Philippines, Ghana and the Ivory Coast.
 b) Sawnwood: Malaysia and Singapore.
 c) Plywood: South Korea, Taiwan and Singapore.
- II) MAJOR IMPORTERS: a) Sawlogs: Japan, South Korea and the E. E. C.
 b) Sawnwood: The E. E. C., Singapore (for re-export), Canada and U. S. A.
 c) Plywood: the E. E. C., the U. S. and Canada.

Given this setup of the trade, it will be useful to point out some of the peculiarities of the hardwood trade, especially vis a vis softwood. The softwood trade is usually conducted by large-scale firms (multi-nationals included) and brokers whereas hardwood traders are usually small, and normally deal in a wide variety of species, specifications and grades for given end uses. The hardwood trade is very specialized, almost custom-built with demand often tied down to very exact specifications. The flow of the raw material tends to heavily depend on the reputation and reliability of the traders, delivery schedules and negotiating abilities. Hardwood importers, especially in Europe, tend to specialise in either plywood or sawnwood with each market having fairly specific structural characteristics. Most hard sawnwood importers, for instance, rarely handle volumes in excess of 20,000 to 25,000 cubic metres a year, whereas soft sawnwood importers could trade in this amount a month. In the United States, there is an organised futures market in Chicago for lumber and plywood, where standardisation in terms of grades and specification is crucial to the trading.²

2 Trading on lumber futures began on the Chicago Mercantile Exchange on 1 October 1969, with softwood plywood included two years later. For a broad overview of the futures market in lumber, see B. H. Box (editor): "Futures Trading in Plywood and Lumber - a Profit Margin Insurance," Papers presented at the October 1970 Seminar in New Orleans, as well as Chicago Board of Trade: "Commodity Trading Manual, 1976." Wood futures are as yet not traded in any other exchanges in the world.

Potentially, the tropical forests can supply some 30,000 to 40,000 different woody species, but trading is concentrated on a narrow range of species - not more than 150, mostly in small quantities. Less than two dozen of them could be described as commodities traded in bulk. The crucial factor is that the selling of the hardwood is by species rather than in terms of characteristics desired for specific end uses. This appears to be uneconomic. A classification and marketing system based primarily on density and enduse performance appears appropriate for general utility timbers, and will be a useful avenue for promoting lesser known species whose supply is less reliable.³

The paucity of data on world trade on individual species makes it difficult to analyse intra-species competition. Nevertheless, we propose to look deeper individually into the hardwood sawlog, sawnwood and plywood trade to learn about the market structure and price determination.

Section 2.2 The Sawlog Trade

Table 2.4 gives the world market shares of the exports (volume) of hardwood sawlogs. In 1975, Indonesia and Malaysia supplied 57 percent of the total world exports, with Malaysia taking nearly a quarter of the world share. For both countries this represents a phenomenal growth, for in 1950, their share was about 5 percent each. Indonesia's dominance took place only in the 1970's while Malaysia was already supplying a major share of the world exports since 1965.

A significant development is the reduction in exports from Africa and the Philippines which supplied more than half of the world exports in 1950's. Now their shares have been reduced by a half, principally due to dwindling supplies and restrictions in log exports to promote

3 See Lian (1968) and Wong (1974).

Table 2.4

Hardwood Sawlog Trade

(1950 to 1975)

EXPORT SHARE (percent of total world export volume)

	1950	1955	1960	1965	1970	1975
Malaysia	5	9	17	12.6	23	23
Indonesia	4	neg	0.9	0.7	20	34
Philippines	28	24	29	32	25	13
Papua New Guinea	neg	neg	neg	neg	0.4	1
Africa	27	37	36	27	18	14
South America	neg	0.5	2	2.4	1	neg
O. E. C. D.	27.8	17	11	0.1	4	5

IMPORT SHARES (percentage of total world import volume)

Figures in bracket denote percentage of total volume imported from Malaysia, ie, the Malaysian market share in the country.

	1950	1955	1960	1965	1970	1975
Japan	4 (n. a.)	30 (n. a.)	40 (24)	47 (37)	55 (30)	49 (38)
South Korea	neg (neg)	neg (neg)	neg (neg)	3 (52)	8 (35)	13 (34)
Hong Kong	neg (neg)	neg (neg)	3 (97)	2 (97)	1 (84)	1 (85)
Singapore	neg (100)	neg (100)	neg (100)	2 (99)	5 (99)	2 (96)
United Kingdom	16 (neg)	7 (neg)	3 (neg)	2 (neg)	0.7 (neg)	0.5 (neg)
France	7.6 (neg)	6.5 (neg)	7.9 (neg)	6 (neg)	4 (neg)	4 (neg)
W. Germany	5 (neg)	14 (neg)	12 (neg)	9 (neg)	5 (neg)	3 (neg)
Italy	6 (neg)	3 (neg)	58 (neg)	7 (neg)	5 (neg)	5 (neg)
O. E. C. D.	97	75	69.4	78	80	72

neg = negligible; n. a. - not available

Source as at Table 2.1

domestic processing.

In West Africa, standing volume of commercial species is declining rapidly within the most accessible localities. In Ghana and Nigeria, for instance, nearly all high forest has been allocated on concession, and there seem to be no unallocated tracts of forests within or outside reserves which are capable of sustaining major industrial units. In the Ivory Coast, most of the accessible forest area has been converted to agriculture. However, improved transport facilities and political stability may open up closed forests in Central Africa. Likewise, the O. E. C. D. countries, which exported a quarter of the world hardwood exports, principally within Europe and North America, now only contribute about five percent.

The leader in world imports of sawlogs is Japan, taking almost half of the world exports during the last 15 years to feed principally its processing industries to meet the demand in construction. Between 1966-1985, 27 million new housing units will be built in Japan, with about 20% all wooden buildings. The other major buyers are South Korea and the European Economic Community. While Japan and the E. E. C. import for domestic processing and consumption, South Korea principally imports veneer logs for processing into plywood, veneer, particle board and other panels which are then re-exported to the industrialised countries.

There appears to be a high degree of concentration in the world hardwood sawlog trade - a small number of countries involved in exporting and importing. In the case of exports, the three major suppliers account for about 70 percent of the world exports while the three trading groups take 75 percent of the imports (basing on 1975 figures).⁴ In market structure terms, there appears to be what may be called an oligopoly-oligopsony structure.

4. In the case of the softwood trade, there is similar concentration with the U. S. A. , The U. S. S. R. , New Zealand and West Germany exporting about 90 percent of the world exports in 1976. Japan took 66% of the imports in the same year, depicting monopsonistic tendencies, as in the case of hardwood imports.

In a move to regulate production and to bargain for better prices from importers (particularly the Japanese), Malaysia, Indonesia, the Philippines and Papua New Guinea have formed a cartel called the Southeast Asian Lumber Producers Association, SEALPA. The body, set up in 1974 following a slump in world wood demand, aims at fixing a floor price by adjusting production.⁵ However, due to the strong Japanese monopoly and the urgent revenue needs by Indonesia and the Philippines (both incurring large balance of payments deficits), SEALPA does not appear to have had a major impact in manipulating supply to affect prices.⁶ Japan is already diversifying its wood supply sources by making investments in Brazil and Argentina. Nevertheless, SEALPA represents a joint forum to bilaterally negotiate with importers, and at the same time enabling those involved in the trade to keep abreast with developments.

Table 2.5

Malaysia Export of Sawlogs by Country of Destination (1971-1977)

	71	72	73	74	75	76	77
Japan	53%	59%	66%	71%	66%	72%	72%
Korea	15%	14%	15%	13%	17%	13%	12%
	7%	8%	(neg)	(neg)	6%	8%	11%
Singapore	16%	15%	6%	5%	8%	4%	2%
Others	9%	4%	13%	11%	3%	3%	3%

Source as at Table 2.1

- 5 Under the scheme, yearly quotas are set up on total log exports to Japan (19.2 million cubic metres in 1978 compared to 21.6 million cubic metres in 1977), and the quota is shared among the member countries. A floor price has been fixed and it is reviewed monthly. At the same time the members are standardising grading methods of logs, and designing ways to promote lesser known species.
- 6 See Takeuchi (1974), p.6 and 7. He believes that Southeast Asian countries can command higher economic rents if they jointly discourage exports in unprocessed wood. No facts and figures are however given to justify this view.

From the Malaysian perspective, the geographical concentration of imports is high. Table 2.5 shows that almost all of Malaysia's log exports are concentrated on three countries - Japan, South Korea and Taiwan, with Japan taking about 70 percent. Malaysia supplies about 40 percent of Japan's total imports of hardwood, while the corresponding figures for South Korea is 35 percent and Taiwan, about 30%. Singapore and Hong Kong are heavily dependent on supplies from Malaysia, with over 90 percent of their total imports coming from Malaysia.

To promote domestic processing, the government banned the export of eleven popular species of logs from Peninsular Malaysia. In March, 1978, this was extended to three more species. Since September, 1976, there have been quotas imposed on the exports of all other varieties of logs of 16 inches (40.6 cm) and above in diameter to encourage wider use of lesser known species of local timber. With these export restrictions and the increased domestic processing in Malaysia, Malaysia's major importers are diversifying their sources of log supply, with Japan, South Korea, Taiwan and Singapore making investments in Indonesia and Papua New Guinea.

The potential new areas of tropical hardwoods - Papua New Guinea and Latin America - are likely to be more expensive to exploit. They contain a very low volume of timber per hectare, yielding only about a third of the volume found in a typical Southeast Asian forest. Also, the species-mix per hectare in these areas is more diversified than those in Malaysia, the Philippines and Indonesia. Together with a lack of infrastructural facilities, the exploitation and marketing costs are much higher.

Section 2.3: The Sawwood Trade

This is generally less concentrated than the log trade as shown in Table 2.6. Malaysia is a leader in the exports of hard sawwood, supplying almost a quarter of the world exports. In 1950 its share was five percent. The rest of the export market is divided among a very large number of countries, none of which supplies more than five percent of the world share. Indonesia and the Philippines, which are the main competitors in the sawlog trade, however, lag considerably behind Malaysia in the sawwood business, although they have the potential. Prior to the 1950's the O. E. C. D. countries were the main exporters (60 percent of exports in 1950), but currently their share has been cut by half.

On the import side, the O. E. C. D. countries take the giant's share with the E. E. C. taking over a third of the world's imports. In 1950, the E. E. C. took half the world imports. Countries which recently have expanded their imports of sawn hardwood are Canada, Singapore and the Middle East. U. S. A. 's share has fallen by one-third from 1950 to 7% in 1975.⁷ Most of the increased demand can be attributed to the expansion in construction activity in the developed countries, coupled with the growing affluence which opened new markets for the high quality species from Malaysia, like meranti, ramin and keruing.

The wood exported to western countries is graded according to the Malaysian Grading Rules (based on the Empire Grading Rules) which have given importers guarantees of quality and standardisation of sawn-wood from Malaysia. The bulk of Malaysia's ungraded timber is released domestically or ends up in the less sophisticated Middle Eastern markets, which take up about eight percent of Malaysia's

7 In respect of the soft sawwood market, in 1976, Canada, the U. S. A. , the U. S. S. R. and Scandinavia supplied about 80% of the world exports, while the imports were also taken by the developed countries, with the E. E. C. , the U. S. A. and Japan taking about 70%. Thus the softwood market is predominantly concerned with trade among developed countries while that of hardwood, essentially between the less developed countries and the developed.

Table 2.6

<u>SAWNWOOD TRADE</u>		(1950-1975)				
<u>EXPORT SHARES</u>		(percent of total world export volume)				
	1950	1955	1960	1965	1970	1975
Malaysia	8	9.6	13	13.7	19.7	23.6
Singapore	n. a.	n. a.	n. a.	7	10	3
Philippines	6.6	3	6	2	0.3	neg
Indonesia	neg	neg	neg	neg	neg	5
Africa	4.8	9.7	13.8	13.3	11	9
South America	6.8	6.3	2	4.8	8	7
OECD	60	27	30.7	40	32	31

IMPORT SHARES (percent of total world import volume)

Figures in brackets refer to Malaysia's market share in the country of origin

	1950	1955	1960	1965	1970	1975
E. E. C.	49 (neg)	40 (neg)	40 (11.3)	41 (18.8)	43 (23.8)	37 (53)
U. S. A.	22 (neg)	17 (neg)	15 (neg)	14 (0.11)	12 (0.12)	7 (1)
Canada	neg	neg	5 (neg)	5 (neg)	3 (neg)	6 (neg)
Australia	neg	3 (n. a.)	4 (95)	4 (87.9)	4 (80)	3 (61)
Singapore	neg (99)	neg (99)	neg (99)	1 (92)	4 (98)	8 (99)
OECD	77 (n. a.)	72 (n. a.)	71.7 (15)	75.5 (38)	76 (25)	64 (48)

neg - negligible

n. a. - not available

Source: as at Table 2.1

exports.⁸ The grading factor has been important in expanding sawn-wood exports from Malaysia.

Table 2.7

Malaysian Exports of Sawnwood by Country of Destination (1971-77)

	71	72	73	74	75	76	77
Singapore	18%	18%	17%	23%	22%	19%	20%
E. E. C.	43%	44%	47%	37%	53%	56%	43%
U. S. A.	8%	9%	5%	6%	2%	2%	neg
Australia	11%	9%	9%	13%	8%	8%	7%
Others	11%	12%	22%	13%	15%	15%	22%
Japan	9%	8%	neg	8%	2%	neg	neg
Middle East	-	-	-	n. a.	n. a.	n. a.	8%

Neg - negligible

Source as at Table 2.1

Japan's feeble interest in sawn hardwood, or any processed hardwood, is a source of disappointment to most producers. Up to 1964, the Japanese government restricted imports of tropical wood in the manufactured form. The lifting of the restrictions however do not seem to have resulted in Japan increasing its imports.⁹ Rather, in the

8 In 1975, 56% of timber exported was graded, compared to 25% in 1972. There have been periodic disputes among Middle East buyers and Malaysian sellers over quality expectations. The Board is trying to translate the Grading Rules into Arabic to minimise squabbles. See Akbar Khan: The Middle East Market for Timber products in Malaysian Timber Congress (1976), p. 66-67.

9 At conferences on wood matters, the Japanese importers have said that they prefer to import logs instead of processed wood because manufactured products from tropical countries have not been to Japanese specifications, for Japanese carpenters and craftsmen still think in terms of shaku and koku (Japanese measures) when using sawnwood. As 15 large trading companies, forming the Japanese Lumber Industries Association, control supplies to the 4000 wholesalers and 26000 retailers, foreign exporters have found it difficult to sell their products directly in Japan.

case of Malaysia, Japan's share of Malaysia's exports is now less than two percent compared to about 10 percent in 1970. (Table 2.7). Most of the Malaysian exports go to the E. E. C. and Singapore.

Besides the vagaries of world demand conditions stemming mainly from business cycle fluctuations, the sawnwood trade is likely to face two major problems. The first is the availability of regular supplies. The rapid clearing of forests in most hardwood log supplying countries have put constraints on the availability of logs for processing. This is particularly so in Malaysia, where the government in December 1978 lifted restrictions to permit imports of certain species to help rationalise the distribution pattern of log supply to the domestic timber processing industry. Import duty of 15% and an import surtax of 5% were lifted on all imports. The second problem is from possible substitutes both from the wood and non-wood sectors. Plywood and particle board have made inroads in areas where sawn wood was previously used, and so have plastic, steel, aluminium. See Appendix 2A.

Section 2.4: The Plywood Trade

The plywood market is a relatively more competitive market, partly because both hard and soft wood can be used to produce it. Unfortunately, no statistics are available to indicate the relative proportions of softwood and hardwood used in the production of various wood-based panels on a worldwide basis. Although Malaysia's export share is only about 5 percent of the world market, plywood is the fastest growing industry of the forestry sector. Malaysia became a net exporter only in 1966.

South Korea is the largest world exporter of plywood with a quarter of the world exports in 1975. The other leading suppliers are Taiwan, and Singapore. The rest comes from industrialized countries, predominantly from the E. E. C., U. S. A. and Canada. (See Table 2.8).

T A B L E 2.8
PLYWOOD TRADE (1950 - 1975)

<u>EXPORT SHARES</u>	(Percent of total world export volume)					
	1950	1955	1960	1965	1970	1975
Malaysia	nil	nil	0.7	3.8	3.2	5.0
Singapore	nil	nil	neg	0.4	3.0	7.0
The Philippines	n.a.	n.a.	7.0	5.7	6.0	3.0
South Korea	n.a.	n.a.	0.3	6.7	18.0	24.0
Taiwan	nil	nil	0.1	0.1	13.0	15.0
Africa	n.a.	n.a.	5.3	4.3	3.0	1.0
South America	neg	neg	1.0	0.8	3.0	10.0
O.E.C.D.	n.a.	n.a.	n.a.	57.0	42.0	34.0

<u>IMPORT SHARES</u>	(Percent of total world import volume)					
	1950	1955	1960	1965	1970	1975
U. S. A.	9.0	33.0	35.0	34.0	38.0	31.0
Canada	neg	1.0	3.0	3.0	3.0	11.0
E. E. C.*	10.0	49.0	46.0	43.0	38.0	34.0
Rest of the World	81.0	17.0	16.0	20.0	21.0	24.0
Share of Developed Countries	n.a.	n.a.	n.a.	86.0	92.0	88.0

Neg - negligible

n.a. - not available

* For all years, the figures show the total imports of all the current nine members to facilitate comparison .

Source: As at Table 2.1

The major importers are also the developed countries, with E. E. C. and U. S. A. taking a third each of all imports. More than 28% of Malaysian exports go to E. E. C. The market share for Malaysian plywood is 6% of all E. E. C. imports while the corresponding figure in U. S. A. is less than one percent. The major competition in the North American markets comes from South Korea, Taiwan and the Philippines, all of which came earlier in the field, and their special political and military ties with the U. S. A. give them favourable treatment in terms of quotas. Malaysia's other leading importer is Singapore, which re-exports the bulk. It has already overtaken the Philippines, a major rival in the world market share of plywood.

One of the difficulties which Malaysia's plywood exporters face is that most wood-based products are subject to high import duties in consuming countries mainly aimed at protecting their own industries. Australia imposes a 43 percent import duty on plywood in addition to quotas, the United States and Japan, 20 percent and the E. E. C., 13 percent. Thus, Malaysian plywood producers, saddled with high shipping costs to Europe which constitute at least 20 percent of the free on board value, have to be very cost sensitive to ensure that their prices are competitive. Further problems of the industry are considered in Chapter 4.

Section 2.5: Summary of the Salient features of the wood trade

Collating the analysis, we can observe the following salient features of the wood trade:

1. There appears to be a pattern of regional specialisation with East Malaysia, Indonesia and the Philippines the log exporters, West Malaysia, Singapore, Hong Kong, Taiwan and South Korea, the in-transit processing countries, while Japan and Australia are the leading importers. Malaysia has made inroads in the wood processing field, especially in sawnwood and plywood

with the intransit processing countries importing a large bulk of the raw material from Malaysia itself.

2. Viewing from an international perspective, the specialisation in terms of the less developed countries supplying the raw material and the developed countries processing it, prevalent in the fifties and early sixties, is giving way to greater participation by middle income group countries like Singapore, Korea, Taiwan and Malaysia in wood processing. This pattern of raw material processing is similar to the situation of other primary commodities like rubber, oil palm and cotton.
 3. The O.E.C.D. countries, principally the United States, the E.E.C. and Japan, are the largest end-markets for processed hardwood, while the world export share, in percentage terms, of the processed wood trade is declining. Today's economic factors seem to indicate that logs can be manufactured into products in the country of origin more cheaply than in the destination country - due to rising cost of labour, freight charges, and handling in overcongested ports.¹⁰
 4. Malaysia's market shares in sawlogs, sawnwood and plywood have increased tremendously between 1950-75, with Malaysia as the leading world supplier of hardwood. On the contrary, the African and South Americas countries, despite their enormous reserves, have experienced fall in the sawlog trade without making much progress in the wood processing area.
- 10 Converting logs to sawnwood and plywood reduces by 40-60% of the volume and weight of the raw material, and potentially, freight cost would be less for transporting the processed wood to the consuming centres than shifting sawlogs. Since log raw material costs account for between 50-75% of the total cost of producing processed wood, ceteris paribus, log producing countries should have cost advantage in primary processing activities over log-importing processing centres like Singapore, South Korea, Japan and Taiwan.

Section 2.6: Price Behaviour of Malaysian Wood Products

There are several complications when considering the price structure and behaviour of hardwood products. Some of the major ones are as follows:

1. Due to the differing varieties of grades and species of hardwoods commercially traded, (and hence exhibiting different degrees of elasticities of demand and supply as well as the elasticity of substitution) it becomes very difficult to specify one good indicator of price for hardwood logs or sawnwood. Moreover, the prices do depend on a set of factors, rather variable, like the reputation and reliability of the supplier, the ability to supply on designated specifications, credit reliability.¹¹ If one were to attempt a species by species analysis (given the data), one may miss out some of the more broad and underlying features of hardwood price behaviour. On the other hand, by using the average price covering all the species, the respective qualities, and dimensions, we may come out with some general behaviour of hardwood prices, but miss out the behaviour of particular species which have their unique supply and demand characteristics that quite often deviate from the general behaviour of hardwood prices.¹²
2. There are two kinds of variations in prices - short term depending on speculative factors, government spending, income, business conditions, and the long term prices influenced by changes in cost

11 Some marketing problems of tropical timber are surveyed in Wassink, (1973), and The Toulumne Corporation (1971).

12 Most studies, including those by the F. A. O., use the export (import) unit value, ie, the total value of logs exports (imported) divided by the total volume exported (imported), thus implicitly averaging out species, and grades variations. A weighted average of the prices of species and grades will be more desirable but unfortunately, due to constant variations in the species and grade mix of tropical logs traded, it makes the weighting effort very difficult.

conditions, technology, productivity and development of substitutes. The long run average cost will be fundamental in affecting the long-term price. Empirically, these variations could only be distinguished if we have long time -series data.

3. Any long-run price comparisons are biased by price indices which do not account for quality changes. The industry today manufacturers to higher technical standards and applies more services to its products than the last century.

We now shift our attention to the period 1960-76, and look at the price developments of Malaysian hardwoods and compare them with aggregated unit values of all the hardwood species traded in the world market. The computations for sawlog prices are in Table 2.9, while for sawnwood they are in Table 2.10 and for plywood, Table 2.13.

In real terms, Malaysian sawlog and sawnwood prices have risen by about 50% between 1960-76, or an average annual rise of about 3%. In nominal terms, the increase is more than twice these figures. The picture is similar if we look in terms of world unit values of both sawlogs and sawnwood. The point of divergence has been the difference between the world unit values and the Malaysian unit values. For saw logs, generally, the world export price was higher by about 4 and 35 percent, the gap narrowing down in the seventies. For sawnwood, world prices were between 16 and 35 percent higher. The differences could be due to a host of reasons - qualitative and species variations, unequal bargaining power, besides the differing elasticities of supply and demand.

During the period there have been changes both in the supply and demand that kept the real increase at almost steady levels despite year to year fluctuations. On the supply side, the increased production costs due to higher wages and capital investment have been somewhat mitigated by increased recoveries and higher productivity. On the demand side, the post-war construction boom both at home and abroad have kept prices buoyant, although some substitution of wood by non-

PRICES (UNIT VALUES) OF HARDWOOD SAWLOGS, WORLD AND MALAYSIA (1960 - 1976)

	M A L A Y S I A *		W O R L D *		Difference between world and Malaysian Prices Value (M\$ per cu m) % ③
	M\$ per cu m (f.o.b.)	Annual Change	M\$ per cu. m (f.o.b.)	Annual Change	
1960	56.8	-	80.8	-	24.0
1961	52.9	-6.9	80.2	-0.7	27.3
1962	55.5	4.9	79.1	-0.4	24.4
1963	56.3	1.4	76.3	-4.6	20.0
1964	50.8	-9.8	73.2	-4.0	22.4
1965	55.1	8.5	73.4	0.3	18.3
1966	59.9	8.7	70.8	-3.5	10.9
1967	67.1	12.0	73.7	4.0	6.6
1968	66.7	-0.6	77.0	4.5	10.3
1969	68.9	3.3	77.3	0.3	8.3
1970	72.2	4.8	70.8	-8.3	-1.4
1971	73.2	1.4	69.6	-1.8	-3.6
1972	65.0	-11.2	70.3	0.9	5.2
1973	97.5	50.0	95.5	36.0	-2.0
1974	108.1	10.9	113.2	18.5	5.1
1975	79.0	-26.9	105.8	-6.5	26.8
1976	120.9	53.0	126.5	19.6	5.6

Correlation Matrix		* Unit Value	Total Value of Exports
Malaysia	World		Total Volume of Exports
Malaysia	1.00	③	
World	0.90	Percentage difference of world values over Malaysian values.	
		f.o.b. - free on board	

Source: At at Table 2.1

T A B L E 2.9

PRICES (UNIT VALUES) OF HARDWOOD SAWNWOOD, WORLD AND MALAYSIA (1960 - 1976)

	MALAYSIA *		WORLD *		Difference between world and Malaysian prices Value (M\$ per cu m)	% @
	M\$ Per Cu. m. (f.o.b.)	Annual Change	M\$ Per Cu. m. (f.o.b.)	Annual Change		
1960	131.0	-	167.0	-	36.0	21.6
1961	113.0	-13.7	165.5	-0.9	52.5	31.7
1962	104.4	-7.6	160.2	-3.2	55.8	34.8
1963	114.5	9.7	160.0	-0.2	45.5	28.4
1964	127.4	11.3	186.1	16.3	58.7	31.5
1965	128.7	1.0	192.8	3.6	64.1	33.2
1966	115.9	-9.9	194.0	0.7	78.1	40.3
1967	124.7	7.6	190.3	-1.9	65.6	34.5
1968	134.0	7.5	187.9	-1.3	53.9	28.7
1969	139.6	4.2	197.8	5.3	58.2	29.4
1970	147.0	5.3	200.2	1.2	53.2	26.6
1971	147.1	0.1	188.5	-5.8	41.4	22.0
1972	160.0	8.8	224.8	19.3	64.8	28.8
1973	257.6	61.0	257.3	14.4	-0.3	negligible
1974	253.9	-1.4	302.6	17.6	48.7	16.1
1975	233.7	-8.0	327.7	8.3	94.0	28.7
1976	290.4	24.3	349.1	6.6	58.7	16.6
<u>Correlation Matrix</u>						
	Malaysia		World			
Malaysia	1.00		0.96			
World	0.96		1.00			

Source: As at Table 2.1

TABLE 2.10

* Unit Value - $\frac{\text{Total Value of Exports}}{\text{Total Volume of Exports}}$

@ Percentage difference of world values over Malaysian values

f.o.b. - free on board

wood has reduced the wood content in construction.

An interesting point to note is that although the correlation between world unit values and Malaysian ones is strong (Table 2.11), the annual percentage changes differ. For example, for sawlogs, the fall in prices between 1963 and 1964 was twice that of the decrease in world unit values, while in 1973-74, the rise was twice that of world values. If we were to look at the prices of individual Malaysian species in Table 2.12 it can be seen that there are similar variations among the different Malaysian species. The picture is again the same for sawnwood. This confirms the difficulty of generalising the elasticities of demand and supply for hardwoods.

For plywood, the picture is slightly different (Table 2.13). First of all the world unit values reflect prices of plywood that is produced using softwood as well as hardwood, and in some cases both. There are quality variations, and hence Malaysian and world unit values are likely to diverge considerably (between 6 and 50% for 1960-76 period).

For Malaysian plywood, the real rise during the period was about 70 percent, or about 4 percent per annum, and the nominal increase was almost twice that - 150 percent. In the world market the real increase between 1960 and 1976 was only about 8 percent compared to a nominal rise of 52 percent. For Malaysia, the rapid rise in unit values was mainly due to increased productivity and recovery rates, especially in the 1970's when the industry underwent rapid modernisation, thus reducing average costs. In the world, the stable prices, despite the construction boom, could be due to firstly the creation of excess supply from new producers like Singapore, Taiwan, South Korea and Malaysia, and secondly, and more likely, the substitution by other wood-based panels like particle board, and fibre board.

The matrix on Table 2.11 shows a strong correlation among the prices of hardwood sawlogs and sawnwood as well as plywood, which is only logical. If we were to compare with the movement with rubber and oil palm prices, the correlation is not so strong, and in fact, for rubber is very weak. This is significant for Malaysia for if rubber prices are

CORRELATION MATRIX OF PRICES (UNIT VALUES) OF MALAYSIAN COMMODITIES
(1960 - 1976)

	Sawnwood	Sawlogs	Plywood	Rubber	Oilpalm	Petroleum
Sawnwood	1.00	0.94	0.97	0.17	0.65	0.83
Sawlogs	0.94	1.00	0.91	0.15	0.56	0.77
Plywood	0.97	0.91	1.00	0.21	0.76	0.91
Rubber	0.17	0.15	0.21	1.00	0.29	0.32
Oilpalm	0.65	0.56	0.76	0.29	1.00	0.87
Petroleum	0.83	0.77	0.91	0.32	0.87	1.00

TABLE 2.11

PENINSULAR MALAYSIA: AVERAGE LOG PRICES OF MAIN SPECIES (1960, 1971-1977)
 (Malaysian Ringgit per 50 cubic feet or 1.416 cubic metres)

	Belau	Chengal	Keruing	Kempas	Kapur	Dark Red Meranti	Yellow Meranti	White Meranti	Mengkulang	Mersawa
1960	na	na	70	na	na	75	na	na	na	na
1970	90	na	70	75	na	110	75	na	na	110
1971	87	112	61	53	75	165	60	83	96	85
1972	88	118	60	54	76	na	62	93	102	92
1973	128	152	109	77	116	176	85	136	139	132
1974	131	181	108	85	108	134	82	127	126	123
1975	126	196	113	84	104	161	84	119	120	113
1976	138	183	121	86	125	211	97	136	127	129
1977	88	127	na	62	93	na	na	na	na	na

na - not available

Sources: Forestry Department, Peninsular Malaysia Forestry Statistics, 1971-76, 1972-77.
 Malayan Forester, various issues, 1960-1976

TABUNG 2.12

PRICES (UNIT VALUES) OF PLYWOOD, WORLD AND MALAYSIA (1960 - 1976)

	MALAYSIA*		WORLD*		Difference between world and Malaysian prices. Value (M\$ per cu m) % ^③
	M\$ per cu. m. (f.o.b.)	Annual Change (%)	M\$ per cu. m. (f.o.b.)	Annual Change (%)	
1960	200.0	-	428.4	-	228.4
1961	250.0	25.0	427.0	-0.3	177.0
1962	250.0	0.0	396.5	-7.1	146.0
1963	250.0	0.0	396.5	0.0	146.0
1964	244.4	-2.2	433.1	9.2	177.2
1965	326.5	33.6	431.5	-0.4	105.0
1966	359.2	10.0	443.5	2.8	84.3
1967	375.6	4.3	445.2	0.4	69.6
1968	381.9	1.6	434.3	-2.4	53.4
1969	327.5	-16.6	454.2	4.6	126.7
1970	368.6	12.5	446.6	-1.7	78.0
1971	332.9	-10.9	426.3	-4.5	93.4
1972	341.9	2.7	466.5	9.4	124.6
1973	496.5	45.2	529.2	13.4	32.7
1974	464.6	-4.4	589.1	11.3	124.5
1975	528.9	7.8	596.0	1.2	67.1
1976	483.2	-8.6	652.7	9.5	169.5

Correlation Matrix		* Unit Value	③ Total Value of Exports Total Volume of Exports
Malaysia	World		
Malaysia	1.00		
World	0.83		

③ Percentage difference of world values over Malaysian values.
f.o.b. - free on board

Source: As at Table 2.1

TABLE 2.13

low, then the loss of foreign exchange earnings from rubber, if not met by greater output, could be compensated by higher prices from the wood trade. The price of rubber has fallen by 17 percent in real terms between 1960 and 1976, partly due to competition from synthetic rubber and partly due to reduced costs resulting from better yields. While the rise for tin prices has doubled in real terms during the period, arising from the rapidly depleting resource, oil palm prices rose only by 3 percent during the same period, similar to sawlogs and sawnwood.

In terms of the degree of fluctuations, the instability indices Appendix 7B indicate that the difference among the main primary commodities exported by Malaysia is small except for petroleum. Sawnwood prices during the period had the least amount of instability. Overall, the 1960-76 period could be described as a relatively stable period as far as price fluctuations went, compared to say the 1950's decade, or the decades before that. If not for the rapid changes in oil prices from 1973, prices of the primary commodities would have been less unstable.

One interpretation of the price trends over the period up to 1976 is that there appeared to be no significant constraints on the supply of forest products except for certain clearly defined qualities. It would seem that rising costs in the forest and mill were offset by improved technology and labour productivity. The respective supply/demand/price relationships of sawlogs and their products have evolved more or less in parallel.

CHAPTER 3

THE FOREST RESOURCE BASE, OWNERSHIP AND
ADMINISTRATIONSection 3.1: Forest Area and Inventory

Like any equatorial country, blessed with plenty of sunshine and rainfall throughout the year, Malaysia has a luxuriant and extensive forest base, but it is a resource that is dwindling with the rate of economic development. When we talk of the supply of trees, there is a need to distinguish between physical supply and economic supply. The physical supply is the total recoverable quantity of the resource in existence, under given biological and technical conditions. But the economic aspect would involve cost-revenue considerations, and is a schedule showing the flow of resources that will be supplied at different price levels. When we talk of resource scarcity, we have to take both physical and economic aspects into account. In economic terms, a mere existence of the physical supply is of little use unless one is able to harvest the raw material at a price that can be sold. Protective forests which are part of the resource base that are preserved for environmental reasons will not be considered as part of the economic supply. Nor will inaccessible forests that are not economical to harvest.

The supply has both a static aspect and a dynamic aspect. By static we mean the existing stock of trees, and a forest inventory usually shows the number of trees, their age, species, average volume and grades. The dynamic aspect concern the growth and mortality rates of trees that will affect the supply at different periods in the future. These depend on the inherent characteristics of the species and on its environment. These, together with cost-revenue factors, can help to determine the optimal time path of harvesting of trees over one or more cutting cycles. Appendix 3A summarises the concept of growth in forestry and a review of the rates of studies in Malaysia.



A complete forest inventory of Malaysia was only ready in the early seventies - 1972 in the case of Peninsular Malaysia and 1973 or the Borneo states.¹ This implies that a large part of the extraction and management has been done without adequate knowledge of the resource base. The inventories, done in liaison with the F. A. O., concentrate on the physical aspect of the resource - the species and the amounts available in terms of diameter class.

Currently, about 70 percent of the Malaysian total land area is under forest. The spread is greater for some regions as shown in Table 3.1; about 86 percent of Sabah is forested, while Sarawak's corresponding figure is 77 percent. In Peninsular Malaysia, out of the 7.2 million hectares (55% of total land area) that is under forest, about 1.2 million hectares^{are} for agricultural conversion. Of the rest (6 million hectares) nearly a third are protective forests - mainly on poor soils and steep terrain. These forests are for soil, water and environmental conservation as well as wildlife protection. The base for eventual permanent forest management for commercial wood is only 3.2 million hectares or about 24 percent of the total area. In comparison, rubber occupies 5 percent and oil palm, 2 percent of the total land area of Peninsular Malaysia. In Sarawak and Sabah, the long-term economic forest base is envisaged at 3.6 million hectares or 26 percent and 2.7 million hectares or 36.5 percent of the total land area respectively.

About 65% of the total primeval forest area has been harvested. Until 1976, harvesting operations were going on at the rate of over 400,000 hectares per annum. This has resulted in fears that if the rate continues unabated, Malaysia's virgin forest base would be gone by 1990, or even earlier.²

1 As there is no comprehensive account of data on wood supply covering Malaysia as a whole, it was necessary to collect data from a variety of sources, and where discrepancy arose the figures given in official data are used. Most of the data in this section comes from Forest Department (1976), F. A. O. (1970-75), Technical Reports 2 and 5, Forest Research Institute (1976) and National Timber Congress (1976).

2 The Ministry of Finance Economic Report, 1978-79 envisages that with a rate of 370,000 hectares per annum, the forests would be depleted by 1990. p. 119.

M A L A Y S I A - FOREST AREA AND EXPECTED PERMANENT COMMERCIAL FOREST BASE
(1975 - million hectares)

	Total Land Area	Total Area Under Forest	% of total area	Expected permanent forest base	% of total land area
PENINSULAR MALAYSIA	13.2	7.2	54.5	3.2	24.2
SARAWAK	14.0	10.7	76.5	3.6	25.7
SABAH	7.4	6.4	86.4	2.7	36.5
MALAYSIA	34.6	24.3	70.2	9.5	27.5

- Sources: a) Department of Statistics, Malaysia, Annual Bulletin of Statistics, 1977.
 b) F.A.O., "A National Forest Inventory of West Malaysia," 1973.
 c) Forestry Department, Peninsular Malaysia, "Forest Resources in Peninsular Malaysia", ASEAN Seminar on Tropical Rainforest Management, Kuantan, 1977.
 d) H.S. Martyn and M.P. Udarbe, "Forestry Planning and Management in Sabah", In National Timber Congress, p 16 - 17.
 e) J. Yong and E.G. Cheong, "The Nature of the Resource Base in Sarawak", In National Timber Congress (1976) p 14 - 17.

T A B L E 3 . 1

The method of extraction appears to confirm the Ricardian hypothesis (1891) that society tends to use resources in order of declining economic quality - an order which results in increasing cost per unit.³ Harvesting has been selective and concentrated on the commercially acceptable high quality trees of the most favoured species located in the most accessible forest lands. Hence, the remaining forest area contains a relatively larger proportion of lower quality and smaller dimension trees of favoured species, and almost full stock species that are less commercially viable. In other words, the quality of trees coming out of virgin forests in the next ten years is likely to be lower than that in the preceding years. The supply is therefore likely to be less elastic.

An important feature of the area set aside for permanent commercial forest management is that a large part of it lies in soils and terrain not particularly suitable for agriculture.⁴ In other words, the opportunity cost of the permanent forest area vis a vis agriculture is low. Much of the permanent forest will be on hills rather than on lowlands once the existing forest is harvested. Studies have shown that natural regeneration tends to be absent, scarce or concentrated on the ridges, and hence artificial regeneration would be necessary to maintain existing levels of productivity and quality.⁵ This means that the costs of production and harvesting of the next generation of forests will be higher than those incurred in the lowland forests.

The total acreage of forest land disturbed by shifting cultivation, while not significant in the case of Peninsular Malaysia, is important in East Malaysia. In Sarawak, about 22 percent of the land area is estimated to be under shifting cultivation; the area involved in Sabah is about 10 percent.

3 The Ricardo Theorem states that among several pools of a given resource, the pools of the highest quality (or of the lowest extraction costs) tends to be used first. This was mathematically developed by Hotelling (1931).

4 See Forest Research Institute (1976), p. 5-6.

5 The Forest Research Institute is conducting studies on silviculture procedures in hill forests to ensure that artificial regeneration is carried out successfully. The existing silvicultural procedures are based on techniques developed for lowland dipterocarp forests which usually contain adequate natural regeneration of the economic species.

Section 3.2: The Characteristics of Main Commercial Species.

There is a vast literature describing the features of tropical forests, and for Malaysia in particular, Deusch and Thomas (1940) and Whitmore (1975) are illuminating. We will not concern ourselves too much on the biological attributes but rather point out the salient aspects that have an important bearing on economic issues.

The so-called mixed tropical rain forest is characterised by the dominance of the family of Dipterocarpaceae which form about 75% of the commercially valuable timber. Unlike the monoculture pattern of growing coniferous trees in temperate countries, dipterocarp forests have a large variety of species, of different age and size classes, growing at different rates. Scientific studies have identified over 600 species in Malaysia, of which about a sixth are of the dipterocarp variety. Within the forest, individual trees may be increasing in height or girth at different rates varying with species, with crown size, availability of light and other factors.

From the economic point of view there is a high degree of uncertainty of supply, not only in terms of the type and volume of species but also quality.

The inventory for Peninsular Malaysia observed that only about two dozen of the 160 or so known species are of commercial significance, or which the five most popular ones - meranti, keruing, kempas, merbau and mengkulang, constitute 55 percent of the total output. The meranti alone take almost a third. A detailed list of the main species, their characteristics, uses and competitors is at Appendix 3B. There is a high degree of concentration in few species commercially. Although there has been evidence that other lesser known species are as good, commercial exploitation will be difficult unless dependability of supplies is assured.

The other major forest type is the peat swamp or wetland forest covering 3 million hectares or about 25 percent of the forest area. Over 80 percent are of commercial importance especially in Sarawak

where the ramin (*Gonystylus bancanus*) is popular in Western Europe. In areas protected from strong tidal currents are the mangrove swamps which are important for manufacturing dissolving pulp, charcoal and poles.

Section 3.3 Ownership, Wood Disposal and Management

More than 95 percent of the forest lands are owned by the respective state governments, which in effect, means that there are thirteen legal owners - the state governments.⁶ Effectively, the states have virtual monopoly rights over their respective forest lands, with full powers of disposal.⁷ Only since August 1977 has the Federal Government, amidst outcries of dwindling log supplies, formulated what has been called a National Forest Policy aimed at coordinating forestry programmes. The National Forest Council, the body implementing the policy, has, however, no jurisdiction over Sabah and Sarawak, both areas of huge log supplies. Legally, the state governments have still full rights over their forest lands but morally and politically, there is a machinery to prevent the haphazard and piece meal forest exploitations that have taken place in the past. Being owners, the respective state governments are also responsible for the management of forest operations.

In the forestry literature, there are at least three main methods of wood disposal from state land:

- 6 This stems from traditional English law, where the general ownership by the head of State, the Crown, cover vacant lands, and in this context forest lands. See F. A. O (1971) and Schmithusen (1976).
- 7 The Malaysian Constitution gives the Federal government powers "to ensure the orderly development and continuation of the forest produce industry to encourage uniformity and enforcement of the laws in each of the states . . ." See 9th Schedule, article 94(1). For a review of forest legislation see Lawson (1973).

- a) outright sale of forest land including timber on it by state to private individuals or corporations;
- b) sale of all timber directly by the state of its agencies while retaining ownership and management rights over the land;
- c) grant timber harvesting rights, where only standing trees are sold to private loggers, while the government retains ownership and management rights.

The first method (a) is not common in Malaysia barring a few exceptional cases in Sabah.⁸ The Malaysian government land policy is aimed partly at maintaining control of resource rich lands in its hands for political and revenue reasons.⁹ Method (b) too is not adopted because of the lack of expertise in logging practice, although state participation through joint ventures has taken place in the last few years. This method is quite common in developed countries like U. S. A. and Scandinavia.

In Malaysia, the principal method is to grant logging concessions, which are more commonly known elsewhere as forest utilization rights. A logging concession is basically an exclusive right given by the state government to an individual, a private company or to a corporation to exploit the forest potential, to harvest trees and or to manage a designated area under specified conditions. The state retains the ownership of the area while the concessionaire is able to use, exploit or manage the lands. This method is a common practice in most developing countries, though not necessarily an efficient one, as is made clear in the next section.

Turning to management aspects of forest lands, it will be useful to briefly consider some of the techniques used. A knowledge of the

- 8 A former Chief Minister is alleged to have devised means to transfer permanently some forest lands to himself and his retinue.
- 9 Control on the role of land in post-independent Malaya evolved from deliberate government policy to adjust to the dualistic economy as a result of foreign take-over of plantations and mines. Malay Reservation Areas were set up that were legally not allowed to be sold, leased, to non-bumputras. See Wan (1976).

management methods will be useful to understand the supply response of sawlogs and other wood products considered in Chapter 6. A useful overview of management techniques is by Clawson (1976) and U. S. D. A. (1976).

It has been a tradition in classical forest management to aim at sustained yield, which, put simply, means that trees should be cut down to make way for new ones once they have passed their best growth rates.* Looking in terms of a desired age-class forest, a steady state could be described as when a new part of each forest is being planted at every instant of time an old part is cut down, and forests of all ages are represented in equal degree. (Waggener, 1969; Clawson, 1976, 1977; Samuelson, 1976). This has been labelled by foresters as a synchronized forest. The point of maximum growth is practically chosen as the maximum mean annual increment of wood growth. Putting in stock-flow terms, sustained yield is a steady-state system when extraction rates are limited to the flow component of the system and natural resource stocks remain unchanged through time.

The concept of maximum sustained yield can be criticised both from economical and biological grounds. Economically speaking the concept ignores all cost-revenue considerations. Under sustained yield, the supply function of stumpage will be completely price inelastic. From the biological side, the concept of yield is ambiguous, especially in cases in which several ecologically independent species are harvested (Clark 1976). In such cases, the maximization of yield for each species separately is impossible, so that some form of weighting may be necessary. But the weighting method could be difficult. Should it be based on economic value or weight or biological value?

If economic factors are incorporated in the decision to harvest, the optimum time path of exploitation changes. Models incorporating the economic calculus take maximum sustained yield as a constraint on rather than a desideratum of exploitation. The basic objective of these models (Faustmann, 1968; Fisher, 1930; Boulding 1948; Clark 1976) is to maximise economic rent over one or more cutting cycles.

* The rates should be such that yield is equalized among periods.

The standing forest is viewed as one particular form of growing capital.

Turning to Malaysia, the system is based on the allowable cut concept, which simply means that a fixed annual coupe is allowed to be harvested. The cut is itself determined by sustained yield factors and other not too clearly defined social, political and economic variables.

Specifically, it is called the 'Malaysian Uniform System' defined as "a system for converting virgin tropical forest to more or less even-aged forest containing a greater proportion of economic species."¹⁰ The system, based on a 70-year rotation, implies clearfelling lots of forest stand, each lot being of a different age group, but within each lot all trees are even-aged. Unwanted species are poisoned off while enrichment planting carried out to sustain marketable species. The annual harvest is programmed by a host of rather ill-defined factors, principally the rate of conversion of land to agriculture. Sometimes, as will be clear later, private pressure and political lobbying may govern the outcome.

The Department observes that the harvesting rate has far exceeded the annual coupe. In 1972, the final felling was about five times above the annual allowable cut. The land is sometimes exposed to erosion and breeds unwanted growth. Where land is solely reserved for forest management, there is a large back-log of areas requiring treatment and artificial regeneration. Depending on the canopy opening, and on the composition of the lower storeys left standing, and of the undergrowth, the character of regeneration may be different and the quality lower. In Peninsular Malaysia, between 1970 and 1978, only about 6,000 to 7,000 hectares have been replaced, about 10% of the desired levels. There has been a backlog of about 2 million hectares needing replanting treatment due to insufficient funds, shortage of staff

10 Forest Department Annual Report, 1972, p. 2. Possible forest management systems in the context of Malaysia are considered in Griffin and Caprata (1977).

and improper planning and coordination.¹¹

Section 3.4: Economic Implications of Logging Concession Policy

A study of the forest concession policy is crucial to understand the economic efficiency of forest management in Malaysia. We can examine the policy by looking at the amount and length of the forest concessions, and more importantly, at the criteria for allocating concessions. This will enable us to grasp some of the possible avenues for breeding corruption, which the industry has become noted for.

As explained earlier, since forestry is a state matter, the characteristics and criteria of concession policy vary from state to state, and within each state, from one period to another depending on the party in power. Generally, the amount and length of concessions depend largely on the subsequent use of the area. If it is for agricultural conversion, as most forest lands have been in the past, the licences are annual, averaging 400 hectares. If the areas are for permanent forest management, the lands are leased out for anything from five to forty years. Table 3.2 shows the number and duration of the so-called "long term agreements" for the various states in Peninsular Malaysia. Recently, there has been a tendency to give small parcels to individuals, and larger areas, ranging between 20,000 and 125,000 acres (8-50,000 hectares) to state corporations and large companies aimed at setting up integrated timber complexes, and hopefully, managing their concession area on their own. About 770,000 hectares, or half of the forest reserves in Peninsular Malaysia, have been reserved for such complexes, on a 28-30 year cutting cycle. This recent shift of emphasis from the individual concessionaire to a corporation ties in closely with the aims of long

11 See Ministry of Finance Economic Report, 1978-79, p. 119, as well as Forest Department Annual Report, 1972 and Business Times issue 1.12.78.

FOREST CONCESSION AREAS DESIGNATED AS LONG-TERM AGREEMENT,
PENINSULAR MALAYSIA - AS AT DECEMBER, 1976

State	Area (hectares)	Number of Agreements	Duration (years)	Average Area per Agreement (hectares)
Johore	87 660	9	15 - 20	9 740
Kedah	14 870	24	1 - 10	620
Kelantan	467 134	24	13 - 40	19 464
Negeri Sembilan	34 600	8	7	4 325
Pahang	340 853	9	17 - 30	37 873
Perak	149 628	12	6 - 29	12 468
Selangor	29 148	2	21	14 574
Trengganu	216 228	11	7 - 25	19 657
TOTAL	1 340 483	98	1 - 40	1 211

- Notes:
- a) Agreements are between state governments and companies or individuals, mostly owning mills or integrated complexes.
 - b) Annual coup ranges between 75 to 11, 130 hectares.
 - c) Total area still unlogged as at 31 December 1976 was 1032188 hectares or 77% of total concession area.

Source: Forestry Department, Forest Statistics, Peninsular Malaysia, 1971 - 1976, p 4 - 12.

T A B L E 3.2

term forest management as well as the setting up of processing and other wood-base plants. Prior to this change, a large part of the area has been exploited under conditions of insecurity of tenure, discouraging incentives to invest in downstream processing.

Another shift in forest concession policy has been to give most of the concession areas to bumiputra individuals and corporations to promote their participation in industry. The Forest Department estimates that about 70 percent of all logging licences go to bumiputras. This implies that there is no free competition for bidding of concessions, ruling out the direct bidding by the capital owning non-bumiputras and foreign entrepreneurs.

Even if the special privileges could be supported on distribution grounds, practically they appear to weave an intricate pattern of abuse in the industry. Far from producing a dedicated bumiputra entrepreneurial group, the procedure has resulted in most of the bumiputra concessionaires transferring through back-door arrangements the licenced areas for the non-bumiputras, mostly Chinese, to operate. It is legal to hire contract labour as there is a lack of such expertise among the Malays.¹² The Chinese entrepreneur, especially if he owns wood processing plants, is only too eager to advance credit against delivery of logs. For the bumiputra concessionaire, it is an easy method to make money as he does not need any capital, except to exert his effort to secure the concession. More often than not, the politically influential bumiputras, most of them relatively well-off, have the best opportunity of securing the harvesting rights.

12 Once the concession has been issued the extraction of the forest produce is regulated by a permit or licence. The licensee obtains sublicences for each worker, between three and six months in duration, and is difficult to prove whether these workers are actually hired by the concessionaire. F. A. O. (1970-75) noted that due to the subcontracting practices it was difficult to obtain statistics of those actually doing the logging, and furthermore, it was found that contractors hardly kept proper records.

Such a practice, locally known as an Ali-Baba liaison, in which the Malay Ali provides the licences, and the Chinese Baba runs the business, is also common in a host of other arrangements where the policy of special preference is practised, for example, mining contracts, export and import licences, and taxi licences. There is thus an implicit distinction between a de jure concessionaire and a defacto operator. This nexus involving "proxy bumiputra participation" adds costs to the production process, as the silent partner has to be handsomely rewarded for his role. Popenoe (1969) observed in a study of Malay entrepreneurs that the mere provision of capital or licences or sheltered markets was not sufficient to create an entrepreneurial personality. In forestry, it seems to have created Malay millionaires overnight (during the timber price boom of the early seventies) but very few entrepreneurs.

Even if the 'right' bumiputras were to get the concessions, the allocation procedure has built-in avenues for corruption. The allocation body of all state lands, including logging concessions, is usually the State Executive Committee (Exco) made up of elected or appointed officials from the ruling party, headed by the Menteri Besar (Chief Minister). As the allocation committee meets usually in closed sessions to consider tenders or applications, it is well-placed to bring in political considerations in alienating state land to private individuals or companies. Besides favouring party supporters, this system would appear to make it easy for the party in power to manoeuvre concessions to its advantage especially near an election.¹³ This procedure could dissipate resources quickly, especially in the case of forestry where the issue of licences has been done on an ad hoc basis with little planned management. There have been cases of state officials accused of farming out concessions at rather uneconomic rates, possibly in return

13 A critical account on the political involvement in land matters is in Guyot (1971).

for political or monetary favours.¹⁴ Lately, some state governments have implemented the tender system, but its administration is still open to question.

Barriers to entry in forestry are thus not exactly economic, but rather, social and political in character. The degree of competition is restricted, and even if one were to accept this on distribution grounds, the allocation procedure appears to be one where the influential set their own rules to win the game. By any standard, this procedure of transferring economic rent is inefficient, although it is impossible to ascribe quantitative estimates to it. There would thus appear to be high opportunity costs in terms of economic growth in attempting to achieve the distribution objective, and to the extent that this is not achieved, the social costs are even higher. Corruption at the top can dissipate at lower levels, where say a forest clerk assessing royalty duty could be put in a prisoner dilemma situation, whether to join the band wagon and accept the bribe or stay out and be relatively worse off economically in the end. Such costs of corruption are very long term in nature, and could hinder the pace of development, which depends not only in the availability and quality of resources, but also on the political forces at work. It would seem that political interference dissipates the potentially strong impact the rich forest resource base could have on Malaysia's economic development.

14 The opposition Parti Islam state government in the east coast state Kelantan was toppled following disclosures that some prominent members, including a Minister, farmed forest area concessions to a Singapore firm at rates far below the normal market price.

CHAPTER 4

AN ECONOMIC PURVIEW OF MALAYSIA'S WOOD-
BASED INDUSTRIESSection 4.1 Introduction - Broad Overview of Wood-based
Industries.

We will analyse the various aspects of forestry, beginning with logging, followed by sawmilling, veneer and plywood, and other down-stream industries like furniture, moulding and particle board. Attention will be on the following attributes - growth in output, exports and home demand, ownership and degree of concentration, size distribution, investment and efficiency.

As indicated in Chapter 1, besides the studies by F. A. O. (1970-1975) and Radzuan (1975), the literature on the area is scattered in a large range of publications, including state annual reports and papers delivered at forestry seminars. More often than not, the analytical rigour and economic implications are subdued by the strong bias towards technical aspects, and in some cases, lobbying by representatives of various interest groups for government assistance. Nevertheless, by collating the information, and interpreting the statistics, we hope to formalise in a compact and orderly form some of the salient economic facets of the industry, and the behavioural traits that would enable us to interpret the quantitative results in subsequent chapters in a better light.

Table 4.1 gives a broad overview of the number of establishments of wood-based industries in Malaysia covering 1968, 1972 and 1979. Apart from sawmilling, most of them are relatively new - less than twenty years old. Nearly all are small by world standards with a gross annual value of output of less than M\$5 millions per plant (about US \$2 million). The annual survey of manufacturing industries in 1972 showed that, apart from logging, sawmilling and plywood, none of the plants in

NUMBER OF ESTABLISHMENTS OF WOOD-BASED INDUSTRIES

	1 9 6 8		1 9 7 2		1 9 7 9			
	Sarawak	Sabah	P. Malaysia	Sarawak	Sabah	P. Malaysia	Sarawak	Sabah
Sawmills	443	na	504	na	na	556	135	154
Plywood Mills	15	na	32	2	na	35	2	3
Planing and Joinery	64	na	54	14	na	95	na	na
Mouldings	na	-	na	-	-	52	14	1
Furniture & Fixtures	660	15	863	na	na	620	na	na
Wood Packing	36	-	17	na	na	na	na	na
Prefabricated Wooden Units and Components	3	-	3	-	-	8	-	-
Particle Board	-	-	1	-	-	1	1	2
Wood Preservation	na	-	na	na	na	94	4	na
Woodwool Slab	na	-	2	na	na	2	na	na
Pencil Factories	1	-	1	-	-	1	-	-
Match Factories	2	-	2	1	na	3	1	na

na - not available

- - no permanent establishments

Source: Department of Statistics: Survey of Manufacturing Industries, 1968, 1972, Peninsular Malaysia Annual Bulletin of Statistics, 1968-1977, Malaysia
 Survey of Manufacturing Industries, Sarawak, 1972
 Department of Forestry: Forest Statistics, Peninsular Malaysia, 1976, 1977
 Annual Reports, P. Malaysia, Sarawak and Sabah, various issues.

TABLE 4.1

the other wood-based industries had a gross value of output above M\$2 millions per annum with more than half producing below the M\$50,000 mark.

While sawnwood, plywood, veneer, particle board and mouldings can be described as export-oriented industries, the rest mainly cater for the domestic market, and were initially set up to substitute imports. A study of Hoffmann and Tan (1973) showed that between 1959 and 1968 the wood-based industries reduced imports by 6 to 9 percent, with the main stimulus coming from demand expansion (80 to 90%). Their contribution to total manufacturing exports has risen from 10 percent in 1968 to 12 percent in 1977, the highest in terms of value except for machinery and textile and footwear.

Regionally, they are unevenly distributed, most of them located in and around urban centres, especially in the west coast states of Peninsular Malaysia, which now have become timber deficient due to heavy exploitation.

We look first at the logging industry.

Section 4.2: The Logging Industry

Logging covers all activities concerned with the harvesting of trees, such as felling, bucking, skidding and bunching.¹ It is one of the fastest growing sectors in terms of value of output and foreign

1. Felling describes all the steps necessary to sever a standing tree, while bucking involves cutting a tree into segments called logs or bolts. Skidding concerns the movement along the ground of trees or tree segments from the stump to a landing area, and bunching is the piling or stacking process after the harvest. The Malaysian Industrial Classification, 1972, includes in the definition of logging, the hauling and transportation of timber up to the point of delivery to transport or manufacturing establishment. Useful references on logging techniques are in Conway (1976) and F. A. O. (1974).

exchange earnings, as noted in Chapter 1. Despite the importance of the industry, the first and only census of loggers in Peninsular Malaysia was completed in 1975, covering the year 1972. For Sarawak, there is a separate census (1970), while strangely, Sabah has yet to publish a report on logging despite the fact that it contributes one of the largest sources of revenue.² Fortunately, part of the lacunae has been filled by informative reports on the industry presented at various timber conferences.³ With the aid of the information from the census, the reports and personal communication with forest officials, we hope to bring out the main economic facets of the industry.

a) Sawlog Production, Exports and Domestic Consumption.

There was a five-fold increase of sawlog production between 1960 and 1976, with an average annual growth rate of 12.5% (Table 4.2). The rise has been mainly due to rapid conversion of forest lands to meet the needs of agriculture, and buoyant world demand. Regionally, Sabah has overtaken the Peninsular as the largest producer of sawlogs with a share of 46.8% in 1976 compared to Peninsular Malaysia's 36.4% and Sarawak's 16.8%. With export controls operating in P. M., most of the sawlogs are used for domestic processing, while in the Borneo states, a large part of the exports is still in the raw state though a phased programme of export quotas has been announced. For P. M. logs from Indonesia have to be imported to meet its manufacturing requirements in view of the relative nearness compared to the Borneo states.

Turning to exports, for Malaysia as a whole, 46.4% of all sawlogs produced were exported in 1976 compared to 37.5% in 1960. As shown in Table 4.3, Sabah is still the largest exporter, while

2. See Department of Statistics, Peninsular Malaysia (1975) and Department of Statistics Sarawak (1970).
3. A. G. Mordeno, Investments in Logging Operations in Malaysia, (p. 22. 25) in National Timber Congress (1976), gives useful insights into investment and cost aspects, while B. R. Ibbotson, Logging in Hill Forests in Sabah, p. 26 and Warren Ellis: An Overview of Logging Methods in Malaysia, p. 18-22 illuminate some of the problems of logging in Malaysia.

SAWLOG PRODUCTION, MALAYSIA (1960 - 1976)

Year	M A L A Y S I A		P. Malaysia	Sarawak	Sabah
	Output *000 cu m	Change(%)	(% share)	(% share)	(% share)
1960	5 568	-	40.5	21.0	38.5
1961	6 030	8.3	36.9	21.0	43.3
1962	6 443	6.8	35.8	21.1	43.1
1963	7 786	20.8	34.4	21.7	43.9
1964	8 407	8.0	35.5	22.0	42.5
1965	9 681	15.2	33.3	23.8	42.9
1966	12 340	27.5	30.9	24.2	44.9
1967	13 515	9.5	31.1	26.8	42.1
1968	15 201	12.5	33.4	27.8	38.7
1969	12 882	-15.3	33.7	27.3	39.0
1970	17 698	37.4	36.8	26.4	36.8
1971	18 015	1.8	39.7	21.7	38.6
1972	20 608	14.4	43.3	15.4	41.3
1973	24 024	16.6	40.4	13.5	46.1
1974	21 358	-11.1	40.4	13.2	46.4
1975	19 126	-10.5	39.5	13.1	47.4
1976	26 201	37.0	36.4	16.8	46.8
1960- 1976		Average 11.2	Average 36.6	Average 21.0	Average 42.4

Sources:

F.A.O. Yearbook of Forest Products, various issues 1960-77
 Forestry Department, Forest Statistics, Peninsular Malaysia
 Forestry Department, Sarawak, Annual Report, various issues
 Ministry of Finance, Economic Report, various issues, 1974-79
 Bank Negara, Quarterly Economic Bulletin, various issues.

T A B L E 4.2

SAWLOG EXPORTS, MALAYSIA - 1960 - 1976

Year	Volume '000 cu m	Annual Change (%)	% of total Output	Value M\$ mill.	Annual Change (%)	P.M. % share of volume	SARAWAK % share of volume	SARAH % share of volume
1960	2 088	-	37.5	118.6	-	18.6	16.7	37.5
1961	2 582	23.7	42.8	136.6	15.2	15.5	19.4	65.1
1962	2 937	13.7	45.6	163.1	19.4	18.6	25.5	55.9
1963	3 643	24.0	46.8	204.9	25.6	16.2	24.1	59.7
1964	4 045	11.0	48.1	205.4	0.2	17.4	17.0	65.6
1965	4 781	18.2	49.4	263.3	28.2	17.0	25.4	57.6
1966	6 432	34.5	52.1	385.1	46.3	17.1	30.0	52.9
1967	7 091	10.2	52.5	475.6	23.5	16.3	31.6	52.1
1968	8 240	16.2	54.2	549.5	15.5	16.5	36.3	47.2
1969	8 768	6.4	68.1	604.3	10.0	16.6	34.9	48.5
1970	8 914	1.7	50.4	643.6	6.5	18.2	35.1	46.7
1971	8 772	-1.6	48.7	642.0	-0.3	18.3	29.0	52.7
1972	9 119	4.0	44.2	592.5	-7.7	16.0	21.9	62.1
1973	10 122	11.0	42.1	987.0	66.6	6.6	18.7	74.7
1974	9 553	-5.6	44.7	1 032.8	4.7	6.1	17.6	76.3
1975	8 473	-11.3	44.3	669.5	-35.2	4.9	14.8	80.3
1976	12 172	43.7	46.4	1 471.9	119.9	3.0	24.3	72.7
1960-76		Average 12.5	Average 48.1		Average 21.8	Average 14.3	Average 24.8	Average 60.9

Source: As at Table 4.2

TABLE 4.3

SAWLOG APPARENT DOMESTIC CONSUMPTION, MALAYSIA (1960 - 1976)

Year	M A L A Y S I A		P. M. (% of total home consumption)	SARAWAK	SABAH
	Volume '000 cu m	Annual Change(%)			
1960	3 632	-	67.4	22.4	10.2
1961	3 940	8.5	66.9	17.5	15.6
1962	4 028	2.2	74.3	15.1	10.6
1963	4 278	6.2	64.8	19.2	16.0
1964	4 635	8.3	61.7	25.0	13.3
1965	5 211	12.4	65.3	21.0	13.7
1966	5 448	4.5	68.8	19.3	11.9
1967	6 495	19.2	70.4	21.2	8.4
1968	7 007	7.9	79.2	17.7	31.1
1969	4 002	-42.9	66.1	31.8	2.1
1970	6 862	71.6	69.0	23.0	8.0
1971	9 285	35.2	79.9	15.7	5.4
1972	11 796	27.0	81.0	12.1	6.9
1973	14 004	18.7	82.6	10.9	6.5
1974	11 781	-15.9	88.5	9.9	1.6
1975	13 970	18.6	76.5	9.2	14.3
1976	14 684	5.7	84.7	10.0	5.3
1960- 1976		Average 11.7	Average 71.7	Average 17.7	Average 10.6

Apparent Domestic Consumption figures are calculated as follows:
Total Production minus exports plus imports.

Source : As at TABLE 4.2

T A B L E 4.4

LOGGING - LEGAL STATUS OF OWNERSHIP AND PRODUCTIVITY

	PENINSULAR MALAYA		SARAWAK			
	Number of Establishments	Productivity ^b per unit	Productivity ^c per employee	Number of Establishments	Productivity ^b per unit	Productivity ^c per employee
Individual Proprietorship ^d	258 (55%)	140 376	8714	160 (59%)	48 829	4011
Partnership ^d	148 (31%)	266 554	11239	30 (11%)	24 550	5069
Private Limited Company	64 (13.6%)	776 500	16710	68 (25%)	15 152	7819
Public Limited Company	2 (0.4%)	647 000	10520	13 (4%)	1 060 137	5862

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- a Temporary licences to longhouses or village headmen included
 b Value added (value of output minus value of input) divided by the number of establishments
 c Total number of paid employees on full time divided by the value added
 d Includes concession holders and/log contractors (some overlapping in cases where contractor works for several licences of concession holders)
- Computed from: 1. Census of Loggers, Sarawak, 1970 p 1-5
 2. Census of Loggers, Peninsular Malaysia, 1972 p 1-6

TABLE 4.5

Peninsular Malaysia's share has fallen to only 3% in 1976, mostly to Singapore. The growth in value of exports for the same period was 21.8%, almost twice that of volume, indicating the effect of rising prices.

About 72% of sawlogs for domestic use is consumed by P. M., while Sarawak used 18% and Sabah 10% of their production levels. (Table 4.4). The growth rate has kept almost in line with output increases.

(b) Degree of Competition

The census reports show that there were 472 logging establishments in Peninsular Malaysia in 1972, and 298 in Sarawak in 1970. In Peninsular Malaysia, more than half of the establishments were in three states - Pahang, Trengganu and Johore, with Pahang having 25 percent of the establishments producing more than one third of the total output of logs.

Table 4.5 shows the legal status of the establishments, and the size structure in terms of output value and fixed assets. The following principal features emerge:

- i) More than 80 percent in P. M. and about 70 percent in Sarawak are under individual proprietorship or partnership. Only about 20 percent in both parts are registered companies. Direct foreign involvement is less than 5 percent in both areas, very significantly different from the situation in terms of rubber and oil palm, where 42.2 percent of the planted acreage were owned by foreigners in 1973, while the corresponding figure in coconut and tea estates is 68.9 percent.
- ii) Average output per unit is generally 2 to 3 times higher in establishments that are registered as companies than sole proprietorship and partnership.
- iii) Average productivity per employee also follows the same trend in Peninsular Malaysia, whereas in Sarawak the difference is relatively small. Productivity per employee in non-Malaysian

owned establishments is higher than those of Malaysian origin.

In the case of (ii) and (iii) above, productivity differentials could be attributed to the higher level of mechanization where ownership is in the hands of foreigners and/or companies. One has to treat these figures with caution firstly because there could be under-reporting by sole-proprietor-partnership units due to poor book-keeping habits, and secondly, using only one point in a time series could be unrepresentative.

As noted in the last chapter, there exist many contractual arrangements between licencees, contractors and subcontractors. Contract logging is necessary because, the short-leases for concession areas, coupled with the heavy capital investment involved, make it uneconomical for concessionaires to invest in long-term full-time logging activities. Another reason is that logging expertise is in the hands of the Chinese and foreigners while concession holders are usually bumiputras, lacking technical competence in the field.

The contractual arrangement has given rise to an oligopolist-oligopsonist position common in rice and fishing sectors. As concession holders and sometimes loggers are not au fait with the business, they make use of truck operators as sales agents. Truck operators have a good knowledge of sawmill and plywood mill owners interested in buying the logs, and it is usually through them that wood processors are dependent on their supplies. Vis a vis the processors, the truck operators behave as oligopolists while in relation to loggers or concession holders, they act as oligopsonist. As such, despite the positive discrimination policy practised in favour of bumiputras, the truck operators (mainly Chinese) are still entrenched in the business. However, despite criticisms of their role, these middlemen do perform a useful function in the chain of distribution.⁵

5. For a deeper treatment of the role of market intermediaries in less developed countries, see Bauer and Yamey (1954). They argue that a compulsory elimination of any class of intermediaries will mean "that their services have to be performed on more onerous terms by one or another of the parties between whom they stand." In our case, the concessionaire or the logger or the miller will have to do the job, more effectively performed by a specialized trucker.

The relationship of the three parties in the business (the owner of forest lands (the state), the concessionaire and the logger), all separate from one another, has however implications in terms of the efficiency of harvesting. F. A. O. (1970) noted that logging was conducted as an entirely ad hoc activity in which sub-contractors were virtually under-supervised. This resulted in on-the-spot decisions on procedures, road alignment and tree selection by men who have little understanding of the long-term consequences. The concessionaire can be regarded as an "absentee employer" who, with little knowledge of the technicalities of the business, gives only broad directions on the species desired, which results in bad harvesting standards. Logging becomes very selective, with little regard to ecological balance or proper drainage. It is like a gold rush - get the best saleable species in the quickest and cheapest (to the sub-contractor) way, and scoot.

(c) Costs and Investment

In terms of technology, Malaysian loggers have assembled a vehicle known as the "San Tai Wong," suitable to the terrain of Malaysia, rather than relying on imported equipment. However, the degree of application of modern technology varies with the size of the logging area. With forest areas being shifted to hilly parts, the scope of mechanisation will increase, and unless scale economies are there, the costs will be higher. Figures in Table 4.6 show that more than 90% of the fixed costs are in machinery and transport equipment. A summary of equipment and operating costs is in Appendix 4A. On the basis of these estimates, to be economically viable, the logger must have not less than 2,000 hectares of forest land per annum for harvesting.⁶ In the future, economic considerations would therefore favour

6. A. G. Mordeno explains how a huge investment in equipment could be made on a staggered basis for a large concession area. Basing on his figures, and taking into account operating costs, logging operations would appear to be economically viable for a concession area yielding about 150,000 cubic metres per year, about six times the average output per unit as at 1972.

FIXED ASSETS OF WOOD BASED INDUSTRIES - PENINSULAR MALAYSIA
('000 Malaysian dollars)

	Land	Building and Other Construction	Transport Equipment	Machinery & Equipment	Total Value
Logging (as at 31.12.1972)	116 (0.3%)	1 613 (5%)	25 575 (72%)	8 331 (22.7%)	35 365 (100%)
Sawmills (as at 13.12.1972)	11 729 (14.9%)	26 048 (33.1%)	21 065 (26%)	20 061 (26%)	79 513 (100%)
Plywood & Veneer (as at 13.12.1972)	6 173 (6.3%)	21 374 (22%)	7 908 (8%)	61 117 (63%)	96 572 (100%)
Total	18 104	1 234	49 766	55 754	214 239

Source: Department of Statistics, Census of Loggers, Peninsular Malaysia, 1972, Kuala Lumpur.
Department of Statistics, Survey of Manufacturing Industries, 1972, Peninsular Malaysia, K.L.

TABLE 4.6

capital intensive logging firms with large logging areas. This means that the number of logging establishments will decrease. However, Conway (1976) is of the view that despite mechanisation, logging will continue to be labour intensive.⁷ In the U. S. A. and Canada, labour constitutes between 40 and 45% of the total variable cost, while in Malaysia it is estimated to be only 25%, despite the fact that more men are employed per hectare. We will take this issue of employment in logging in Chapter 7.

Section 4.3.1: The Sawmilling Industry

a) Production, Exports and Home Consumption

Sawmilling is the first stage in wood-processing, and it involves the conversion of sawlogs into sawn pieces usually exceeding five millimetres. The industry is over 60 years old, with licencing first introduced in 1928. However, it received impetus only after 1931 following the development of trade between the British in Malaya and China. The industry was in a slump during the war years, and did not receive a boost till the 1950's during the Korean War commodity boom.

In 1976, the 822 mills of Peninsular Malaysia produced over 90% of the total Malaysian output, with Sarawak's 128 mills manufacturing 6.7% while Sabah's 154 mills, 2.9%. Sawnwood production quadrupled during 1960-1976, with an average annual growth rate of 9.4% (Table 4.7).

On the average, about 45% of the sawnwood produce is exported, with inferior grades going mainly to the domestic market. As for sawlogs, the growth in value terms was twice that in volume terms during 1960-76, also largely due to price increases (Table 4.8). Peninsular Malaysia supplies the bulk of the exports (about 73 percent), and most of these come from four states - Perak, Selangor, Johore

7. Conway (1976), p. 51

SAWNWOOD PRODUCTION, MALAYSIA (1960 - 1976)

Year	M A L A Y S I A		P. Malaysia (% share)	Sarawak (% share)	Sabah (% share)
	Output ('000 cu m)	Change (%)			
1960	1 396	-	74.3	20.3	5.4
1961	1 315	-5.8	74.3	20.8	4.9
1962	1 387	5.5	76.4	19.5	4.1
1963	1 509	8.8	74.8	21.9	3.3
1964	1 682	11.5	72.9	23.8	3.3
1965	1 710	1.1	70.5	26.0	3.5
1966	1 799	5.2	72.8	23.6	3.6
1967	2 104	17.0	70.8	25.9	3.3
1968	2 465	17.2	76.7	20.3	3.0
1969	2 501	1.5	77.8	19.0	3.2
1970	2 780	11.2	74.2	22.7	3.1
1971	2 894	4.1	77.8	19.0	3.2
1972	3 607	24.6	83.2	14.2	2.6
1973	4 038	11.9	82.5	15.1	2.4
1974	4 068	0.7	86.2	10.4	3.5
1975	3 810	-6.3	88.0	10.1	1.9
1976	5 364	40.8	90.4	6.7	2.9
1960- 1976		Average 9.4	Average 77.8	Average 18.8	Average 3.4

Source: As at Table 4.2

T A B L E 4.7

SAWNWOOD EXPORTS, MALAYSIA - 1960 - 1976

Year	Volume '000 cu m	M A L Annual Change (%)	Y S I A % of total Output	Value M\$ mil.	Annual Change (%)	P. M.		
						% share of volume	SARAWAK % share of volume	SABAH % share of volume
1960	573	-	41.0	75.1	-	53.6	41.0	5.4
1961	453	-20.9	34.4	55.3	-31.7	55.3	42.8	1.9
1962	481	6.2	34.7	50.2	-2.1	59.5	38.0	2.5
1963	570	18.5	37.8	65.2	29.9	62.6	36.5	0.9
1964	726	27.4	43.2	92.4	41.7	63.0	36.0	1.0
1965	753	3.7	44.0	96.9	4.9	63.0	36.0	1.0
1966	713	-5.3	39.6	82.6	-14.8	68.5	31.0	0.5
1967	853	20.3	40.8	106.9	29.4	68.0	32.1	1.9
1968	1 114	29.8	45.2	149.3	39.7	75.8	23.1	1.1
1969	1 235	10.9	49.4	172.3	15.4	76.5	22.7	0.8
1970	1 415	14.6	50.9	208.0	20.7	76.1	22.3	0.7
1971	1 344	-5.0	46.4	197.7	-5.0	78.3	21.0	0.7
1972	1 799	33.9	59.9	387.7	45.5	81.5	16.8	0.8
1973	2 230	24.0	55.2	574.4	99.7	88.3	11.5	0.2
1974	1 998	-10.4	49.1	507.3	-11.7	89.1	10.8	0.1
1975	1 890	-5.4	49.6	441.5	-13.0	86.8	12.8	0.4
1976	3 055	61.6	57.0	887.3	101.0	87.8	9.4	1.8
1960- 1976		Average 12.7	Average 45.2		Average 21.8	Average 72.7	Average 26.1	Average 1.2

Sources: As at Table 4.2

TABLE 4.8

SAWNWOOD APPARENT DOMESTIC CONSUMPTION, MALAYSIA (1960 - 1976)

Year	M A L A Y S I A		P. M. (% of total home consumption)	SARAWAK	SABAH
	Volume '000 cu m	Annual Change(%)			
1960	849.0	-	85.7	5.7	5.6
1961	883.0	4.0	85.1	8.9	6.0
1962	938.0	6.2	84.0	9.3	5.7
1963	958.0	2.1	82.1	12.7	5.2
1964	993.0	3.7	87.7	14.0	6.8
1965	991.0	-0.2	74.1	19.0	6.9
1966	1 025.0	3.4	72.8	20.1	7.1
1967	1 288.0	25.7	73.1	21.0	5.9
1968	1 389.0	7.8	79.3	13.6	7.1
1969	1 246.0	-10.3	79.6	13.7	6.7
1970	1 396.0	12.0	70.4	22.6	7.0
1971	1 649.5	18.2	79.0	16.4	6.6
1972	1 865.4	13.1	78.3	11.7	10.0
1973	1 831.5	-1.8	69.2	20.4	10.4
1974	2 109.8	15.2	79.0	13.0	8.0
1975	2 017.5	-4.4	82.7	9.5	7.8
1976	2 463.5	22.1	85.3	5.1	9.6
1960- 1976		Average 7.3	Average 78.9	Average 13.9	Average 7.2

Apparent Domestic Consumption figures are calculated as follows:
Total Production minus exports plus imports.

Source : As at Table 4.2

T A B L E 4.9

and Pahang. Sabah only exports about 1% of the total, with most of the logs sent abroad, principally to Japan and Taiwan, in unprocessed form.

The growth of domestic consumption of sawnwood has been lower than exports - averaging 7.3% per annum (Table 4.9). The Peninsular consumes about 80% of the total with the rest going to the Borneo states.

b) Ownership and Efficiency

Generally, the industry has grown up under the circumstances of a seller's market and an abundant supply of logs. This created complacency which has resulted in a large number of fragmented, under-utilized plants throughout the country. The number of saw mills in Malaysia today is out of proportion to the available forest working areas. The historical development has also left behind an industry that is heterogeneous in size, ownership and level of modernization.

As in the case of the logging industry, most of the mills are under individual ownership or partnership, usually family-owned and managed. About 50 percent of the mills account for only 20 percent of the output, and have a very low log intake - less than 30 cubic metres per 8 hours shift. They mainly serve the rural and small urban centres, frequently operating on a part-time basis. Most of the timber is ungraded and sold domestically.

The other 49 percent produced 80 percent of the total output in 1972, and virtually all the exports. Of the total, 22 percent or about 100 sawmills produced 65 percent of the total export of the sawn timber. However, only about 60 of them have kiln drying facilities to ensure uniform moisture content to prevent timber against fungi and insects, and other downstream facilities like pressure treatment plants, moulders and table operated planers.

F. A. O. (1972) estimated that the saw milling industry operated

on 56 percent of its manufacturing capacity.⁸ The average production of the large export-oriented mills is about 70 to 140 cubic metres a day compared to only about 20 cubic metres for an average plant geared to the domestic market. The recovery rate is low ranging from 30 to about 60 percent compared to over 80 percent in western countries.⁹ The F. A. O. notes that 20 percent of total production (or 35 percent of local market sales) comprise exports rejects caused by inefficient manufacturing. The problem of low recovery could be partly solved by investing in sawmills to process small diameter logs of 18 inches or 46 cm and below which are normally rejected by large sawmills.¹⁰ In 1978, 43 small diameter log mills were in operation. For the larger diameter mills, the use of highly efficient gangsaws and bandsaws could improve recovery.

It has to be realised that due to the heterogeneous nature of tropical hardwoods, it would be very difficult to achieve recovery rates of softwoods in western countries. No two logs are the same. Even when the log is broken down into cants, the location of knots and other defects is crucial in the production process. Thus there are limits to automation revolution within the industry. The value of rough sawnwood, however, can be enhanced by further conversion processes, such as precision sawing, kiln seasoning, planing or fashioning into furniture component parts or decorative quality mouldings.

8. F. A. O. (1970-75), Technical Report No. 4, defined capacity as the volume of logs required to maintain existing output of installed machinery operating on an eight-hour shift per day at 250 working days per year. Forest Department estimates put the capacity utilization at 55%, while Radzuan (1975) in his study of 17 mills in Johore found a rate of 42%.
9. Lee Lat (1976) noted considerable variations in recovery rates depending on the species used, and these ranged from 35 to 79%. The sample used was very small. Radzuan's study showed an average recovery rate of about 70% for Johore sawmills.
10. In a study of small diameter logs, C. D. Sylvester in National Timber Congress (1976) notes that a processor usually dislikes small logs because, firstly, the mill's capacity is reduced considerably (and costs consequently rise) and secondly, the recovery from small logs is lower from larger ones.

Sawmill offcuts may be used as raw materials for further processing into a diversified range of products such as ^{fire board}, particle boards, blockboards, and mouldings. This could be achieved by greater integration in the industry,

However, experience of the seven newly created integrated plants shows that the picture is not all that rosy. Most of them are in the red, and as Harun Ismail (1976) and Chong (1979) note, one of the reasons for the inefficiency of the timber complexes, mostly with state involvement, is that they have little experience in managing timber processing business. Production costs are much higher than those incurred by smaller plants, as they are fitted with equipment technologically too advanced or unsuitable for meeting local needs.¹¹ There have been many instances of integrated timber plants with their own concession areas selling logs to other sawmillers to meet cash flow problems.

F. A. O. (1970-75) recommended to the Malaysian government to launch a deliberate policy of relocating sawmills from timber deficient states in the west coast of Peninsular Malaysia to the east coast states of Trengganu, Kelantan and Pahang where large stocks still exist. Forest Department figures show that the more developed west coast states in Malaysia, Selangor, Perak and Johore, consumed about 45 percent of the output channelled to the sawmilling industry while producing only about 13 percent in 1976. The three east coast states produced in the same year about 60 percent of the logs while consuming only 40 percent.

11 Harun Ismail also notes that the designs of some sawmills in these complexes are so sophisticated that they require highly skilled personnel to operate and maintain, who are very difficult to get in Asia. Much of the equipment was found unsuitable and incurring high capital cost, for example the length sorter, double cut saws. Many of these mills are not suitable for cutting non-homogeneous tropical hardwoods, and about 15% of the logs have to be sold to smaller mills.

One can be sceptical about the F. A. O proposal for in a situation of free competition, one would expect a profit-oriented producer to close down his plant if it is persistently running at a loss. Likewise, entrepreneurship would enter in any area which promises rewards. Given conditions of workable competition, one can expect market forces to take care of the spatial aspects of the problem. Many small mills cater for the villages and small towns, and have been able to survive even with single bench mills as they are run mainly by family labour. The low costs keep the prices of ungraded timber within the reach of low income groups.

State governments have set up integrated plants in timber-rich areas, and tax incentives have been provided for location of plants in these areas.¹²

c) Level of Investment

The 1972 Survey of Manufacturing Industries in Peninsular Malaysia showed that the sawmilling industry invested about M\$ 79.5 million in fixed assets, almost double the figure in 1968 (M\$ 38 million), the previous census. The estimated figure for 1977 is M\$ 285 million a three fold rise from 1972 although some of it is due to price changes. For Sarawak, it was 17.6 million in 1972, the highest of all the manufacturing industries surveyed.

Relatively speaking, the sawmilling industry has a low capital-output ratio. Table 4.7 shows that about 26 percent of the total fixed investment in 1972 went to machinery and equipment, the rest going

12. Tax incentives to encourage manufacture are:

(a) pioneer status: tax relief ranging between 2 and 8 years based on capital invested and other criteria.

(b) Labour Utilization relief - 2-8 years.

(c) locational tax relief - 5 to 10 years based on location in priority areas.

(d) Investment Tax Credit which allows a company to deduct from its taxable income an amount equal to at least 25 percent of its fixed capital expenditure.

In Sarawak, the royalty rates are reduced on logs domestically processed.

See Federal Industrial Development Authority (1979).

to transport equipment (26.5 percent), land and land improvement (15 percent) and building (33%).

The Forest Department estimates that at 1979 prices, a sawmill with a log capacity of 100 to 130 cubic metres per day would require an investment of M\$ 1.5 to M\$ 4 million. However, to modernize an existing plant costs between M\$ 0.5 to M\$ 1 million, and is relatively cheaper. Most of the input costs go to log supplies (70 percent) while the wage bill takes about 20 percent of the production expenses.

Section 4.4: Plywood and Veneer Industry

Veneer can be described as a thin sheet of wood, and plywood, a basic sandwich of veneers. The plywood manufacturing process is unique in the sense that a highly variable raw material is manufactured into a product that is stronger and more versatile than the wood from the original tree.¹³ A list of its uses and substitutes is in Appendix 2A.

a) Production, Exports and Domestic Consumption

Plywood production has achieved a very rapid rate of growth, averaging 38 percent per annum over 1960-76 period (Table 4.10). About 90% of the output comes from Peninsular Malaysia, with Sabah and Sarawak sharing the remainder. Although the industry was set up before the last war, it was only in the sixties that it assumed an important role in exports, which increased exponentially by 1.68% per annum in volume and 1.72% in value during the same period (Table 4.11). On the average about 60% of the plywood produced is exported. Growth of home demand has been relatively slower than exports averaging 1.4% per annum with Peninsular Malaysia consuming most of the home supplies (Table 4.12). Ample log supplies and the availability of cheap labour,

13. See Baldwin (1975) on technical aspects of plywood manufacture.

PLYWOOD PRODUCTION, MALAYSIA (1960 - 1976)

Year	M A L A Y S I A		P. M.	SARAWAK	SABAH
	Output '000 cu m	Annual Change (%)	% share	% share	% share
1960	5	-	—	—	—
1961	7	40.0	-virtually 100%	negligible	negligible
1962	10	42.9			
1963	12	20.0			
1964	12	0.0			
1965	27	125.0	96.3	—	3.7
1966	58	114.8	86.2	8.6	5.2
1967	72	24.1	68.7	16.7	5.6
1968	120	66.7	85.0	10.0	5.0
1969	171	42.5	87.1	8.8	4.1
1970	197	15.2	90.8	5.1	4.1
1971	231	17.3	89.6	5.6	4.8
1972	330	42.9	92.8	3.6	3.6
1973	375	13.6	90.9	4.3	4.8
1974	311	-17.1	87.2	3.8	9.0
1975	404	29.9	87.8	4.0	8.2
1976	524	29.7	90.2	5.0	4.8
		Average	Average	Average	Average
		38.0	88.3	6.9	5.2

Source: As at Table 4.2

T A B L E 4.10

PLYWOOD EXPORTS, MALAYSIA - 1960 - 1976

Year	Volume '000 cu m	M A L A Y S I A Annual Change (%)	% of total Output	Value M\$ mil.	Annual Change (%)	P. M. % share of volume	SARAWAK % share of volume	SABAH % share of volume
1960	1.0	-	20.0	0.2	-			
1961	2.0	100.0	28.6	0.5	150.0			
1962	3.0	50.0	30.0	0.8	50.0			
1963	2.0	-33.3	16.7	0.2	-73.3			
1964	9.0	350.0	75.0	2.2	1000.0			
1965	9.8	8.9	36.3	3.2	54.5	97.4		2.6
1966	14.2	44.9	24.5	5.1	59.3	87.1	9.3	3.6
1967	45.7	221.8	63.5	14.9	192.1	79.3	15.6	5.1
1968	76.4	67.2	63.7	23.7	59.5	87.2	8.5	4.3
1969	111.0	45.3	64.9	23.3	-1.0	89.9	7.3	2.8
1970	143.9	29.6	73.0	48.1	106.4	89.9	3.6	5.5
1971	195.9	36.1	84.8	60.5	25.8	90.1	5.2	4.7
1972	272.0	38.8	82.4	81.6	34.9	91.1	3.6	5.3
1973	376.7	38.4	100.4*	158.3	94.0	93.6	4.0	2.4
1974	218.3	-42.0	70.2	101.4	-35.9	91.8	3.2	5.0
1975	249.8	14.4	61.8	96.9	-4.5	87.2	2.0	10.8
1976	424.5	69.9	81.0	188.5	94.6	92.8	2.3	4.9
1960- 1976		Average	Average	Average	Average	Average	Average	Average
		65.0	57.5	112.3	89.3	5.9	4.8	

* Excess of exports over output from stocks

Source: As at Table 4.2

T A B L E 4.11

PLYWOOD APPARENT DOMESTIC CONSUMPTION, MALAYSIA (1960 - 1976)

Year	M A L A Y S I A		PENINSULAR MALAYSIA (% of total home consumption)	SARAWAK and SABAH (% of total home consumption)
	Volume '000 cu m	Annual Change (%)		
1960	13.0	-	92.3	7.7
1961	16.0	23.1	87.5	12.5
1962	20.0	25.0	90.0	10.0
1963	23.0	15.0	91.3	8.7
1964	14.0	-39.1	85.7	14.3
1965	23.2	65.7	90.5	9.5
1966	46.8	101.7	91.9	8.1
1967	29.2	-17.6	92.5	7.5
1968	46.6	59.6	94.4	5.6
1969	64.0	37.3	96.9	3.1
1970	57.1	-10.8	94.7	5.3
1971	44.1	-22.8	95.2	4.8
1972	67.0	51.9	92.5	7.5
1973	82.4	23.0	87.4	12.6
1974	97.7	18.6	90.1	9.9
1975	158.2	61.9	89.8	10.2
1976	101.6	-35.8	88.6	11.4
1960- 1976		Average 20.9	Average 91.3	Average 8.7

Apparent Domestic Consumption figures are calculated as Follows:

Total production minus exports plus imports.

Source: As at Table 4.2

T A B L E 4.12

together with rising demand in the E. E. C. and the U. S. A. in the 1966-73 period gave a boost to the industry. The development has followed the traditional pattern of sawmill expansion, although the rate of entry and exit have been lower because of the need for a relatively higher level of investment.

b) Investment, Ownership and Efficiency

The total level of investment in plywood-veneer mills in P. M. alone in 1972 was M\$ 96.6 million, with machinery taking up 60% of the total fixed cost (Table 4.7). In five years this doubled to M\$ 170 million, though part of the increase could be due to inflation. Forestry department estimates put the cost of setting up a plywood-veneer mill at between M\$ 10 and M\$ 20 million, about 5 times higher than that of a sawmill at 1979 prices. The land area required is about 4 times that by a sawmill - about 16 hectares for the average mill.

About 60% of the mills produce less than 560 000 cu metres per annum, a figure relatively small compared to mills in other developed countries. 12 of the current 40 mills in Malaysia (35 in PM, 3 in Sarawak and 2 in Sabah) are public companies, being able to raise capital through share issue. Since 1972, the trend has been to set up integrated plants, but as noted earlier, nearly all of the seven such plants in operation are running below capacity.

The average recovery rate is between 40-60%, somewhat lower than in other countries such as Japan and South Korea. Very few of the plants have facilities to reprocess the waste into products like fibre board and particle board, and most of the waste ends up as fuel. One reason is management complacency brought about by the abundant supplies of cheap veneer logs at least till the early seventies. The machinery and supervision have not encouraged a greater sensitivity to minimise waste.

The general problem is again of obtaining veneer logs, for the requirements of plywood are rather rigid - the need for relatively

homogeneous and large diameter logs, supplies of which are dwindling. Most plywood producers do not have their own forest concessions to ensure steady supplies, making long-term planning difficult.

Section 4.5: Other Wood-based Industries

a) Furniture and Fixtures

One would expect the furniture industry to be a thriving one given the availability of wood resources.¹⁴ Unfortunately, despite the fact that there are over 80% enterprises involved in the business in Malaysia, only four of them produce ample quality supplies to serve the export market. The rest are formed of small and medium sized carpentry shops and manufacturers catering for the domestic market.

A survey carried out by a government body, the Federal Industrial Development Authority, F. I. D. A., in 1976 noted that there has not been significant growth in the industry apart from the establishment of new joint-venture projects mainly producing knock-down furniture for export. The main problems are a lack of professionals in the trade, and scarcity of skilled workers, the difficulty of obtaining a continuous availability of good quality wood, problems of other materials like upholstery, fitting materials, tools. There is a high degree of fragmentation, with little innovation in designs.

There has been rapid expansion of domestic demand - 78 percent between 1963 and 1970. During the same period however, export expansion was less than one percent although imports were down by 22 percent. The low cost of the furniture meets the demand of the low and middle income groups who form the majority of the country. The richer classes tend to prefer imported high quality furniture, often made out of Malaysian wood.

There is a need to ensure the availability of craftsmen, more

14. See Federal Industrial Development Authority (1976) and Kitigawa (1979).

research in designs, and effective marketing before Malaysia can make inroads into the high quality markets of the west and Japan. South Korea, Taiwan and Singapore have already taken the lead in this direction.

b) Mouldings

Timber mouldings are pieces of wood worked into an ornamental shape for the use of panelling, framing, and other decorative purposes.¹⁵ The more common ones are door jambs, picture frames, casings, architraves and half and quarter rounds. Although the Malaysian moulding industry started in 1965, it did not make much progress until the early seventies. In 1977 the export earnings amounted to about 77 million dollars compared with only M\$5 million in 1968, representing a rise of 15 times. The growth was slowed down during two short periods of recession - 1969-1970 and 1974-1975.

There are currently 52 plants in Peninsular Malaysia, 14 in Sarawak and one in Sabah working mainly or fully for the export market. The moulding industry is a potentially rich field to absorb lesser known species, and some level of success has been achieved in at least two of them - red balau and geruntu for panelling. As it is a fashion-oriented industry, the designs have to keep pace with changing tastes.

c) Prefabricated Housing Units and Components

This is a domestic-oriented industry although small amounts are exported to Indonesia and Australia. Basically, wooden component parts such as flooring and floor supports, roofing, panels, window frames are manufactured to be assembled in houses on the sites.

15. A broad overview is provided by F. L. C. Kok, Profile of the Timber Moulding Industry in Malaysia, in National Timber Congress (1976) p. 46-48

Currently 8 establishments produce prefabricated housing to cater mainly for government housing schemes and flood resettlement projects. The scope of the industry is bright, at least domestically, in view of the large number of lowcost housing schemes undertaken by the government. The level of fixed investment in the industry is low (2.2 million dollars in 1972), and unless the industry is modernised, the scope for exports is limited.

d) Particle Board or Chip Board

This is a recent addition in wood-based panel products, its first commercial production having started in West Germany in 1941. An excellent avenue for using wood residues, particle board or chip board uses sawdust, planer shavings, chipped or flaked wood. The raw materials are bonded by an organic binder and other agents such as pressure, heat and moisture.

There are 4 plants in Malaysia. In value terms it earned about \$805,000 in 1976 which was a rise of 28 times over the figure in 1971 (\$27,891). The industry is a potential threat to plywood, and already 10 percent of all wooden materials used in buildings locally use particle board.

e) Others

The other wood based industries include wood packaging, wood preservation plants, woodwool slabs, pencil and match factories. They are aimed at import substitution and meeting increasing domestic demand, and their export potential at the moment is limited.

CHAPTER 5

METHODOLOGY, DATA AND COMPUTATIONAL PROCEDURE

Section 5.1 Introduction

In the last four chapters we analysed the various facets of forestry in Malaysia, and the world hardwood trade. This will provide the background and foundation for the next two chapters which will be the core of the thesis. We are going to delve into two issues that are important in evaluating the economic performance and viability of hardwood forestry in the context of the development needs of Malaysia. Broadly, these issues are:

- 1) The potential of the forestry sector to promote economic growth, in particular, generate foreign exchange and meet domestic needs.
- 2) The capacity of the sector to sustain or expand employment.

Both these issues are inter-related, but we propose to consider them separately to examine crucial underlying relationships of various economic variables. We will then piece them together and look at them in the light of both economic and non-economic factors. In this way, we hope to suggest guidelines for policy decisions, and, at the same time, point out deficiencies and the directions for future research.

Given these objectives, the next question is the best approach to consider these issues. A procedure usually adopted in applied research is to formulate economic models and empirically verify them. But economic phenomena are too complex to be cast into a self-contained closed model. The forestry sector does not exist in a vacuum; it is inter-related, both domestically and internationally, to other sectors. Even relationships within the sector are complicated. The model can never take into account the detailed circumstances surrounding the issue to be explained. We thus have to be selective, deliberately dealing with a few important relationships. In our case, we are interested in a

supply and demand model and an employment model, both to be formulated in a consistent way for empirical verification. One has to be very clear about the assumptions the model is built upon to derive meaningful conclusions.

Myrdal (1968) concisely summed up the usefulness of models in focussing relationships and guiding policy:

"Models should be judged by their relevance to the problem under investigation, their logical consistency, their adequacy to reality, including their correspondence to observable facts. They should not be judged by their comprehensiveness, their faithful reflection of numerous features of reality, their inclusion of all concrete details The progress of knowledge is the interaction between observations relating to any part of the model and adjustment of the model." ¹

As our interest is in empirical verification, the relationships are formulated in such a way as to be, at least in principle, quantifiable. We are aware of the danger of limiting ourselves to problems that can be solved mathematically, or adopting inappropriate economic assumptions for the sake of mathematical and computational convenience. In all cases, economic principles will take precedence, and factors that are difficult to quantify will not be neglected at least, in the interpretation of results. The language of mathematics or symbolic logic after all is only a medium of logically formulating and testing our premises.

The technique which we will use to measure economic relationships is econometrics, and it will be useful to briefly discuss the advantages and limitations of the method to appreciate meaningfully the results in Chapters 6 and 7.

1. p. 1963-1965, Volume III. Appendix 3, concerning the usefulness of economic models in planning, is informative for a researcher interested in less developed countries.

Econometrics is a technique combining economic theory, mathematical economics and statistics, and basically is the measurement of models embodied in stochastic equations. The aim is to obtain numerical estimates of the coefficients of the economic relationships for testing hypotheses arising out of economic theory. The broad objective is to guide economic policy. However, models are as good as the theory and data they contain, and not necessarily in terms of their size and sophistication. In a sense, we are searching for stable patterns of cause and effect in economic phenomena. The built-in snag in this apparently logical framework is the stability in the causal mechanism, and therefore the supposition that it will be the same phenomenon that would repeat itself.³ Although the econometric model may give the appearance of a rather rigid analytical device, it can be a flexible tool, readily adaptable to new information and decisions. It is not a substitute for judgement, but rather serves to focus attention on factors about which judgement must be exercised.⁴ All structures are stochastic in nature, and are assumed to contain random errors, arising out of inadequate knowledge or measurement.

Formulating economic relationships in a general sense is a problem of interpolation within the sample boundaries, while the principal problem of prediction or forecasting is one of extrapolation beyond the confines of the sample. As Klein (1971) argues, there is no distinction among structural estimation, theory testing and prediction

2 Good introductory books on the subject are by Gujarati (1978), Wonnacott and Wonnacott (1970), Koutsoyiannis (1973) and Maddala (1977). At a more advanced level, Johnston (1972) and Malinvaud (1966) are comprehensive, while Rao and Millar (1971), Desai (1976) and Draper and Smith (1966) do more justice to empirical issues.

3 Streisler (1970) p. 25.

4 Suits (1962) p. 107.

for they are part of one larger econometric problem.⁵ Prediction is a device that serves to test hypotheses about economic structure or improve its estimates, and as such should be continuous as a means of updating and revising structural models. It is not a pure science, and is done in the spirit of meliorism. Significance tests are after all forms of evidence, and one should be free to collect all the pieces of evidence that can be used as long as this is done judiciously.

Section 5.3: Data sources and quality of statistics

Good data are in large part a product of development itself. One of the most important limitations of any quantitative study of less developed countries is the paucity of reliable long time-series statistical data. Malaysia is no exception, more so as different states were at varying stages of economic and social development at the time of federating in 1963. Prior to 1963, data ^{were} compiled separately for Peninsular Malaysia, Sabah and Sarawak, and in some fields, particularly forestry, ^{this} is still being done. Generally, the quality of data from Peninsular Malaysia is better than that of the Borneo states. Malaysian primary commodities like rubber and oil palm have only been studied from data on Peninsular Malaysia even in the post-independence phase although these commodities do form an important part of the economic base of the Borneo states as well. Wherever possible, we will make quantitative estimates both on a country-wide basis, and in terms of specific regions. Here we would be breaking new ground. Elsewhere, it may only be feasible to concentrate on Peninsular Malaysia due to the availability of longer time-series data.

5 Klein (1971) p.10-14. Some authors like Desai (1976) and Encel, et al (1975) make a distinction between prediction and forecasting. Forecasting is concerned with the course of a variable over some future time period, while prediction is concerned with its course in response to changes in causal variables. In other words, forecasting is part and parcel of the prediction process.

Oshima (1971) succinctly summed up the choices available for less developed countries faced with data problems:

"The economic statistics of underdeveloped countries will never be accurate for the perfectionists and the meticulous scholar Confronted with poor data collected on the basis of inappropriate concepts, one can sweep aside all the existing data, ignore them completely and speculate boldly or take an agnostic position, as some do. Or one can adjust for the inadequacies and incomparabilities wherever possible, note carefully the short-comings that cannot be corrected and arrive at regularities and findings which do not transcend the roughness of the data and then speculate about the explanation of the regularities. " ⁶

We would choose to follow the last alternative suggested by Oshima for unless knowledge is applied, it is not fully tested. For a relatively new political state like Malaysia, evaluating and testing data are particularly valuable in the present state of statistical development in the forestry sector.

A wide variety of sources, both published and unpublished have been used. The collection and compilation of data have been arduous tasks in view of the multiplicity of sources and the dilatory nature of the government bureaucracy. In many instances the data were measured differently by the various collecting agencies. (The units of measurement still being used are hoppus tons, cubic feet, square feet and cubic metres). Hence, compilation, cross-checking and standardisation were inevitable. As far as convenient, we have used the metric system in line with international practice.

Section 5.4: Aggregation and its implications

As all work in this thesis is based on aggregate data, it is useful to consider some of the major implications of using such data to consider the results in the correct perspective.

6 Oshima (1971) p. 56.

A large part of economic theory is couched in micro-language referring mostly to the individual person (consumer or producer) and or firm, but empirical analysis is usually in terms of groups of individuals or firms or the whole economy. This does not mean that empirical considerations would have to be in micro terms to be in cognisance with theory, for theory itself has been derived with aggregates in mind, explaining "average" behaviour.⁷ For practical convenience, aggregation is inevitable.

Since the last war, there has been a considerable debate on the issue.⁸ Theil (1965) distinguishes three forms of aggregation - over individuals, such as firms and consumers, over commodities, such as inputs or consumer goods, or within a particular commodity group with various grades and specifications, and over various time periods, such as data in annual or quarterly basis. Such various forms of aggregation may overlap - for instance, aggregation over time periods may take place for each individual and commodity, while aggregation over commodities may occur for each individual. We could even distinguish yet another level of aggregation - geographical or over regions. The problem of aggregation does not lie so much in its conflict with economic theory as with respect to technical issues involved in interpreting the results.

A frequent observation in empirical studies is that the R^2 , i. e., the measure of the goodness of fit of the regression equation, appears to be higher than that of microrelations, and also higher than

7 For instance, Marshall's representative firm is an attempt to bridge the micro-macro gap by explaining average or a typical firm behaviour, never intending to claim to show the behaviour of any particular firm.

8 Klein in 1946 started off an interesting discussion of the problem of aggregation in economics, and among the more useful papers are Klein, *Macroeconomics and the Theory of Rational Behaviour*, *Econometrica*, p. 93-108; K. May, *The Aggregation Problem for a One-industry Model*, *ibid*, p. 285-298 and Shou Shan Pu, *A Note on Macroeconomics*, p. 299-302, all in *Econometrica*, 1946.

the composite R^2 of all micro-relations.⁹ Theil suggests that unless there is "perfect aggregation" (realised through an appropriate weighting procedure), there could result what he calls an "aggregation bias," an error that may be committed when constructing the model. The results of equations especially in small models could be very sensitive to the degree and kinds of aggregation and would be difficult to accept without reservations.

Grunfield and Grilicha (1960), on the other hand, hold the view that aggregation does not always produce such a bias, but rather an aggregation gain. They argue that as long as micro-relations are not perfect, there can be a gross gain from aggregation due to the elimination of the specification error. A gross error, due to the aggregation of differing micro relations, could also arise, but it is probable that there could be a net gain.¹⁰ Disaggregation has its advantages, and could suggest how to improve theory. But it has to be realised that different levels of aggregation require theories with different levels of abstraction. Aggregation is not necessarily bad if one is interested in aggregates.

As far as this study is concerned we will consider disaggregation on geographical lines. Wherever possible, the regression equations would be calculated for four regions - Malaysia as a whole, and for

- 9 An explanation put forward by Theil (1965) is: "If the conditions of the Central Limit Theorem are fulfilled . . . the variances of the macrodisturbances (caused by aggregation) tend to be smaller in a relative sense as the number of individuals (or commodities, etc) increases, so that the 'predictive power' of the macro-equations may seem to be greater than that of the microequations (relations postulated by economic theory)!" Those in brackets excluded from quotes. However, Grunfield and Griliches (1960) attribute a higher R^2 for aggregate relations to a high degree of correlation between independent variables of individual or behaviour units.
- 10 They argue that the Central Limit Theorem does not imply that the variances of a sum of random variables will be smaller than the sum of the variances. Nevertheless, a higher R^2 does not imply that aggregation is necessarily good, only that we are using a different yardstick.

Peninsular Malaysia, Sarawak and Sabah. This would shed light on the implications of aggregating data over different regions of the country. The wood commodity aggregates would be split up in terms of particular items such as sawlogs, sawnwood and plywood. Data constraints prevent us from breaking them into particular species. Only annual observations are considered as data on shorter time periods are sketchy.

Section 5.5: Computational Procedure

All econometric computations were done on the Edinburgh Multi Access System (IC4 475 computer), using an Econometric Software Package, ESP (1973) and Time-series Software Package, TSP (1978).

The initial selection of variables was based on economic theory. Where data were not available or in poor quality, proxy variables were tested.

The computational techniques to select variables are backward-elimination or step-down procedures, forward-selection or step-up procedures, and stepwise regression.¹¹ Backward elimination involves estimating the equation with all possible variables, and progressively eliminating or modifying variables with partial-correlation coefficients or the t ratios of F ratios less than a specified value. With most economic data, where variables are closely related, this procedure proved to be cumbersome, and computationally expensive. Forward selection was more economical, and involved adding or dropping variables, depending on their partial-correlation coefficients, and tests of significance. In some cases a combination of both methods was necessary, forward selection in deciding which variable to use, and backward elimination to decide which variable to discard. In all cases, economic significance or coefficients, wherever feasible, was given

11 See Beale, Kendell and Mann (1967) pg. 357-66.

higher preference than their statistical significance in modifying relationships.

To facilitate the selection process, sample correlation coefficients as well as covariance coefficients between all pairs of variables were obtained. Provided a variable was not of considerable economic significance, where two variables in an equation had strong sample correlation coefficients and high covariance coefficients, the less important one was deleted to avoid problems of multicollinearity. Multicollinearity refers to a situation where, because of strong interrelationships among the independent variables, it becomes difficult to disentangle their separate effects on the dependent variable. The results in parameter estimates are sensitive to changes both in the precise model specification and the data set being employed. The standard errors may become infinitely large, and the estimates of coefficients indeterminate, although they remain statistically unbiased. Dropping a variable can be tricky for sometimes it can make other coefficients biased. Where there were grounds to suspect this, the variable was retained as the overall forecasting ability of the model is not affected.

A problem of time series data is autocorrelation or serial correlation where the successive values of the residual or error term tend to be correlated. This does not affect the statistically unbiased nature of the parameter estimates of OLS. However, the variances of the parameter estimates are underestimated (and the t statistic overestimated). The reliability of the estimates is therefore overstated, with a false smaller variance, we may conclude that an estimate is reliable, while in reality it is not. We performed two kinds of tests to check autocorrelation. The first method was to check the plots of the residuals over time to see if there was any systematic pattern. If the residuals are randomly distributed around zero, then there is no evidence of autocorrelation. This method was supplemented by the use of the Durbin-Watson test, where the difference in residuals is compared to the actual residuals:

$$d = \frac{\sum_{t=2}^{t=N} (e_t - e_{t-1})^2}{\sum_{t=1}^{t=N} e_t^2} \quad (5.1)$$

This is simply the ratio of the sum of squared differences in successive residuals to the residual sum of squares. A great advantage of the \underline{d} statistic is that it is based on the estimated residuals, which are computed in regression analysis. The exact sampling or probability distribution of the \underline{d} statistic is difficult to derive, because as Durbin and Watson (1951) have shown, it depends in a complicated way on the explanatory values present in a given sample. The \underline{d} is computed from e_t which are dependent on the given explanatory variables. Therefore, unlike the t or F tests, there is no unique critical value which will lead to the rejection or the acceptance of the null hypothesis that there is no first-order serial correlation in the disturbance terms. However, Durbin and Watson have worked out a lower bound, d_L and an upper bound, d_U , such that if the computed \hat{d} is greater than or equal to d_U , (with $n - K$ degrees of freedom, where K is the total number of parameters), we accept the null hypothesis that $\hat{\rho}$ is zero, i. e. that there is no autocorrelation. On the other hand if the computed $d \leq d_L$, we reject the null hypothesis that $\hat{\rho} = 0$, and therefore accept that there is evidence of autocorrelation. If $d_L < d < d_U$, the test is inconclusive, that is, we cannot be sure of the presence or absence of autocorrelation. What is required in this case would be an increase in the number of observations. For negative correlation, i. e. ($\hat{\rho} < 0$) there is no evidence of autocorrelation if $(4-d) \geq d_U$, and if $(4-d) \leq d_U$, then there is such evidence. If $d_L < (4-d) < d_U$, the test is inconclusive.

The \underline{d} statistic is however not reliable if there is a lagged dependent variable as one of the explanatory variables in the equation. The computed \underline{d} value in such a model generally tends towards 2 which is the value expected in a truly random sequence, thus giving a built-in bias against discovering (first-order) serial correlation, Durbin (1970) has proposed a large-sample test of first-order serial correlation in

models incorporating lagged dependent variables, called the \underline{h} statistic.

$$h = (1 - \frac{1}{2}d) \sqrt{\frac{N}{1-N \cdot V(\hat{\beta})}} \quad (5.2)$$

where N = sample size, $\text{var}(\hat{\beta})$ = the variance of the coefficient of the lagged dependent variable, and d = the statistic defined in (5.1). For large sample size, Durbin has shown that the \underline{h} statistic follows the standardised normal distribution, i. e., with zero mean and unit variance. The statistical significance of an observed \underline{h} can be easily determined from the standardized normal distribution table. However, since our sample size is small, (at the maximum being 17 data points), we cannot place too much reliance on this statistic. For want of anything better we would report both the \underline{d} and \underline{h} statistics. We would cross-check them with the graphical method of examining the plots of the residuals.

One of the ways we tried to cure autocorrelation was to see if there were any missing variables, or if the functional form was wrong. Checks on data were also made. Where everything failed, we used the Cochrane-Orcutt iterative technique, details of which are spelled out in Appendix 5A.

CHAPTER 6

AN ECONOMETRIC ANALYSIS OF THE SUPPLY AND DEMAND
OF MALAYSIAN WOOD-PRODUCTSSection 6.1 Introduction

This chapter analyses quantitatively the supply and demand relationships of Malaysian sawlogs, sawnwood and plywood to enable us to understand the main economic forces at work in the sector. The estimates would aid the policymaker to gauge the potential of the forestry sector to generate foreign exchange as well as meet needs at home.

The main objectives are:

- 1 To formulate and verify the main variables affecting the supply, exports and home consumption of the three commodities;
- 2 To provide quantitative estimates of short-run and long-run supply and demand elasticities;
- 3 To forecast till 1985 demand levels of the three commodities.

Specifically, we propose to consider the following hypothesis stemming from economic theory of supply and demand:

- i) a low or inelastic price elasticity of demand for the three commodities, all producer goods. The elasticity of demand for wood is influenced by the importance of timber in the cost of building construction and the elasticity of demand for the buildings themselves. The primary use of Malaysian wood is derived from the demand for housing and other building construction, generally regarded as lying in the inelastic range. Leaving aside substitution effects for the time being, the larger the proportion of the cost of wood to the total cost of construction, the higher is the price elasticity of demand for wood. For instance, if the cost of wood is 10% of the total construction

costs, then, say a 10% increase in wood prices would raise construction costs by 1%. The relative small importance of wood in the total costs of construction, together with the probable price inelastic demand for residential construction, suggests that the demand for wood may lie in the inelastic range. Malaysian hardwood, however, can be substituted by hard and soft woods from other countries, and this could imply that the demand is sensitive to price changes, and therefore price elastic. However, a large part of Malaysian wood that is exported is regarded as of high quality, often ending up in the homes of upper income groups, and can therefore be expected to have a lower price elasticity of demand, as indicated by other studies discussed in Section 6.2.2. For plywood, however, the demand is likely to be price elastic since Malaysia supplies only about 5% of the amount traded in world markets, and the quality is rather irregular.

- ii) a high income elasticity of demand dependent on business conditions promoting construction;
- iii) a high cross-elasticity of demand for sawnwood, plywood and particle-board, all potential substitutes for one another;
- iv) an elastic supply response of suppliers particularly of sawnwood and plywood to changes in prices, and a relatively less elastic response from suppliers of logs in view of the imperfect market as well as the long gestation period for the growth of trees.

incorporated into an econometric commodity model, and the problems of specification, and estimation are considered. And the last part shows how commodity models can be applied, and he uses the world lauric oils (cocunut oil and palm oil) market as a case study. Although the market conditions of each commodity differ, Labys' work is useful in guiding a researcher in commodity analysis, which is still in its infancy. His study is neither original nor exhaustive but fills a gap in commodity model building and application. A collection of quantitative models of commodity markets covering commodities that include petroleum, sugar and fisheries in Labys (1975) is also helpful. The other works useful for specific aspects of commodity analysis are Leamer and Stern (1970) on trade equations, Orcutt (1970), Kravis and Lipsey (1971) and Driehuis (1976) on prices, and Brown (1975) on commodity control models.

A commodity model, like any other economic model, is a formal representation of a commodity market or industry based on relationships reflecting underlying economic principles. The form of the model commonly considered is one whose solution is reached through the equilibrium set of supply and demand conditions, based on specified assumptions. Given the complexity of the phenomena one hopes to measure, the model must be identified to ensure the existence of separate supply and demand equations. This survey will try to show that confusion between what are supply variables and what demand exists among researchers in forestry.

During the last thirty years, the specification of forestry models has evolved from simple graphical methods of analysing supply and demand of one commodity to more complex ones specifying the interlocking market relationships between various wood products in the sector.

The early studies of supply and demand in forestry were mainly graphical analysis, and the more well known are those of Zivruska (1955) and Holland (1960). Using time series data covering the period 1922-53, Zivruska analysed lumber production and price experience since World War One. He regressed the price variable (index of wholesale lumber prices) on quantity of lumber produced for three different periods, 1922-29,

1931-41 and 1945-53, and noted that the price elasticity of supply had reduced from 0.76 in the first period to 0.37 in the last. He interpreted the regression lines of the three periods as zones within which the intersections of supply and demand took place in response to short-term fluctuations in each period and the shifts between the lines represent the long term trend in the level of intersection. Theoretically speaking, the quantity variable could represent both supply and demand, and the elasticities therefore computed could be a mixture of both supply and demand elasticities.¹ Also the effects of other factors explaining supply and demand is ignored. Practically speaking, the quality of data for the three periods may not be homogeneous.

Holland, too, used a similar model to show, in terms of changing demand and supply, how lumber prices have risen while total lumber consumption expanded only moderately between 1920-55. He goes further by trying to predict the price index for lumber to the year 2010, but his price equation is also a hybrid of supply and demand variables. The independent variables he used were per capita lumber consumption, per capita expenditure on construction, and an index of lumber processing costs. Such a method is theoretically speaking invalid, and the results consequently, dubious. Despite their naivety, the two studies pointed the way for further improvements.

The next crop of models were mainly consumption functions used by the FAO (1960, 1966), the United States Department of Agriculture (USDA) (1958, 1973) to forecast consumption of forest products. Basically, the functions show the average relationship between consumption of particular wood products and national income and population (usually expressed as per capita income). Both cross-section and time-series data have been used, and the usual model takes the following form:

$$C_{ij_t} = f(Y_{i_t}, \epsilon_{ij_t}) \quad (6.1)$$

where C_{ij_t} is the per capita consumption of product j ($j=1, \dots, P$) in country i ($i=1, \dots, K$) in time t ; Y_{i_t} is the per capita income

1. This is a problem of identification. See Working (1927), Fisher (1966) and Labys (1973) p. 130-31.

or the gross domestic product.

The function is estimated by least squares. The theoretical validity of this function is based on Engel's laws of consumer behaviour in relation to income.

Gregory (1966) tried to improve the FAO model by adding, what is called, a wood availability index, which could be generally written as:

$$WAI = C \left[\left(\frac{\text{Softwood Area}}{\text{Population}} \right)^a \left(\frac{\text{Hardwood Area}}{\text{Population}} \right)^b \right]$$

where a and b are the respective weights for softwood and hardwood acreage in commercial use, and C is the constant multiplier. The index does not reflect changes in quality, nor does it make sufficient allowance for cost factors. Gregory added this variable to the consumption function above with some modifications and computed the income elasticity of demand. While his wood availability index is a step nearer in specifying physical limits of forests, it is not a demand variable, and hence its use in the consumption function is theoretically speaking incongruous. The FAO-USDA type of specifications, though simple, are reasonable rule of the thumb guides given data limitations. However, if data ^{are} available, the specification may be improved by the addition of other factors explaining demand, such as price and prices of complements and substitutes, as well as including in the model a supply function, where the wood availability index variable could be more relevant.

In terms of rigour, the largest econometric work in forestry has been that of McKillop (1967), who studied the supply and demand relationships of lumber, paper, paperboard, plywood, veneer, roundwood and stumpage in the United States by using data of 1929-1941 and 1947-60. His economic model consisted of two major parts - a subsystem of supply and demand relationships for secondary wood-product such as lumber and plywood, and a similar subsystem of primary products, namely, roundwood and stumpage. Within the wood products subsystem, relationships are inter-related in the sense that the price of one wood product (say,

lumber) may affect the demand for another (plywood or veneer), and it in turn may have its demand affected by the price of some other product (say, paperboard). Both subsystems are subject to exogenous forces (like income), and at the same time they influence each other because roundwood and stumpage prices affect wood products supply, and these primary products in turn have their demand affected by the prices of wood products.

McKillop's specification in a sense was more detailed than previous studies. But he made the same mistakes as some earlier studies by including supply variables in his demand equations. While the use of the ratio of past prices of the commodity in consumption to its wood substitutes and non-wood substitutes is theoretically justifiable, his inclusion of such supply variables in the demand equation as wages, productivity, freight rates and value of construction is ad hoc. His supply equations, however, are more acceptable and rigorous in the sense that costs of inputs are meticulously stated. But there is a disadvantage in using too many variables. One can expect the current and past prices of wood products and its substitutes to be correlated, and also value of construction with wages, the price of petroleum products with electricity. This results in multicollinearity, and as such, we can expect the parameter estimates to be sensitive to changes in the specification of the model, although they may remain unbiased. However, if the sole purpose is to forecast, then multicollinearity would not pose too serious a problem. McKillop did not present the variance-covariance matrices of the relationship of key variables, and as such, the extent of multicollinearity is difficult to gauge. Also lacking was an indication of the degree of serial correlation, if any.

Despite the misspecification of the demand equations, the point elasticities of supply and demand for the products studied showed the right signs, but about half the results were not statistically significant. One, of course, has to be careful of accepting such findings.

Despite its limitations, McKillop's efforts to study the inter-relationships in the forest products industry represent a bold step in

the forestry literature. But his scope was very broad, and he did not dig into any particular relationships, giving only cursory treatment to individual variables explaining supply and demand.

A recent study by McKillop (1973) is more concentrated. It considers the economic structure of the trade in logs and lumber between North America and Japan. An econometric model, consisting of three supply and three demand equations, was formulated, using quarterly data for the period 1950-1970. The equations were: Japanese demand for U.S. logs, U.S. lumber and Canadian lumber; U.S. supply of logs and lumber to Japan and Canadian supply of lumber to Japan. The main explanatory variables specified in his demand equations were the price of logs and lumber, the prices of wood imports from the Soviet Union and the Philippines, the level of residential construction in Japan (measured by new residential floor space), ocean freight rates, the U.S. dollar - yen exchange rate, the stock of logs in Japan, and the index of manufacturing production in the previous quarter. However, in the final results he discarded the exchange rate, ocean-freight rates and wood imports from the Soviet Union on grounds of either multicollinearity or data deficiencies. He noted the level of residential construction, Japanese stock levels and prices of wood imports from the Philippines were significant factors in explaining demand from Japan of North American lumber and logs. The absolute values of the point estimates of elasticity are almost all above one in case of demand. On the supply side, McKillop appears to be on less firm ground. He assumed that the supply schedule was totally elastic, and instead of quantity supplied appearing as the dependent variable, he used the current value per thousand board feet of exports of softwood, roundwood or lumber to Japan as the dependent variables. His main explanatory variables were unfilled orders of softwood lumber in the Douglas Fir region at the end of the previous period, the gross stocks at the previous period, price in previous quarter and a dummy variable representing restrictions on the export of logs from Federal lands in the Western states - 0 through second quarter of 1968 and 1 thereafter. The results showed the right signs for stocks (an increase lowering prices),

and the dummy variable (export controls increasing export prices). Both were significant, but unfulfilled orders were not. Lagged prices showed a positive impact on current price and was significant.

While McKillop's study is impressive in formulating a model explaining trade relationships between countries, its deficiency again lies in its inconsistency with existing supply and demand theory, particularly with its neglect of supply factors in explaining price.

While McKillop's (1973) focus of stumpage-lumber relationships was in respect of trade with Japan, Robinson (1974) formulated an econometric model to formulate the domestic relationship of the price elasticities of supply and demand in the Pacific Northwest for Douglas-fir and southern pine, used primarily in construction. The market participants were divided into three groups - timberland owners, sawmillers and builders. The builders were linked to the sawmillers by the interaction of the supply and demand relations in the lumber market. The sawmillers represented the entire processing sector, and linked to the timberland owners through the stumpage market. Robinson expressed stumpage quantities on the basis of equivalent lumber, so that the quantity^{of} stumpage demanded was made equal to the quantity of lumber supplied. These assumptions made it possible to combine the equation for the sawmiller's supply of lumber with the equation for his demand for stumpage into a processor's behaviour relation. Canadian exports were explicitly recognized by expressing the supply of lumber in two equations representing the domestic and imported sources. Lumber demand equations were specified on the basis of demand per dwelling unit as well as total quantity of lumber consumed to separate the influence of changes in the type and size of dwelling units built. In all there were eight interdependent relations including price equations of Douglas fir stumpage and lumber, and the stumpage price of southern pine. (The lumber price of southern pine was treated as a predetermined variable on a priori evidence). Two Stage Least Squares were used to estimate the parameters for the period 1947-67.

Typically, factors of production have low price elasticities and high income elasticities of demand. But Robinson's results for the

Douglas fir lumber demand equation showed the reverse. He explained the discrepancy by arguing that the income variable measured only changes in the size and type of dwelling units constructed, not their number. If the number instead of the size of dwelling units is used, then the elasticity was found to be unity. No reason was attributed to the large value of the price elasticity of demand (-0.87). The supply price elasticity was however found to be in conformity to a priori notions - relatively inelastic. Robinson's model showed how the specification of a variable affected the elasticity calculations. If lagged variables had been incorporated more reliable long-term supply and demand elasticities could have been provided. His elasticities could have been biased because he ignored competition for the common resource base from plywood and pulpwood consumption.

The models of McKillop and Robinson implicitly assumed perfect competition in both the sellers' market and the buyers' market. However the study by Leuschner (1973) of the aspen pulpwood market in Wisconsin is different in terms of market structure. On the buyers' side there is an oligopsonistic situation such that the action of one large firm could have considerable effect on the market price of aspen pulpwood. On the sellers' side however, the market was more competitive with a large number of independent dealers, producers and dealer-producers. The situation is complicated because some producers work only part time, and would stay in the industry in any particular year according to how much they think they are earning. The market structure was posited to have an effect on price elasticities. Leuschner's final demand equation has however only one explanatory variable - the total pulping capacity of pulpmills located in Wisconsin. He dropped the price variable in the final equation because he argued that the short-term demand for pulpwood would not depend on price because of the high fixed costs of operating a pulpmill. He also discarded the price of substitutes because a major change in the species composition used at a mill usually required developing new pulping formulae of installing new equipment, and this chain of events could take 5 to 10 years.

As expected, his results in a linear functional form for the period 1948-1969 showed that quantity demanded is positively related to capacity (an exogenous variable), with an elasticity of 2.8. When the price variable was incorporated, it was found to be non-significant. The neglect of price factors in explaining demand and other factors like prices of substitutes and income is, theoretically speaking, inadequate. Likewise, his supply equation is deficient - while the price was taken into consideration, cost factors, prices of substitutes, technology were completely ignored. The other independent variables were the quantity supplied lagged one year and the level of imports lagged one year. The point price elasticity of supply was 2.6, statistically significant at 10% level. The coefficients of the other two variables showed that supply increased as the quantity sold in the previous year increased and decreased as the imports in the previous year increased. Leuschner's findings, however, have to be taken with caution in view of the deficiencies in the specification of his model.

Models incorporating lagged responses have been used only recently in forestry literature. Before we consider them it would be useful to discuss the concept of a lag. For example, a rise in the price of, say, plywood may not affect production immediately. A firm simply cannot increase output if it is already at capacity. Even if it is working below capacity, there are other factors to take into consideration, like procuring additional veneer logs, or hiring and training new workers. The lapse of time between a cause (say, a rise in price) and its effect (an increase in output) may take a specific time - three months, a year or even several years.

Junz and Rhomberg (1973) distinguish several kinds of lags, which their study of 13 exporting countries showed to stretch for as long as four or five years. First of all, there is the recognition lag - the time it takes for market participants to be aware of changed conditions. Then, there could be a decision lag - the time taken to place new orders or expand business or set up new firms. At the same time, there could be a replacement lag when no new additional materials are bought until

existing stocks are used up or existing equipment worn out. Even if orders are made immediately, there could be a delivery lag. (Trade figures are only published months or perhaps years after the orders are first placed). The production process itself takes time depending on the commodity; the gestation period could itself give rise to a production lag.

All these factors show delayed responses on the supply side. Similarly, there could be lags on the demand side. In forestry, the focus so far has been only on the demand side, ie with respect to variables affecting consumption. Nerlove (1957) distinguishes three reasons for such lags in consumption:

- a) Psychological:- under which we include forces of habit and assumptions on the part of consumers that changes may be only temporary. Consequently, habit and uncertainty about the future make for rigidity in consumer behaviour. If a change in price or income persists for a sufficiently long period, consumers may become convinced of its permanence and act accordingly.
- b) Technological:- which includes factors such as a lack of knowledge about possible substitutes.
- c) Institutional:- which includes situations in which certain contractual items of expenditure or savings (for example, instalment credit insurance) may need to be adjusted before shifts can be made in consumption patterns.

The distinction between the various causes of lags is seldom clear-cut, and in empirical research, one must decide on available evidence whether the behaviour of producers or consumers is likely to be affected by one or more of these considerations.

Dynamism is achieved in commodity models by the use of distributed-lag or autoregressive procedures. A distributed-lag model is when the regression equation not only uses the current but the lagged (past) values of the explanatory variables. It is an autoregressive model if there are one or more lagged values of the dependent variable among its explanatory variables. The most common ones used are those of Koyck (1954) and Nerlove (1957). But we would consider these in the next section

when we present our model. At this juncture, we would review two studies that incorporated such delayed responses in their models forecasting future consumption levels of wood products.

Buongiorno's (1977) dynamic consumption function for forest products could be written as follows:

$$C_{i_t} = \alpha C_{t-\theta}^\beta Y_t^\gamma Y_{t-\theta}^\delta$$

or in log terms,

$$\log C_{ij_t} - \log \alpha + \beta \log C_{i_{t-\theta}} + \gamma \log Y_t + \delta \log Y_{t-\theta} \quad (6.2)$$

where C_{ij_t} and Y_t are as in the FAO-USDA models

θ is the time lag, which in his case stretched to 10 years. He argued that the driving force in the growth of consumption of forest products in a country is the growth of income, as measured by a change from $Y_{t-\theta}$ to Y_t . But the response to a given change in income varies depending upon the initial level of income and consumption. For example, two countries may have the same level of income, but the housing stock of one, say country A, is lower than that of B. These two countries may respond quite differently to the same increase in the level of income, with sawnwood consumption rising faster in the country with an initial low level of consumption. He carried out statistical estimates of the functions for 11 wood products using data from 130 countries observed at 10 year intervals (1961-71). He grouped countries on per capita income basis - 24 developed and 106 less developed. The results total higher standard errors and lower values for the latter. They generally showed positive signs for $\hat{\alpha}$, $\hat{\beta}$ and $\hat{\gamma}$, and negative for $\hat{\delta}$, since for given C_{t-1} and Y_t , the country with the highest income growth, and thus the lowest $Y_{t-\theta}$, should usually reach higher levels of future consumption. However, multicollinearity, particularly between Y_t and Y_{t-10} and even between Y_{t-10} and C_{t-10} could lead one to doubt the validity of individual results, although for forecasting purposes

they may be appropriate. One weakness of Buongiorno's work is its highly aggregative nature, which may give rise to problems of aggregation discussed in Section 5.4. Supply factors are also not given due consideration.

Buongiorno (1978) again worked with a similar model presented above in a study of income and price elasticities of paper and paperboard consumption for 43 countries, but developed and less developed, using 1963-1973 data.

The difference between equation (6.2) and equation (6.3) presented below is that the lagged income variable is dropped, and is another variable, the price of the most direct substitute, S_t is incorporated. Newsprint and printing and writing paperboard were considered. $\hat{\beta}_2$, $\hat{\beta}_1$, and $\hat{\beta}_3$ are the income, price and cross-price elasticities of demand, respectively.

$$\log C_t = \log a + \beta_1 \log P_t + \beta_2 \log Y_t + \beta_3 \log S_t + \beta_4 \log C_{t-1} + u_t \quad (6.3)$$

Buongiorno estimated the equation with and without the lagged consumption variable by the ordinary least squares method. All the coefficients had the expected signs, positive for $\hat{\beta}_2$ and $\hat{\beta}_3$ and negative for $\hat{\beta}_1$. The coefficient of C_{t-1} was less than one but more than 0.80 in most cases, implying rapid adjustment. However, there was evidence of positive serial correlation for the static model, and negative serial correlation for the dynamic model. He assumed that this was due to a specification error, arising from the use of pooled cross-section and time series data of 43 countries.

Buongiorno then estimated his model by adding a set of dummy variables to the explanatory variables in equation (6.3), one for each country. D_i , the dummy variable for country i , is one for all observations relating to that country, and zero for other countries to take into account the bias due to differences between countries not accounted

for by the variables in the model. The recomputed results showed that many of these country effects differ significantly from zero at the 95% confidence level. The inclusion of the dummy variable was reported to have suppressed all serial correlations for the dynamic models, although positive serial correlation remained for the static models. Income and price elasticities were not seriously affected by introducing country effect in the static models, but this was not so for the dynamic model. The coefficients of lagged consumption considerably decreased while the short-term income and price elasticities increased markedly. The study goes to show the sensitiveness of elasticity estimates to model specification.

Using another way of taking into account of differences across countries, Buongiorno regrouped the countries into high income and low income categories, and re-estimated equation. Serial correlation for both static and dynamic models was evident. An F test did not lead to rejecting the hypothesis that demand equations were similar for high and low income countries. However, the validity of the test is uncertain because of significant differences in the residual variances for the two groups of countries.

The McKillop-Robinson-Leuschner models are market models considering the interrelationships between supply and demand. Process models, on the other hand, emphasise the inter-relationships between the finished product and earlier stages of processing, in particular, as supply and demand as inputs and finished products within an industry. Such process models have been used to study the U. S. steel industry by Higgins (1969) and the petroleum industry by Adams and Griffin (1975). In forestry, Adams and Blackwell (1973) combine the features of the industrial process model with that of the market model for the U. S. forest products industry. At the level of lumber and plywood, as in a typical industry model, requirements from intermediate stages of production are linked to final demand. Price determination includes a mark-up on average input cost. At the level of saw logs and veneer logs, on the other hand, supply and demand determine price as in a

market model. These were incorporated in 12 stochastic equations and 3 identities, and were tested as a self-contained system over the period 1949-69. Eight dependent variables were the production and consumption of logs, lumber and plywood. The consumption demand for the latter was divided into those for construction, and those for other uses. No subdivision was given for the others. There were three price equations for the above commodities, and another one for veneer, which was determined purely by the supply price of logs and a time trend. There was one equation accounting for imports from Canada and another explaining log exports to Japan. Basically the price of lumber was a function of capacity utilization in wood products industry and the price of sawlogs, while that of plywood by similar factors but for reasons not explained a time trend was incorporated. The price of sawlogs results from the interaction of demand for sawlogs and veneer logs, which was proxied by a dummy variable indicating supply shortages and a time trend, and supply, i.e. the domestic production of all logs. Japanese exports as in the case of the McKillop model depended on new residential construction in Japan, export controls (proxied by a dummy variable) and a time trend. The demand for lumber from Canada was a function of the price and U. S. A. production.

The entire equation system was simulated over the sample period, 1949-69, using actual values of the exogenous variables and calculated values of the endogenous and lagged endogenous variables. They found that the simulation errors were generally quite modest, and approximately the same magnitude as the single equation errors. The responses of the model to changes in demand were tested by making small changes in the exogenous model.

The model, despite its complexity and generality, is useful for industrial studies such as the Malaysian wood industry if data ^{are} \wedge collected appropriately in an input-output format, tracing relationships within the sector. Adam and Blackwell's model however would be more useful for individual regions, as well as covering various types and qualities of lumber specifications.

The broad picture that emerges from this survey is that over the

years, models used in forestry to reflect supply and demand relationships have become more sophisticated and rigorous, taking into account inter-relationships within the sector as well as introducing dynamic adjustment mechanism. But in most cases, this inevitably has been at the expense of precision. There is a trade-off between the scope of the study and the specification of the model. The larger the scope (i. e. covering several countries and/or many products simultaneously), the more general is the specification, and consequently, the implications would be broad, too. Ultimately, the model we choose would depend on our objectives and the quality of data we are working with. If one is only interested in broad trends and guidelines, then a large, aggregative model incorporating several interlocking relationships would suffice. However, if our requirements are more specific, we may need a highly disaggregative model concentrating on one product, preferably broken down in various end uses or specifications, on a regional or countrywide basis.

Section 6. 2. 2: Survey of Forestry Models - Malaysia

We now turn to the literature on Malaysia, where three studies have operated on relatively speaking simple models. The F. A. O. model described earlier was applied to Malaysian conditions to forecast the level of domestic consumption in Peninsular Malaysia for sawn wood and plywood. We would look at these forecasts when we compare them with those worked out in this study. Other demand variables postulated in economic theory (price of the product, prices of other products and taste) were ignored. Supply aspects were also not considered.

Using the same figures of the F. A. O. study (1973), Radzuan (1976) added the price variable to the model also to forecast future consumption of sawnwood and plywood in Malaysia. However, for sawnwood, his per capita income variable was computed as $1/Y$ because he reckoned that "as income increases, consumption will rise initially at a rapid rate until it reaches a certain level beyond which it will assume an asymptotic pattern," which his results showed to be 15.6 cubic feet or 0.44 cubic

metres. Although his result was statistically significant, we feel that experience in the industrialized countries do not give any evidence of such a relationship. Radzuan's income variable for the plywood consumption function was similar to that of the F. A. O. study, but the coefficient value was not significantly different from zero. The price variable in both equations, however, was not significant, indicating a point elasticity that was virtually zero in both cases.

Luqman (1978) studied the demand for Malaysian sawnwood and plywood in the European Economic Community with special reference to West Germany and the United Kingdom. His model was similar to that of Radzuan but he tried both the linear and log linear specifications. He, however, traced the effects of the gross domestic product and population separately on demand besides using the per capita G. D. P. variable. Generally, the t values for the latter were higher. The results show a negative sign for the G. D. P. variable in respect of E. E. C. as a whole and U. K., but a positive sign for West Germany. However, for the E. E. C. one must be aware that the relationship between G. D. P. and demand pertains to Malaysian wood products only. Malaysia only supplied about 28% of the total sawnwood imports of the E. E. C. and about 6% of plywood imports in 1976.

For sawn wood, Luqman's price variable showed an elasticity of 0.15 for the E. E. C. as a whole, but it was not significant. For West Germany and U. K., however, the corresponding values were 0.87 and 0.77 respectively both significant. In other words, increases in price did not reduce the demand for Malaysian sawnwood. For plywood the picture is slightly different, showing a priori expected signs for the E. E. C. (-0.25) and the U. K. (-6.14). For West Germany, the price elasticity was exceptionally large at +4.2. Although all these results were significant, one has to take into account the fact that prices of unit values used were those that were averaged over other hardwood species prices besides Malaysian wood. Also, Luqman ignored the effect of substitutes, which could affect the price elasticity.

Our study would try to expand from existing work on Malaysian

forestry in four main areas:

- i) Previous studies have ignored examining sawlogs, which have earned more foreign exchange than either sawnwood or plywood. We would consider the market response of this commodity.
- ii) Supply aspects for wood products have not been considered previously, and we would work out supply functions for sawlogs, sawnwood and plywood. The demand function would be worked out separately for exports and home consumption.
- iii) Previous efforts have been solely concentrated on Peninsular Malaysia. However, our study will deal not only with Malaysia as a whole, but the three main regions as well - Peninsular Malaysia, Sarawak and Sabah.
- iv) Dynamic aspects taking lags into account, absent in earlier studies, will also be worked out in addition to those that assume that adjustment of supply or demand takes place during the existing time period.

Section 6.3.1: A Proposed Econometric Model for Malaysian
Wood-products.

Our procedure to formulate and estimate a model for the Malaysian forestry sector is as follows:

- a) Identify the products and markets to be studied;
- b) Formulate supply and demand relationships of the products and markets on the basis of economic theory;
- c) Express these relationships in a mathematical form to facilitate estimation;
- d) Estimate these relationships, particularly supply and demand elasticities;
- e) Analyse the results in the light of economic theory and other factors not formally specified in the equations due to difficulty of measurement or non availability of suitable data.

As no method can take into account of all possible influences, the selection of the variables affecting the supply and demand has been done on the basis of those whose influence cannot be neglected. Our aim is to choose and estimate those relationships that do not change freely in structure over the sample period. There is a restriction - the variables chosen should be quantifiable directly or by proxy. Hence behavioural factors such as sales promotion, reliability and after sales services have to be excluded, not because they are unimportant, but they are difficult to measure. Nevertheless, in interpreting any results based on only quantifiable variables, due consideration will be given to qualitative factors, which also include the social and political environment. It is in this spirit that we will formulate the model, list out its empirical restrictions, quantify, estimate and interpret the market relationships.

As mentioned earlier, we are confining our attention to three wood products, viz, sawlogs, sawnwood and plywood. These are the most important commodities both from the production and export points

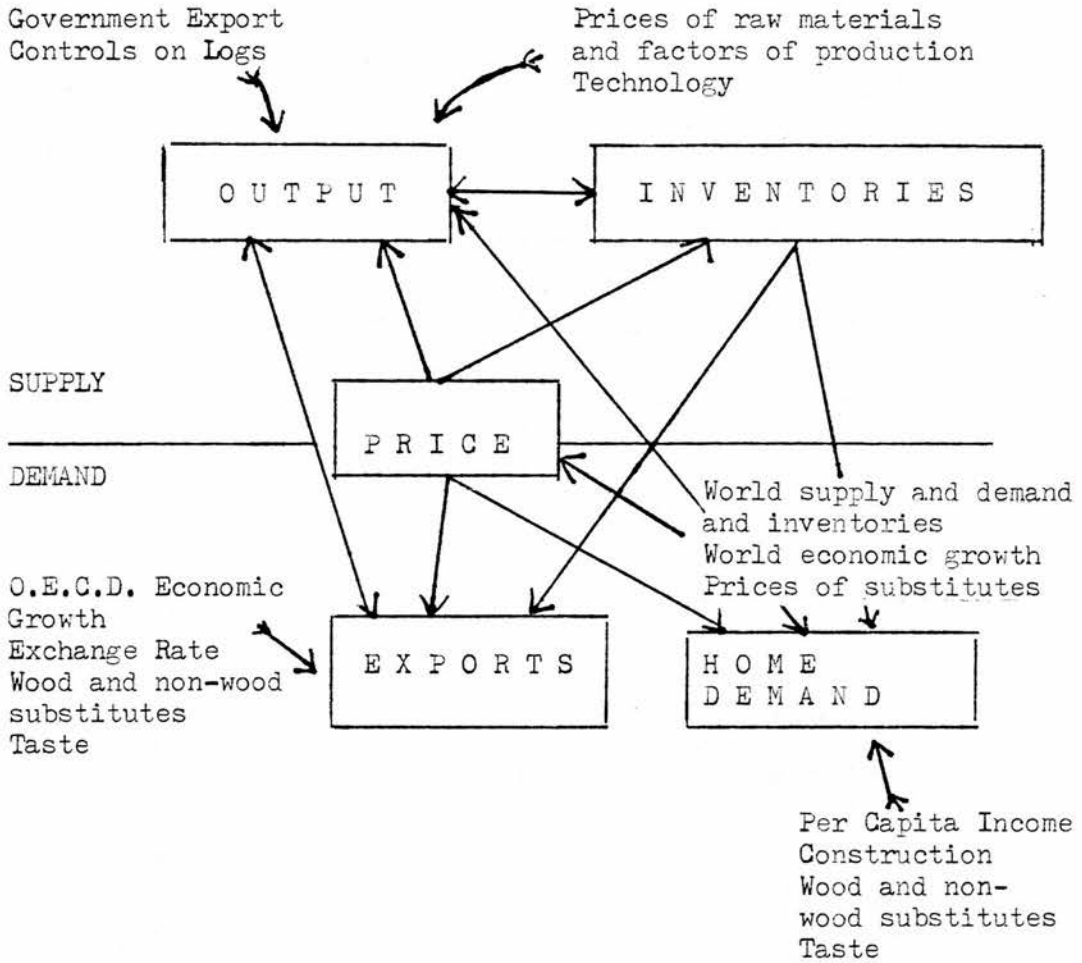
of view, and comprise more than 80% of the total value of output in the sector. We are not considering each individual species because of difficulties of getting data as explained in Chapter 5, although ideally, this is more appropriate. However, a general analysis of all the commercial species lumped together can still be useful in indicating broad trends.

We will use data covering the whole of Malaysia, whereas all previous studies only considered Peninsular Malaysia. To study the effects in different regions, we will also estimate the model for individual areas, viz, Peninsular Malaysia, Sarawak and Sabah. Besides showing the degree of variations in demand and supply elasticities, it will point out the biases of aggregation.

Although Malaysia has been a major world supplier of hardwood sawlogs and sawnwood as shown in Chapter 2, we can assume that it is a price taker. In other words, prices for its products are determined by world market conditions. This is not too unrealistic as these prices also take into account ^{the} international competition from other species and other products. However, within Malaysia there could be other factors, such as location and institutional arrangements, that may affect the domestic price besides world conditions. But to incorporate price as an endogenous variable for the domestic market, and an exogenous one for the world market would raise complications especially when we have no reliable time series as domestic price indices. In any case, to the extent that domestic requirements will have to compete for supplies destined to the export market, the use of an exogenously determined price can be justified.

The other common assumption of free competition- profit maximisation and homogeneity to product - also applies. The homogeneity condition implies that there is no distinction made for each individual product with regard to quality or location in each geographical area. Classical economic theory is based on an individual firm or industry, and we will assume that these micro relations apply at the macro level as well.

The model is based on the classical economic theory of supply



Direction of arrows indicate the source of effect on individual variables, and dual-directionality implies simultaneity

FLOW DIAGRAM SHOWING THE RELATIONSHIP OF MAIN VARIABLES AFFECTING THE SUPPLY, DEMAND, AND PRICE OF A WOOD-BASED COMMODITY IN MALAYSIA

DIAGRAM 6.1

and demand, where demand is determined by the price of the product, the prices of substitutes and complements, income and tastes of consumers, while supply is affected also by the price of the product as well as those of other products, the prices of factors of production and technology. We will elaborate on them when we formally outline our model.

The demand equation is differently specified from previous studies. We are separating the demand into exports and home consumption, and these are assumed to be independent of each other although, especially for sawlogs, there is competition for supplies by millers in the domestic market and exporters. Generally, in most cases, the good quality species end up in the world market, where prices are higher, while inferior grades are mainly released in the domestic market. We are separating export from home demand because the relative degree of influence of factors explaining each are likely to be different.

The relationship of the key variables affecting the supply, demand and price of each wood product is represented in Diagram 6.1. Basically, supply is determined by the price of the product, prices of the raw materials and other factors of production, technology inventories and government policy variables. The policy variables are government export control measures, particularly of sawlogs in Peninsular Malaysia. Export demand is affected by the price, world income growth, exchange rate of currency, the prices of substitutes and taste, while home demand is influenced also by the price of the commodity and those of its substitutes, and the per capita income of the country, and the level of construction activity and taste. Prices are determined on world supply and demand conditions, as well as world inventories, and prices of substitutes. More formally, the model can be expressed in equation form as follows:

$$(1) \quad Q_t = f(P_t, P_{t-\theta}, L_t, F_t, T_t, Z, u_t) \quad (6.4)$$

$$(2) \quad X_t = g(P_t, Yw_t, Sw_t, R_t, J_t, u_t) \quad (6.5)$$

$$(3) \quad H_t = h(P_t, Ym_t, Sm_t, J_t, u_t) \quad (6.6)$$

$$(4) \quad I_t = I_{t-1} + Q_t - (H_t + X_t) \quad (6.7)$$

Definition of variables:

Q_t	:	Quantity supplied or produced of sawlogs or sawnwood or plywood - Malaysian (volume)
X_t	:	Malaysian exports of commodity in question (volume)
H_t	:	Malaysian domestic consumption of commodity (volume)
P_t	:	Price of commodity under analysis in current period
$P_{t-\theta}$:	Lagged price variable
L_t	:	Supply of sawlogs or stumpage
F_t	:	Cost index of factors of production
T_t	:	Technological changes reflected by changes in real level of capital investment
Z	:	Dummy variable to indicate log export controls
Yw_t	:	Income growth of importing countries
Sw_t	:	Ratio of consumption of commodity and substitutes, $Sw_1, Sw_2 \dots Sw_n$ (world)
Sm_t	:	Ratio of consumption of commodity and substitutes, $Sm_1, Sm_2 \dots Sm_n$ (Malaysian)
R_t	:	Exchange rate
I_t	:	Malaysian inventories
I_{t-1}	:	Malaysian inventories (in period t-1)
J_t	:	Taste, and general psychological image of wood
Ym_t	:	Per capita income - Malaysian
u_t	:	Stochastic disturbance term

Equation (6.4) is the supply equation. We expect a priori a positive sign for the price variable, indicating a greater supply response to higher prices. Given raw material supplies and other inputs, the production of sawlogs, sawnwood and plywood can be done within a year, and as such we can expect the current price (averaged over 12 months) to be the appropriate guide for production decisions. However, it will be useful to incorporate the average price in the

previous period to take account of decisions made at the beginning of the year. The variable could also be the average price for the year in question and the previous year. The appropriate price formulation will necessitate experimentation.

The supply of stumpage for sawlogs, and sawlogs for plywood and sawnwood is important especially in a situation of dwindling supply of trees. However, the problem is one of measurement especially where there are no time series data on the amount of stumpage available. As for sawlog supplies to processing industries, there are no breakdown figures for those that feed saw mills, and those that cater for plywood mills (veneer logs). Under these circumstances, a proxy variable, such as a time trend could be suitable to pick out these effects.

As to the other variables, F_t , the cost of input index, we will expect increases in cost to reduce supplies (a negative sign on the coefficients), while for the technology factor, T , its effect will be to increase output over time (therefore, the sign will be positive). There are problems in measuring changes in technology, with changes in the real value of capital equipment a reasonable proxy. Because of data problems, a usual way to take into account changes in technology is to use a time trend.² The cost of input index is also difficult to get especially in less developed countries. Previous studies (McKillop, 1967) have used wages in the industry and price of electricity as indicators of cost. Again, for want of a better measure, a time trend could pick out these changes.

Z is a dummy variable to indicate export control measures. As explained in Chapter 2, the Malaysian government banned the exports of selected species, and imposed restrictions on others from 1972. We will use 1 for the year where controls were imposed, and 0 where there was free trade. We can expect a negative sign if the controls had been effective.

2. See Desai (1976) p. 138 and Labys (1973) p. 21-22.

Turning to the export function (6.5), we can expect a low price elasticity coefficient, as the three products are producer goods forming a small part of the total cost of the end products. Ideally, the most appropriate price index should be a weighted one incorporating the various grades and specifications of Malaysian wood. Usually, such a kind of weighted index is not available, and unit values, averaging the prices of different species, grades and specifications are used. The price index would need modification if the currency exchange rate fluctuates. One could use a separate exchange rate variable to trace the effects of a change in the exchange rate on export demand, or, alternatively, the price variable, if calculated in domestic currency, can be expressed in terms of a trading currency, the most popular being the American dollar.³ If the exchange rate variable is expressed as the amount of Malaysian ringgit one U. S. dollar will buy, we can expect the coefficient to have a positive sign, implying that a strengthening of the American currency vis a vis the Malaysian, ceteris paribus, would increase Malaysian exports of the product in question.

We can also expect a positive coefficient for the world income variable. Since, Malaysia's main trade is with O. E. C. D. countries, an increase in the real Gross Domestic Product is likely to stimulate greater demand. Another good indicator of world business conditions is the level of world trade, reflected by world imports or exports.

The variable incorporating the prices of substitutes will also have a positive sign, implying that an increase in the price of a substitute results in consumers shifting to the commodity in question. There are however alternative ways of specifying the substitution pattern among commodities. Pringle (1971) distinguishes three phases in inter competition among wood products and vis a vis non wood products. The first phase is when two established commodities like plywood, sawnwood and particle board competing with one another.

3. See Tyler (1973) for exchange rate effects on exports, p. 5.

Another phase is the initial replacement of one product by a new competitor (for example paperboard containers replacing bottles for milk). The third kind of situation represents potential threat by a new competitor. In such cases, methodological problems may arise in specifying the variable or variables, and therefore in forecasting the consumption of the replacing or replaced commodity. Pringle suggests the ratio of consumption of the competing material and commodity in question, for any substitution between commodities would be reflected in the ratio. McKillop (1967) however used both the current prices of competing materials and ratios of past prices as variables in demand equations which were developed for several commodity groups. There is a time lag in substitution, and we would prefer to use the ratios of prices lagged one year for the goods in question. It is however acknowledged that in some cases, price differences may not be too important as say quality or ease of handling. In case of substitutes which cannot be based on historic data, simulation exercises could shed some light if technical and cost attributes can be worked out.

Another factor in demand analysis is the psychological image of wood. Over the years the taste for wood has changed with a growing number of non-wood substitutes like plastic. This has affected the overall competitive conditions of wood. This is a behavioural factor difficult to measure, and we would use the time trend to examine its affect on demand. If such factors have increased the demand for wood, we can expect a positive sign.

For the home demand equation (6.6), we expect low price elasticities for similar reasons as explained above. The sign of the substitutes variable is expected to be also positive as explained above, and so would be for the per capita income variable. In place of income, the amount of construction activity could be a reasonable alternative.

Equation (6.7) is an identity, and inventories are specified as an adjustment mechanism.

Price theory does not provide us with the precise functional form

for the model.⁴ Whether a linear, or loglinear or a nonlinear functional form gives the best results will come from empirical verification itself. Most applied studies opt for the linear or the loglinear functional form. The former assumes an additive effect of the explanatory variables on the dependent variable, while the loglinear provides for a multiplicative effect. The coefficients of the linear model can be interpreted as point elasticities, whereas in the loglinear form the β 's are elasticity coefficients. The loglinear model assumes that the elasticity coefficients remain constant throughout, implying that a given percentage change in each explanatory variable would have a constant percentage effect on the dependent variable for all values of the explanatory variable. (Sometimes the loglinear or the double-log form is called the constant elasticity model). Given the ease of interpreting the coefficients as elasticities, we prefer the loglinear functional form.

The model presented is a simplified one, taking into account only key relationships. We are aware of the complex relationships of different commodities within the sector, and as well as the links with other sectors in the economy, such as transportation and construction. To capture all these effects, either in a domestic or international setting, will involve a very lengthy and complicated model, which besides its problems of specification, will be difficult to verify empirically. In any case, even if this were possible, the findings will be very general. We reckon that pragmatically, we have more to gain if we verify the relationships, commodity by commodity, estimating the most important variables.

Section 6.3.2 An Alternative Dynamic Model

The implicit assumption of the above model has all along been

4. See Gujarati (1978), p. 52-56, Johnston (1972), p. 47-55, and Maddala (1977), p. 6-9. Leamer and Stern (1970) suggest that the use of different functional forms may be looked upon as testing the significance of a particular functional form rather than the significance of the particular explanatory variable, p. 9.

output or demand adjust to changes in variables affecting them, during the time period under consideration. As explained in Section 6.2.1, when we considered dynamic models, this need not be so. An alternative model is presented to take account of the various lags mentioned previously. By estimating the above model, (simply referred to as the static model) and comparing it with the dynamic model, we hope to evaluate importance of lags in the adjustment process.

As indicated previously, different models have been used to incorporate dynamic adjustment relationships, of which the most well-known are those of Koyck and Nerlove. A useful survey is by Griliches (1967), while Tomek and Cochrane (1962) test their usefulness in a study of meat, and Lim (1975)^a for tin. More well-known in the sphere of commodity studies is the Nerlove (1957) stock adjustment or partial adjustment model. A distinction is made between short and the long-run elasticities as well as the role of expectations. The demand or supply in any one period is assumed to adjust only partially towards the desired or equilibrium level. In other words expectations are not static.

Our static export demand equation (6.5), taken here as an example, in dynamic terms, assuming a loglinear functional form, will be as follows:

$$\log X_t^* = \beta_0 + \beta_1 \log P_t + \beta_2 \log Yw_t + \beta_3 \log Sw_t + \beta_4 \log R_t + u_t \quad (6.8)$$

where X_t^* is the expected or desired exports of the commodity at time t , and the other terms as explained earlier.

Since the actual values of equilibrium exports cannot be observed, equation 6.8 cannot be estimated directly. Following Nerlove's partial adjustment hypothesis, expressed here in proportional terms for consistency with the rest of the model:

$$\left(\frac{X_t}{X_{t-1}} \right) = \left(\frac{X_t^*}{X_{t-1}^*} \right)^\delta \quad (6.9)$$

where δ , such that $0 < \delta < 1$ is known as the speed of adjustment or coefficient of adjustment and where $\left(\frac{X_t}{X_{t-1}} \right)$ = actual proportional change and

$(X_t^* | X_{t-1}) = \text{desired change.}$

Equation 6.9 postulates that the actual change in exports in any given time period t is some fraction δ of the desired change for that period. If $\delta = 1$, it means that the actual exports/^{are} equal to the desired exports, i. e., there is complete adjustment within the period. However, if $\delta = 0$, means that nothing changes since actual exports at time t are the same as that observed in the previous time period. Typically, δ is expected to lie between these extremes due to the lags explained previously. Values of δ greater than one or less than zero are not easy to interpret. If >1 this could imply over-reaction by market participants, and if below zero could mean shortfalls.⁵ In log form the adjustment mechanism could be equivalently written as:

$$\log X_t = \log X_t^* + (1 - \delta) \log X_{t-1} \quad (6.10)$$

This shows that the observed exports at time t is a weighted average of the desired exports at that time and the exports existing in the previous time period, δ and $(1-\delta)$ being the weights. Now substitution of (6.10) into (6.8), and taking logs, gives:

$$\begin{aligned} \log X_t &= \delta \log (\beta_0 + \beta_1 P_t + \beta_2 Yw_t + \beta_3 Sw_t + \beta_4 R_t + u_t) + (1-\delta) \log X_{t-1} \\ &= \delta \beta_0 + \delta \beta_1 \log P_t + \delta \beta_2 \log Yw_t + \delta \beta_3 \log Sw_t + \delta \beta_4 \log R_t \\ &\quad + (1-\delta) \log X_{t-1} + \delta u_t \end{aligned} \quad (6.11)$$

The error term is δu_t , and if u_t satisfies the assumptions of the classical linear regression model, so will δu_t . One could therefore expect ordinary least squares to yield consistent estimates although

5. See Yandle (1970), p. 82-85. He says that where δ is >1 equilibrium will be reached only after a series of such over-reactions of decreasing amplitude if $1 > \delta > 2$. When δ is >2 , the situation is analogous to that of an exploding cobweb.

there could be some bias in small samples.⁶ Although X_{t-1} depends on u_{t-1} and all the previous disturbance terms, it is not related to the current error term u_t . Therefore as long as u_t is serially independent, X_{t-1} will also be independent or at least uncorrelated with u_t , thereby satisfying the O. L. S. assumption between the explanatory variables and the error term.

For estimating purposes, equation (6.11) could be re-written as:

$$\log X_t = b_0 + b_1 \log P_t + b_2 \log Yw_t + b_3 \log Sw_t + b_4 \log R_t + b_5 \log X_{t-1} + u_t \quad (6.12)$$

The coefficient of adjustment is obtained from $(1-b_5)$, its value normally ranging between 0 and 1. The estimate of b_1 is the price elasticity, b_2 , the income elasticity of demand, b_3 , the cross-price elasticity of demand, b_4 , the exchange rate effect on demand. δ is $(1-b_5)$, the speed of adjustment. The long run elasticities in all cases can be obtained by dividing the estimated b 's by $\hat{\delta}$. The adjustment coefficient determines the relationship which should exist between the short and long run elasticities.

We could make similar adjustments to equations 6.4 and 6.6, again assuming a loglinear functional form:

$$\log Q_t = a_0 + a_1 \log P_t + a_2 \log L_t + a_3 \log F_t + a_4 \log T_t + a_5 Z + a_6 \log Q_{t-1} \quad (6.13)$$

$$\text{and } \log H_t = c_0 + c_1 \log P_t + c_2 \log Ym_t + c_3 \log Sm_t + c_4 \log H_{t-1} + u_t \quad (6.14)$$

The short-run and long-run elasticities of the respective coefficients can be worked out in a similar way.

6. For proof, see Johnston (1972) p. 274-278.

One has, however, to be careful in interpreting these elasticities where $\hat{\delta}$ may be biased either because of a specification error or due to serial correlation of the error term.

Section 6.4: Data Used in Computation of Models

Figures of production and exports of the three commodities were taken from the relevant official statistics. As in the experience of other less developed countries, statistics for exports are usually more reliable than production because of the ease of collection and checks. In all cases figures are aggregated over species and grades, as time-series data on breakdown are not forthcoming. Official figures for home consumption were not available, and the apparent consumption was calculated by deducting from production, exports and adding imports. This method is crude as it does not take into account stocks, but is generally used in most studies of less developed countries, and in developed ones too, since records of actual domestic consumption are difficult to come by.

There are no records of the forest inventory before 1970, and as such figures for the amount of matured area remaining after harvest cannot be worked out on a time-series. It is hoped the constant term and the time trend variable covering 1960-1976 will pick up this effect.

Likewise there ^{are} no reliable time series data on the state of competition and substitution among the various wood products and non-wood products. However, to capture this and also to calculate the cross-price elasticities of demand for wood products the ratios of the respective world unit values of sawnwood, plywood and particle board, all competitors, lagged one year were used. The lag is to allow for time of adjustment.

For prices, the comments made in Chapter 2 are relevant. In all cases, world and Malaysian unit values were used which have been aggregated over grades and species. In other words, some

average elasticity is obtained, and this may be used satisfactorily in projections, provided the species and the grades vary equally in the period of observation. Since cost figures are not available, one can argue that the price data could be deflated. There are practical problems. The biggest is selecting an appropriate deflator for the time period covering both Malaysia and the world, particularly the latter, where prices have varied in different countries. It was felt that using ad hoc deflators aggregated over regions and commodities would mar the analysis more than leaving them in terms of current prices, despite built in biases. Leamer and Stern (1970) are also of the view that it may be preferable to use the current-value variable to avoid errors introduced in the process of deflating.

The paucity of data on the cost index and technology is made up by the use of the exponential time trend, implying constant growth.

To assess the impact of business conditions in importing countries, the combined G. D. P. of O. E. C. D. countries was used. Most of the Malaysian forestry produce ends up in these countries. Also tried out as proxies were the value of world trade and the world G. D. P. index. For corresponding Malaysian conditions, a host of variables were experimented with - the Gross Domestic Product at Factor Cost, the National Income, the per capita income, the per capita G. D. P., the value of construction, and the value of manufacturing. Data on these came from official publications.

The time period of analysis is 1960-1976, with 1980 and 1985 used for extrapolation. In the case of plywood for Sabah and Sarawak, the period of analysis is 1965-76: as the industry did not exist prior to 1965. This is a post-independent phase, not marked by sustained disturbances to production. The data points are on an annual basis, and hence despite the length of the period (17 years), the number of degrees of freedom to work with are limited. Quarterly figures are

KEY TO VARIABLES USED IN EQUATIONS AND RESULTS

SAWLOGS

- Q_L : Quantity of Sawlogs Produced (cubic metres)
- X_L : Exports of sawlogs (cubic metres)
- H_L : Home consumption of sawlogs (cubic metres)
- P_L : Malaysian Unit Value of sawlogs (M\$ per cu m)
- PA_L : Malaysian Unit Value of sawlogs averaged over year t and year t-1 (M\$ per cubic metre)
- PE_L : Malaysian Unit Value of sawlogs adjusted for exchange rate (U.S.\$ per cubic metre)

PLYWOOD

- Q_P : Quantity of plywood produced (cubic metres)
- X_P : Exports of plywood (cubic metres)
- H_P : Home consumption of plywood (cubic metres)
- P_P : Malaysian unit value of plywood (M\$ per cu m)
- PA_P : World Unit Value of plywood averaged over year t and t-1 (U.S.\$ per cubic metre)
- PW_P : World Unit Value of plywood (U.S.\$ per cu m)

Note: Variables with subscript t-1 denote one year lag values

ABBREVIATION:

- OLSQ : Ordinary Least Squares technique
- DW : Durbin-Watson d test
- \bar{R}^2 : Adjusted coefficient of determination (R^2)
- C : Constant term

SAWWOOD

- Q_S : Quantity of Sawwood produced (cubic metres)
- X_S : Exports of sawwood (cubic metres)
- H_S : Home consumption of sawwood
- P_S : Malaysian Unit Value of Sawwood (M\$ per cu m)
- PA_S : Malaysian Unit Value of sawwood averaged over year t and year t-1 (M\$ per cubic metre)
- PE_S : Malaysian Unit Value of sawwood adjusted for exchange rate (U.S. \$ per cubic metre)

COMMON VARIABLES

- Y_W : Gross Domestic Product of O.E.C.D. countries
- Y_M : Malaysian per capita income (M \$)
- C T : Value of Malaysian Construction Expenditure
- P_{SP} : Ratio of world unit values of sawwood and plywood
- P_{PB} : Ratio of world unit values of particle-board and plywood
- P_{SB} : Ratio of world unit values of particle-board and sawwood

- T : Exponential time trend
- D : Dummy variable, 1 for 1972-76 and 0 for others

- CORC : Cochrane-Orcutt Iterative technique
- h : h test
- S.E.R. : Standard Error of Regression
- Rho : Final value of rho in CORC

TABLE 6.1

more appropriate if available, explaining seasonal trends as well as short-run elasticities. Nonetheless, a model based on annual data permits analysis of longrun policy decisions concerning investment, controls, tree acreage and inventories.

Section 6. 5: Interpretation of the Results

We will consider the results commodity by commodity. To facilitate reading, and at the same time to avoid clutter, only the results important from the point of view of economic and statistical criteria are given. The results are also presented of equations where there are large variations among different alternative specifications of important variables. Table 6. 1 gives the description of the variables used in the equations and the key to the results. By saying a variable is statistically significant, we will mean that it is significant at least at 90% level of confidence; otherwise it is regarded as insignificant.

Section 6. 5. 1: Saw Logs

a) Supply Elasticities

The main results of the supply function of sawlogs for Malaysia, and its regions are at Table 6. 2. We will first consider the results of the static model. Result A1 was most satisfactory both from the statistical and the economic points of view. The price variable, specified as unit value of time period t , was of the right sign (+) showing a very low price elasticity of supply, as expected. However, the variable was insignificant. Respecifying the variable in terms of average prices of year t and $t-1$ gave the wrong sign (-). The results of the individual regions also gave the negative sign to the price variable, but in all cases the coefficient was low and non significant (Results B1, C1 and D1). Apart from data quality, one reason for

SELECTED RESULTS OF SUPPLY FUNCTION OF SAWLOGS

DEPENDENT VARIABLE: $\log Q_L$

REGION	METHOD AND SPECIFICATION	C	$\log P_L$	$\log PA_L$	T	D	$\log Q_{L,t-1}$	R^2	D.W. (h)	S.E.R.	Rho
MALAYSIA	A1 OLSQ	8.27	0.07	-	0.10	-0.15	-	0.92	1.51	0.13	-
	Static	(7.50)	(0.26)		(6.08)	(-1.24)					
	A2 OLSQ	5.49	0.12	-	0.07	-0.11	0.31	0.93	2.03	0.13	-
	Dynamic	(1.99)	(0.40)		(1.86)	(-0.90)	(1.09)		(-0.59)		
	A3 OLSQ	8.68	-	-0.62	0.10	-0.06	0.27	0.94	2.56	0.12	-
	Dynamic	(3.09)		(-1.49)	(2.88)	(-0.54)	(1.03)		(-1.11)		
PENINSULAR MALAYSIA	B1 OLSQ	10.18	-	-0.70	0.14	0.00	-	0.95	1.18	0.12	-
	Static	(6.33)		(-1.68)	(7.12)	(0.00)					
	B2 OLSQ	3.13	-0.05	-	0.05	-0.08	0.61	0.95	1.84	0.11	-
	Dynamic	(1.47)	(-0.21)		(1.64)	(-0.78)	(2.45)		(0.32)		
	B3 OLSQ	5.62	-	-0.72	0.07	-0.03	0.62	0.97	2.39	0.09	-
	Dynamic	(2.86)		(-2.22)	(2.83)	(-0.35)	(3.00)		(-0.78)		
SARAWAK	C1 OLSQ	8.40	-0.28	-	0.08	-	-	0.41	0.55	0.33	-
	Static	(3.10)	(-0.39)		(1.98)						
	C2 OLSQ	-1.53	0.66	-	-0.03	-	0.87	0.82	0.98	0.18	-
	Dynamic	(-0.64)	(1.52)		(-1.07)		(5.44)		(1.95)		
	C3 GORC	1.85	0.73	-	-0.03	-	0.43	0.85	1.26	0.15	0.70
	Dynamic	(0.76)	(2.83)		(-0.83)		(1.64)		(1.47)		
	C4 OLSQ	3.30	-	-0.35	0.03	-	0.75	0.78	1.33	0.20	-
	Dynamic	(0.87)		(-0.45)	(0.58)		(4.01)		(1.33)		
SABAH	D1 OLSQ	9.23	-	-0.39	0.12	-	-	0.95	1.77	0.11	-
	Static	(6.89)		(-1.11)	(7.02)						
	D2 OLSQ	7.05	-	-0.42	0.09	-	0.30	0.95	2.16	0.10	-
	Dynamic	(3.20)		(-1.21)	(2.98)		(1.24)		(-0.32)		
	D3 OLSQ	4.75	0.22	-	0.06	-	0.28	0.95	1.59	0.11	-
	Dynamic	(2.30)	(0.98)		(2.10)		(1.14)		(0.81)		

TABLE 6.2

the negative supply response to price increases may be due to the way log concessions are farmed out as explained in Chapter 3. As noted earlier, non-economic factors play a large part in the timing of the release of supplies from public forest lands, thus affecting a logical price-production relationship.

Another possible reason is that the unit values used are based on exports, whereas the supply variable (Q_L) includes lower grade species not exported. Hence, the unit values are likely to be higher than would have been the case. A reliable domestic log price index might have given better estimates, if it had been available.

The time trend variable, a proxy for other factors not measured, such as cost, technology and stumpage supplies, was significant. For Malaysia, its coefficient value was low at 0.1. This is plausible as technology and increases in labour productivity have a stimulating effect on production, but rising costs and dwindling stumpage supplies, have the reverse effect. On balance, these developments over time have increased supply. However, one has to be aware that in future, a declining stumpage supply will affect saw log production.

The other important variable is the dummy, which had the right sign (-), showing a dampening effect of controls on production. It was however insignificant. In the regions, we only used the variable for ^{Peninsular Malaysia} (PM) but the coefficient value was almost zero and significant. The plots of the residuals did not give any evidence of serial correlation for the Malaysian equations although the d statistic lay in the inconclusive region. For the regions, there was some evidence of positive serial correlation, but this was eradicated by re-specifying the model in dynamic terms, as explained below.

We shall, however, first consider the dynamic equations for Malaysia as a whole. A2 gives the results of the equation where the price variable is formulated in current value terms, and again it is insignificant, though of the right sign. The \bar{R}^2 is only increased marginally from 0.92 to 0.93, and the lagged dependent variable (LDV) is insignificant. Respecifying the price variable in terms of average values of period t and $t-1$, however, altered the sign of the price variable, and it was significant. The possible reasons explained above

for the wrong sign of the price variable may be relevant here. The coefficient values of the time trend and dummy do not change drastically. The d and h statistics as well as the plots of the residuals do not give any evidence of serial correlation. Choosing between the results of the two kinds of formulations, we will prefer the static one on grounds of economic plausibility.

For the regions the impact of the dynamic formulation varies, although for all cases there is no conclusive evidence of serial correlation. For Peninsular Malaysia (B2 and B3) the signs remain consistent, and the LDV is significant. The \bar{R}^2 only increased marginally. For Sarawak, the explanatory power of the \bar{R}^2 is doubled in the dynamic formulation, and the price variable is of the right sign and is statistically significant (C2 and C3). The time trend sign, however, changes to negative, but the coefficient value is small and insignificant. For Sabah, the dynamic formulation (D3) gives a positive sign to the price variable, but it is insignificant.

It can be seen that the dynamic model improves the results of the supply functions for the individual regions, when compared to the static formulation, while for Malaysia as a whole, the results are not very different from the static formulation. Choosing the best results for the four classes, the long run elasticities of supply are shown to be 0.17 for Malaysia as a whole, -0.13 for PM, 1.28 for Sarawak and 0.30 for Sabah, with only those of the Borneo states significant. One possible reason for regional variations could be the manner of administering log concessions, which would affect the supply response of sawlogs. However, one has to be careful in comparing the elasticities of the different regions in view of differences in data quality. The price variable also is a composite one covering a wide range of species, but for each individual region species composition varies. For instance, ramin forms about 60% of the production of Sarawak, and appropriately, a value relating to that species would have been more appropriate, if available.

b) Export Demand Elasticities

The results of the static equations for the export demand in Malaysia in Table 6.3 (A1, A2 and A3) indicate the price inelastic nature of the export demand, but the variable is not significant. The expected sign (negative) is in respect of equation specifying the price averaged over two years (A2), while the current price variable (A1) and price variable adjusted for exchange rate (A3) have positive signs. At the same time there are regional variations in the results. For PM (B1 and B2) the elasticities are of the right sign with a coefficient that is greater than one for both exchange rate adjusted prices and current prices, and are statistically significant. For Sarawak (C1), the sign is right, but the coefficient value is insignificant, while Sabah (D1 and D2) equations showed the wrong signs, with one statistically significant result (D1) showing the price elasticity of 0.37.

All the results show a high income elasticity of demand, with significant coefficients. For PM, the coefficient value was twice that of Sabah, and about 20% higher than Sarawak's confirming the greater openness of its economy to the growth of E. E. C. countries.

The time trend coefficient proxying for factors mentioned earlier, displayed an expected negative sign in the results of all classes. For Malaysia as a whole it was -0.07 (A1), statistically significant, while there were regional variations, with PM, -0.36, Sarawak, -0.30 and Sabah, 0.10, all statistically significant.

The dummy variable to reflect export controls was of the expected negative sign and statistically significant (A1, A2, B1 and B2).

Overall, for the static equations, evidence for serial correlation was inconclusive. \bar{R}^2 was high (more than 0.9) for Malaysia, PM and Sabah, while that of Sarawak was about 0.6. Again regional variations, particularly of the price elasticities of demand, could be due to different species composition, and distance to markets. For PM, production for export was not important after 1972 due to export controls.

Turning to the dynamic formulation for Malaysia (A4, A5 and A6), there

SELECTED RESULTS OF EXPORT DEMAND FUNCTION OF SAWLOGS

REGION	METHOD & SPECIFICATION	DEPENDENT VARIABLE: $\log X_L$										SER	Rho
		C	$\log P_L$	$\log PA_L$	$\log PE_L$	$\log Y_W$	T	D	$\log X_{t-1}$	\bar{R}^2	D.W. (h)		
MALAYSIA	A1 OLSQ	-22.37	0.18	-	-	4.13	-0.07	-0.30	-	0.97	1.59	0.09	-
	Static	(- 3.54)	(0.85)			(4.78)	(-1.63)	(-3.41)					
	A2 OLSQ	-20.35	-	-0.04	-	3.96	-0.05	-0.29	-	0.96	1.53	0.09	-
	Static	(- 2.49)		(-0.12)		(3.85)	(-0.12)	(-3.22)					
	A3 OLSQ	-21.41	-	-	0.05	4.07	-0.06	-0.30	-	0.96	1.54	0.09	-
	Static	(- 3.34)			(0.33)	(4.57)	(-1.43)	(-3.17)					
A4 OLSQ	-22.62	0.16	-	-	4.18	-0.07	-0.30	-0.01	0.96	1.59	0.09	-	
Dynamic	(- 2.22)	(0.73)			(2.38)	(-1.47)	(-2.17)	(-0.03)		(0.81)			
A5 OLSQ	-23.47	-	-	0.03	4.46	-0.07	-0.33	-0.09	0.96	1.54	0.10	-	
Dynamic	(- 2.24)			(0.19)	(2.50)	(-1.37)	(-2.36)	(-0.26)		(0.91)			
A6 OLSQ	-23.38	-	-0.03	-	4.49	-0.06	-0.33	-0.11	0.96	1.52	0.10	-	
Dynamic	(- 1.91)		(-0.07)		(2.38)	(-0.96)	(-2.33)			(0.95)			
PENINSULAR MALAYSIA	B1 OLSQ	-70.08	-	-	-1.08	11.09	-0.36	-0.57	-	0.91	2.44	0.16	-
	Static	(- 6.20)			(-3.78)	(7.08)	(-4.70)	(-3.39)					
	B2 OLSQ	-68.54	-1.27	-	-	11.15	-0.36	-0.73	-	0.89	2.43	0.17	-
	Static	(- 5.57)	(-3.30)			(6.62)	(-4.31)	(-4.30)					
B3 OLSQ	-41.26	-	-	-0.80	6.67	-0.21	-0.51	0.34	0.91	3.15	0.16	-	
Dynamic	(- 1.56)			(-2.21)	(1.66)	(-1.37)	(-2.93)	(1.20)		(-2.28)			
B4 GORC	- 3.02	-	-	-0.50	0.84	0.00	-0.47	0.76	0.97	2.50	0.09	0.86	
Dynamic	(- 0.25)			(-2.63)	(0.45)	(0.06)	(-6.15)	(5.96)		(-1.99)			
SARAWAK	C1 OLSQ	-59.82	-	-	-0.39	9.43	-0.30	-	-	0.61	1.06	0.37	-
	Static	(- 2.40)			(-0.63)	(2.76)	(-1.83)						
C2 OLSQ	-10.37	-	-	0.37	1.63	-0.08	-	0.69	0.69	1.37	0.33	-	
Dynamic	(- 0.32)			(0.56)	(0.33)	(-0.45)		(2.05)		(1.25)			
SABAH	D1 OLSQ	-23.26	-	-	0.37	4.19	-0.10	-	-	0.98	1.36	0.08	-
	Static	(- 4.57)			(2.95)	(6.00)	(-3.10)						
	D2 OLSQ	-24.98	-	0.47	-	4.32	-0.11	-	-	0.96	1.74	0.09	-
	Static	(- 3.09)		(1.24)		(4.30)	(-1.95)						
D3 OLSQ	-26.27	-	-	0.34	4.84	-0.11	-	-0.21	0.98	1.03	0.07	-	
Dynamic	(- 4.80)			(2.79)	(5.73)	(-3.30)		(-1.30)		(1.93)			
D4 OLSQ	-35.21	-	0.72	-	6.04	-0.15	-	-0.42	0.97	0.91	0.08	-	
Dynamic	(- 4.16)		(2.06)		(5.11)	(-2.88)		(-2.18)		(2.17)			

TABLE 6.3

was little improvement in the quality of the results under different price specifications. The addition of the lagged dependent variable did not increase the \bar{R}^2 , and it was not significant. In all cases, the $\hat{\delta}$ was just above one, indicating complete adjustment. The price, income elasticities varied very little compared to the static formulation.

For the regions, the dynamic specification for PM (B3) appeared to show negative serial correlation. Respecification of the model by using alternative forms for the price variable, removing the time trend and dummy and using world trade growth instead of O. E. C. D. G. D. P. did not improve the results. The Cochrane-Orcutt Technique was applied to correct for autocorrelation, and the result showed improvement (B4). The price elasticity of demand was of the right sign (-) and significant, and so was the dummy variable (-). The lagged dependent variable was also significant, showing an implied value of 0.34. This variable was also significant for Sarawak (C2) showing a $\hat{\delta}$ of 0.31. For Sabah, the coefficient was explosive with a value of more than one which some researchers interpret as over-reaction of market forces. For Sarawak, the signs of the price elasticity changed compared to the static formulation while the sign remains the same for Sabah with significant t values (D3 and D4).

c) Home Demand Elasticities

The results of the static equations for Malaysia (in Table 6.4) show the expected negative sign for the average price variable (result A1) while the equation incorporating a current price variable gave virtually a zero elasticity of demand. Neither of them is significant. The results of the other coefficients have the right signs - positive for the construction variable proxying the income effect, and positive for the dummy variable, indicating that export controls divert supplies to the home market. Both variables are significant. The time trend has a negative sign with a low coefficient value, but it is not significant. There is no evidence of serial correlation.

The price formulations (P_L and PA_L) of the two equations (B1

SELECTED RESULTS OF HOME DEMAND FUNCTION OF SAWLOGS

DEPENDENT VARIABLE: $\log H_t$											
REGION	METHOD AND SPECIFICATION	C	$\log P_L$	$\log PA_L$	$\log CT$	T	D	$\log H_{t-1}$	\bar{R}^2	D.W. (h)	S.E.R.
MALAYSIA	A1 OLSQ Static	2.44 (0.74)	0.01 (0.02)	-	1.09 (1.98)	-0.03 (-0.52)	0.32 (2.17)		0.90	2.09	0.15
	A2 OLSQ Static	3.05 (0.77)	-	-0.12 (-0.21)	1.06 (1.90)	-0.02 (-0.35)	0.33 (2.17)	-	0.90	2.11	0.15
	A3 OLSQ Dynamic	1.56 (0.31)	-0.02 (-0.06)	-	1.16 (1.80)	-0.04 (-0.54)	0.28 (1.26)	0.08 (0.23)	0.89	2.12 (-0.23)	0.16
	A4 OLSQ Dynamic	2.06 (0.38)	-	-0.15 (-0.26)	1.14 (1.77)	-0.03 (-0.43)	0.29 (1.30)	0.09 (0.27)	0.89	2.14 (-0.28)	0.16
PENINSULAR MALAYSIA	B1 OLSQ Static	2.67 (2.01)	0.16 (0.41)	-	0.84 (3.11)	-	0.40 (2.14)	-	0.89	2.09	0.19
	B2 OLSQ Static	2.84 (1.78)	-	0.04 (0.08)	0.90 (2.89)	-	0.40 (2.12)	-	0.89	2.09	0.20
	B3 OLSQ Dynamic	2.95 (1.59)	-	0.09 (0.13)	0.90 (2.77)	-	0.43 (1.61)	-0.04 (-0.13)	0.88	2.07 (-0.14)	0.20
SARAWAK	C1 OLSQ Static	5.30 (5.75)	-	-0.95 (-1.90)	0.96 (3.67)	-	-	-	0.62	1.06	0.17
	C2 OLSQ Dynamic	3.25 (2.70)	-	-0.82 (-1.88)	0.66 (2.50)	-	-	0.47 (2.29)	0.72	1.79 (0.42)	0.15
SABAH	D1 OLSQ Static	1.86 (0.11)	-1.69 (-0.97)	-	2.09 (0.75)	-0.09 (-0.33)	-	-	-0.10	2.66	0.81
	D2 OLSQ Static	7.18 (2.16)	-1.90 (-1.21)	-	1.21 (1.29)	-	-	-	-0.02	2.69	0.78
	D3 CORC Static	6.42 (2.46)	-1.30 (-0.87)	-	0.91 (1.05)	-	-	-	0.15	2.03	0.73
	D4 OLSQ Dynamic	9.24 (2.27)	-	-1.26 (-0.57)	0.87 (0.76)	-	-	-0.42 (-1.67)	0.06	2.09 (-0.18)	0.75

TABLE 6.4

and B2) for PM give similar results. The price elasticity of demand is less than 0.1 in both results, and not significant. The elasticity with respect to construction expenditure and the dummy are of the right signs and significant.

While the results of Malaysia as a whole, and PM show almost a zero change in home demand to price changes (which is plausible given the huge demand in the processing sector), the picture is different for Sarawak. The sign is negative, with an elasticity coefficient for Sarawak at -0.95 that is statistically significant. This difference, apart from data quality, could be due to the newness of the processing sector, where the demand for sawlogs is small.

Poorer still are the results of Sabah, where only about 10% of the amount produced goes to home consumption. While the signs of the coefficients are in conformity of a prior expectations, the statistical significance of the results is very poor with an adjusted R^2 that is below zero (D1). Autocorrelation was evident as shown by the d statistic. Removal of the time trend (D2) did not solve this problem. Respecifying the model gave poor results, and the Cochrane-Orcutt technique was ultimately used, and Result D3 is more acceptable, though the explanatory power is still low (0.15) compared to the other areas. The price elasticity of demand is more than one, but is insignificant.

The dynamic model (results A3 and A4) reduced the \bar{R}^2 from 0.9 to 0.89. While the signs of the coefficients remain similar, their significance strength is reduced. The lagged dependent variable, indicating that more than 90% adjustment between actual and desired home demand, is not significant. The picture is similar for PM (B3). For Sarawak (C2), although the t values are weakened for all the coefficients, the \bar{R}^2 is increased from 0.62 to 0.72 by the inclusion of the lagged dependent variable which is significant. While the evidence of serial correlation was inconclusive for the static equation (C1), there did not appear to be evidence for it in the result of the dynamic model. For Sabah, too, the lagged dependent variable is significant, but the overall result is still poor (D4).

Section 6.5.2: Sawnwood - Supply, Export and Home Demand
Elasticities

a) Supply Elasticities

Table 6.5 has the main results, with A1 and A2 giving those of the static formulation for Malaysia. The former used P_S and the latter PA_S as alternative price formulations. P_S is of the right sign, but insignificant, while PA_S has the wrong sign (indicative of a negative supply response to increases in prices), and is also insignificant. As explained for sawlogs, the composite nature of the price variable, accounts for the poor significance of the result. A low supply response to price was also due to the shortages of log supplies, but the time trend does not seem to pick this up. Rather, it has a positive sign that is very significant, and it is likely that technical progress has outweighed other effects such as dwindling log supplies. The dummy variable, proxying on log export controls aimed to divert supplies to domestic processing, is also of the right sign, and statistically significant in A2. The picture is the same for Peninsular Malaysia (B1) which produces most of the sawnwood.

There are, however, variations with respect to the supply price elasticity for the Borneo states. Sarawak's result (C1) shows a negative sign for the price variable that is significant. (Other alternative forms of the price variable were attempted, but it gave similar or poorer results). It is difficult to justify this result, although it is possible that higher margins obtained from selling sawlogs could divert log supplies from the processing sector even in a situation of a price rise. For Sabah, the signs and values are acceptable, although the result is not significant (D1 and D2). The signs and values of the time trend coefficients for the Borneo states equations are similar to the other above-mentioned results. However, the \bar{R}^2 for Sarawak (0.58) and Sabah (0.70) are lower than for PM (0.98) and for Malaysia as a whole (0.98). In all these equations, there is no evidence of serial correlation.

SELECTED RESULTS OF SUPPLY FUNCTION OF SAWNWOOD

REGION	METHOD AND SPECIFICATION	DEPENDENT VARIABLE: $\log Q_S$								
		C	$\log P_S$	$\log P_{A_S}$	T	D	$\log Q_{S,t-1}$	\bar{R}^2	D.W. (h)	S.E.R.
MALAYSIA	A1 OLSQ Static	6.32 (8.56)	0.15 (0.92)	-	0.08 (9.14)	0.04 (0.92)	-	0.98	2.01	0.07
	A2 OLSQ Static	7.34 (9.34)	-	-0.08 (-0.44)	0.09 (10.17)	0.11 (1.44)	-	0.98	2.29	0.07
	A3 OLSQ Dynamic	7.72 (4.38)	0.20 (1.16)	-	0.09 (4.63)	0.05 (0.61)	-0.24 (-0.88)	0.98	1.72 (0.56)	0.07
	A4 OLSQ Dynamic	7.85 (4.22)	-	-0.05 (-0.22)	0.09 (4.20)	0.11 (1.38)	-0.09 (-0.31)	0.97	2.21 (-0.42)	0.07
PENINSULAR MALAYSIA	B1 OLSQ Static	6.18 (7.77)	0.12 (0.68)	-	0.09 (9.45)	0.07 (0.87)	-	0.98	1.78	0.07
	B2 OLSQ Dynamic	7.04 (3.94)	0.16 (0.82)	-	0.10 (4.10)	0.08 (0.88)	-0.16 (-0.54)	0.98	1.60 (0.79)	0.07
SARAWAK	C1 OLSQ Static	11.24 (7.77)	-	-1.22 (-3.76)	0.10 (4.66)	-	-	0.58	1.76	0.17
	C2 OLSQ Dynamic	6.25 (2.47)	-	-0.77 (-2.31)	0.05 (1.80)	-	0.53 (2.28)	0.68	2.58 (-1.15)	0.14
SABAH	D1 OLSQ Static	2.21 (1.53)	0.36 (1.12)	-	0.03 (1.50)	-	-	0.70	2.69	0.18
	D2 OLSQ Static	2.14 (1.39)	-	0.38 (1.09)	0.04 (1.61)	-	-	0.70	2.69	0.18
	D3 OLSQ Dynamic	3.05 (1.75)	0.40 (1.13)	-	0.04 (1.70)	-	-0.22 (-0.87)	0.69	2.25 (-0.50)	0.18
	D4 OLSQ Dynamic	2.87 (1.75)	-	0.48 (1.36)	0.04 (1.87)	-	-0.30 (-1.17)	0.70	2.03 (-0.06)	0.17

TABLE 6.5

As for saw logs, the dynamic formulation does not improve the result for the supply functions of Malaysia (A3 and A4), PM (B2) and Sabah (D3 and D4). In all these cases, the lagged coefficient is explosive, and not significant. The t values of the other coefficients are reduced by its inclusion while the \bar{R}^2 remains similar or marginally weaker. For Sarawak, however, there is improvement in the results over those based on the static model (C2). While the t values are weakened, the signs remain similar. The lagged variable is significant showing an adjustment speed of 0.47. The \bar{R}^2 increases from 0.58 to 0.68. There is no conclusive evidence of serial correlation.

Apart from Sarawak's result, the long-run price elasticities of supply, though plausible from the economic standpoint, are difficult to accept from the statistical criteria. Nevertheless, they seem to be reasonable first approximations of the supply responses in the sawmilling industry.

b) Export Demand Elasticities

The results of the static equations for Malaysia (A1 and A2) in Table 6.6 show that increases in unit values of Malaysian sawnwood do not appear to have reduced the exports, but rather increased them. Based on economic theory the expected sign should have been negative, but here it is positive and significant. One explanation is that generally sawnwood prices have increased over the years as explained in Chapter 2, and the price increases of other species particularly from Africa had been more rapid than those from Malaysia. Hence, given the fact that sawnwood only forms a small part of the total expenditure of construction, where it is principally used, it is likely that increases in its price have not dampened demand. The coefficient value for $\log P_S$ and $\log PE_S$ are small, 0.47 and 0.27 respectively. The study of Luqman (1978) also showed a positive sign for the price variable in respect of exports of Malaysian sawnwood to the E.E.C. market, with a coefficient of 0.15. However, for the cross-price elasticities

SELECTED RESULTS OF EXPORT DEMAND FUNCTION OF SAWWOOD

DEPENDENT VARIABLE: $\log X_S$

REGION	METHOD & SPECIFICATION	C	$\log P_S$	$\log P_{A_S}$	$\log P_{E_S}$	$\log Y_W$	$\log P_{SP}$	$\log P_{SB}$	$\log X_{S,t-1}$	\bar{R}^2	D.W. (h)	S.E.E.
MALAYSIA	A1 OLSQ	-11.10	0.47	-	-	2.15	-0.52	1.00	-	0.98	1.97	0.08
	Static	(-4.88)	(2.77)			(9.07)	(-0.64)	(2.00)				
	A2 OLSQ	-9.97	-	-	0.27	2.21	-0.88	1.07	-	0.97	2.03	0.09
	Static	(-4.08)			(2.02)	(8.50)	(-1.01)	(1.93)				
	A3 OLSQ	-14.06	0.61	-	-	2.62	-0.18	0.82	-0.24	0.98	1.88	0.08
Dynamic	(-4.08)	(3.09)			(6.01)	(-0.22)	(1.61)	(-1.29)		(0.24)		
A4	OLSQ	-12.12	-	-	0.35	2.59	-0.63	0.93	-0.19	0.97	1.93	0.09
	Dynamic	(-3.48)			(2.25)	(5.04)	(-0.69)	(1.59)	(-0.88)		(0.14)	
A5	OLSQ	-16.87	-	0.73	-	3.08	-0.19	1.08	-0.42	0.98	2.05	0.09
	Dynamic	(-3.67)		(2.38)		(5.15)	(-0.20)	(1.98)	(-1.56)		(-0.10)	
PENINSULAR MALAYSIA	B1 OLSQ	-17.54	0.54	-	-	2.88	0.69	-0.91	-	0.99	1.81	0.08
	Static	(-7.92)	(3.28)			(12.50)	(1.16)	(-1.87)				
	B2 OLSQ	-16.27	-	-	0.32	2.94	0.39	-0.98	-	0.98	1.83	0.09
	Static	(-6.75)			(2.47)	(11.46)	(0.61)	(-1.79)				
B3	OLSQ	-22.30	0.71	-	-	3.56	0.86	-0.25	-0.25	0.99	1.66	0.08
	Dynamic	(-5.97)	(3.73)			(5.95)	(1.52)	(-1.32)	(-1.54)		(0.68)	
B4	OLSQ	-27.49	-	0.91	-	4.31	1.25	-0.90	-0.49	0.99	1.82	0.09
	Dynamic	(-4.73)		(2.90)		(5.88)	(1.61)	(-1.60)	(-1.92)		(0.36)	
SARAWAK	C1 OLSQ	-2.00	-	-	-0.45	1.25	-0.13	0.21	-	0.50	1.96	0.12
	Static	(-0.61)			(-2.52)	(3.59)	(-0.11)	(0.29)				
	C2 OLSQ	0.02	-	-0.71	-	1.23	-0.22	-0.12	-	0.53	1.84	0.12
	Static	(0.01)		(-2.72)		(3.66)	(-0.19)	(-0.16)				
C3	OLSQ	-1.38	-	-	-0.41	1.05	-0.29	0.21	0.15	0.47	1.95	0.13
	Dynamic	(-0.38)			(-2.11)	(2.04)	(-0.23)	(0.28)	(0.53)		(0.10)	
C4	OLSQ	0.57	-	-0.66	-	1.01	-0.41	-0.09	0.17	0.50	1.89	0.12
	Dynamic	(0.16)		(-2.33)		(2.08)	(-0.34)	(-0.12)	(0.61)		(0.22)	
SABAH	D1 OLSQ	23.39	1.89	-	-	-3.46	-5.32	8.43	-	0.24	2.90	0.68
	Static	(1.26)	(1.36)			(-1.79)	(-0.80)	(2.06)				
	D2 COBC	20.46	2.00	-	-	-3.13	-5.34	10.11	-	0.38	2.10	0.61
	Static	(1.45)	(2.00)			(-2.28)	(-0.93)	(3.11)				
D3	OLSQ	27.17	3.81	-	-	-5.32	-2.53	11.45	-1.99	0.40	2.52	0.60
	Dynamic	(1.63)	(2.43)			(-2.72)	(-0.42)	(2.91)	(-0.01)		(-1.02)	
D4	COBC	24.81	3.33	-	-	-4.61	-3.93	12.26	-0.43	0.42	2.02	0.59
	Dynamic	(1.71)	(2.32)			(-2.60)	(-0.70)	(3.32)	(-1.36)		(-0.04)	

TABLE 6.6

in relation to plywood and particle board, the sign was right (+) and significant for particle board, and not so for plywood (-). However, this result has to be interpreted with caution, as we are separately evaluating the relationship of sawnwood prices with plywood and particle board under ceteris paribus conditions. Also, substitution effect of non-wood substitutes was not considered for reasons explained earlier. The time trend was not incorporated in the equations because it was strongly correlated with the other variables, and also it reduced the overall quality of the results besides being insignificant. The income variable, Y_W , was of the right sign and significant, showing that demand expanded with the economic growth of the O. E. C. D. countries.

There are considerable regional variations in the results. For Peninsular Malaysia, (B1 and B2), the price elasticity is similar to that obtained in Malaysia since the bulk of Malaysian sawnwood exports come from this area. For Sarawak, the sign is negative and significant (C1 and C2), whilst for Sabah, the sign is positive and significant (D1). The price coefficient of Sabah unexpectedly high (1.89). Other factors, such as institutional arrangements, not captured in the equation could be important, considering that the \bar{R}^2 is very low, 0.24, compared to 0.99 for PM and 0.53 for Sarawak. Serial correlation was suspected. Changing the specification of the variables as well as the functional form did not improve the result. The Cochrane-Orcutt technique was used for the equation, and the final result is an improvement (D2) but the price coefficient is still high. The coefficients for the cross-elasticities are also of the wrong sign for plywood for both Sabah and Sarawak and insignificant, whilst for PM, the sign is right but the coefficient insignificant. For the cross-price elasticity in relation to particle board, the expected sign (+) was correct for Sabah and significant, but not so for PM and Sarawak. The reservations cited earlier for interpreting this result apply. As for the income variable, the discrepancy was in the case of Sabah where the sign was wrong more likely due to the fact that most of the exports from there go to

neighbouring areas particularly Indonesian Borneo.

The dynamic formulation for Malaysia (A3, A4 and A5) did not improve the results. The L. D. V. showed more than complete adjustment, being significant only for one specification (A5). For PM, there was only marginal improvement, with the L. D. V. significant (B2 and B3) showing an adjustment greater than one. Turning to Sarawak (C3 and C4), the dynamic formulation gave poorer results, and the picture is the same for Sabah (D3), where positive serial correlation was evident. As a last resort, the Cochrane-Orcutt technique was used (D4) and the final result is an improvement, though the overall results are far from satisfactory. As mentioned earlier, sawmilling there is still in its rudimentary stage, and the official data, poor in quality, as exemplified in this result.

c) Home Demand Elasticities

The results at Table 6.7 are economically speaking more plausible, compared to those of the export demand, particularly for Malaysia (A1 and A2) and PM (B1 and B2). The price coefficient is of the expected sign and the coefficient value low as predicted, but it is insignificant for similar reasons explained earlier. The price elasticity coefficient is -0.07, not very different from that obtained by Radzuan (1976) for sawnwood (-0.03) for his study covering the period 1955-1970. The cross-price elasticities are of the right sign, but significant only for particle board. The income variable shows a value of 0.65 and 0.95 for the two specifications (A1 and A2), but whilst the signs are correct, the variable is insignificant. Unlike that of the export equations, the time trend was not dropped for it was found to be positive and significant. There was no evidence of serial correlation, and the fit was impressive (0.96).

For the regions, as expected, the results of PM did not vary greatly from those of Malaysia - B1, but the \bar{R}^2 was slightly lower - 0.93. However, for Sarawak and Sabah, some form of respecification of the model was necessary. Using the model as such for Sarawak gave wrong

SELECTED RESULTS OF HOME DEMAND FUNCTION OF SAWWOOD

DEPENDENT VARIABLE: $\log H_S$

REGION	METHOD & SPECIFICATION	C	$\log P_S$	$\log PA_S$	$\log Y_M$	$\log P_{SP}$	$\log P_{SB}$	T	$\log H_{S,t-1}$	\bar{R}^2	D.W. (h)	S.E.R.
MALAYSIA	A1 OLSQ Static	2.03 (0.66)	-0.07 (-0.27)	-	0.65 (1.32)	0.60 (0.67)	0.56 (1.32)	0.05 (3.60)	-	0.96	1.80	0.07
	A2 OLSQ Static	0.72 (0.16)	-	-0.21 (-0.46)	0.90 (1.07)	0.91 (0.77)	0.45 (0.90)	0.05 (2.67)	-	0.96	1.76	0.07
	A3 OLSQ Dynamic	1.80 (0.50)	-0.09 (-0.30)	-	0.65 (1.26)	0.56 (0.56)	0.57 (1.27)	0.05 (1.87)	0.05 (0.15)	0.95	1.83 (0.33)	0.07
	A4 OLSQ Dynamic	-0.17 (-0.03)	-	-0.29 (-0.53)	1.00 (1.05)	0.93 (0.75)	0.43 (0.84)	0.04 (1.22)	0.10 (0.28)	0.95	1.81 (0.38)	0.07
PENINSULAR MALAYSIA	B1 OLSQ Static	4.05 (0.75)	-	-0.06 (-0.12)	0.37 (0.37)	0.27 (0.19)	0.52 (0.91)	0.06 (2.79)	-	0.93	1.95	0.08
	B2 OLSQ Dynamic	1.67 (0.22)	-	-0.28 (-0.39)	0.67 (0.55)	0.47 (0.31)	0.43 (0.70)	0.04 (1.04)	0.19 (0.46)	0.93	2.09 (-0.18)	0.08
SARAWAK	C1 OLSQ Static	32.09 (2.39)	1.44 (1.34)	-	-5.09 (-2.35)	-0.75 (-0.19)	-2.38 (-1.27)	0.24 (3.91)	-	0.53	1.98	0.31
					<u>log CT</u>							
	C2 OLSQ Static	-6.91 (-1.10)	-0.78 (-1.14)	-	1.88 (3.46)	5.68 (1.68)	-3.57 (-1.74)	-	-	0.48	1.84	0.32
	C3 OLSQ Static	-3.77 (-0.70)	-	-1.53 (-2.42)	2.07 (4.47)	5.02 (1.80)	-4.34 (-2.46)	-	-	0.62	2.10	0.27
	C4 OLSQ Dynamic	-3.13 (-0.54)	-	-1.29 (-1.54)	1.72 (1.90)	4.38 (1.36)	-3.60 (-1.47)	-	0.16 (0.45)	0.59	2.17 (-0.34)	0.28
SABAH	D1 OLSQ Static	9.97 (0.99)	-	1.21 (1.21)	$\log Y_M$ -1.50 (-0.81)	-2.23 (-0.87)	1.82 (1.76)	0.11 (0.84)	-	0.91	2.25	0.15
	D2 OLSQ Static	-11.10 (-1.27)	-	-0.64 (-0.67)	2.60 (1.76)	0.77 (0.26)	1.26 (0.97)	-	-	0.85	1.53	0.19
	D3 OLSQ Dynamic	9.90 (0.92)	-	1.19 (1.02)	-1.48 (-0.74)	-2.24 (-0.82)	1.83 (1.67)	0.11 (2.04)	0.01 (0.03)	0.90	2.27 (-0.53)	0.16
	D4 OLSQ Dynamic	-4.75 (-0.51)	-	-0.55 (-0.61)	1.47 (0.94)	-0.58 (-0.19)	1.66 (1.32)	-	0.51 (1.53)	0.87	2.33 (-0.65)	0.18

TABLE 6.7

signs to almost all the coefficients as shown in C1, After a great deal of experimentation with different variables it was found that the value of construction instead of the per capita income gave better results as shown in C2 and C3, which are also without the time trend. With the respecification, all the variables except for $\log P_{SB}$ had the right signs, and the price variable was significant if specified as PS_S (C3). For Sabah, too, the results were poor for the original specification (D1), and the removal of the time trend gave the right expected signs to all the coefficients.

The dynamic equations (A3 and A4) deteriorated the results marginally, with the \bar{R}^2 reduced from 0.96 to 0.95. The L. D. V. was not significant, showing very rapid adjustment - over 0.9. This is also the case of PM (B2) and Sarawak (C4) where the L. D. V. is insignificant. For Sabah, result D4 (without the time trend) is better than D3, which again gave the wrong expected signs. The L. D. V. for D4 was significant, with a value of 0.51.

Section 6.5.3: Plywood - Supply, Export and Home Demand Elasticities

a) Supply elasticities

The static equations (Table 6.8, results A1, A2 and A3) differ in respect of the price specification. Using world prices (P_{PW}) and averaged world prices over t and $t-1$ give the wrong sign implying that supply is cut down as a result of a price rise. The result appeared dubious, although statistically significant. Serial correlation was evident judging from the d statistic, and this could have overestimated the t ratios for both the price and time trend variables, with the latter having the expected sign. The price variable was then respecified in terms of Malaysian unit values, but the variable, although having the right sign (showing a positive supply response) was

SELECTED RESULTS OF THE SUPPLY FUNCTION OF PLYWOOD

REGION	METHOD AND SPECIFICATION	DEPENDENT VARIABLE: $\log Q_p$									
		C	$\log P_p$	$\log P_{A_p}$	$\log P_{PW}$	T	$\log Q_{p,t-1}$	\bar{R}^2	D.W. (h)	S.E.R.	Rho
MALAYSIA	A1 OLSQ	12.36	-	-	-2.31	0.40	-	0.97	1.16	0.25	-
	Static	(5.07)			(-4.44)	(15.43)					
	A2 OLSQ	13.20	-	-2.47	-	0.40	-	0.97	1.06	0.25	-
	Static	(5.29)		(-4.66)		(16.35)					
	A3 OLSQ	-0.59	0.40	-	-	0.29	-	0.93	0.42	0.40	-
Static	(-0.08)	(0.43)			(5.89)						
A4	CORC	-0.15	0.58	-	-	0.18	-	0.97	1.57	0.24	0.83
	Static	(-0.05)	(1.16)			(2.04)					
A5	OLSQ	-3.48	0.75	-	-	-0.01	0.88	0.97	1.78	0.24	-
	Dynamic	(-1.16)	(1.37)			(-0.20)	(4.88)		(0.44)		
PENINSULAR MALAYSIA	B1 OLSQ	21.96	-	-	-2.82	0.46	-	0.97	1.09	0.31	-
	Static	(7.37)			(-7.37)	(14.32)					
B2	OLSQ	2.51	1.15	-	-	0.28	-	0.92	0.32	0.48	-
	Static	(0.38)	(0.95)			(4.20)					
B3	CORC	5.58	1.04	-	-	0.12	-	0.98	1.92	0.21	0.81
	Static	(1.99)	(2.16)			(1.67)					
B4	OLSQ	-1.38	0.55	-	-	-0.01	0.88	0.98	1.92	0.26	-
	Dynamic	(-0.38)	(0.82)			(-0.22)	(5.67)		(0.16)		
SARAWAK	C1 OLSQ	3.87	-	-	-0.55	0.13	-	0.45	1.90	0.29	-
	Static	(1.06)			(-0.60)	(2.00)					
	C2 OLSQ	4.94	-0.63	-	-	0.11	-	0.46	1.84	0.29	-
Static	(0.98)	(-0.68)			(2.45)						
C3	OLSQ	0.46	-	-	0.22	0.03	0.27	0.55	2.30	0.27	-
	Dynamic	(0.11)			(0.24)	(0.35)	(1.62)		(-0.60)		
SABAH	D1 OLSQ	-1.99	-	0.35	-	0.21	-	0.95	1.54	0.17	-
	Static	(-0.87)		(0.67)		(5.85)					
D2	OLSQ	-2.47	-	0.53	-	0.14	0.22	0.95	1.62	0.18	-
	Dynamic	(-1.04)		(0.94)		(1.48)	(0.88)		(0.75)		

TABLE 6.8

insignificant (A3). The main reason for the insignificance of the price variable for world unit values could be that these figures take into account ^{the} plywood produced from softwood and other kinds of hardwood species, and hence, not completely appropriate for Malaysian plywood, made mostly from hardwood. The Malaysian unit values for plywood were simply calculated by dividing total value of exports by total volume.

Negative serial correlation was evident. Neither removing the time trend nor changing its specification helped. The use of the Cochrane-Orcutt technique corrected the serial correlation, judging from the d statistic and the plots of the residuals. The t values of the price variable generally improved but was only significant at the 85% confidence level. The positive sign of the time trend implied that other factors proxied by the trend, on balance, increased supply.

For Peninsular Malaysia, the situation was similar since it supplied about 90% of the total output. But the price elasticity of supply is higher (though not significant) at 1.15 (B3).

For Sarawak, all forms of price specifications gave the wrong sign (-), and the coefficient was insignificant (C1 and C2). For Sabah, the sign was correct (+), but like all others, insignificant. The time trend variable for all equations was positive and significant.

The dynamic specification, unlike those in the equations for sawlogs and sawnwood, improved the results with the lagged dependent variable highly significant (A5). The result showed a low speed of output adjustment (0.12). The \bar{R}^2 increased from 0.93 to 0.97, and there was no evidence of serial correlation. However, the time trend variable had virtually a zero coefficient that was not significant. This is also the case for Peninsular Malaysia and Sarawak, where the respective L. D. V. 's are significant. For PM, the speed of supply adjustment is lower (0.12) than for Sarawak (0.73). This could be due to the fact that there is more competition for logs in the peninsular from mills than in Sarawak. This could also be the reason for the rapid speed of adjustment for Sabah (0.22) as indicated in D2, but the

variable is not significant. For all regions, the sign of the price variable is right (-), with a supply response higher than in the case of sawlogs and sawnwood.

b) Export Demand Elasticities

Looking at the results in Table 6.9 of the static equations, A1, and A2, the price elasticity is greater than one for the two price specifications. But the coefficients are only significant at the 85% confidence level. The coefficients have the correct sign (negative). The cross-price elasticity with respect to plywood is of the correct sign, but not that relating to particle board. Both variables are, however, insignificant. The income elasticity of demand is shown to be high and significant, indicating, as expected, that the economic growth of O. E. C. D. has an important effect on plywood exports. Incorporating a time trend to pick up other factors such as freight charges (the prices being at f. o. b. values) and competition from other substitutes not specified did not improve the result, and was insignificant (A3).

For Peninsular Malaysia and Sabah, the price coefficients have a large value with the correct sign (-) and is significant (B1 and D1), but for Sarawak, it has the wrong sign (+) and is insignificant (C1). There are variations in the cross-price elasticities too; that relating to plywood is of the wrong sign (-) for all the regions, while for particle board, it has the correct sign(+) only for PM and Sabah. Except for that relating to Sabah, all of them are not significant. The income variable is significant and of the correct sign(+), although there are variations in the magnitude of the coefficients, the largest being for PM.

While the \bar{R}^2 's for Malaysia (0.97), PM (0.99) and Sabah (0.88) are impressive, that relating to Sarawak is poor (0.19). The result is even poorer if the time trend is not incorporated. Some degree of positive autocorrelation was evident, and the corrected results (C2) show only a marginal improvement.

SELECTED RESULTS OF EXPORT DEMAND FUNCTION OF PLYWOOD

DEPENDENT VARIABLE: $\log X_p$													
	METHOD & SPECIFICATION	C	$\log P_{PW}$	$\log P_{AP}$	$\log Y_M$	$\log P_{SP}$	$\log P_{PB}$	T	$\log X_{P,t-1}$	\bar{R}^2	D.W. (h)	SER	Rho
ASIA	A1 OLSQ	-76.48	-1.14	-	11.16	2.64	-0.47	-	-	0.97	2.05	0.34	-
	Static	(- 7.22)	(-1.34)		(12.00)	(0.97)	(-0.23)						
	A2 OLSQ	-75.97	-	-1.10	11.04	2.60	-0.18	-	-	0.97	1.95	0.35	-
	Static	(- 6.49)		(-1.11)	(11.55)	(0.85)	(-0.08)						
	A3 OLSQ	-72.39	-1.20	-	10.60	2.82	-0.39	0.03	-	0.97	2.07	0.36	-
Static	(- 2.31)	(-1.21)		(2.54)	(0.90)	(-0.18)	(0.14)						
A4	OLSQ	-101.38	-1.25	-	14.76	3.87	-0.08	-	-0.30	0.97	1.62	0.34	-
	Dynamic	(- 3.51)	(-1.46)		(3.90)	(1.21)	(-0.04)		(-0.98)		(0.37)		
A5	OLSQ	-98.10	-	-1.10	13.91	3.79	0.13	-	-0.24	0.97	1.60	0.35	-
	Dynamic	(- 3.11)		(-1.08)	(3.56)	(1.08)	(0.06)		(-0.76)		(0.79)		
SULAR SIA	E1 OLSQ	-63.60	-	-3.12	12.14	-2.22	0.91	-	-	0.99	1.97	0.20	-
	Static	(- 9.38)		(-5.43)	(21.93)	(-1.25)	(0.75)						
E2	OLSQ	-58.61	-	-2.97	11.32	-2.19	0.66	-	0.06	0.99	2.00	0.21	-
	Dynamic	(- 2.20)		(-3.08)	(2.67)	(-1.18)	(0.37)		(0.19)		(0.00)		
C1	OLSQ	-32.02	0.76	-	4.89	-1.56	-2.63	-0.30	-	0.19	2.91	0.20	-
	Static	(- 0.77)	(0.45)		(0.77)	(-0.28)	(-0.89)	(-1.18)					
C2	CORC	-21.00	1.46	-	2.83	0.21	-3.64	-0.24	-	0.26	2.60	0.20	-0.54
	Static	(- 0.34)	(0.54)		(0.27)	(0.03)	(-0.79)	(-0.70)					
C3	OLSQ	-62.56	0.56	-	8.93	-0.61	-0.52	-0.37	-0.52	0.24	2.41	0.20	
	Dynamic	(- 1.29)	(0.34)		(1.17)	(-0.11)	(-0.15)	(-1.45)	(-1.12)		(-0.80)		
C4	CORC	-61.29	1.82	-	7.83	2.03	-0.60	-0.37	-1.02	0.38	2.51	0.19	-0.14
	Dynamic	(- 1.19)	(0.85)		(0.95)	(0.32)	(-0.18)	(-1.38)	(-1.46)		(-0.99)		
D1	OLSQ	-42.34	-2.50	-	7.35	-3.67	2.73	-	-	0.88	2.69	0.16	
	Static	(- 4.53)	(-2.59)		(4.71)	(-1.77)	(1.60)						
D2	OLSQ	- 6.54	-3.39	-	2.41	0.36	0.91	0.60	-0.44	0.94	2.55	0.20	
	Dynamic	(- 0.12)	(-0.67)		(0.27)	(0.03)	(0.30)	(2.25)	(-1.48)		(-1.09)		

TABLE 6.9

The dynamic specification does not appear to improve the quality of the results for Malaysia (A4 and A5) and for PM (B2). There was neither improvement of the \bar{R}^2 nor was the lagged dependent variable significant. For Sarawak (C2), serial correlation was evident, and changing the specification and omitting variables such as the time trend did not help. The Cochrane-Orcutt procedure was resorted to (C3), but the results are not satisfactory, though the \bar{R}^2 is relatively better, (0.38). Given that plywood exports are a small part of the wood exports of Sarawak, it is difficult to be specific on the major forces at work in explaining exports. For Sabah, however, the dynamic specification was an improvement (D2). The L. D. V. was significant, though the adjustment speed was more than one. The inclusion of the time trend (+) gave better results and was significant.

c) Home Demand Elasticities

Examining first the static equations (A1 in Table 6.10) all the coefficients have the correct a priori signs (-), but, except for the time trend and the cross-price elasticity with respect to particle board, none is significant. Although the d statistic gave some evidence of serial correlation, the plots of the residuals did not indicate any systematic pattern. Respecifying the equation by changing the form of the price variable, and excluding some variables however did not improve results. Since the coefficients are consistent with economic theory, the result is retained.

The only breakdown was in respect of Peninsular Malaysia which took about 90% of the consumption. The consistency of the signs remains intact. Comparing with the results obtained by Radzuan (1976) the price elasticity is -1.14 while his result showed almost a zero elasticity for the period 1956-70. His income elasticity also had a zero coefficient compared to ours of 1.65. The latter could be due to his specification of income as a reciprocal as explained in Section 6.2.2. Another reason for the difference could be due to the fact that his specification of the variables was in the linear form.

SELECTED RESULTS OF HOME DEMAND FUNCTION OF PLYWOOD

DEPENDENT VARIABLE: $\log H_p$

REGION	METHOD & SPECIFICATION	C	$\log P_{PW}$	$\log P_{AP}$	$\log Y_M$	$\log P_{SP}$	$\log P_{PB}$	T	$\log H_{p,t-1}$	\bar{R}^2	D.W. (h)	S.E.R.
MALAYSIA	A1 OISQ	-4.91	-0.91	-	1.34	0.13	3.13	0.12	-	0.86	2.39	0.26
	Static	(-0.36)	(-0.60)		(0.52)	(0.04)	(1.83)	(1.58)				
	A2 OISQ	-5.63	-1.05	-	1.60	0.21	3.02	0.12	-0.11	0.85	2.33	0.28
	Dynamic	(-0.39)	(-0.64)		(0.57)	(0.07)	(1.66)	(1.55)	(-0.35)		(-0.65)	
	A3 OISQ	-17.64	-	-2.62	4.26	0.81	4.37	-	0.09	0.82	2.48	0.31
	Dynamic	(-1.54)		(-1.66)	(2.06)	(0.25)	(2.02)		(0.26)		(-0.94)	
PENINSULAR MALAYSIA	B1 OISQ	-5.62	-1.31	-	1.65	0.35	3.37	0.12	-	0.86	2.34	0.27
	Static	(-0.40)	(-0.83)		(0.62)	(0.11)	(1.91)	(1.58)				
	B2 OISQ	-6.04	-1.41	-	1.82	0.42	3.29	0.13	-0.08	0.84	2.30	0.29
	Dynamic	(-0.41)	(-0.83)		(0.63)	(0.13)	(1.74)	(1.51)	(-0.25)		(-0.59)	

TABLE 6.10

The dynamic specification (A2) did not increase the explanatory power, with an adjustment speed of greater than one and not significant. However, if the time trend is excluded, and the price variable respecified as average prices of period t and $t-1$, the speed of adjustment becomes 0.91 but still insignificant. The price elasticity coefficient almost doubles, and is significant. This shows the sensitiveness of the coefficients to the specification of the equation. For PM too, the dynamic formulation gave poorer results (B2).

Section 6.5.4: Comparison of Supply and Demand Elasticities of Wood-products

Table 6.11 gives a summary of the supply elasticities obtained from the calculations. For Malaysia, the short-run elasticities increase with the degree of processing, the lowest being for saw-logs (0.07) and the highest for plywood (0.75). Sawlogs depend on the amount of stumpage available, and this is determined (besides biological factors) by the release of matured forest lands for logging, which as explained in Chapter 3, is less responsive to economic determinants, and more to political and social factors. We can therefore expect low supply responses to price changes. Sawnwood and plywood depend on saw-logs, but these can be stored when demand is not high, and released when production of processed woods need to be increased. Hence, we can anticipate slightly higher elasticities. In the long-run, we expect the supply elasticities to rise, and this is also confirmed in the results.

A similar kind of consistency with respect to supply elasticities can be noted for PM and Sabah. For Sarawak, there is a discrepancy with respect to sawnwood which has the wrong sign, the reasons for which were explained in the last section.

Turning to export demand elasticities, a similar picture emerges with respect to price elasticities as shown in Table 6.12. For Malaysia,

PRICE ELASTICITIES OF SUPPLY OF MALAYSIAN WOOD PRODUCTS
(1960 - 1976)

	M A L A Y S I A		P. M A L A Y S I A		S A R A W A K		S A B A H	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
SAWLOGS	0.07*	0.17*	-0.70*	-0.13*	-0.28	1.28	-0.39	0.30
SAWNWOOD	0.15*	0.16*	0.12*	0.14*	-1.22	-1.63	0.36*	0.36
PLYWOOD ⁺	0.75	6.25	1.04	4.58	0.22*	0.30*	0.53*	0.68*

+ For Sabah and Sarawak, the time period is 1966-1976.

* Not significant at 90% level of statistical confidence

TABLE 6.11

	ELASTICITIES OF EXPORT DEMAND FOR MALAYSIAN WOOD PRODUCTS (1960 - 1976)									
	P R I C E I N C O M E				G R O S S		P R I C E			
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
<u>Sawlogs</u>										
Malaysia	-0.04*	-0.03	3.96	4.04	-	-	-	-	-	-
P. Malaysia	-1.08	2.08*	11.09	3.58	-	-	-	-	-	-
Sarawak	-0.39*	0.01*	9.43	5.26	-	-	-	-	-	-
Sabah	0.37	0.31	4.19	4.36	-	-	-	-	-	-
<u>Sawnwood</u>										
Malaysia	0.47	0.51	2.15	2.17	-0.52*	-0.13*	1.00	0.76		
P. Malaysia	0.54	0.61	2.88	2.89	0.69	0.84	-0.91*	0.60		
Sarawak	-0.71	-0.80	1.23	2.05	-0.22*	-0.49*	-0.12*	-0.11*		
Sabah	2.00	2.33	-4.61	-3.22	-5.34*	-2.75*	10.11	8.57		
<u>Plywood</u> ⁺										
Malaysia	-1.14	-0.89	11.16	11.22	2.64*	3.06*	-0.47*	-0.10*		
P. Malaysia	-3.12	-3.16	12.14	12.04	-2.22*	-2.33*	0.91*	0.70*		
Sarawak	0.76*	0.90*	4.89*	3.88*	-1.56*	1.00*	-2.63*	-0.33*		
Sabah	-2.50	-2.35	7.35	1.67	-3.67	0.25*	2.73	0.63		

* Not significant at 90% level of statistical confidence

+ For Sabah and Sarawak, the time period is 1966-1976

TABLE 6.12

the lowest elasticity is for saw-logs, both short-run and long-run, and the highest for plywood, although some of the results are not statistically significant as indicated. This is because, as explained in Chapter 2, the degree of competition is higher in plywood than saw-logs. The ordering is similar for the regions as well.

All the three products have high income elasticities showing that demand is dependent on business conditions in the O. E. C. D. countries. The long-run income elasticity of demand is slightly higher than the short-run for most of the results, and all these are statistically significant.

The overall results for cross-price elasticities are, however, quite poor, mainly due to the difficulties of specifying the exact substitution pattern for each commodity based on end-use. Most of them have the wrong signs and are statistically insignificant. As such it is difficult to draw firm conclusions from the results.

Turning to home demand elasticities, outlined in Table 6.13, it can be seen that for Malaysia as a whole, the results seem to indicate low price elasticities as hypothesised, for saw-logs and sawnwood. For plywood, the price elasticity is however higher at -0.91. For the Borneo states, the elasticities of sawlogs and sawnwood are larger in view of the lower stage of development compared to the Peninsular. As such, demand is very sensitive to price changes. When the price of sawlogs is high, most of the sawlogs are diverted to exports. Also, processing facilities are limited in East Malaysia.

For all cases, the income effect on demand is elastic, the highest being for plywood. For the Borneo states, the income elasticity of demand for sawnwood is higher than for PM. It is likely that the two areas may respond quite differently to the same increase in the level of income, with consumption rising faster in a region with an initial low level of income. For most cases, the long-run income elasticity of demand is larger than the short-run one.

The short-run cross-price elasticities of demand for sawnwood with respect to plywood wood in the Malaysian results is 0.60, a figure not very far off with respect to particle board, 0.56. The relationship

ELASTICITIES OF HOME DEMAND FOR MALAYSIAN WOOD PRODUCTS
(1960 - 1976)

	P R I C E		I N C O M E		S a w m o o d / P l y w o o d		P a r t i c l e - b o a r d	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
<u>Sawlogs</u>								
Malaysia	0.00*	0.00*	1.09	1.11	-	-	-	-
P. Malaysia	0.04*	0.09*	0.90	0.87	-	-	-	-
Sarawak	-0.95	-1.46	0.96	1.81	-	-	-	-
Sabah	-1.30*	-0.87*	0.91*	0.61*	-	-	-	-
<u>Samwood</u>								
Malaysia	-0.07*	-0.09*	0.65*	0.68*	0.60*	0.59*	0.56*	0.60
P. Malaysia	-0.06*	-0.35	0.37*	0.83*	0.27*	0.58*	0.52*	0.67*
Sarawak	-1.53	-1.54	2.07	2.05	5.68	5.21	-3.57	-4.29
Sabah	-0.64*	-1.12*	2.60	3.00	0.77*	1.18*	1.26*	3.39*
<u>Plywood</u>								
Malaysia	-0.91*	-2.87	1.34	4.69*	0.13*	0.89*	3.13	4.80
P. Malaysia	-1.31*	-1.31*	1.65*	1.69*	3.37	0.39*	0.12	3.05

* Not significant at 90% level of confidence

TABLE 6.13

is similar in the long-run. However, the results are quite different when applied on a regional basis. For Sarawak, the cross-price elasticity between plywood and sawnwood is very high, and significant. But that with respect to particle board has the wrong sign. For Sabah, the cross-price elasticity of sawnwood with respect to particle board is higher than in relation to plywood, though the results are not significant. Borneo states, do not appear to be reliable given the wrong sign of the P_{SP} for Sabah and the P_{PB} of Sarawak. Despite the deficiencies in the results of the cross-price elasticities, one can still get an approximation of the importance of substitution effect among wood-based commodities. (We will spell out the main kind of data necessary to measure future cross-price elasticities in our concluding chapter).

Section 6. 6: Econometric Forecasts

The use of econometrics to forecast the future path of important variables can be regarded as a step towards developing a scientific approach to economic prediction. Nevertheless, remarkable insights have been made about the future course of economic life by individuals based on intuition and other subjective criteria. It is our view that while the econometrics approach is in some sense objective, it is not a substitute for individual judgement. We will therefore work out the forecasts from what we consider are the best estimates for each commodity, and discuss their potential validity.

Errors increase with the length of the forecasting lead. We are therefore making forecasts up to 1985, for we reckon that based on experience, stumpage supplies will be more difficult to procure, if not more expensive, after 1985. These estimates are valid to the extent that the elasticity estimates remain constant, which we reckon will be the case at least till the next decade.

As the forecasts are based on observations of annual data, they are not very useful for minor policy changes, but rather more reliable as general guides to supply and demand relationships of the three wood products.

A problem in forecasting is determining the time-path of the exogenous variables. One way is to estimate the future values of these variables by trend analysis, which implies that past developments will recur in the future. In other words, forecasts of the future are made on the basis of relationships determined from sample observations. However, one must also exercise judgement whether past developments will repeat. This is particularly so for the economic growth of O. E. C. D. countries, which during the 1960-76 period showed an exponential rate of growth of 4.4%. Current experience in the world economic scene suggests that this will not be realizable, at least in the early eighties. Hence, in addition to those based on the trend figure, we will also base forecasts of Malaysian exports by using 2% as the real rate of increase of the gross domestic product of the

ASSUMED PROJECTIONS OF EXOGENOUS VARIABLES USED IN FORECASTS
(increase per annum - %)

	<u>TREND</u>	<u>ALTERNATIVE PROJECTION</u>
Gross Domestic Product at 1970 prices of the O.E.C.D. countries	4.4	2.0
Malaysian Per Capita Income	6.0	2.0
Value of Construction Expenditure, Malaysia	9.0	5.0 and 2.0
<u>Prices(Unit Values) of:</u>		
Sawnwood - Malaysia	5.7	-
Sawlogs - Malaysia	4.5	-
Plywood - Malaysia	5.0	-
- World	4.0	-
Particle- board - World	4.5	-
Exchange Rate (M\$ and US \$) - increase in value of ringgit	1.0	-

Note: The Trend is worked out by using least squares to fit the equation $y_t = ae^{bt}$, where $t = 1, 2, 3, \dots, n$, to time-series y_t .

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O. E. C. D. countries, a figure often quoted in financial circles. For forecasting demand in Malaysia, we have two main exogenous variables - the value of expenditure on construction and the per capita income, used separately in the equations. Based on trend analysis, the value of construction at current value terms grew exponentially by about 9%. In addition to this, we will work out forecasts on a rise of 2% and 5%. For per capita income the trend figure is 6% and we will also use 2% real increase for purpose of projections. For prices, the rates determined by trend analysis for the wood-products studies lie in the region of 4 and 6% which we reckon to be a reasonable expectation. Forecasts can, however, be easily revised with changing expectations (see Table 6.14).

While the \bar{R}^2 's are high for the equations covering Malaysia and Peninsular Malaysia (mostly more than 0.9), they are lower for the Borneo states. If the explanatory power of the model is poor, forecasts based on such relationships are likely to be less reliable. Hence, forecasts for sawlogs and sawnwood will be made on the basis of both national and regional estimates, while those of plywood will be confined to Malaysia and Peninsular Malaysia.

Since we are using different equations and sometimes different variables and specifications, the figures for each of the regions which are totalled up are likely to be quite different from those worked on the use of statistics covering the whole of Malaysia. This will to some extent show the gains made by disaggregating data. Generally, the difference between the two totals, one based on Malaysia data, and the other on regional data, lay between 4% and 35%, but in most results it was around 10%. The policy maker has to be therefore very careful in selecting the forecasts, and at the same time be aware of the underlying assumptions. We will discuss the plausibility of the estimates in our detailed analysis of the forecasts of each commodity.

Table 6.15 summarises the forecasts till 1985.

a) Sawlogs

For the whole of Malaysia, output is forecasted to grow exponentially at about 1.64% per annum, similar to the rate of growth between 1960-1976. For Peninsular Malaysia, the exponential growth rate forecasted is 1.8%, slightly higher than the 1.43% achieved in the 1960-76 period. F. A. O. Inventory forecasts show that between 1980 and 1990, an average of 14.4 million cubic metres per annum will be available in P. M. The estimated figures here are about 15 million cubic metres in 1980, not too far off from the F. A. O. forecast, but the figures are doubled for 1985. This discrepancy could be due to the fact that F. A. O. assumed an even flow of logs annually, while past experience suggests that this is not the case. For Sabah, the output growth rate is estimated at 1.74% per annum exponentially compared to 1.47% during 1960-76, while for Sarawak, it is 1.4% per annum similar since 1960. Overall, it would appear that the rates of growth experienced in the 1960-76 period will be experienced till at least 1985. However, it is likely that more lesser known species, discarded previously, will be used economically as new uses are discovered for them. Thus there may be quality variations, though in volume terms there is continuous growth. However, if new government control measures are used, particularly in the Borneo states, the growth rates may be slower.

As far as exports of sawlogs for the whole of Malaysia goes, the exponential growth rate is about 1.5% similar to 1960-76, and based on the growth of the O. E. C. D. gross domestic product by 4.4% per annum. However, using a 2% growth instead, the revised export growth rate becomes 1.13% per annum. This figure will be further reduced if export controls, similar in line with P. M., are introduced in Sarawak and Sabah. Unless this is done, the bulk of the exports will continue to come from Sabah, while exports from P. M. and Sarawak will fall by 80% and 65% respectively over their 1976 levels by 1985.

Turning to home demand, this is forecast to grow at 1.62% per annum till 1985 compared to 1.43% during the sample period if the level

of construction expenditure continued to grow at the trend rate of 9% per annum. If the latter grows at 5%, and 2%, the corresponding home consumption rates will be 1.36% and 1.26%, lower than the 1960-76 period. This will hinge on the overall economic performance of Malaysia that will set the pace for construction activity.

b) Sawnwood

The forecasted exponential rate of output growth is 1.69% per annum till 1985, higher than the 1.42% per annum for the sample period. The total figure for 1980 is about 7.65 million cubic metres, twice that forecast by the F. A. O. (1970-75) - 3.8 million cubic metres. It is difficult to comment on the F. A. O. estimates as the basis for the figures is not explained in the report. However, their figures are likely to be underestimated for production in 1976 already exceeded 5.3 million cubic metres. For P. M. they predicted a figure of 2.8 million cubic metres in 1980 whereas output there in 1976 was itself over 4.6 million. The econometric estimated amount for P. M. in 1980 is 7.65 million, with Sarawak and Sabah contributing about a tenth of this amount. Production levels will ultimately hinge on the availability of sawlogs, which may fall short of desired levels unless imports are increased or the export of sawlogs reduced.

The growth rate for sawnwood exports is shown to be 2.41% per annum from 1976-85, which is higher than the 1.46% of the 1960-76 period. This is only realisable, among other things, if the O. E. C. D. growth rate continues at 4.4% in real terms, but if this is revised to 2% per annum, the rate of increase of sawnwood exports will be 1.59% still higher than the sample period. Most of the new demand is likely to come from Middle-east markets. It is also likely that more sawlogs will be processed ^{before} export than in the 1960-76 period. P. M. will continue to supply the bulk of the exports.

Home consumption is forecast to rise at 1.71% per annum, higher than the 1.4% achieved in the sample period. This is on the assumption that, if other factors remain constant, the per capita income

for the country continues to rise by 6% per annum in real terms. But, if we use a 2% real increase, more likely based on current conditions, the increase in home consumption will represent a rise of 1.6%, still higher than the sample period and that predicted by Radzuan (1976). Radzuan however worked on the basis of a 1% real increase in income. For instance, in 1980, he predicts a figure of 1.9 million cubic metres, compared to our estimates ranging between 2.7 and 2.8 million cubic metres. But, in 1976 itself, Radzuan's forecast 1980 levels were already reached.

c) Plywood

Output is shown to increase by 2.1% per annum till 1985 compared to 1.78% during the sample period. This rate is faster than the growth in production of logs, and can only be realized if logs are imported or recovery rates increased. The existing mills, however, appear to have ample capacity to meet this amount without the need for new plants.

Exports, on the basis of 4.4% growth of the O. E. C. D. gross domestic product, are forecast to grow at 2.4% exponentially per annum, even higher than output. However, if we revise the O. E. C. D. figure to 2% per annum, this will increase exports by 1.77, which is more plausible, but still would require that logs be imported to meet this target.

Turning to home consumption, this is forecast to grow at 2.1% per annum based on a per capita income increase of 6% per annum. If the per capita income rises only by 2%, consumption is expected to grow at 1.87% compared to 1.5% during the sample period. Over 85% of this amount will be consumed in Peninsular Malaysia. For Peninsular Malaysia, the 1980 forecast is about three times the figure predicted by Radzuan (1976), 120,000. In 1976, the home consumption of plywood was already at 102,550 cubic metres, not very far off from Radzuan's 1980 forecast. One reason for the lower figure of Radzuan is that he assumed that real per capita income growth will be 1% per annum from 1975, but actual figures in Table 1.1 give a higher rate.

FORECASTS OF OUTPUT, EXPORTS AND HOME DEMAND OF SAWLOGS,
SAWNWOOD AND PLYWOOD BASED ON ECONOMETRIC ESTIMATES

(MALAYSIA and REGIONS - 1980 and 1985 - '000 cubic metres)

	1 9 8 0				Total	1 9 8 5				Total
	Malaysia	P. Malaysia	Sarawak	Sabah		Malaysia	P. Malaysia	Sarawak	Sabah	
S A W L O G S										
OUTPUT	29 355	15 180	5 140	15 520	35 840	49 000	29 336	5 290	30 300	64 926
EXPORTS:										
a) Based on growth of the gross domestic product of O.E.C.D. at 4.4% (Trend).	18 041	441	2 253	15 520	17 944	33 243	645	3 569	27 011	31 225
b) Based on assumed rate of 2% for (a)	12 546	163	965	10 937	12 065	14 316	63	495	11 180	11 738
HOME DEMAND:										
a) Based on 9% growth of construction expenditure (Trend)	20 425	17 500	1 495	528	19 523	25 974	26 370	1 863	596	28 829
b) Based on assumed rate of 5% for (a)	14 765	14 618	1 233	478	16 329	17 065	18 398	1 270	428	20 096
c) Based on assumed rate of 2% for (a)	13 095	13 095	1 098	307	14 500	15 835	17 326	1 187	403	18 916
S A W N W O O D										
OUTPUT	7 650	6 223	558	143	6 924	11 920	11 000	681	183	11 864
EXPORTS:										
a) Based on growth of the gross domestic product of O.E.C.D. at 4.4% (Trend).	4 536	5 787	255	64	6 106	7 943	9 849	274	95	10 217
b) Based on assumed rate of 2% for (a)	4 447	3 905	230	85	4 220	5 064	4 587	211	183	4 981
HOME DEMAND :										
a) Based on 6% growth of per capita income (Trend)	3 592	2 819	335*	711	3 865	5 906	5 221	450*	1 304	6 975
b) Based on assumed rate of 2% for (a)	3 576	2 672	172 [⊗]	477	3 321	4 725	4 601	169 [⊗]	425	5 195
P L Y W O O D										
OUTPUT	1 400	955	nc	nc	nc	4 800	2 325	nc	nc	nc
EXPORTS:										
a) Based on growth of gross domestic product of O.E.C.D. at 4.4% (Trend)	1 620	846	nc	nc	nc	11 968	4 494	nc	nc	nc
b) Based on assumed rate of 2% for (a)	593	781	nc	nc	nc	1 143	3 514	nc	nc	nc
HOME DEMAND :										
a) Based on 6% growth of per capita income (TREND)	380	327	nc	nc	nc	795	688	nc	nc	nc
b) Based on assumed rate of 2% for (a)	312	254	nc	nc	nc	491	381	nc	nc	nc

* Based on trend projection of construction expenditure at 9% per annum (See Equations C in Table 6.7)

⊗ Based on assumed growth rate of 2% for construction expenditure.

nc Not computed - see reasons in text.

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Section 6. 7: Conclusions of the Analysis

With the reservations cited, we can draw the following conclusions from our study:

- a) Supply elasticities: For Malaysia as a whole, the short-run price elasticities of supply were shown to be low, particularly for sawlogs and sawnwood. This may be due, among other factors, to the manner in which logging concessions are farmed out as discussed in Chapter 3. For sawlogs and sawnwood the long-run elasticities are also low, but high for plywood. If the commercial resource base were to diminish further or disappear, we can expect the elasticities to change in the future, unless imports of stumpage fill in the vacuum.

- b) Export Demand Price Elasticities: The results for Malaysia as a whole indicate a price inelastic demand for sawlogs and sawnwood, most likely due to the superior quality nature of species besides the economic nature of a producer's good. For plywood, the demand was shown to be relatively price elastic. This means that if regular supplies of sawlogs and sawnwood are forthcoming, they can continue to be good earners of foreign exchange. The plywood market is highly competitive, and non-price factors like quality, reliability and forceful marketing are likely to be important.

- c) Home Demand Price Elasticities: The elasticities are again shown to be in the inelastic range for Malaysia as a whole, virtually zero for saw-logs and sawn-wood. During the period of analysis, given the rising business conditions especially in the late sixties and early seventies, the problem as far as local demand went was a shortage of supplies, and the very low price elasticities for the wood-products are expected. For plywood too, the price elasticity of demand is below one.

- d) Income Elasticities of Demand: Nearly all the results show the income elasticity of demand to be high and significant. For exports,

the income elasticity of demand was 3 to 5 times higher than for sawlogs and sawnwood for Malaysia as a whole. This is in conformity with experience in industrialized countries where conditions promoting construction give rise to bullish conditions in the wood market.

For the domestic market, the income elasticity was greater than one for sawlogs and plywood, and slightly lower for sawnwood. The lower elasticity for sawnwood could be due to the fact that most of the products released in the domestic market were of inferior grades or ungraded timber, less demanded with income changes.

e) Cross-elasticities of Demand: Most of the results were poor, but those that were relatively better indicated a considerable degree of substitution among sawnwood, plywood and particle-board. The coefficients are generally larger in the world market than the home, because of the relatively less sophisticated nature of the latter.

f) Static and Dynamic Specifications: For sawlogs and sawnwood, the dynamic specifications generally did not improve the results, and in most cases they appeared to show complete adjustment, and even over-reaction of the market. Under these circumstances, the static results are preferred. For plywood, however, particularly for supply and home demand, the dynamic specification was slightly better for Malaysia as a whole, indicating a low speed of adjustment for supply and a rapid adjustment for demand.

g) Regional Variations: There were considerable regional variations in the results due to differences in quality of data across regions, as well as the fact that the three areas are in different stages of development.

h) Forecasts:

For output of sawlogs, sawnwood and plywood, the econometric estimates indicate that growth rates experienced in the 1960-76 period

will continue to be achieved if the supply of raw materials is maintained, among other things. More likely, imports of logs will be necessary to meet desired levels in sawnwood and plywood, as the growth in sawlog production is expected to be slower than for processed wood.

Exports, based on a 2% growth of O. E. C. D. demand and the growth rates of exogenous variables listed in Table 6.14, are likely to be near or slightly above past levels. These again will hinge on no raw material supply constraints or new control measures to restrict exports, such as of sawlogs.

Home consumption, too, is predicted to rise to rates slightly higher than the sample period, based on assumed projections of the exogenous variables.

CHAPTER 7

EMPLOYMENT IMPLICATIONS IN FORESTRY

Section 7.1 The General Employment Issue in Malaysia

As noted in Chapter One, employment creation is a major tenet of the Malaysian government development strategy. In this chapter we take a more comprehensive study of the scope of forestry employment both within the sector as well as in comparison with other sectors. As explained earlier, the Malaysian employment problem encompasses both growth and distributional aspects. Besides creating new jobs for a growing young population, both in the rural and urban areas, the aim also is to spread more evenly jobs among the three main races.

To get a clear perception of the problem, it would be useful to outline and discuss the fundamentals of the employment issue in Malaysia. An important point is that measures of employment and unemployment are subject to unknown margins of error that are much higher than for similar data of industrialized countries. In most Malaysian surveys, employment is taken to mean a situation where a worker is actively working on the average for six hours or more per day, but some sample socio-economic surveys indicate that a lot of people included as employed actually worked less than 25 hours per week, many of them seasonally unemployed. Included in these figures is family labour where there is no distinct wage-employment relationship. In this sense, the extent of employment is sometimes overestimated, and unemployment, showing a downward bias.¹

In the 1970's, the rate of open unemployment (ie those on the register of the labour exchange) has been between the 6 and 8 percent

1 The Malaysian Socio-economic Sample Survey of Households, 1967-8, noted that the number of self-employed and unemployed family workers amounted to at least forty percent of the labour force. For a critical overview of this problem, see D. J. Blake, Unemployment: The West Malaysian Example, in D. Lim (1975) p. 186-194.

mark, and over 80% of the unemployed are under 30. Official data suggest that the agricultural, forestry and fisheries sector, which took about 50 percent of the labour force in the 1970's, would not be a buoyant sector for absorbing new labour. Most of the new jobs would have to come from the manufacturing and service sectors, currently taking 11 percent and 37 percent of the total employment respectively, if unemployment was to be reduced.²

The unemployment problem and the difficulties involved in creating new jobs for a growing labour force are common problems in other countries, both developed and less developed. In Malaysia, however, it takes on a more sensitive dimension when considered in the racial, regional and sectoral contexts. To bring this out, it may be necessary to understand the income and wealth distribution structure in Malaysia. The underlying explanation for income differentials lies in the fact that states of Malaysia differ widely in their human and natural resources, and are at different stages of social and economic development partly due to historical factors. This is reflected in differentials in productivity, skills and education, the degree of urbanization, and the racial composition. Productivity and wages are higher in the non-agricultural sectors than in the agricultural sectors, although intra-sectoral differences also exist between the low productivity and high productivity industries within both these sectors. This inter-sectoral difference corresponds to what may be called a rural-urban imbalance.³

The issue becomes complicated when race is considered. There is a strong correlation of the various types of differentials - rural urban,

2 The Third Malaysia Plan (1976-80) envisages that manufacturing would provide 26 percent of the new jobs, the services sector, 21.6 percent, with the rest coming from agriculture, forestry and fishing and construction. Recent economic progress reports show that the rate of new job creation between 1976-1979 has been slower than expected.

3 Tables (iii) and (iv) in Appendix 7A show that in 1970, urban mean incomes were twice that of rural mean incomes; the mean incomes of Malays were about half that of the Chinese. See also D. R. Snodgrass: Trends and Patterns in Malaysian Income Distribution, 1957-70, in Lim (1975) p. 251-68. In another study Lim (1971) noted that incomes in the non-agricultural sector were generally two to three times higher than in the agricultural sector.

agricultural-non-agricultural, inter-state - with those of racial differences. Due to historical factors, the bumiputras are largely confined to the low productivity jobs in the rural agricultural sectors, while the immigrant population, especially the Chinese, are concentrated in high-productivity non-agricultural occupations in the urban centres.⁴ (See Table (i.) in Appendix 7A).

In comparison with other less developed countries, the various kinds of income differentials are not especially large, but the economic "ethnic dualism" necessitates different policy objectives from those prescribed for a more racially homogeneous populace of other less developed countries. If we examine the wealth distribution figures in Appendix 7A (ii), a similar racial economic dualism emerges.

In employment policy terms, this means that if one was to follow a laissez faire policy in allocating scarce jobs in the country, there is a fear of maintaining this racial economic dualism intact unless, of course, the growth rate of jobs is so high as to make everyone fully employed. Leaving aside distributional consequences, an optimal policy of promoting economic growth (and employment) within a free enterprise economy, or even a mixed one, will be to direct investment to the most buoyant sectors, give jobs to the potentially most productive sections of the population, and locate jobs where the cost is the lowest and the return highest. To reduce racial economic disparities, the Malaysian government has, however, resorted to intervention aimed at channeling funds to less productive sectors and regions, giving bumiputra preferences in jobs, education places, allocation of shares in companies, issue of

4 About 70 percent of those engaged in agriculture are Malays, principally in rice farming. Chinese control 60 percent of the secondary sector and 50 percent of the tertiary sector. Prior to the second world war, the need to create new jobs was not important for the country was suffering from a labour shortage, mitigated to some extent by the British colonial policy of encouraging Chinese and Indian immigrant labour to feed tin mines and rubber estates respectively. For a broad overview see Lim (1967) and Amin and Caldwell (1977).

licences.⁵

There are trade-offs between growth and distribution that are difficult to quantify. A more rigorous debate on the matter would inevitably lead us to trespass into areas of politics, sociology, and justice, which are not too relevant immediately. Our aim had been to paint a backdrop for considering manpower issues in forestry, which we will now turn to.

Section 7.2 Malaysian Forestry Employment

In 1976, about 100,000 people were directly employed in the forest and forest-based industries, less than three percent of the total labour force in Malaysia. Despite the low rate of direct aggregate participation, forestry employment had a rapid growth rate - about 46 percent in 5 years between 1972 and 1976. (Table 7.1). If figures of sectors dependent on forests are included, (for example, transport, trade and construction), the contribution is even higher.⁶ About three quarters of the total employed are concentrated in Peninsular Malaysia. (Table 7.2), and sixty percent of these are found in the sawmills and plywood-veneer mills.

5 The rationale of this policy is to eliminate the identification of race with economic function. In efforts to restructure ownership of wealth, the government plans to ensure that the bumiputras own 30 percent of the issued share capital of companies by 1990.

6 United States Department of Agriculture (1963) noted that in the U. S. A., data on employment attributed to timber production shows that, for each worker employed in forest management, another four were employed in harvesting and six more in primary manufacturing, and another 30 were employed in timber-based secondary manufacturing and in construction, transportation and marketing facilities.

Table 7.1

TOTAL DIRECT FORESTRY EMPLOYMENT - MALAYSIA
(1972 and 1976)

	1972	1976	Percentage Change (1972-76)
Peninsular			
Malaysia	51 125	72 868	43
Sarawak	7 867	13 587	73
Sabah	9 425	13 578	44
Total	68 417	100 033	46

Sources:

- 1 Forest Department: Peninsular Malaysia Forest Statistics 1971-76; 1972-77 (unpublished)
- 2 Forest Department: Sarawak Forest Statistics, 1977 (unpublished)
- 3 Department of Statistics, Annual Bulletin of Statistics, Malaysia, various issues 1972-77
- 4 Department of Statistics, Sarawak: Survey of Manufacturing Industries, Sarawak, 1972.

In racial terms, the only detailed figures available are from 1975 to 1977, and they show an increasing participation by the bumiputras. This is a deliberate government move to diversify their means of livelihood. For instance, in plywood-veneer, 70 percent of those employed were bumiputras in 1977 compared to 65 percent in 1975. In sawmilling, the corresponding figures are 55 percent and 42 percent. In logging, however, the manpower is still predominantly Chinese - 56

PENINSULAR MALAYSIA: FORESTRY EMPLOYMENT (1972 - 1977)

Year	Logging	Sawmills	Plywood/ Veneer	* Other Wood-based Industries	Total Employment	Annual Change (%)
1972	10 763	19 532	11 754	9 076	51 125	-
1973	11 490	17 000	13 302	11 950	53 742	5.00
1974	11 850	18 954	12 807	13 119	56 730	5.60
1975	12 211 (42.5)	17 070 (42.1)	12 929 (65.3)	14 962	56 572	-0.03
1976	13 227 (40.6)	24 240 (41.7)	13 785 (66.3)	15 585	67 197	18.80
1977 ^a	14 500 (43.5)	25 577 (55.3)	11 101 (70.2)	16 690	72 868	8.00

Notes: All figures refer to number of persons employed on full-time basis. Those in brackets refer to estimated number of bumiputras employed as a percentage of total employment

* These include particle board, pencil & match factories, wood wool mills.

^a Estimated by Forestry Department

Source: Forestry Department; Forestry Statistics, Peninsular Malaysia, 1971-76 and 1972-77. Department of Statistics, Annual Bulletin of Statistics, various issues, 1972-76. Department of Statistics, Census of Loggers, Peninsular Malaysia, 1972

Table 7.2

percent in 1977, a one percent fall from 1975. (Table 7.2).

Forestry could be viewed both as a rural and urban industry. This rural-urban character ties in quite neatly with the peculiar pattern of the employment needs in Malaysia, for it appears to favour a man-power policy that could be biased towards rural Malay employment and yet provide opportunities for jobs in urban areas largely through wood-based industries.

Section 7.3 Objectives of the Study

Given the above employment picture, we now propose to consider numerically the following facets of forestry employment:

- i) the propensity to employ in logging, sawmilling and plywood-veneer manufacture, and their degree of labour absorption in comparison with two other leading Malaysian primary sectors - rubber and oil palm,
- ii) the degree of stability of employment in relation to the rubber and oil palm sectors,
- iii) the cost of providing jobs in the forestry sector in terms of capital and land inputs in comparison with other selected agra-based industries.

In this way we hope to spell out policy objectives that could be useful in managing forestry employment. A deficiency of this study is the absence of a quantitative assessment of the linkage and multiplier effects on forestry employment. This is due to a lack of a comprehensive input-output matrix of forestry and its relationship to other sectors.⁷

⁷ The latest Input-Output Table of the major Malaysian economic sectors (1970), which came out at the end of 1975, appears deficient. For instance, the input-output relationship between the forestry and the construction sectors is completely ignored as well as the relationship between the logging and wood-processing industries.

This lackuna to some extent is made up in two ways. The study represents a first comprehensive dynamic analysis of the forestry employment in Malaysia in quantitative terms; and also the first effort to compare the employment implications of forestry with other sectors.⁸

Section 7.4.1 Employment Functions of Forestry, Rubber and Oil Palm Sectors

We will proceed to study the techniques of analysing employment behaviour and apply them in the context of wood and wood-based industries in Malaysia. The behaviour will be compared with that of the rubber and oil palm sectors, both of which are competitive users of lowland areas in the country. Specifically, we would examine the following:

- 1 the degree and speed of labour absorption among the forestry, rubber and oil palm sectors, as a result of changes in output, export and domestic demand;
- 2 the forces that explain the level and speed of labour absorption;
- 3 the likely employment trends in the three sectors.

We would like to examine the contention that, in conformity with the experience of more developed economies, the degree of labour absorption in the agricultural and forestry sectors is likely to fall as a

8 There are two stimulating quantitative studies concerning Malaysian employment. Thoburn (1977) considered employment creation and skilled labour requirements of tin, rubber and oil palm sectors, but his analysis is static, considering only the year 1972, which need not necessarily be a normal year for all of the three sectors. The study by Lim (1975) looked at labour absorption of selected manufacturing industries (1959-70), and is commented upon in Section 7.4.2.

result of technological developments and capital substitution effects.⁹ A verification of this hypothesis can have useful policy implications in terms of manpower planning, and can thus implicitly help to evaluate the opportunity cost of investment in wood based industries.

Besides being competitors of land use, the rubber and oil palm sectors were selected for comparative purposes because they are historically the leading export sectors in Malaysia where data is more readily available. Furthermore, unlike, say, the rice growing sector, oil palm and rubber are largely commercially oriented sectors, and together with forestry, they are important areas in the government's land development policy for promoting wider bumiputra participation.¹⁰

At this stage it would be useful to define some of the important terms used in the study. By labour absorption we would mean changes in the level of employment as a result of variations in output, which could be due to changes in exports or domestic consumption. In other words, we would be measuring the employment-output elasticity which could be defined as the percentage change in the number of workers employed in comparison with the percentage change in physical output or the real value added.

Likewise, employment-exports elasticity could be defined as the ratio of the percentage change in the number of workers employed to that of the change in volume of exports, while the home consumption - employment

9 See F. Kaiser and G. Guttenberg (1970) who noted increases in labour productivity and reductions in labour force of sawmills in U. S. A. between 1954 and 1967. *and Sartorius*

A more in-depth study by Henle (1968) observed that in most developed countries there were gains in productivity due to mechanisation, rationalisation and more use of skilled and professional manpower.

10 Though rice cultivation employs about 400,000 people, very little information is available on their pattern of employment and wage structure. Often the relationship is based on kinship and kind payments. See J. T. Purcal, (1975): Employment Pattern in the Rice Growing Areas of West Malaysia in Lim (1975), p.195-212.

elasticity can be put as the proportionate change in employment as a result of proportionate change in home consumption. We can look at these elasticities both from the demand and supply angles, although in a labour-surplus country like Malaysia, demand for employment would be more useful.

Section 7.4.2: Employment Models and Applications - A Review

Leaving aside Marxist theories, which have a different perspective of looking at employment-output relationships, neoclassical theories have evolved a rigorous and logical structure to consider the labour input in the production in quite similar lines as capital. The aim of such theories is to specify a level of "optimal" labour input to meet particular levels of output, and in a dynamic context, it involves analysing the mechanism of adjusting actual labour levels to optimal ones.

The econometric technique has been a convenient method of empirically verifying employment models to explain the actual and optimal number of men employed by a firm, industry or sector. A crucial requirement is the availability of either cross-section or time series data or both. Such kind of employment functions are being used in studying employment-output relationships, particularly in the manufacturing sector, and not so much in the agricultural sector which is the most important sector in many less developed countries. Useful surveys of various kinds of cost-minimising and profit-maximising employment models are made by Fair (1969), Killingsworth (1970), Roberts (1972) and Briscoe and Peel (1975). The profit maximising models explain the labour input in terms of the output and the real wage, while the cost minimising approach postulates a two stage decision process in the short-run. The first part involves determining the desired employment levels, E^* , dictated by the production function, and the second aspect involves choosing a level of hours, h^* , that would

minimise wage costs. We plan to focus our attention on cost-minimising models formulated by Brechling (1965) and Ball and St Cyr (1966) which are more convenient for empirical testing, and at the same time theoretically cogent. We would also look at the model presented by Ireland and Smyth (1967, 1970), which looks at the problem in a similar fashion but using a different production function.

Basically, the models formulated by Brechling, Ball and St Cyr and Ireland and Smyth, aim at estimating an optimal level of employment so as to minimize a specified function of various costs involved in the labour input decision, given the state of technology and capital equipment. This is essentially a short period or cyclical employment decision as opposed to a long period one which involves optimal capital-labour mix decisions for producing a given level of output.

The labour input is acknowledged to have at least two dimensions - the number of people employed E and the number of hours worked per person h so that when a firm or industry wishes to change employment, it could alter the number engaged, the hours worked, or both. (This is analogous to the recognition that the capital input has two dimensions - the total stock and its rate of use). The short-run cost minimising decision is therefore concerned with allocating a given volume of man-hours (at a given output) between employment and hours worked.

Both Brechling and Ball and St Cyr assume output, capital and technology to be exogenous, although realistically this is not the case, as will be pointed out later. They begin by postulating a short-run Cobb-Douglas production function, a technical equation that represents the most efficient relationship between inputs and output a firm or industry can achieve in equilibrium when adjustment among the inputs is complete.

$$Q_t = A e^{gt} (Eh)_t^a \quad (7.1)$$

Where Q = net output, E = number employed, h = productive hours worked and $A e^{gt}$ is the shift parameter, which takes into account the influence of capital and technical progress and is assumed to grow

exponentially. (This expression is theoretically inadequate but formulated to conform to data deficiencies, and is expedient to work with).

The employment function is simply an inversion of this production function:

$$Eh_t = A^{1/a} e^{-\rho t/a} Q_t^{1/a} \quad (7.2)$$

The next step is to establish a relationship between the effective wage rate and the number of hours worked. Ball and St Cyr approximate this relationship by a quadratic:¹¹

$$W_h = a - bh + ch^2 \quad (7.3)$$

where W_h is the average wage paid per productive hour.

There will be an average level of hours at which this function is minimised. The cost equation which the firm attempts to minimise with respect to Eh is:

$$C_t = W_h (Eh)_t + F_t \quad (7.4)$$

where F = fixed cost, and $W_h(Eh)_t$ represent variable costs of production relating to labour.

Given the above production function, h_t can be expressed as a function of Q_t and E_t :

$$h_t = \frac{Q_t^{1/a} e^{-\rho t/a}}{A^{1/a} E_t} \quad (7.5)$$

Substituting this expression for h_t in the cost function (7.4), and minimising the resulting expression with respect to E_t , gives the firm's desired employment level, E_t^*

$$E_t^* = \frac{2c}{A^{1/a} b} e^{-\rho t/a} Q_t^{1/a} \quad (7.6)$$

11. See next page.

This expression obtained the level of employment which minimises costs subject to both the hours cost function and the production function. In other words it minimises both wage costs and hours costs with respect to the production function. The weakness of the Ball and St Cyr formulation is that unless "normal" hours remain the same, the ratio $2c/b$ will not be constant. The shape of the effective wage quadratic (7.3) will alter if "normal" working hours change. Brechling, on the other hand, allows for this variation. His wage equation is:

$$W = E (h_1 w_1 + h_2 w_2) \quad (7.7)$$

where w_1 and w_2 are the "normal" wage and overtime wage rates respectively and h_1 and h_2 are the corresponding number of hours worked at these rates. If H is the "normal" number of hours, the choice then between men and hours will be dependent upon H and the ratio $\left(\frac{w_2}{w_1} \right)$.¹²

We now deal with the labour adjustment process, i.e., the relationship between desired employment dictated by the production function and actual employment, similar in flavour to Nerlove model used in the commodity model in the previous chapter. The gap between desired and actual employment levels arises due to three main reasons,

- 11 When actual hours of work exceed normal or standard hours of work, the effective hourly wage rises above the straight-time hourly wage rate due to the premia payment for overtime (ie, in excess of normal hours). When actual work is below the normal hours, costs are still incurred in terms of fixed costs of employing workers. When these hourly wage rates are plotted against actual hours worked per man, the function is thus roughly U-shaped and can therefore be approximated by a quadratic.
- 12 Brechling summarises the relationship as follows: A rise in the ratio of overtime pay to standard pay $\frac{w_1}{w_2}$ either has no effect or leads to a substitution of men for hours. A fall in the level of "normal" hours will have no effect when actual are below "normal" hours; it will raise employment and lower hours when the latter are equal to "normal" hours; finally it will lower employment and raise hours when the latter exceed "normal" hours. (p. 192)

of which the main one is the cost of labour adjustment. Labour is regarded as a quasi-fixed factor with costs of hiring, firing and training workers besides non-monetary obligations to unions or workers directly.¹³ This could lead to labour hoarding, a situation when labour that is not fully used is kept on for transitional variations in output or legal and moral constraints on dismissals. Such costs have a long-term dynamic character difficult to capture in practice. Another related reason is uncertainty of demand levels and wages. The third reason is a more practical one - the difficulty in carrying out a concurrent adjustment of other inputs like capital stock. For these reasons, the adjustment behaviour is assumed to be reflected by a simple linear first-order adjustment process, more commonly known as the Koyck adjustment process:

$$\frac{E_t}{E_{t-1}} = \left(\frac{E_t^*}{E_{t-1}} \right)^\lambda \quad 0 < \lambda \leq 1 \quad (7.8)$$

where λ measures the speed of labour adjustment between t and $t-1$, and its interpretation is similar to δ in Chapter 6. This means that if the estimated value of λ is 0.27, and if logarithms are used, it would imply that 27% of any difference between the logarithms of desired and actual levels is made up during the period between $t-1$ and t .¹⁴

Adding the Koyck adjustment process, and taking natural logarithms, the Ball and St Cyr formulation becomes:

13 For treatment of labour as a quasi-fixed factor, see Oi (1962). Further points on labour hoarding are considered by G. Evans: *The Labour Market Mechanism and the Hoarding of Manpower* in Wabe (1974), p. 97-152.

14 If $\hat{\lambda}$ is negative, it may imply that labour units are reduced despite increases in output demand, and if λ is more than unity, it would mean that the firm is hiring more workers than desired for that level of output. Such extremes should not arise if employer behaviour is assumed to be rational, or if quality of data is accurate.

$$\log E_c = a_0 - \frac{\rho\lambda}{a}t + \frac{\lambda}{a} \log Q_t + (1-\lambda) \log E_t - 1 \quad (7.9)$$

where $a_0 = \log \frac{2c}{A'b}$. From 6.9 we can derive estimates of the structural coefficients of λ , the speed of labour adjustment, a , the returns to labour, and p , the time trend effect on employment. We could also derive the employment-output elasticity, $\hat{\beta}$, which is simply the inverse of \hat{a} .

While Ball and St Cyr's model is in a multiplicative form, that of Brechling was in the linear additive form, where $E_t = f(Q, K, T, H, w_2, w_1, E_{t-1})$.¹⁵ The implicit assumption in the linear format is that the marginal propensity to absorb labour is constant, whereas the logarithmic function implies that whilst the average and marginal propensities to absorb labour will change, the employment-output elasticity will remain constant. One, therefore, has to be careful in making forecasts of future employment levels, especially when there are reasons to believe that β might change.

Whilst Ball and St Cyr and Brechling use a Cobb-Douglas production function, Ireland and Smyth postulate a Constant Elasticity of Substitution (CES) production function:

$$Q_t = e^{\rho t} \left[a(Eh)_t^{-w} + (1-a)(Ku)_t^{-w} \right]^{-v/w} \quad (7.10)$$

The capital input variable, Ku , is the capital used during period t , instead of the actual stock of capital in existence. The CES production function is homogenous to the degree v , v being the measure of the short-term returns to scale. Ireland and Smyth assume that the percentage change between Ku and Eh is proportional, and as long as there is excess capacity, this is more plausible than the exponential time trend

15 Another difference between the two models is that Brechling adds a quadratic time trend, t^2 , to his equation to allow for the possibility that technical progress has been accelerating over time. This variable was found to be significant, and improved the \bar{R}^2 . As an extension, Brechling also added the stock of capital, K , to the equation, and it too was found to be significant and improved the \bar{R}^2 but one could question the results on grounds of multicollinearity between the time trend and K .

used by Ball and St Cyr to reflect growth in capital services. Using the same cost function of Ball and St Cyr, and incorporating the Koyck lagged adjustment process, they come out with an equation similar to Ball and St Cyr's:

$$E_t = G e^{-\rho\lambda t/v} / Q_t^{\lambda/v} E_{t-1}^{1-\lambda}$$

or in natural logarithms,

$$\log E_t = a_0 + \frac{\rho\lambda}{v} + \frac{\lambda}{v} \log Q_t + (1 - \lambda) \log E_{t-1} \quad (7.11)$$

The only significant difference between equations 7.9 and 7.11 is that in equation 7.11, v has replaced α in the coefficients of $\log Q_t$ and t . In the Ireland and Smyth model, v is the measure of the short-run returns to scale, whereas α is the elasticity of output with respect to labour alone. In the Ball and St Cyr study, most of α 's turn out to be greater than one, and Ireland and Smyth argue that they should more realistically be interpreted as measures of short-run returns to scale rather than labour alone. Smyth and Ireland results based on Australian manufacturing data, showed, on their interpretation, evidence of increasing short-run returns to scale. Ball and St Cyr's and Brechling studies, based on British manufacturing industry, show increasing returns to labour, based on their interpretation of α . They however, acknowledge that the elasticities could be biased upwards as nominal hours paid for rather than actual productive hours are used. To take this into account, Ball and St Cyr adjusted the nominal hours input by the factor $(1-u_t)$ representing unemployment in the industry. But their results are mixed, some of them not sensible, others with reduced serial correlation and elasticity estimates, but most of them still showing increasing returns to labour.

We have merely looked at some major cost minimising models. There are other models based on profit maximising considerations such as those of Dhrymes (1969) and Nadiri (1968), both are concerned with

achieving an optimal capital-labour mix. Nadiri and Rosen (1969) integrate employment and investment functions, estimating a model which takes into account the utilization rates of labour and capital. Solow (1968) theoretically looks at the cost minimising problem in a more dynamic perspective, by explaining short-term demand for labour in terms of long term needs. We do not propose to delve deeply into these studies, for, given the data availability, they are inappropriate for our present circumstances. The reader is therefore referred to the principal surveys mentioned above for a comprehensive purview. As to their empirical usefulness, Roberts (1974) and Briscoe and Peel (1975) are revealing. Instead, it would seem to be more beneficial to survey the literature on the use of employment models in Malaysia and other less developed countries, before we outline and estimate our model.

While there is a growing literature on employment issues in less developed countries, the use of econometric employment models similar to the ones we have presented, has been limited, mostly due to data deficiencies of employment implications of industrialization, for a broad review see Morawetz (1974).

Our immediate concern is with methods to estimate the employment-output elasticity, and one of the earliest was attempted by Baer and Hervé (1966) to estimate the labour-absorptive capacity of manufacturing industries in nine less developed countries, mostly from Latin America, over the period 1945-61. Basically, it involved working out percentage changes in employment, and comparing them with those in output, or more strictly, the real value added. Their employment-output elasticity was implicitly defined as the ratio of percentage change in the number of persons employed to the percentage change in the real value added. Their study showed that output grew at a faster rate than employment not only in advanced industries such as transport equipment, fabricated metal products and chemicals, but also in more traditional ones such as textiles and shoes. In some cases the total employed actually declined. They attributed this to the adoption of relatively capital-intensive techniques, modernization of old capacity and a natural increase in labour efficiency. As rough indicators of the degree of capital intensity of various industries, they worked out

the installed power capacity per person employed, or, when this measure was not available, per capita electricity consumption by industry groups. The tentative conclusion that could be derived from these figures was that mechanization had taken place across the board. In a specific study of cotton weaving industry in India, Baer and Hervé noted that the most labour-intensive technique is never the one producing the highest return per unit of capital. The basic argument then was, they reckoned, that given capital as the scarce factor in less developed countries, the problem was not to save the use of it in the production process, but rather to maximise the output which can be got from it.

While the conclusions of the study are interesting and logical, there are limitations in their method of measuring employment-output elasticity. The comparison of output and employment is very sensitive to the choice of the base and terminal years, which may not be normal years. One has to be careful in interpreting the results, particularly when comparing different industries, as the "normal" year for one industry may not be so for another. Baer and Hervé also fail to work out jointly the combined influence of both output and capital and technology in determining employment levels.

In a similar style, Oshima (1971) compared the level of labour absorption in the agricultural, manufacturing and services sectors of six East Asian countries, including Peninsular Malaysia, covering differing post-war time periods. While Baer and Hervé used the arithmetic mean method to compare changes in employment and output, Oshima tried the geometric mean approach, which involves averaging rates of change.¹⁶ Defending his approach, Oshima said his method was "not intended to serve as or to embody a theoretical model (or a system of hypotheses) whether of the partial or general equilibrium type," but rather as "a frame-

16 If the rate of employment increase is 10 percent from time t to t_1 , and 15 percent from t_1 to t_2 , then the geometric mean of the increase during the two years is $\sqrt{1.10 \times 1.15} = 1.1247$. The average rate is 12.47%, and if both sides of the equation are squared, the result is $(\sqrt{1.10 \times 1.15})^2 = (1.1247)^2 = 1.6$. If $t_2 = 1.6$ and $t = 1$ and $t = 0.1247$, The last equation could be written as $t_1 = t_0 (1 + r)^2$ the familiar compound interest formula. See Yamane (1973) p. 56-59.

work of a heuristic, problem oriented analysis, to collect and classify data, to establish regularities, to describe and interpret them." The limitations cited previously for the Baer and Hervé study are also relevant here. In respect of P.M. (1957-67), Oshima noted that the performance of the agriculture sector with respect to labour absorption was poor. Its employment elasticity was 0.30 compared to 0.56 and 0.71 respectively for manufacturing and services. For all six countries, the rate of labour force growth was twice that of agricultural employment growth, while the growth rate in manufacturing employment was 5 times that of agriculture. He attributed the poor performance of agriculture in all 6 countries to the low income elasticity of demand for agricultural products and the low priority given by the government to this sector thus creating bottlenecks in supply. No definite reasons were cited for the better performance of the manufacturing sector, which besides capital firms included mining and constructive industries, both large and labour intensive. Nevertheless, in all cases the employment elasticities were low, mostly less than 0.6. But these figures are difficult to accept, unless capital and technological changes are also taken into account.

Turning to whole studies in Malaysia, Lim (1975) measured the employment-output elasticity for 11 industry groups in Peninsular Malaysia for the period 1959-70. He used three different procedures - the Baer and Hervé-type simple arithmetic method, the simple geometric mean method used by Oshima and the econometric technique. The latter comprised of simple regressions, linear and log linear, with the number employed as the dependent variable, and the value added as the independent variable. He also used the Ball and St Cyr type of model incorporating the lagged adjustment process, with and without the effect of capital and technology on employment. The values of the elasticities differed according to the method, with the lowest values for the Baer and Hervé method. In all cases, the coefficients were below one, indicating a low labour absorption propensity. His analysis confirmed that different methods of estimating the elasticity produce different values so that the

projected level of employment would depend on the method used in estimating the elasticity. Some of Lim's results are difficult to accept fully because they completely ignore the effect of capital and technology, both of which are important determinants. Where the time trend is incorporated, both arithmetic and quadratic, the elasticities are generally lower than those without the trend, although 65% of the results are statistically insignificant at the 5% level of confidence.

One major limitation of his work is that Lim used value of output rather than volume as an indicator of productivity. Such an index could disguise price changes which can affect the value without any physical change in output. As far as forestry sector goes, he aggregated all the wood-based plants, including those making rattan furniture, which is unsatisfactory as productivity within the forestry sector varies as noted in Chapter 4. The bulk of the modernisation of the wood products sector was a late sixties and seventies phenomenon not captured by his study. As data on which his calculations were based on is not disclosed, it is difficult to verify whether there is some degree of homogeneity among the industries he has chosen in terms of size, capital utilisation and time of operation. Also he ignored the individual effect of exports and domestic demand on employment, which we would attempt to verify. Despite the limitations, Lim's study represents an important effort of analysing manpower issues in a more rigorous fashion lacking in the literature of less developed countries.

Still on the literature on Malaysia, Ariff (1970) considered the effect of price instability, among other things, on employment and wages in the rubber industry of Peninsular Malaysia. His employment data related to full time employees in rubber estates, ignoring the small holding sector. First of all, he used the Coppock's Instability Index (see Appendix 7B) to compare the level of instability in employment and rubber prices, and noted that the instability index for employment during the period 1950-1966 was low (2.8) compared to that of prices (30.0). He attributed this to the inelastic response of rubber output to price changes, referring to his earlier Ph. D. research where his

computations of price elasticity for output showed a figure of 0.06. The instability index for output during the same period was 4.5. He then regressed the number of workers on output, and found that employment was not very sensitive to changes in output, with a 10% increase in output only raising the labour force by 0.08%. The coefficient relating to output appears, however, dubious because firstly, it is statistically insignificant at 5% level, secondly, the equation has a bad fit with an R^2 of only 0.11, and lastly, the formulation ignored the role of capital and technological changes affecting employment. Ariff then regressed the number of workers on rubber acreage, and his results showed that a 10% change in acreage led to a 5% rise in employment, a coefficient that is statistically significant above 5% level, but the overall fit is still low with an R^2 of 0.22. Again this formulation ignored the effect of capital and technology. Perhaps, a single equation incorporating the output, land and capital and technology variable may have been more suitable.

Another weakness of Ariff's study is that his choice of period (1950-1966) is not very satisfactory. The starting period, 1950, saw the biggest price boom in the history of rubber prices, while price oscillations in later periods were less pronounced, leading to some built-in bias when comparing to output and employment changes. Also no attempt was made to compare the period before independence in 1957 with that after independence to bring out the effects of differing economic policies, as well as to test the homogeneity of data between pre- and post-independence phases. Despite these shortcomings, a more revealing part of Ariff's analysis was the effect of the wage structure on employment. The money component of wages was shown to be adjusted to price changes to enable workers to benefit from wage increases during a price rise, and keeping their employment secure during a slump by accepting wage decreases. The non-money component, namely housing and health services, remained intact, not varying with rubber prices.

Frank Jr. (1968) tested the relationship between productivity

and employment growth in mining activities in Nigeria, Ghana and Zambia, and railway transport systems in Nigeria and East Africa. He regressed annual percentage changes in employment on annual percentage changes in output volume for the above industries, covering the period 1948-63. For the East African railways, he incorporated a third variable - the ratio of the increase in capital expenditure to employment. Frank's aim was to work out the percentage increases in output required to prevent a drop in employment. He observed large increases in labour productivity. The required growth in output to prevent employment from falling ranged between 1.7 and 6.7 percent. The biggest weakness of Frank's study was that he assumed instantaneous adjustment of employment to output changes, thus ignoring any lagged effects which are more likely. Except for one equation, the effects of capital and technology on employment were also ignored. Frank Jr. also did not spell out whether the employment variable took into account part-time workers and changes in hours worked, which could affect labour productivity. Frank's interpretation of the constant term is dubious. He described it as "the rate at which employment decreases in these industries when employment is stagnant." The constant term in fact can be regarded as a scale factor, and depends upon the unit of measurement. Despite these shortcomings, Frank's study seems to provide another piece of evidence for increases in productivity in less developed countries.

The International Labour Organization (I. L. O.) has also been involved in a host of employment studies, and Lydall's (1975) study epitomizes the rather aggregative nature of most empirical evaluations. The study, based on 1963 data, aims, among other things, at estimating the employment effects of a liberalisation by developed countries of their imports ranging from textiles, footwear to electrical goods. As far as the initial effects went, his broad conclusion was that the displacement of one worker in the E. E. C. led to the employment of between 2 and 4.6 workers in less developed countries depending on their level of development. A similar displacement in the U. S. A. led

to an additional 2.8 and 6.5 workers employed in less developed countries. These results are based on a series of regressions, in which he regressed the per capita Gross Domestic Product separately on gross output per person, value added per person and wages per employee in 12 selected industries. While there is disaggregation in terms of industries, the usefulness of the results is somewhat weakened by the fact that the regressor, the G. D. P. per head, is aggregated across an array of countries with differing stages of development, productivity and industrial policies. There is also the practical problem of measuring data with different foreign exchange rates. Aggregating data, without any sort of weighting, of countries like Malaysia, Iran, Costa Rica and Zambia, is of limited use for any policy formulation for any country, besides, of course, giving a broad picture. The data used (1963) is rather dated for fast developing countries like South Korea, Brazil and even Malaysia. Using just one data point (1963) to draw conclusions regarding employment effects can be regarded as dangerous generalization for policy decision purposes.

Watanabe (1972), doing another study for the I. L. O, looked at the employment effects of growth of exports for the South Korean economy. He examined both the direct and indirect effects, the latter arising out of linkage and multiplier mechanisms. However, since our interest is more in direct effects, we would only look at his methods of evaluating them. Watanabe reckoned that the output-labour ratio, which he defined as the gross output (i. e. total costs of intermediate inputs plus value added before tax), would be most appropriate to trace the employment effects of an increase in exports. However, because of inaccuracies and arbitrariness in the data, he presented a modified formula:

$$E_d = \sum_i^n \left(\frac{A_i}{B_i} \cdot V_j \right)$$

E_d , the direct employment effect, therefore is determined by the relationship between A_i , the value of raw materials required for

a unit of export of product i , B_i , the raw material consumption per worker in industry i , and V_i , the value of exports of product i . (Of course the influence of subsidies and relief from import duties of raw materials if incorporated may give biased estimates of E_d). Watanabe noted that the direct employment effect per unit of export A/B is largest in textile products. Of course, such a comparison is questionable because of differing capital-output ratios of the different industries. Watanabe's whole analysis is static, using only one data point - 1969. If this was not a normal year, the employment effects would be biased. He assumed immediate adjustment of labour to exports, which is usually not the case, and hence the formula may not be a reliable guide for employment policy, except for providing some initial notions of the export-employment relationship.

An important analytical study in the context of less developed countries is by Sen (1975) who examined the effect of non-economic factors on employment. These factors are technical possibilities, institutional features, political feasibility and behavioural characteristics, most if not all of them vary over time. He suggested that any work on employment policy must begin with a sorting out of things that are within the control of the planners and things that are not. Sen dealt with some of the problems of measuring employment behaviour in the context of both economic and non-economic factors. He succinctly captured the difficulty of applied research on employment in less developed countries, when he said:

"One of the difficulties of using a very broad framework of analysis involving institutional, social and political factors, is the near certainty that its practical application will be extremely difficult. Methodologically, one is faced with the choice between, on the one hand, using an uncomplicated model which will be easy to apply, but which will miss many important dimensions of employment policy and technological choice, and on the other, using a more comprehensive model which would be more appropriate if it could be applied but which would be difficult to apply."

In the context of Malaysia, this difficulty is very real. Although

Sen dealt with the empirical problems in the context of Indian agriculture, he did not himself present a comprehensive model covering both economic and non-economic factors. Nevertheless, he did shed light on the difficulties of adopting Western techniques in considering employment issues in less developed countries.

Section 7.4.3: Model to estimate Employment Elasticities and the Speeds of Labour Adjustment in Forestry and Agriculture

We plan to use the Ball and St Cyr model analysed earlier, with some variations, to measure the employment-output elasticity, and the speed of labour adjustment of the five industries. We are thus composing a model which may appear rather naive, but it is tailor-made to conform to the circumstances of a country where statistical collection is less rigorous. As noted earlier, the theoretical literature is rich in the formulation of more sophisticated models, which are useful developments, but rather inappropriate in our present circumstances. We reckon that a simple uncomplicated model sometimes can bring out more clearly some of the salient issues than a semicomplete, highly sophisticated model, combining various interlocking decisions.

Inevitably, we have to impose several restrictions on the model, and the major ones are formally presented below:

- i) The model is essentially a demand determined one, implicitly assuming that there are no labour supply constraints.¹⁷ Such a restriction may be unrealistic in the context of certain skill

17. Muellbauer (1978) tackles the issue of supply constraints, and argues that if there are labour shortages, the employment models in the literature would not be explaining manpower demand, but rather labour hoarding and overtime working. In Malaysia, figures on forestry unemployment are not available to verify the supply side.

requirements, or in labour deficient regions, but generally, will be more acceptable in a labour surplus country like Malaysia. For simplicity, the quality of labour units is assumed to be homogeneous and constant, although efficiency does vary among individuals, and over time.

- ii) The desired hours of work, h^* , remain constant over time. This is not unrealistic in the context of Malaysia where the normal hours worked per day and the working week have more or less remained as they were in the last thirty years. While labour hoarding may be prevalent, we have implicitly allowed for this via the Koyck adjustment process.
- iii) Although the actual number of men employed is not equal to desired levels (ie, $E \neq E^*$) and likewise actual hours worked are not equal to desired hours ($h \neq h^*$), for operational convenience, we assume that $Eh = (Eh)^*$.
- iv) The industry is on the production function, ie, it is in an equilibrium position with its inputs fully adjusted at a particular level of output. Realistically, this may not be so as we are not aware how far each industry deviates from the production frontier.
- v) In line with other studies, output is assumed to be exogenous to the industry, but realistically, an industry could adjust output, or plan output and employment jointly, rather than tinkering employment to output levels.
- vi) The capital stock, an important variable in the production function in its relation to labour, is also assumed to be exogenous and constant in the short-run.

By

assuming the capital stock to be constant, we are implying that there is no excess capacity in the capital input. The danger is that this could result in an overestimation of the capital-output elasticity. Capital services more appropriately should be treated

in flow terms indicating the degree to which they are used. A reasonable measure of capital is difficult to get, though the amount of electricity consumption or the effective hours of work could be more acceptable proxies if data are available.

vii) Another assumption concerns the capital-labour mix, which is assumed to be exogenously determined. Our interest is in a short-run relationship, but in the longer run the wages-rent ratio could change. For instance, if wages were to rise relative to capital, it is likely that capital will be substituted for labour wherever possible. Time series data on wage levels for the Malaysian wood industries are unreliable, and we hope to pick out any changes in the wages-rent ratio via the time trend.

For both vi) and vii), a usual way of representing the growth of capital and technology is by using time trends (Labys (1973) and Desai (1976)), as indicated in our analysis of supply and demand modelling. Most employment studies use an exponential time trend (or arithmetic time trend) representing constant growth of capital and technology. Another way of depicting this is to use a logarithmic time trend which allows for both increases and decreases in the application of capital and technology. As we are not clear on the kind of growth, we will use both formulations to see which gives better results. In formulating our equations, however, we have used the exponential time trend for convenience.

viii) The problems of aggregation outlined in Chapter 5 are relevant here. We will again assume that the economic theory at the micro level holds, to some extent, at the macro (industrial) level.

We have already derived the model in the last section, and the equation we will use is (7.9), presented again below for convenience:

$$\log E_t = a_0 - \frac{\rho\lambda}{\alpha} t + \frac{\lambda}{\alpha} \log Q_t + (1 - \lambda) \log E_{t-1} \quad (7.9)$$

For estimation purposes, equation (7.9) could be written as:

$$\log E_t = a_0 + a_1 \log Q_t - a_2 t + a_3 \log E_{t-1} + u_t \quad (7.12)$$

where $a_1 = \frac{\lambda}{\alpha}$, the output-employment elasticity, α , is measured as $\frac{1 - a_3}{a_1}$;

$a_2 = -\frac{\rho\lambda}{\alpha}$ and $a_3 = 1 - \lambda$, and the speed of labour adjustment is measured by $(1 - a_3)$. The employment-output elasticity,

$\hat{\beta}$, is implicitly calculated as follows:

$$\frac{a_1}{1 - a_3}$$

We propose to make two extensions. One concerns output. All along we have been assuming that the firm would produce the desired output, Q_t^* , and set its labour input to meet this requirement. In reality, this need not be so. The firm, instead of adjusting labour, may prefer to build up inventories when demand is slack for this could be cheaper. Its decision will depend on a host of factors, but principally it will depend on the relative costs of storage and labour adjustment. The firm may not even change output to meet higher demand, but raise price instead. Such cost comparisons are difficult to capture. To incorporate this, we could formulate a simultaneous model incorporating employment and output decisions jointly, as Briscoe and Peel (1975) have done, but this will be practically complicating as well as not consistent with our original formulation. Hence, we propose to incorporate a first-order Koyck adjustment factor, μ , to output as well, following Dhrymes (1969) and Roberts (1974):

$$\frac{Q_t}{Q_{t-1}} = \left(\frac{Q_t^*}{Q_{t-1}} \right)^\mu \quad \text{with } 0 \leq \mu \leq 1 \quad (7.13)$$

This yields:

$$\log Q_t^* = \frac{1}{\mu} \log Q_t - \frac{(1-\mu)}{\mu} \log Q_{t-1} \quad (7.14)$$

Replacing $\log Q_t$ by the expression for $\log Q_t^*$ in equation 7.9 gives:

$$\begin{aligned} \log E_t = & A + \frac{\lambda}{\alpha\mu} \log Q_t - \frac{\lambda(1-\mu)}{\alpha\mu} \log Q_{t-1} - \frac{\rho\lambda}{\alpha} t \\ & - \lambda \log E_{t-1} + u_t \end{aligned} \quad (7.15)$$

For estimation purposes, this could be written as:

$$\log E_t = a_0 + a_1 \log Q_t + a_2 t + a_3 \log E_{t-1} + a_4 \log Q_{t-1} + u_t \quad (7.16)$$

where $a_4 = \frac{(1-\mu)}{\alpha\mu}$, and the other coefficients as explained earlier. The implied employment-output elasticity is then estimated as

$$\frac{a_1 + a_4}{1 - a_3}$$

If an output lag exists, we can expect $\log Q_{t-1}$ to have a negative sign, and if μ is equal to unity, the adjustment is complete and Q_{t-1} term disappears.

Our second modification involves estimating the individual effects of export and home demand on employment, something which previous studies have side-stepped. It is already a familiar contention in development economics literature that exports boost production, and therefore employment. Likewise would an increase in home demand for a product. But which absorbs more labour? In other words, what are the export-employment and home-demand-employment elasticities? We will modify and extend our model to try to answer this.

The problem will be easy to solve if we know which portion of the labour force in the industry concerned is devoted to producing for exports, and which for home demand. All then we have to do is to estimate equation (7.12) separately to determine the demand for labour stemming from changes in exports and home consumption.

$$E_{1t}^* = A_1 Q_{1t}^{\beta_1} e^{\beta_3 T} \quad (7.17)$$

$$\text{and } E_{2t}^* = A_2 Q_{2t}^{\beta_2} e^{\beta_4 T} \quad (7.18)$$

where, E_1 and E_2 are employment for exports Q_1 and home demand, Q_2 respectively, β_1 and β_2 their respective elasticities, and β_3 and β_4 , their corresponding time trend effects on employment proxying, among other things, changes in capital and technology.

However, E_1 and E_2 are not known separately, and very often the same labour force is engaged to produce both for export and home consumption. What statistics show is $(E_1 + E_2) = E$. Likewise

output data is also usually in the form of $(Q_1 + Q_2) = Q$, but since figures for exports are available, a simple way will be to deduct from total output, exports, and the residual could be regarded as apparent home consumption.

A convenient way would be to add (7.17) and (7.18) together:

$$E_t^* = E_{1t}^* + E_{2t}^* = A_1 Q_1^{\beta_1} e^{\beta_3 T} + A_2 Q_2^{\beta_2} e^{\beta_4 T} \quad (7.19)$$

And taking logarithms:

$$\log E_t^* = \log (A_1 Q_1^{\beta_1} e^{\beta_3 T} + A_2 Q_2^{\beta_2} e^{\beta_4 T}) \quad (7.20)$$

We can assume that the coefficients with respect to the time trend for both exports and home production to be the same as it is likely that changes in capital and technology for both kinds of production processes are quite similar. Hence, β_3 will be equal to β_4 . For simplifying estimation, we can also assume the constant terms A_1 and A_2 to be equal, although they are likely to be different. Equation (7.20) can now be re-written as:

$$\begin{aligned} \log E_t^* &= \log [A_1 e^{\beta_3 T} (A_1^{\beta_1} + Q_2^{\beta_2})] \\ &= \log A_1 + \log (Q_1^{\beta_1} + Q_2^{\beta_2}) + \beta_3 T \end{aligned} \quad (7.21)$$

As in the case of the earlier model, we can add a labour adjustment process, but only with some restrictions. This is because we have no a priori information on the process nor on the cost of labour adjustment with respect to changes in exports and home demand. To avoid complications, we can assume the adjustment process of labour to meet exports and home demand to be identical. As done previously, this can be approximated by a linear first-order Koyck adjustment process, and the implied speed of adjustment will again be measured by

$$\log E_t^* = A_1 + \lambda \log (Q_1^{\beta_1} + Q_2^{\beta_2}) + \lambda \beta_3 T + (1 - \lambda) \log (E_{t-1})$$

As the parameters, β_1 and β_2 are non-linear, we cannot use the

Ordinary Least Squares technique for estimation, but special non-linear methods explained in the next section.

For estimation purposes, we can write (7.22) as:

$$\log E_t = a_0 + a_3 \log (Q_1^{a_5} + Q_2^{a_6}) + a_3 a_2 T = (1 - a_3) \log E_{t-1} + u_t \quad (7.22)$$

where $\frac{a_5}{1-a_3}$ measures the implied export-employment elasticity, $\hat{\beta}_1$, while $\frac{a_6}{1-a_3}$, the employment elasticity with respect to home demand, $\hat{\beta}_2$. The interpretation of the other coefficients is: $(1 - a_3) = \hat{\lambda}$, ie the implied speed of labour adjustment, and $a_3 a_2 = \beta_3$.

We have to be careful in comparing $\hat{\beta}_1$ and $\hat{\beta}_2$, for the respective "base" of exports and home consumption may differ. But this will be clarified when we interpret the results.

Section 7.4.4: Data and Estimation Problems

Data availability and quality variations among industries considerably narrowed the scope of the analysis. As reasonably lengthy time series on employment figures were not available for the whole of Malaysia, we confined most of the estimation to data covering Peninsular Malaysia only, where there are relatively more reliable statistics. For logging, however, we used Sabah as a case study as time series data were available. Although the figures included other kinds of forestry workers, these do not pose too serious a problem as they are small in number. In any case, logging is a major industry in the state.

Demand for manual and non-manual workers is likely to differ, and separate estimates will be more appropriate, but disaggregated on this form is not available for the industries concerned. Even for rubber, statistics until 1975 were aggregative combining administrative staff and estate workers. Annual figures on a calendar year basis were used as data for shorter periods for the forest industries were not

available. The use of annual figures to some extent eliminates seasonal influences, common in agriculture and forestry. Full-time workers are considered, as only discontinuous figures are available for part-time staff. The latter are not used to facilitate comparability. In any case, to study job generation capacity, full-time employment figures are more meaningful.

The type of measurement errors that can be expected for employment figures was explained in Section 7.1, while that for output, exports and domestic consumption in Chapter 6. Value added was not used because it may not be a reliable indicator of productivity as price changes in value could disguise productivity alterations, unless data are properly deflated. For rubber, and oil palm the level of data collection is more rigorous, and in all cases official figures of and exports were used. But it was difficult to get figures for domestic consumption of oil-palm, and calculating apparent consumption by deducting from output exports gave implausible figures. Hence, the separate effects of exports and home consumption were not estimated for oil palm.

The time trend was used to capture capital, cost and technology trends, as reliable figures on wages and capital usage are not forthcoming. To test the reliability of this variable, we used the linear, logarithmic and quadratic time trends.

As in the case of the forest commodity model, the time period chosen here was also 1960-76 for all industries except plywood, a relatively new industry for which we used the 1965-76 period.

We drew up a correlation matrix of all the variables used in the study for each industry. Generally, all the variables had a strong positive correlation (more than 0.85) with current and past levels of employment in the industry concerned, except for rubber where a strong negative correlation is indicated. In other words, production, exports and home consumption levels of rubber moved in opposite directions of employment during this period. The correlation matrices gave us initial clues regarding the relationship between employment with the

other variables.

The functional form we chose was the loglinear one, assuming a multiplicative effect on the error term. Such a procedure, also used by the other studies, enable us to interpret coefficients in terms of elasticities. We also experimented with the linear and semi-log forms but the results were generally poor, and in most cases implausible.

Equations (7.12) and (7.16) were estimated by Ordinary Least Squares, while equation (7.22) was worked out by nonlinear iteration technique, based on the Gauss-Newton method.¹⁸ Heuristically for non-linear econometric estimation there is the problem of testing whether the local maximum is in fact the global maximum. Initial starting values were either selected randomly or based on a prior information from results of the least squares technique. We experimented with differing starting values to increase the certainty that it is the only maximum. The biggest problem was encountered in respect of logging and rubber equations, particularly those having arithmetic and quadratic time trends, where convergence was not achieved.

For comparative purposes, we estimated the employment-output by the simple arithmetic and geometric mean methods. Such variations and extensions enable us to cross-check the reliability of the elasticity estimates.

The symbols used in the table of results are:

- Q_t : Gross volume of output at time t
 X_t : Gross volume of exports at time t
 HC_t : Gross volume of apparent domestic consumption at time t
 E_t : Number of persons employed on full-time at time t
 β : Implied Employment-output elasticity
 $\hat{\beta}_1$: Employment-export elasticity
 $\hat{\beta}_2$: Employment-home consumption elasticity
 $\hat{\lambda}$: Implied speed of labour adjustment

18 The algorithm used for numerical nonlinear estimation is spelt out in Berndt, Hall, Hall and Hausman (1974). Also useful for nonlinear econometric problems is Goldfield and Quandt (1972), particularly Chapters 1 and 2.

T: Time trend

Those with subscript $t-1$ are one year lag values.

D. W. : Durbin-Watson statistic

h : h-statistic

\bar{R}^2 : Adjusted multiple coefficient of determination

S. E. R. : Standard error of regression.

By significant, we mean that the t values of the coefficient is statistically significant at least at the 90% confidence level.

Section 7.4.5: Analysis of the Results

Before we consider the findings of the employment-output elasticity, $\hat{\beta}$, the implied speed of labour adjustment, $\hat{\lambda}$, and the effects of the time trend, T, there are some observations concerning the overall results:

1. Autocorrelation does not appear to be a serious problem for nearly all the equations, when inspecting the Durbin-Watson statistic, the h-statistic (which takes into account equations with a lagged dependent variable) and the plots of the error terms. The single-equation least squares technique, though biased in small samples, is consistent and asymptotically efficient when serial correlation is absent.
2. A priori, one could expect multicollinearity especially of the time trend with Q, Q_{t-1} , X, HC and E_{t-1} , but the variance-covariance matrices of all the results did not give any evidence of this, except those of the non-linear rubber equations where the variance-covariance values among the estimated coefficients of the arithmetic time trend, X and HC were higher.
3. Most of the fits, except those of logging equations, were greater

than 90%, but this is mostly due to the choice of $\log E$ rather than $\Delta \log E$ as the dependent variable. (ΔE_{t-1} is the change in employment between period t and $t-1$). A sample check of the estimated equations shows that if $\Delta \log E_t$ had been used, most of the fits would have fallen absolutely by 30 to 60%. The low fits for logging is fundamentally due to poor quality data.

4. The estimates and the statistical quality of the results varied considerably with the form of the time trend specification, and to a lesser extent whether the variable, $\log Q_{t-1}$, was included. (We will take this up in detail later).
5. The non-linear econometric estimation to trace the individual effects of exports and home consumption on employment improved the standard errors of regression for the rubber and plywood estimates, while maintaining similar S.E.R.'s for sawnwood and logging. Generally, the S.E.R.'s were lowest for rubber and highest for logging, partly confirming data quality variations.

The full results are contained in Appendix 7C. We will consider the results for each industry before we compare them. Detailed analysis of the $\hat{\beta}$, $\hat{\lambda}$ and the time trend effects, measured by the $\hat{\rho}$, are done in the next section.

a) RUBBER

A large number of results, especially those incorporating the linear time trend, were implausible for they gave negative values to the speed of labour adjustment, $\hat{\lambda}$, and the employment-output elasticity, $\hat{\beta}$. Since the rubber industry is more established, we incorporated quadratic time trend implying a more rapid growth in technology and capital, but the results did not improve. The addition of the output adjustment factor, Q_{t-1} , also did little to improve. The most acceptable was the equation with the logarithmic time trend, and all coefficients, except the constant term, were statistically significant,

and the results are presented below:

Dependent Variable : $\log E_t$

Independent Variables:

C	$\log Q_t$	$\log E_{t-1}$	$\log T$	\bar{R}^2	DW (h)	S.E.R.	$\hat{\lambda}$	$\hat{\beta}$
-3.25	0.34	0.79	-0.17	0.92	1.88	0.056	0.21	1.62
(-0.66)	(1.47)	(1.94)	(-1.52)		(0.25)			

The $\hat{\beta}$ estimate implied that if output were to go up say by 10%, employment would rise by about 16%. (The full implications of this in terms of job creation are left until the next section). The pattern of employment demand is shown to be output-elastic, and significant. The speed of labour adjustment ($\hat{\lambda}$) is rather low, indicating that only 21% of difference between the logarithms of the desired change and actual levels was made up during the year. Either this could be due to changes in part-time employment, which was not considered, or due to the nature of the employment conditions as pointed out by Ariff (1975) and explained in Section 7.4.2. The time trend coefficient had the right sign (-), indicating that capital and technology over time tended to increase labour productivity and reduce the demand for labour. The growth in labour productivity could be attributed to better yields of rubber, which increased output by 105% between 1960 and 1976, while employment actually fell by 39%.

Looking at the results of the equation separating the effects of exports and home demand on employment, the specification with the logarithmic time trend was regarded as the best:

Dependent Variable : $\log E_t$

Independent Variables:

C	$\log X_t$	$\log HC_t$	$\log E_{t-1}$	$\log T$	DW (h)	S.E.R.	$\hat{\lambda}$	$\hat{\beta}_1$	$\hat{\beta}_2$
1.26	0.30	0.98	0.54	-1.00	2.23	0.05	0.46	= 0.65	
(0.49)	(0.25)	(2.97)	(1.34)	(-1.99)	(0.43)				= 2.13

The above results showed that export-output elasticity (0.65) is lower than the home-consumption-output elasticity (2.13), which means that a 10% change in home demand could change employment by more than 20% while a 10% increase in exports would raise employment by 6.5%. But, we must be careful of comparing $\hat{\beta}_1$, and $\hat{\beta}_2$ because home consumption forms less than 5% of total output at 1976 levels with the rest going to exports. This implication becomes clearer in the next section.

The speed of adjustment ($\hat{\lambda}$) is again low at 0.46 (but higher than above) showing a gap between actual and desired employment levels. This could be due to the fact that employers are unwilling to employ more workers because they are uncertain if an increase in the demand for either exports or home demand would be sustained, and may prefer to use part-time staff or resort to over-time.

As for the previous equation, the time trend showed a negative sign, and could be interpreted as previously.

b) OIL PALM

As for rubber, the most plausible result both from a priori economic beliefs and statistical quality was one with the logarithmic time trend. Incorporating $\log Q_{t-1}$ too did not improve the results. As shown below, the $\hat{\beta}$ is considerably lower than rubber (0.23), indicating a low labour absorption capacity, but the result is insignificant statistically. The speed of adjustment is slightly higher at 0.3, but still leaving a wide gap between actual and desired employment levels during the time period. The reasons outlined for a low λ are also relevant to oil palm.

Dependent Variable : $\log E_t$

Independent Variables

C	$\log Q_t$	$\log E_{t-1}$	$\log T$	\bar{R}^2	DW (h)	S.E.R.	$\hat{\lambda}$	$\hat{\beta}$
0.40	0.07	0.70	0.16	0.96	2.30	0.099	0.30	0.23
(1.50)	(0.57)	(3.14)	(1.51)		(-0.60)			

The statistically significant time trend has a positive sign, contrary to what we would expect, and changing its specification did not alter the sign. But since the time trend could pick out other factors besides capital and technology, it is difficult to make firm conclusions on employment behaviour.

As indicated in Section 7.4.4 that since we had no reliable data on home consumption of Malaysian oil palm, we did not estimate the separate effects of exports and home consumption changes on employment.

c) LOGGING

The results are poorer than the rest, with relatively lower \bar{R}^2 values, and this is mainly due to data quality as explained earlier. The most acceptable equation is again with the logarithmic time trend which is statistically significant.

Dependent Variable : $\log E_t$

Independent Variables

	C	$\log Q_t$	$\log E_{t-1}$	$\log T$	$\log Q_{t-1}$	\bar{R}^2	DW (h)	S. E. R.	$\hat{\lambda}$
(i)	0.25	0.36	0.70	-0.28	-	0.52	1.99	0.11	0.30
	(0.10)	(0.24)	(3.30)				(0.02)		
(ii)	1.10	0.47	0.71	-0.18	-0.23	0.46	2.05	0.12	0.29
	(0.40)	(1.73)	(3.28)	(-0.78)	(-0.81)		(-0.10)		

$\hat{\beta}$

(i) 1.20

(ii) 0.83

Adding the variable, $\log Q_{t-1}$, not only reduces the \bar{R}^2 , but also makes the time trend variable insignificant. However, it strengthens the significance of the output variable. The $\hat{\lambda}$ is similar to oil palm, 0.30. Apart from data quality, the low \bar{R}^2 could be due to mixing variables such as the number of hours worked. The $\hat{\beta}$ coefficient shows an elastic response of employment to changes in output, but it is not significant.

The best non-linear specification was the one with the loglinear time trend:

Dependent Variable : $\log E_t$

Independent Variables:

C	$\log X_t$	$\log HC_t$	$\log E_{t-1}$	$\log T$	\bar{R}^2	DW	S. E. R.	$\hat{\lambda}$
0.67	0.78	0.56	0.68	-0.44		1.44	0.12	0.32
(0.37)	(1.63)	(2.25)	(1.44)	(-0.72)		(1.11)		

2.43

$(\hat{\beta}_1)$

1.75

$(\hat{\beta}_2)$

The $\hat{\beta}$ for exports and home-consumption are significant, showing larger values for the former. Again for Sabah, home consumption of sawlogs is in the average 10.6% of production (see Table 7.4), and the percentage change must be very large to stimulate the hiring of more workers. The speed of adjustment is similar to the previous result, and so is the overall standard error or regression. The time trend is of the right sign, as previously, but not significant.

d) SAWNWOOD

One distinguishing feature in the sawnwood results in comparison with the others is that the inclusion of $\log Q_{t-1}$, the output adjustment variable, does improve the results. Besides being significant, it also strengthens the significance of the output variable, $\log Q_t$. Our choice now hinges on selecting one of the two results presented below, with one of them incorporating the arithmetic time trend, and the other the logarithmic trend:

Dependent Variable : $\log E_t$

Independent Variables

	C	$\log Q_t$	$\log Q_{t-1}$	$\log E_{t-1}$	T	\bar{R}^2	DW	S. E. R.
i)	5.06	0.68	-0.49	0.29	0.02	0.94	2.07	0.08
	(1.68)	(2.35)	(-1.79)	(1.30)	(0.70)		(-0.13)	
					$\log T$			
ii)	4.74	0.74	-0.34	0.16	0.12	0.95	1.86	0.08
	(2.35)	(3.35)	(-1.38)	(0.57)	(0.08)		(0.28)	
	$\hat{\lambda}$	$\hat{\beta}$						
i)	0.71	0.26						
ii)	0.84	0.48						

The t values of (ii) are better than (i) above in respect of the output variable ($\log Q_t$) and the constant term. For (i), $\log Q_{t-1}$ and the time trend coefficients is stronger, though the time trend does not have the expected sign (-) and is not significant. Recomputing the t statistics of the coefficient adjustment variable, $(1 - \hat{\lambda})$, in terms of the $\hat{\lambda}$ gives a t value of 3.28 to (i) and 2.99 to (ii) both significant. The time trend effect is further examined in the next section. We opted for selecting (i) because results of the non-linear specification presented below ^{are} better for the arithmetic time trend specification, and this facilitates comparability.

The speed of adjustment, $\hat{\lambda}$, is more rapid than the other industries we have considered, and possible reasons for such a variation are examined in the next section. The $\hat{\beta}$ is in the inelastic range at 0.26, implying that changes in the demand for employment have been less than the others except oil palm.

When considering the individual effects of exports and home consumption, the best result is with the arithmetic time trend:

Dependent Variable : $\log E_t$

Independent Variables :

C	$\log X_t$	$\log HC_t$	$\log E_{t-1}$	T	DW	S.E.R.	$\hat{\lambda}$	
3.25	0.72	0.43	0.01	-0.01	1.79	0.085	0.99	0.73 $\{\hat{\beta}_1\}$
(1.33)	(5.20)	(0.87)	(4.00)	(-0.15)	(0.43)			0.43 $\{\hat{\beta}_2\}$

The respective employment elasticities for exports and home consumption should be more comparable as the base is more or less similar (see Tables 4.8 and 4.9). The results show that an increase in exports results in more workers engaged than a rise in home consumption. Comparison becomes difficult to accept as the home consumption variable is not significant statistically, whereas the export variable is significant at the 0.9995 level. This is primarily due to the poor quality data for home consumption. The level of labour adjustment is almost complete during the time period, an implied speed higher than our previous result and is significant. The time trend variable is again insignificant, and unlike the previous result, it has the expected negative sign, indicating that the demand for labour is reduced over time.

e) PLYWOOD

In terms of statistical quality, the results are best for plywood, relatively the newest industry in our study. Varying the time trend specifications did not vary the $\hat{\beta}$ and $\hat{\lambda}$ considerably, confirming their relative robustness. In all cases, inclusion of the $\log Q_{t-1}$ variable weakened slightly the results, and as such we will select the equation not incorporating it. In any case, the variable was statistically insignificant. The best result was in the equation with the arithmetic time trend specification and is presented below:

Dependent Variable : $\log E_t$

Independent Variables

C	$\log Q_t$	$\log E_{t-1}$	T	\bar{R}^2	DW (h)	S. E. R.	$\hat{\lambda}$	$\hat{\beta}$
-1.30	0.37	0.69	-0.04	0.99	1.65	0.069	0.31	1.19
(-1.27)	(2.51)	(3.58)	(-1.33)		(0.70)			

The $\hat{\lambda}$ is similar to that achieved in oil palm and logging, while the $\hat{\beta}$ is similar to that in logging, showing a relatively high labour absorption propensity. The time trend has the expected sign (-), although its t value is weak.

For the equation incorporating the effects of exports and home consumption on employment, we are faced with two choices - one with $\log X$ and the other with $\log HC$:

Dependent Variable: $\log E_t$

Independent Variables:

C	$\log X_t$	$\log HC_t$	$\log E_{t-1}$	T	DW	S. E. R.	$\hat{\lambda}$	
0.47	0.92	0.52	0.71	-0.16	1.92	0.085	0.29	$\hat{\beta}_1: 3.17$
(1.33)	(6.84)	(1.21)	(1.83)	(-0.83)	(0.16)			$\hat{\beta}_2: 1.79$
				$\log T$				
1.47	1.10	0.80	0.77	-4.52	2.11	0.080	0.23	$\hat{\beta}_1: 4.78$
(2.87)	(4.49)	(1.79)	(1.47)	(-0.84)	(-0.22)			$\hat{\beta}_2: 3.48$

In both cases, the $\hat{\beta}_1$ for exports is higher than for home consumption, in conformity with a priori notions, but for the arithmetic time trend specification, the $\hat{\beta}_2$ for home consumption is not significant. However, for the $\log X$ and $\log E_{t-1}$ variables, the t values in this specification are stronger. However, to facilitate comparability with the loglinear formulation, we would be more inclined to accept the result with the arithmetic time trend formulation. The $\hat{\lambda}$ is not very different from the earlier result at 0.29. The time trend variable is of the right expected sign, but not significant.

Section 7 4.6 Comparisons of Employment Elasticities. Speeds on Labour Adjustment and Time Trend Effects on Employment.

We will look more closely at the values of $\hat{\lambda}$, $\hat{\beta}$ and the effects proxied by the time trend variable. At the same time, we will compare the $\hat{\beta}$'s with the corresponding employment-output elasticities worked out by the arithmetic method and the logarithmic method. Table 7.3 below summarises these results.

Table 7.3
Estimated Employment-Output Elasticities

	Rubber	Oil Palm	Logging	Sawnwood	Plywood
Econometric Specification	1.62 ($\hat{\beta}_1$: 0.65*) $\hat{\beta}_2$: 2.13)	0.23*	1.20 ($\hat{\beta}_1$: 2.43 $\hat{\beta}_2$: 1.75)	0.26 ($\hat{\beta}_1$: 0.73 $\hat{\beta}_2$: 0.43)	1.19 ($\hat{\beta}_1$: 3.17 $\hat{\beta}_2$: 1.79)*
Arithmetic Method	-0.31	0.29	0.05	0.78	0.31
Logarithmic Method	-0.52	0.69	0.53	0.43	1.03

Note: Figures in brackets are based on non-linear equations tracing the separate effects of changes in exports and home demand on employment.

* Not statistically significant at least at 90% confidence level.

a) The Employment-Output Elasticity

Focussing our attention on the results of the econometric formulation, there are variations in the $\hat{\beta}$'s of the five industries. The lowest propensity to absorb labour appears to be in oil palm (0.23) and sawnwood (0.26), while those of the rest is greater than one, with the highest for rubber (1.62). And comparing these estimates with those of the arithmetic method and the logarithmic method, one can see variations with the corresponding values calculated by the econometric method. For instance, for rubber, the non-econometric methods show that employment in rubber falls with increasing output,

while the econometric estimates suggest a symmetrical response between output and employment. For the other industries, there are variations, though not as wide as in rubber. For example, in plywood, both the econometric and logarithmic methods show a value greater than one, while those by the arithmetic method only give a figure of 0.3. The limitations of the simple methods were given in Section 6.4.2. One major source of bias is that the simple methods do not take into account the effect of capital and technology, as well as dynamic aspects of labour adjustment.

Perhaps, the elasticities are more meaningful to the policy maker if we were to translate them in terms of new jobs created. This is done in Table 7.4, which lists the number of new jobs possible per annum based on the elasticities we have calculated. If output is increased by 10 percent over the respective 1976 volume of the five industries, and if we use the elasticity estimates of the econometric method, the highest number of jobs created are in rubber (28,240) and the lowest in sawnwood (630) showing respectively an increase of 16% and 2.6% of their 1976 employment levels. For logging and plywood the rise is 12% and for oil palm, 2.3% over their 1976 levels. The arithmetic and logarithmic methods show the highest level of employment generation for oil palm, while for rubber they show decreases as explained earlier. It is difficult to compare the industries, for a 10% increase in say, the volume of rubber is not the same as a 10% increase in that of sawlogs. The various industries have different bases. A 10% increase in output from a larger base is not the same as a 10% rise in a smaller base. To permit comparability, we can express the output in value terms although it has to be realised that a million ringgit increase to rubber may not have quite the same impact as a similar rise in plywood, a smaller industry.

We have computed the amount of new employment possible with an increase in \$100 million Malaysian ringgit of output for each commodity. The value is derived by multiplying output by the respective 1976 prices. These results^{are} on the right-hand side of Table 7.4.

POTENTIAL NUMBER OF NEW JOBS BASED ON EMPLOYMENT-OUTPUT ELASTICITY ESTIMATES

(Figures in brackets denote $\%$ change in employment over 1976 figures)

	If output increases by 10 percent over 1976 figures		If output value at 1976 prices rises by \$100 Mil	
	<u>Econometric</u>	<u>Arithmetic</u>	<u>Econometric</u>	<u>Arithmetic</u>
Rubber	28 240 (16%)	-5 406 (-3.1%)	9 600 (6.0%)	-1 800 (-1.0%)
				-7 750 (-4.0%)
Oil Palm	1 673 (2.3%)	2 110 (2.9%)	1 500 (2.0%)	1 900 (3.0%)
		5 022 (6.9%)	2 250 (6.0%)	
Logging	1 630 (12.0%)	68 (0.5%)	1 100 (8.0%)	100 (0.7%)
		720 (5.3%)	500 (4.0%)	
Sawnwood	630 (2.6%)	1 894 (7.8%)	467 (1.9%)	1 000 (4.0%)
		1 042 (4.3%)	550 (2.0%)	
Plywood	1 640 (12.0%)	427 (3.1%)	5 750 (42.0%)	1 500 (11.0%)
		1 420 (10.3%)	4 950 (36.0%)	

T A B L E 7.4

Based on the elasticities computed by the econometric method, an increase in the value of output by \$100 million from 1976 levels could generate 9,600 jobs for rubber, while only about 470 for sawnwood. Among the forest-products, plywood has the highest potential - 5,750 jobs. Again basing on the arithmetic and logarithmic methods, oil palm has the highest potential. The other figures are self-explanatory.

One important aspect to note is that based on the econometric method, a \$100 million increase can increase output by 42% in plywood over 1976 levels whereas in rubber it is only 6% only the number of jobs created in the latter is about twice that in plywood. This is because the initial base of rubber is larger than plywood, a relatively new industry.

The value method of comparison, again is not ~~fact~~-proof if the year of comparison is not broadly similar in terms of price stability; in other words, not a normal year. However, 1976 was relatively a more stable period when compared to the late sixties and 1970-73, a boom period for forest products, and 1974-75, one of falling prices.

For all cases the converse may happen if there is a fall in output. In such cases, displacement in percentage terms would be large in industries in which elasticity coefficients are higher, for instance plywood, logging and rubber, based on the econometric results.

We like to reiterate that these results are only valid given the assumptions of the model, formally outlined in Section 6.4.3 and some salient issues considered in the interpretation of the results.

We will now try to examine whether any of the differences in elasticities across industries can be explained. An explanation usually given is that the size and age of the industries vary with rubber the oldest and plywood the newest. We reckon that our specification of the model will take into account of these differences, through output and other variables. We could attribute variations across industries to capital usage, and more precisely the extent of spare capacity, not precisely captured in the model. In chapter 4 we pointed out various studies indicating excess capacity in saw-milling and plywood mills. Because

of the generality of our attempts to specify capital usage, we are unable to derive any meaningful substitution effects between labour and capital, which could be important in explaining for inter-industry differences in elasticities of employment.

Table 7.3 presents the employment elasticities with respect to exports and home demand, but we have also translated these estimates in employment terms in Table 7.5. As in the case of output, we have to realise that export-home consumption ratios differ across industries, a 10% rise in exports and home consumption in terms of employment is not quite comparable. We have therefore also expressed exports and home consumption in value terms, but again caution must be exercised as a 10% increase in value from a smaller base may have different implications from a similar rise arising from a larger base.

For all cases (except oil palm for which we did not compute for reasons explained earlier), the number of jobs created from 1976 levels as a result of a 10% increase in exports or home demand each of the commodities show that greater employment is generated through exports than home demand, the highest again being for rubber, where 11,200 new jobs are created for export changes in comparison with only about 800 by home demand rise. For the wood-based industries export rises generate between 4 and 5.5 times more jobs than those of home demand.

As in the case of output, the percentage rise for jobs via 10% increase in exports is higher for plywood and logging than for rubber, even though in number terms the latter shows the highest propensity to generate new employment. This is due to the differing bases of comparison.

We also worked out the implications of an increase in the value of exports or home demand on job creation, and these figures are presented on the left-hand side of Table 7.5. Basing on a M\$100 million rise, sawnwood and plywood generate the most number of jobs - over 30,000 each for both. But we must be aware that a \$100 million rise represents a 59% increase in the value of exports of plywood while only 3% for rubber. For sawnwood, it is 13% of total value of 1976

RELATIVE IMPACT OF EXPORTS AND HOME DEMAND ON EMPLOYMENT
 BASED ON ESTIMATES OF NON-LINEAR ECONOMETRIC ESTIMATES

	If exports or domestic consumption increases by 10% over 1976 figures		If value of exports or home consumption rises by M\$ 100 mil at 1976 prices	
	<u>Exports</u>	<u>Home Demand</u>	<u>Exports</u>	<u>Home Demand</u>
Rubber	11 193 (6.4%)	787 (0.05%)	3 836 (2.0%)	12 569 (7.0%)
Logging	3 097 (23.0%)	149 (1.0%)	2 214 (16.0%)	1 592 (11.0%)
Sawnwood	1 023 (4.0%)	440 (1.8%)	31 560 (130.0%)	1 860 (8.0%)
Plywood	4 194 (30.0%)	754 (5.0%)	30 870 (224.0%)	17 300 (125.0%)

Figures in brackets denote percentage change in employment over 1976 figures, while all other figures refer to number of new jobs.

See Table 7.3 for elasticity estimates and statistical significance.

T A B L E 7.5

exports for PM, and for logging, 8% of Sabah's total export earnings for sawlogs. In terms of numbers, logging would appear to provide less jobs than plywood or sawnwood as a result of increases in the value of output for exports or home demand.

b) The implied speed of labour adjustment

The results in Table 7.6 below show that except for sawmilling, the speed for labour adjustment captured by $\hat{\lambda}$ is generally low considering the fact that we are using annual figures.

Table 7.6

Implied Speeds of Labour Adjustment ($\hat{\lambda}$)				
Rubber	Oil Palm	Logging	Sawnwood	Plywood
0.21	0.30	0.30	0.71	0.31
(0.46)	(-)	(0.32)	(0.99)	(0.29)

All are statistically significant at 90% confidence level.

Figures in brackets are $\hat{\lambda}$'s based on non-linear equations measuring the respective effects of exports and home demand on employment.

The $\hat{\lambda}$ is similar for logging, plywood and oil palm - about 0.30, while for rubber it is much lower, 0.21. All these results are statistically significant. The non-linear specification however changes the values of $\hat{\lambda}$, but in all cases, except sawmilling, they are still below 0.5. For sawmilling there is almost complete adjustment. While it is difficult to attribute reasons for the high degree of labour adjustment for sawmilling, the low rate for the others could be due to employers resorting to overtime, or using part-time staff, figures of which are not included in the estimation for reasons explained in Section 7.4.4.

Another possible reason could be the variations in their respective unemployment ratios. We have so far implicitly assumed that the industry is able to hire and fire the workers it wants. However, a tight labour market (measured by low unemployment rate)

causes a firm to hire less (because workers are difficult and expensive to find) or fire less (because of the fear of not being able to hire the workers back when needed); and conversely, a loose labour market (measured by a high unemployment rate) would find it easier to hire and lay-off workers.¹⁹

For our study, it is difficult to make conclusions as to the effect of labour market tightness on short-run employment decisions, but recent newspaper reports cite labour shortages especially in the oil palm sector due to outflow of labour to the more lucrative construction sector in Singapore.²⁰ One ideally needs to know not only the overall unemployment rates of each individual sector, but also the rates covering individual skills. In Malaysia, skilled labour is more scarce and one can expect employment behaviour to reflect this.

Other reasons for variations across industries could be attributed to the amount of specific training required, the degree of unionisation and the average wage level in the industry. If the amount and duration of specific training required for a job in an industry is large, one can expect the short-run employment reaction to be smaller, because of the costs of labour-training. In our study, most of the jobs relatively require similar level of training, - rubber tapping, oil palm harvesting, logging and sawmilling do not require long periods of training, and the level of training is not likely to explain inter-industry differences, but rather inter-skill differences. As to the degree of unionisation, one would expect the $\hat{\lambda}$ to be inversely related to it. Highly unionised industries have less freedom to act concerning employment decisions than those with less union pressure. In our case, the degree of unionisation is higher in the rubber and oil palm estate sectors than in forest-based industries, and the latter are potentially better placed to adjust the labour force. Our results do not give any firm conclusions in this direction. As regards to average

19 For a deeper insight into the issue see Fair (1969) p. 95-100. His study of the U. S. manufacturing industry showed some evidence, though not strong, of the effect of tight labour markets on short-run employment decisions.

20 See "Star" (Malaysia) July 23rd, 1979, p. 22.

wage levels, the expectations are less clear-cut. On the one hand, high wages imply that it becomes costly to hold excess labour, and one can expect a larger reaction when output goes down. Yet, on the other hand, high wages may mean the workers are more skilled, and for the reasons explained above, the firm may be reluctant to lay off workers for fear of not being able to get them when they are needed again. For the five industries concerned, the 1972 manufacturing survey indicates that the wage levels, do not vary considerably, although non-pecuniary benefits are higher in the rubber and oil palm sector. Because of our small sample, (5 industries) it is difficult to carry out tests to confirm the relationship between employment behaviour and the various inter-industry attributes mentioned above, but could be a useful extension for future studies.²¹

c) Effect of Time Trend on Employment

One can expect the time trend variable to show a negative sign, indicating that capital stock and technology over time tend to increase labour productivity and reduce the demand for man power. But being a versatile variable, it could also pick out effects such as increase in skill of labour, or relative changes in prices of labour and capital, that could increase the demand for labour. But experience of industrialized countries suggests a trend towards labour shedding. The results in Table 6.7 below indicate this trend for rubber, logging and plywood.

21 Fair (1969) in testing these relationships in the U. S. manufacturing industry did not find any conclusive evidence, mainly because his sample size was small, p. 186-191.

Table 7.7

Implied Elasticities of Employment with respect to Time Trend

Rubber	Oil Palm	Logging	Sawnwood	Plywood
-0.50	2.31	-0.78	0.11*	-0.11*
(-0.78)	(-)	(-0.33)*	(-0.01)*	(-0.11)*

* denotes not statistically significant at 90% confidence level.

Figures in brackets are elasticities based on non-linear equations to measuring the respective effects on exports and home demand on employment.

For sawnwood, the sign is positive but not significant. However, for the nonlinear equations, the sign is negative. A surprising result is in respect of oil palm, where the sign is not only positive, but has a large value on the coefficient (2.31) that is significant. Alternative formulations of the time trend variable showed similar effects of increased manpower demand over time. It is likely that the rapid opening up of new areas for growing oil palm under government land schemes may have increased the demand for manpower, outweighing any possible labour substitution by capital.

Section 7.5: Degree of Employment Stability in Forestry and Agriculture

As further evidence to explain employment behaviour, the degree of employment instability is measured for the five industries. The instability indices (as they are generally called) of employment are compared with the corresponding instability estimates of output, exports and home consumption, all three measured in volume terms. At the same time, to gauge the effect of foreign exchange earnings on employment, instability indices are also measured for the value of exports. Instability indices indicate the relative upswings and downswings of variables over time. An easy way would be to plot the values of variables in a graph, but this will not clearly reveal the relationships especially when comparing one industry with the other in terms of the five key variables we are interested in.

There are many ways of measuring instability, and the more important ones are spelt out in Appendix 7B. Our experiments showed that in terms of ranking instability, the methods outlined give similar results. As such for this study, we will use the more widely-accepted Coppock's Log Variance method, which has the advantage that it corrects trend influences. Seasonal variations are eliminated by the use of annual figures.

The instability indices, spelt out in Table 7.8, reveal the following features.

- a) The degree of employment instability varies among the five industries, the highest being for the newest industry, plywood, and the lowest for rubber, the most established. The degree of employment instability is similar in logging and sawmilling, and in both cases, lower than for oil palm. There does not appear to be any systematic relationship between the degree of instability and the employment-output elasticities measured in the last section. The employment elasticity for rubber, logging and plywood was shown to be greater than one, but rubber has a very low degree of employment instability while

INSTABILITY INDICES OF EMPLOYMENT, OUTPUT, EXPORTS AND
HOME CONSUMPTION FOR FOREST, RUBBER AND OIL PALM INDUSTRIES

	EMPLOYMENT (persons)	Rank	OUTPUT (volume)	EXPORTS (volume)	HOME CONSUMPTION (volume)	EXPORTS (value)
RUBBER	9.2	5	25.1	8.1	12.8	171.5
OIL PALM	13.8	2	28.5	20.0	n.a.	192.0
LOGGING [Ⓒ]	11.3	3	16.8	21.1	207.9	159.2
SAWWOOD	11.1	4	13.7	23.7	11.5	227.3
PLYWOOD [*]	26.6	1	47.6	215.6	47.2	215.1

Notes: The larger the estimates, the greater is the degree of instability. For employment the highest degree of instability gets the highest rank, and so on

[Ⓒ] Sabah only; rest for Peninsular Malaysia

^{*} Period Covered is 1965-1976; for the rest it is 1960-1976.

Only full-time employees are considered for employment indices. Detailed data is at Appendix 7 C.

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plywood, a very high one.

- b) For all industries except rubber, the degree of employment instability is less than for the corresponding indices of output exports and home consumption. For rubber, the employment instability is similar in pattern to the other industries except that it is slightly higher than for exports. Overall, this means that fluctuations in output, exports and home consumption have not been transmitted in the same intensity to employment.
- c) Exports depict greater instability than home consumption in sawnwood and plywood industries, but for logging and rubber, the reverse is the case. For logging, the degree of instability in home consumption is nearly 9 times more than exports. As we used Sabah as a case study, this large variation may be attributed to the rudimentary nature of the processing industry, depending on the left-overs of sawlogs that were not exported. In the case of plywood, exports are nearly 5 times more unstable than home consumption, and this to some extent may account for the high level of employment instability in the industry since exports account for over 80% of the total output. One must, however, reiterate that the period of analysis for plywood, 1965-76, is shorter than for the rest of the industries, and may bias the estimates upwards compared to the others. Overall, the export instability is higher in the wood-based industries than in rubber and oil palm.
- d) The indices for the value of exports are much higher than the corresponding volume indices for all the industries, except for plywood where they were similar. When compared to employment indices, they seem to suggest that the fluctuating picture of export earnings generally do not seem to have been transmitted in the same intensity to employment levels. Ariff (1970) noted a similar situation in respect of rubber, and he explained the relative stability of employment levels to the

method of wage payments where the money component is adjusted to price changes to avoid large lay-offs when export demand was low. While rubber has seen phases of periodic upswings and downswings, the picture in Malaysian forestry is slightly different. Except for the 1974-75 slump, there has been steady growth since 1960 in the sector. There were layoffs in the three wood-based industries during the slump, but figures show that the percentage fall in employment was much smaller than the fall in earnings.

Section 7.6: Factor Intensity Comparisons among Forest-based
and Agro-based Industries

Our aim here is to compare capital and land intensities in relation to labour of forest-based industries and those based on agriculture. This will give us numerical estimates of the implied costs of jobs in terms of the scarce factors - land and capital.

A technique often used in comparing industries is the cost-benefit analysis (C. B. A.), where social costs rather than purely private ones are measured and compared with social benefits derived from them. The technique, formally outlined in Little and Mirrlees (1968), uses shadow or accounting prices which take into account the opportunity cost of scarce factors of production. The method also considers externalities and multiplier effects. We do not propose to delve in the nuts and bolts of the C. B. A. technique, for the literature on it is sufficiently large.²² Rather, the main reasons for its practical unsuitability in our case are outlined.

First of all, the objective of the different sectors vary, partly stemming from the ownership pattern. Some, like forest-lands are

22. A comprehensive collection of views is in Layard (ed) (1972) and Wolfe (ed) (1973).

wholly state-owned, some are joint-ventures between the state and private sector, like some integrated wood complexes, while most of them are in private hands. For those owned by the state, the objective may not be purely profit-maximization, but partly income distribution. For private ones, employment maximisation may not be as important as profit or sales maximisation. Where objectives differ, comparison becomes less meaningful.

There are practical constraints of measuring externalities and multiplier effects. For instance, how can one place a value on the scenic beauty of forests? Calculating shadow costs when the sectors are large can be onerous. A lot of variables are not within the planner's control, and the variations in the assumptions about the areas of control can radically alter the natures of shadow prices.²³

Thus, if we were to use the C. B. A. technique, despite the practical difficulties, we may end up in a similar situation of a study of the British Treasury (1972), where "Like is not compared with like," aptly pointed out in a review and extension by Wolfe and Caborne (1973).

Given these problems, it will be much more revealing if we were to choose simple statistical analysis than grappling with techniques, which is practically more manageable for project analysis than inter and intra sector comparisons.

To get a dynamic picture one will like to have lengthy time series data on capital, land and labour costs of the different industries. Although there have been census and surveys for Peninsular Malaysia on manufacturing industries since 1955, the coverage and methods used for measurement are not comparable from year to year. The most recent census is of 1972, and survey, 1973. Part of the reason lies in the different stages in the development of the various industries. The same reasons compel us to exclude the Borneo states where the level of manufacturing is still in its infancy. Thus data points used here are those where comparability is feasible.

23. See A. K. Sen, "Feasibility Constraints: Foreign Exchange and Shadow Wages" in Layard (1972), p. 140-159.

A) Capital Intensity

Economic theory suggests that the input mix of a production function be so organized that greater use is given to a relatively more abundant factor (say, labour) and less to scarce ones (say, capital). The Capital-Labour mix, however, does not depend on their relative prices alone but also on technical considerations of the product. We will compare the degree of capital used in relation to labour for the wood-based and agro-based industries.

The simplest measure of capital intensity is the traditional capital-labour ratio:

$$\frac{C}{L} = \frac{\text{Value of fixed assets of industry}}{\text{Number of Full-Time Employees}} \quad (6.23)$$

If we treat labour as human capital, we can measure labour productivity as :

$$\frac{V}{L} = \frac{\text{Value Added}}{\text{Number of full time employees}} \quad (6.24)$$

The relationship between the capital-labour ratio and labour productivity is as follows:

$$\frac{V}{L} = \frac{V}{C} \cdot \frac{C}{L} \quad (6.25)$$

If V/C is the capital productivity constant or invariant between industries over time, it can be regarded as a scale factor. Since our period of analysis is relatively short (1968-1973), we can regard it as a constant. One can, however, expect V/C to vary over a longer period.

The main indications of the results are as follows:

- a) There are wide variations in the level of capital intensity among wood-based and agricultural-based industries. The relative

level of capital invested per man has been ^{low} in sawnwood furniture and fixtures and pineapple canning. On the other hand figures for 1973 show that plywood and particle-board mills used two and a half times more capital per job than sawmills, while pulp and paperboard plants used one-third more capital and plywood and particle board firms. Comparing with the agricultural based industries, the C/L of plywood and pulp and paperboard was much higher except for palm oil manufacturing.

- b) In all industries, the C/L has increased between 1968-73, and generally, the increases have been higher in the wood-based firms, partly due to the fact that the agricultural based industries are more established. In the wood-based plants, the increase in C/L during the period of sawmills has been 2 to 5 times lower than other industries except prefabricated wooden buildings where there has been a fall.
- c) Turning to labour productivity, the absolute V/L of the agro-based industries (except pineapple canning) has been generally higher than wood-based industries. This could be due to a host of factors such as prices, the age of the industry, and the level of training. However, the rate of increase in labour productivity in sawmills, plywood and particle board plants and joinery works between 1968-73 has been higher than that of agro-based industries, except for rice mills. The increase in productivity for the latter could be due to higher yields and double cropping. The rapid increases in labour productivity in forest-based industries may be due to higher prices of wood-products and a greater level of capital investment.
- d) Between 1968-73, the percentage change in capital intensity of wood-based industries has generally been higher than changes in labour productivity. The reverse is the case for most agricultural based industries.

CAPITAL INTENSITY AND LABOUR PRODUCTIVITY IN SELECTED WOOD-BASED AND AGRO-BASED INDUSTRIES
(PENINSULAR MALAYSIA - Malaysian Ringgit)

	CAPITAL INTENSITY (C/L)			LABOUR PRODUCTIVITY (V/L)			% Change 1968-72	
	1968	1972	1973	% Change 1968-72	1968	1972		1973
<u>FOREST-BASED</u>								
1. Sawmills	3724	3906	5117	39	5040	6061	8726	73
2. Plywood and Particle-Board mills	7338	8206	14291	95	3780	3974	6597	75
3. Planing, Window and Door Mills, Joinery	2637	5938	8202	211	3692	4982	5681	54
4. Furniture & Fixtures	1603	1170	3031	89	3631	3323	4156	14
5. Prefabricated Wooden Buildings	na	8880	7448	-16*	2327	4109	1488	-46
6. Pulp and Paper- board	na	28715	21686	54	5254	6056	5901	12*
<u>AGRO-BASED</u>								
7. Palm Oil Manufactu- ring	na	32213	34783	8*	na	17705	24805	40*
8. Large Rice Mills	7061	5976	7900	12	2652	7120	12189	360
9. Rubber Remilling & Latex Processing	3749	4474	5778	54	7362	7166	10452	42
10. Coconut Oil Manufacture	5084	6655	8841	-24*	9850	8969	14492	47*
11. Pineapple Canning	na	4663	4520	-3*	4607	2787	3447	-25

Source: Department of Statistics: Survey of Manufacturing Industries, 1968, 1972
Annual Bulletin of Statistics, 1970-76

* 1972 - 1973
na - not available

B) Land Intensity

The spatial aspect of forestry employment has several complications. Firstly, the number of direct employees increases as the forest reaches the harvesting stage. Secondly, there are large numbers of people dependent on the forest produce, like those in transport, and construction. As Mutch (1973) argues forestry is a primary production system whose principal material output (apart from fuelwood) is of use only after considerable processing. Therefore, any measure involving purely the number of direct workers and the area covered by forest will underestimate the employment potential of the sector. Very often, there is integration of forestry and agricultural work, especially in Borneo states.

Unfortunately, data ^{are} not available on the number of workers, say in transport and construction, dependent on forestry. Nevertheless, there are figures on wood processing industries. We propose to compare them with the situation in rubber and oil palm for the period 1972-1976 where comparable data ^{are} available. This is done by calculating the number of acres per direct employee. We are studying the same 5 industries examined in this chapter.

The following features can be observed from Table 7.10.

1. The number of acres per man, when only logging activities are taken into account, is about three times that in rubber and the oil palm sectors, which include workers engaged in processing. However, if wood-based industry workers are included (see details in Table 7.2), the difference is narrowed, but the number of acres per man in rubber and oil palm is about 60 to 75% more than in wood-based industries.²⁴ For rubber, there could
24. The land intensity would have been higher for rubber and oil palm if we consider matured acreage only. But since workers are engaged during the growing period as well, we are including the growing stock acreage. In case of forests only those opened up for logging are considered.

be a downward bias in land intensity, as those employed in industries such as tyres, foot-wear and other rubber products are not included. Likewise, employment in soap and cooking oil manufacture, dependent on oil palm was not included. We were only able to get figures for such dependent industries for the year 1973, and the number of acres per man in rubber was 23.2 while that for oil palm, 20.8, compared to 18.8 in forest-based industries. The picture may, however, be different if other related sectors such as trade, transport and banking are taken into account. But paucity of data makes such an analysis difficult.

2. The number of acres per worker in the forestry sector has decreased between 1972 and 1976. For logging employment only, the decrease is about 21%, while if both logging and processing industries are included it is 26%. On the other hand, there is little change in the case of rubber, while for oil palm, it has increased by 16%. The increase in land intensity in forestry is due to the growth of the down-stream industries and reduction of the forest area. For oil palm and rubber, the maintenance of land intensity levels is due to the shift of rural workers to land schemes opened up by government on areas after the harvesting of trees.

One can expect, with the growth of more wood-based industries and the further cutting down of forests to make way for agriculture, the land intensity in forestry to increase. Employment levels will partly depend on the productivity of hill forests, which will form the next generation of wood supply sources for Malaysian processing industries.

LAND INTENSITY AND EMPLOYMENT
PENINSULAR MALAYSIA - 1972 - 1976

YEAR	ACRES PER EMPLOYEE			
	RUBBER ^a	OIL PALM ^a	LOGGING ^b	LOGGING AND OTHER WOOD- BASED INDUSTRIES ^c
1972	26.9	19.0	97.5	20.5
1973	26.8 (23.2) ^d	22.3 (20.8) ^d	93.1	18.8
1974	26.6	25.0	73.4	15.4
1975	27.9	21.5	61.1	13.2
1976	26.9	23.0	76.7	15.1
Average for 1972-1976	26.8	22.2	80.4	16.6

- Notes:**
- a Employees in estates and small holdings covering both matured and growing acreage, and workers engaged in processing.
 - b Employees in commercial forests opened up for logging.
 - c Includes employees in logging, sawmills and plywood mills as well as other wood-based industries listed in Table 7.1
 - d Includes resource dependent industries

- Source:**
1. Department of Statistics:
Monthly Statistical Bulletin, Peninsular Malaysia
Annual Bulletin of Statistics, 1972-1976
Survey of Manufacturing Industries, P.M., 1972
 2. Department of Forestry:
Forestry Statistics, Peninsular Malaysia, 1971-1977
 3. Census of Loggers, Peninsular Malaysia, 1972.

TABLE 7.10

Section 7.7: Broad Conclusions of the Study

We will now piece together the various aspects of the study on employment behaviour, and discuss the main findings:

1. Employment elasticities with respect to output, exports and home demand

The results showed that employment-output elasticities differed depending on the method of estimating them, and one has therefore to be clear of the specifications of each before making policy judgements. We prefer to place greater reliance on those obtained by the econometric estimation due both to the model's theoretical rigour as well as its statistical and mathematical advantages over the other two methods.

Basing on the econometric model, the results showed variations in the employment-output elasticities of the five industries we examined. The propensity to absorb or shed labour was high in rubber, logging and plywood industries, with an employment output elasticity greater than one, while in oil palm and sawmilling industries, the corresponding elasticities were below 0.3. In practical terms it means that a 10% increase in the output of each of the industries over 1976 levels can generate 3,900 jobs in the three forest-based industries, about 2,800 in rubber and 1,700 in oil palm, given the assumptions of the model. Of the new jobs in the forest-based industries, 1,600 each will be in logging and plywood and about 600 in sawmilling. Employment figures for the period 1977 onwards are not available to enable us to effectively compare the findings. In value terms, a M\$ 100 million rise in the value of output (based on 1976 prices) in each industry could generate over 5,750 jobs in plywood, 1,100 in logging while about 500 in sawmilling.

If changes in supply and demand were to reduce output, the industries with higher employment-output elasticities would shed more labour, provided there are no hiring and firing constraints, and labour hoarding.

In terms of the respective effects of changes in exports and home demand on employment, the results of all industries except rubber had the export-employment elasticity greater than that with respect to home demand. For the three wood based industries, a 10% rise in output of each of the industry could create about 8,000 new jobs while the figure for a similar rise in home demand is only around 1200. We have only considered the direct effects on employment, for in addition, there could also be inter-sector effects.

One of the aspects that one can foresee will be supply constraints stemming from a dwindling wood resource. This could reduce output despite the price inelastic nature of the demand for logs and sawnwood as estimated in the last chapter. A reduction of output could lead to labour shedding. Employment possibilities, at least for rubber, logging and plywood, are promising if efforts are geared to maintain both demand and supply at buoyant levels.

Our findings also showed that the speed of labour adjustment was generally low for all the industries except sawmilling. For most of them only about 30% of the difference between the logarithms of desired and actual levels is made up during one year. The low labour adjustment could be due to the general uncertainty of adjusting manpower and legal restrictions on hiring and firing. Furthermore, shortages of skilled workers may make adjustment difficult.

2. Instability Indices of Output, Export and Employment

Instability indices for 1960-76 showed that changes in business conditions, giving rise to fluctuations in output, and exports and home demand have not been transmitted in the same degree of intensity to affect employment levels in the five industries concerned. In other words, employment levels have been relatively more stable vis a vis export, home consumption and output levels.

3. Capital Intensity, Labour Productivity and Land Intensity

Measurements show that there have been increases in both capital intensity and labour productivity in agro-based and forest-based industries, though the relative degree of rise varies. This in some extent sheds evidence on the likely effects on employment demand due to increases in capital and technology. In terms of land intensity, the number of acres in rubber and oil palm sectors, is slightly higher than in logging and wood-based industries. In other words, the amount of land used in commercial forestry does not appear to be very different from that in oil palm and rubber as often believed to be so. The trend seems to suggest that land intensity in forestry is increasing with the rapid cutting down of forests and expansion of employment in downstream industries.

CHAPTER 8

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

Section 8.1: Discussion on Main Findings

We will now link the main findings of the two econometric studies in the context of the role of Malaysian forestry in the national economy and world trade.

a) Supply and Demand Elasticities

The econometric estimates in Chapter 6 showed that the supply responses to price changes of the three wood products lay in the inelastic range. Besides the dwindling resource supply, the nature of forest concession administration may be a factor. As noted in Chapter 3, the manner of issuing forest concessions was haphazard, with considerable social and political barriers to entry. This could result in a situation where, even if there is a price rise, supply is not increased immediately due to the bureaucracy and the consequent time lag in processing concession applications. In a situation of a price fall, the concessionaire may still be forced to harvest to make the land available for other uses such as agriculture. In this way, the response to price signals becomes distorted. Our estimates indicated that even the long-run supply responses were low, at least for sawlogs and sawnwood. For plywood, the long-run responses were higher because it is less sensitive to the choice of species used. Estimates of regional supply elasticities gave a similar picture, although there were variations in the values of the coefficients.

The estimates also showed the price elasticity of demand for the exports of sawlogs and sawnwood to be in the inelastic range. One reason is that both products are producer goods, forming a small portion of the total cost of the end use, principally the construction field. Another reason is the high quality and decorative nature of some Malaysian species like ramin and meranti, which end up in homes of

upper income groups.

The results broadly confirmed the findings of an earlier study by Luqman Mahmood (1978). If the demand for Malaysian is in the low price elasticity range; it would appear that the Malaysian government could increase its revenue if it were to impose export duties. Such duties have been imposed on other commodities like rubber and tin. In case of sawlogs, exports are being discouraged via controls, but revenue can still be derived by imposing export duties on sawlogs exported from East Malaysia. Since the elasticity estimates are those of hardwood aggregated across species, export duties could be first imposed on the more popular ones like ramin and meranti.

while below 0.3 for sawnwood and oil palm, given the assumptions of the model listed in Section 7.4.3. This means that the propensity to engage or shed labour in rubber, logging and plywood is higher than in the case of others.

Translating in job terms, this implies that for the forest-based industries alone, 3,900 direct jobs can be created if output were to rise by 10% over 1976 levels. The corresponding figures for rubber are 2,800 jobs and 1700 jobs in oil palm. Of course, one has to realise that a 10% increase in output is not the same thing for all industries given the different initial bases of comparison. In terms of the respective effect of exports and home demand on employment, in most cases the elasticity with respect to export changes was higher than for home consumption, taking due account of the differences in the respective bases. For the three-wood based industries, a 10% increase in exports or home demand of each of the industries could create about 8000 new jobs while the figure for a similar rise in home demand is around 1200. These are only the direct effects, not taking into account linkage and multiplier effects.

In other words, given that the elasticity estimates remain stable, the employment prospect would appear to be bright in forestry if the sector continues to thrive.

To compare the levels of employment stability vis a vis output, exports and home consumption, instability indices based on the Coppock's Log Variance method were estimated for the five industries previously considered. The degree of employment instability and the highest for plywood and the lowest for rubber. Logging and Sawmilling had similar degrees of employment instability, and for both cases it was lower than oil palm. For most industries, the degree of employment stability was less than for the corresponding indices of output, exports and home consumption. This implies that fluctuations in output, exports and home consumption were not transmitted in the same intensity to affect employment.

Turning to comparisons of capital intensity, it was shown that this varied among the various wood-based industries studied. Figures for

1973 indicated that plywood and particle board plants used two and a half times capital per job than sawmills, and pulp and paperboard mills, which are not as sophisticated as in industrialized countries, used one third more capital per man employed than plywood. This means that the expanding capital intensity of a firm increased the cost per job. However, this was matched by labour productivity increases during 1968-73. In terms of land intensity, the estimates showed that the number of acres per man in forest-based industries is slightly lower than in cases of rubber and oil palm. This was the case for the year 1973, where comparable data ^{were} available to take into account workers employed in the resource-dependent industries. The picture may be different if other related sectors such as trade, insurance and transport are taken into account.

Section 8. 2: Forestry Management in the Socio-Political Climate of Malaysia

Pure quantitative estimates become less meaningful unless they are examined in a socio-political context of the country that affects not only the management of the resource, but also policies in terms of employment. However, in evaluating this aspect, it is difficult to avoid value judgements especially in matters of economic and political philosophy. Nevertheless, one has to distinguish carefully between what is theoretically desirable and what is practically feasible.

The economic policies of the government were considered in Chapter 1, those relating to employment in Chapter 7, and the manner of wood disposal in Chapter 3. It was shown that one major tenet of the government policy was to participate or intervene in areas to promote positive discrimination policies in favour of bumiputras who lagged behind in standard of living and commercial experience compared to other racial groups. As far as forestry is concerned, nearly all forest lands are owned by the 13 state governments of Malaysia. The nature of administering forest concessions has been haphazard, and promoted political and racial barriers to entry, with the result that the right kind

of expertise may not get the chance to operate.

There could be three possible ways of improving the present position. The first is the outright sale of forest lands to private enterprise at market rates. This could free state bureaucracy, minimise avenues for corruption and promote greater competition. But, while it may be theoretically acceptable to a believer of laissez faire, the existing political and social climate will not support a policy of sale of large chunks of land to non-bumiputras, who have greater financial backing compared to low-income indigenous groups. Another way could be for the state to further extend its participation by being involved in harvesting and the sale of the final products. This proposal has been often made in respect of American State forest lands (Mead, 1964 and Clawson, 1978). The advantages cited are that the state could harvest with due regard to environmental control and proper regeneration, and at the same time reap economies of scale in harvesting and marketing. The logs could be sold by public auction to the highest bidder. This does not appear to be a suitable alternative as most of the commercial expertise lies in private hands, including in down-stream industries.

The third alternative is to make the present system more competitive, removing barriers to entry. This may be achieved by a more effective tendering system, or preferably, open auctioning of forest lands earmarked for logging. The leases should last for several harvesting cycles in permanent forest lands to ensure a greater interest of the concessionaire in maintaining the land, as well as ensuring security of supplies. Such a policy may inevitably have to compromise sometimes with the positive discrimination policies towards bumiputras, justified on grounds of removing inequalities. However, if it is desirable that certain areas are to be retained exclusively for bumiputras in the interest of distribution objectives, the existing system can be still made more free by providing opportunities for a larger number of bumiputras to openly bid for concessions, individually or jointly.

Section 8.3: Possible Ways of Improving Existing Study

The supply and demand model estimated in Chapter 6 can be improved or expanded in a number of ways. One is to treat price as an endogenous variable instead of being exogenous. This means that the domestic price and the world price will have to be worked out simultaneously within the model, taking into account world supply and demand conditions. One will have to carefully distinguish between the factors that affect the domestic price and the world price, and the effect of the world price on the domestic price. This will require in particular separate domestic and export price indices, preferably disaggregated on quarterly basis.

The model could be further disaggregated to take into account of the supply and demand of the various wood-products in their different end uses, such as construction, packaging, or even in more detailed areas such as flooring and panelling. This will give better indication of the elasticities of supply and demand with regard to particular end-uses. The specification of substitutes can be made more precise by considering both wood and non-wood substitutes. Another possibility will be to evaluate competition among species like ramin, meranti and teak, for instance. At present, knowledge of the end-uses of Malaysian wood is vague, and this is an area which agencies such as the Malaysian Timber Trades Association can take the lead. Further investigation in this area can guide marketing decisions.

One limitation of the specification of the supply function was the non-availability of data on wood availability and cost. For the former will indicate the commercial supply available on a time series basis for the various regions of Malaysia. This will enable one to see whether stumpage supplies will be adequate to meet desired levels. In this direction a knowledge of growth rate of various species is crucial. This is an area which the Forest Department can play a leading role. At present, figures are released of areas already logged rather than the amount that will be available on a time series basis. At the same time existing questionnaires on the Survey of Manufacturing Industries should attempt to get figures of cost in three sub-categories, raw-materials, wages

and capital usage. This will help to guide investment decisions. Costing in other areas of forestry such as logging is also necessary.

Turning to the employment model, the demand equation can be improved in several ways. One is to incorporate the amount of capital consumed. In this way the precise labour-capital substitution effects can be estimated. The employment figures could be split up into skilled and unskilled categories as it is likely that their elasticities will be different. This can guide decisions not only on the number of jobs desired but also the type of jobs. Such a disaggregation, already started for rubber, could be extended to other industries. Wage rates for the respective skills should at the same time be properly monitored, preferably in terms of hours worked.

Our model only considered demand aspects. It can be expanded to include supply aspects. This will require knowledge of unemployment and vacancy rates in forestry, which is quite a difficult task. One way is for the Forest Department to start compiling a register of forestry workers, which is lacking at the moment.

Overall, the level of quantitative rigour desired in estimating economic relationships depends highly on the state of the development of statistics, which is itself linked to the economic progress of the country. Data collection is expensive, but if the collection is linked to particular needs of selected areas of research, its use can be maximised. In many cases, such as in surveys of manufacturing, it is done as a method of a formality not particularly linked to any desired end-use. A major step would be to examine the state of statistical collection in forestry, in consultation with research bodies, to draw up a long-term programme to collect data in the form that can be useful for estimation and guiding policy decisions. This study has pointed to some areas where this can be done.

Section 8.4: Other Aspects in Forestry where Research is Desirable.

Since the analysis of the economics of Malaysian forestry is relatively less thorough than for other primary commodities, there are

at least three areas where further research would be useful. We will briefly spell them out.

There is a gap in the estimation of models tracing out the optimal time path of harvesting and re-forestation of tropical trees. Given a long production cycle, lasting 40-50 years, it will be useful to know, given cost, price and interest rate expectations, when to harvest, as well as to work out the age-class pattern to ensure continuity of supplies. Such analysis is already being applied to trees in temperate countries, as well as other renewable resources like red deer, fisheries and ground water. Renewable resource models, as they are often called, can give an indication of the rates of return and the overall economic viability of growing hardwood tropical trees. A knowledge of biological growth rates is crucial, and as pointed out in Appendix 3A, this is still deficient in the tropical literature. Also needed are reliable figures on cost variables.

Another area for study is the potential for a futures market for hardwood along the lines for softwood lumber and plywood in Chicago. Wood satisfies some of the essential conditions for futures trading, such a durable and gradeable commodity, and large numbers of buyers and sellers. An organized market can generate greater information and give signals for production and investment decisions. A crucial requirement however would be regularity of supply, and if such a market operates on a world-wide basis, this to some extent could be achieved. Malaysia is in the process of operating its own commodity exchange with rubber the first commodity dealt with. The data requirements are heavy - the need for day to day figures on prices of the wood commodities. As a start, simulation exercise can shed light on the price behaviour.

The third field concerns matters relating to public finance, i. e. the level of taxation and subsidies appropriate for forestry. For Malaysia, where forests are state-owned, it will be useful to investigate the royalty structure of various species, and how it could be linked to prices. The tax structure should attempt at maximising economic rent, and also work out the implications of subsidies and other control measures on forestry, and in particular, the effect on processing industries.

APPENDIX 1A

A Background Profile of Malaysia

Geography

Malaysia, covering a total area of 34.6 million hectares, stretches from about 100° to 118° longitude with the South China Sea separating the two wings of the country. With the southern part of the country only a degree north of the Equator, Malaysia has a tropical climate with an average daily maximum of about 90°F or 32°C and an average daily minimum of 70°F or 21°C with little seasonal variations. Rainfall is heavy - about 100 inches or 255 centimetres per annum, supporting a dense layer of forests and swamps which cover about 70% of the country.

The western part of the country is known as Semananjung or Peninsular Malaysia (formally, Malaya), while the eastern wing is referred to as East Malaysia, incorporating Sarawak and Sabah (formerly British North Borneo). Peninsular Malaysia is itself divided into 11 states, with 9 of them having their own Sultans. There is a constitutional monarch, chosen from one of the nine Sultans and the kingship is rotated every five years, a unique constitutional structure. The role of the royalty is similar to that in Britain.

History

The colonization of present day Malaysia by the British was done in stages. The island of Penang on the west coast of Peninsular Malaysia was acquired in 1786, followed by Singapore in 1819, and six years later, the town of Malacca on the west coast of the Peninsular. The three were known together as the Straits Settlements and were governed by the East India Company based in Bombay.

As British commercial interests strengthened, British control was extended into the mainland states in 1874. Four of these - Perak, Selangor, Pahang and Negri Sembilan - were merged as the Federated Malay States (F. M. S.) in 1896 with the remaining states, Johore,

Kelantan, Trengganu, Kedah and Perlis, constituting the Unfederated Malay States (U. M. S.). The Straits Settlements, F. M. S. and U. M. S. were known as British Malaya, but after the war, Singapore was separated from mainland Peninsular Malaysia. During the war, British Malaya was occupied by the Japanese in December 1941 and their rule lasted till September 1945. In 1948, the Federation of Malaya, comprising all states except Singapore was formed, and in 1957 it achieved independence from Britain. Sabah and Sarawak, which were separately colonised by the British, joined Malaya and Singapore in 1963 into a grouping known as the Federation of Malaysia. In 1965, Singapore was expelled from the body due to disputes with the federal government in Kuala Lumpur, and it became an independent state.

Malaysia, and its neighbours, Singapore, Thailand, Indonesia, and the Philippines have formed a body called the Association of Southeast Asian Nations, or A. S. E. A. N., whose aim is to forge social, cultural, and economic cooperation. The long term aim is to create a free trade zone to promote economic integration, but the different stages in the economic development of its members and the divergent social political and cultural conditions have made this an onerous and painful task.

MALAYSIA—KEY DATA 1978¹

AREA: Malaysia (Peninsular Malaysia 50,806; Sarawak 48,050; Sabah 28,725)	127,581 square miles	
POPULATION		
Malaysia (Peninsular Malaysia 10.84 m, Sarawak 1.16 m, Sabah 0.90 m)	12.90 million	
Peninsular Malaysia: Malays 5.83 m, Chinese 3.79 m, Indians 1.14 m, Others 0.08 m ...	10.84 "	
Average growth rate, Malaysia 1976-80 (% per annum)	2.7%	
NATIONAL PRODUCT (constant 1970 prices)		
Gross National Product	% growth	% of GNP
	+7.2	100%
	(\$21,558 m)	
Consumption expenditure: Public	+9.0	20%
Private	+8.5	56%
Fixed capital formation: Public	+3.7	9%
Private	+9.0	13%
Exports of goods and services	+3.2	41%
Imports of goods and services	+9.3	36%
NATIONAL INCOME AND SAVINGS		
National income (Public sector 22%, Private sector 78%)	\$32,138 million	
Per capita income	\$ 2,490	
National savings	\$ 9,324 million	
Per capita savings	\$ 723	
DOMESTIC PRODUCT (constant 1970 prices)		
Gross Domestic Product	% growth	% of GDP
	+ 7.0	100%
	(\$22,195 m)	
Agriculture (Rubber 9%, Palm oil 6% of GDP)	+ 1.5	25%
Manufacturing	+11.5	19%
Construction	+10.5	4%
Wholesale and retail trade	+ 6.2	12%
Banking, insurance, real estate and business services	+ 7.2	8%
Government services (public administration, defence, health, education)	+ 9.2	14%
FEDERAL GOVERNMENT FINANCE		
Revenue	\$8,220 million	
Operating expenditure	\$8,100 "	
Development expenditure	\$3,600 "	
Domestic debt	\$1,765 "	
Foreign debt (debt servicing ratio 4.3%)	\$ 565 "	
BALANCE OF PAYMENTS AND EXTERNAL RESERVES (net)		
Current account	+\$ 296 million	
Capital account	+\$2,019 "	
Basic balance	+\$2,315 "	
Net external reserves (6½ months of estimated 1978 retained imports at end August 1978)	+\$6,890 "	
Net change in external reserves	+\$ 150 "	
INTERNATIONAL TRADE		
Total exports (Rubber 50%, Palm oil 68%, Tin 36% of World total in 1977)	\$16,216 million	
Total imports (Food 16%, Petroleum 10%, Machinery and transport equipment 36%) ...	\$13,123 "	
Trade balance	\$ 3,093 "	
MONEY AND BANKING		
Money supply (Currency 49%, Demand deposits 51%)	\$ 7,377 million	
Quasi money	\$10,134 "	
Private sector liquidity	\$17,511 "	
Commercial banks' prime lending rate (w.e.f. June 2, 1977)	7½% per annum	
Malaysian Ringgit (one) = 0.34 SDRs, US\$0.43, £0.22 (end August 1978) (Before Ringgit was floated on June 20, 1973—US\$0.40, £0.16)		
PRICES (Peninsular Malaysia)		
Consumer Price Index, 1967 = 100	Index	% change
of which: Food (weight = 46.8%)	162.5	+5.0
Export Price Index, 1970 = 100	177.6	+4.9
Import Price Index, 1970 = 100	196.6	+5.4
	217.2	+7.0
EMPLOYMENT		
Labour force	Thousand	
	4,790	
Employed (Agriculture 45%, Manufacturing 12%, Government 15%)	4,486	
Unemployment rate	6.3%	

¹ Latest estimates.

Source: Ministry of Finance, Economic Report, 1978-1979

A P P E N D I X 2 A : WOOD PRODUCTS - SPECIES USED, MAIN USES AND SUBSTITUTES (MALAYSIA)

Wood Product	Main Species Used	Main Uses	Wood Substitutes	Non-wood Substitutes
1. SAWWOOD	<p>kempas (<u>Koompassia malaccensis</u>) keruing (<u>Dipterocarpus spp</u>) merbau (<u>Intsia palembanica</u>) mersawan (<u>Anisoptera spp</u>) meranti (<u>Shorea spp</u>) merawan (<u>Intsia palembanica</u>) balau (<u>Shorea spp</u>) chengal (<u>Balanocarpus helmiti</u>) geronggang (<u>Cratoxylon arborescens</u>) tembusu (<u>Pagrafa spp</u>)</p>	<p>Construction structural building elements; boards for flooring; walls; joinery; panelling; scantling; lining. <u>Engineering</u> bridges, wharves, piers, piling, railway sleepers, mining timbers. <u>Packaging</u> boxes, crates, pallets, dunnage. <u>Manufacturing</u> furniture, boats, toy handles</p>	<p>veneer, plywood (mainly in panelling, joinery, furniture, flooring) paper, paperboard and fibreboard (mainly in packaging) particle-board</p>	<p>concrete, bricks, steel, aluminium (construction, engineering) plastic (furniture, packaging)</p>
2. VENEER & PLYWOOD	<p>bintangor (<u>Calophyllum spp</u>) geronggang (<u>Cratoxylon arborescens</u>) mengkulang (<u>Heritiera</u>)</p>	<p>Construction walls, doors, decorative panelling <u>Packaging</u> crates, boxes, tea chests. <u>Manufacturing</u> furniture, boats, caravans.</p>	<p>sawwood (as above) paper overlay (panelling and packaging)</p>	<p>polyester overlay, fibreglass, concrete (construction) plastic (manufacturing and packaging) steel, aluminium (construction)</p>

Wood Product	Main Species Used	Main Uses	Wood Substitutes	Non-wood substitutes
3. PARTICLE BOARD & BLOCK BOARD	<u>jelutong</u> (<u>Oyera costulata</u>)	<u>Construction</u> building elements, walls, panelling, weather boarding, <u>Manufacturing</u> furniture boards <u>Packaging</u> boxes, crates	sawnwood, veneer and plywood (packaging, construction and manufacturing)	steel, aluminium and concrete (construction) plastic (furniture and packaging)
4. POLES	<u>balau</u> (<u>Shorea</u> spp) <u>chengal</u> (<u>Balanocarpus</u> <u>helmic</u>) <u>merbau</u> (<u>Intisia</u> <u>palembanica</u>)	<u>Construction</u> telephone and power lines, sheds, store houses, bridges, wharves, beam posts.	-	steel, concrete, aluminium
5. MOULDINGS	as for sawnwood and plywood	<u>Construction</u> door jams, groove, panelling, level sidings, architraves <u>Manufacturing</u> drawer sides	-	-

Sources: 1. Menon (1960)2. Desch and Thomas (1940)

3. Malaysian Timber Industry Board:

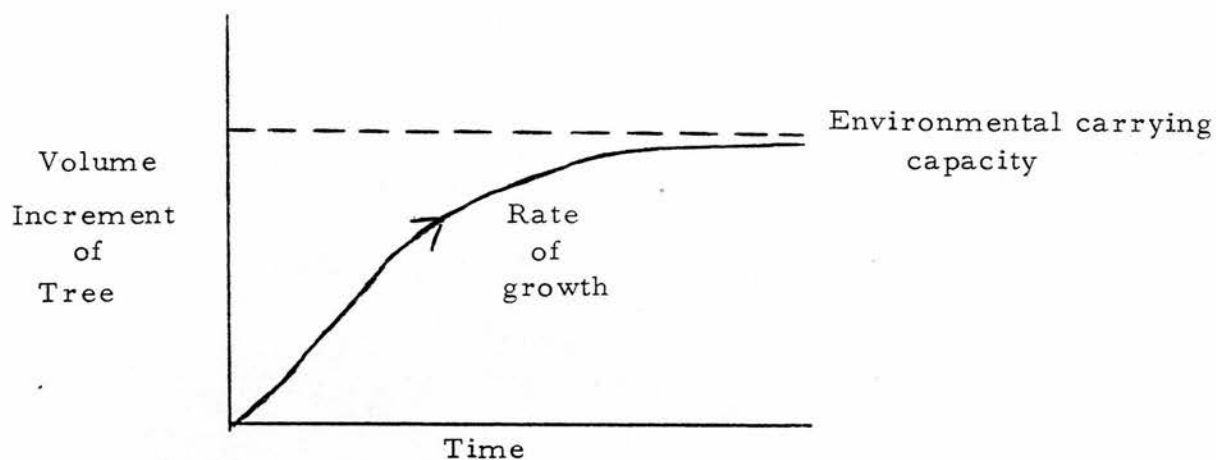
" Malaysian Timber Products for Construction; A Survey "

APPENDIX 3A

GROWTH RATES OF HARDWOOD TREES IN
MALAYSIA

Growth refers to an aspect of the changes in an organic system which may be studied in terms of the growth in the number of its members, and the size of individual members, or in the aggregate mass of the species. The growth of a tree, for example, is measured by increases in diameter, height or volume. From the economic point of view, a knowledge of growth rates of different species is to determine the productivity of the forest under different periods till it is finally harvested, given cost-price-interest rate expectations. However, the concept of productivity to an economist is quite different from that of a biologist. The latter looks at productivity in the ecosystem sense, measuring the total dry weight of the plant community, including leaves, branches, roots and trunks (collectively called the plant biomass), and its rate of change. To the economist, it is the financial yield of a tree that is important, and productivity in this sense would mean the amount of wood obtained in a forest that could be sold. Basically, the growth rate of trees should give the amount of supply of commercial wood forthcoming over varying time periods.

In most renewable resource models, the biological aspects of growth are based on the logistic growth of the law of Lotka (1925). The growth curve, in most cases, takes the shape of a sigmoid, beginning with a value zero, climbing slowly at first and then moving more steeply. After a turning point, the gradient of the curve, i. e., the increment diminishes, and then asymptotically moves to some final value. See Figure.



Growth curve of tree

In forestry literature, the biggest gap has been in knowledge of the growth rates of tropical trees, and hence tables showing inter-temporal yields of various species in different areas are not as reliable as in the case of species in temperate forests. In temperate climates, a distinct layer of wood is added each year, thus forming a definite annual ring. The growth rate can be ascertained by counting the number of rings on stems of various sizes. This is not the case of equatorial rain forests, where the climate has no or little seasonal rhythm, and ^{it} is necessary to employ a far more laborious method to determine rates of growth, which is explained in Edwards (1930), Vincent (1961), Cousens (1959). Another problem is that there are considerable variations in the growth rate of individuals of the same species on the same site. (Fox, 1974; Tang, 1976; Cousens, 1959). An even-aged stand is not an even size one. Apart from soil differences and inherent genetic variability (Whitmore, 1975), the variations could be due to their comparative crown sizes affecting the amount of sunlight (Fox, 1974). In view of the great variability on the composition structure and behaviour of a tropical forest, all information collected cannot be considered to have general applicability (Tang, 1976).

The annual rate of growth based on several studies has been recomputed into productivity figures, and is 1.97 cubic metres per hectare for Tang, Kira and Ogawa, (1971) and Edwards, 22 cubic metres per hectare for Cousens, Tang also suggests that in most areas

the average annual growth rate would range from 1.23 to 2.5 cubic metres per hectare.

In productivity terms, the average yields per hectare have been about 50 cubic metres per harvest since the 1960's, and in the 1930's, it was half this amount. Wyatt-Smith (1961) suggests that this increase is due to the use of many more species rather than any silvicultural assistance.

This is a rich field where further research is necessary to enable one to work out meaningful figures of the time path of supply, useful to determine optimal harvest levels.

MAIN MALAYSIAN HARDWOOD SPECIES, CHARACTERISTICS, USES AND COMPETITORS

TYPE AND CHARACTERISTICS

HEAVY HARDWOODS

These are heavy constructional timbers ranging in weight from 50 to 70 pounds per cubic foot at 15% moisture content. They are naturally durable as they contain within their tissues some toxic materials, eg, alkaloids, repellent to wood destroying agents. They can safely be used without preservative treatment even in positions exposed to fungus or termites. The sapwood of these timbers is, however, not durable.

Examples: balau (Shorea spp.), chengal (Balanocarpus helmiic), merbau (Intsia(Afzella) Palembanica), tembusu (Fagraea fregrans or Fagraea gigantea), resak (Vatica).

MEDIUM HARDWOODS

These are moderately heavy ranging in weight from about 45 to 55 pounds per cubic foot at 15% moisture content. Some of these timbers are heavy and strong enough to be classified as "heavy hardwoods", but under tropical conditions, they lack sufficient natural durability when exposed to the weather or in contact with the ground unless they are properly treated. Most of them are naturally durable in temperate countries.

Examples: Kapur (Dryobalanops aromatica), Kempas (Koompassia malarierostis), Keruing (Dialium guineense), Mengkul (Mengkul)

USES

Heavy structural work in construction, building of power line posts, bridge timbers beams, posts, joinery and furniture

COMPETITORS

Selangau Batu (Indonesian Borneo)
Yakal (the Philippines)
Teak (Thailand, Burma)
Ipil (the Philippines)
Afzella (Africa)

Flooring, posts, salt-water piling, furniture, panelling, gymnasium equipment, and if properly treated, in heavy constructional work

Kapur (Indonesian Borneo)
Gurjun (India)
Eng (Burma)
Aptong (the Philippines)
Yang (Thailand)
Tulip Oak (Australia)
Niangon (W. Africa)

TYPE AND CHARACTERISTICSUSESCOMPETITORS

LIGHT HARDWOODS

These are relatively light in weight ranging from 25 to 45 pounds per cubic foot at 15% moisture content. They are "general utility" timbers, comparable with the softwood general utility timbers of temperate climates. General utility encompasses carpentry work and packaging. Many of them are not durable for external uses, and do not absorb preservatives. Some of the Malaysian species are easy to work and easy to season.

Decorative work, superior joinery, furniture, panelling, flooring, and light construction

mahogany, luan, palosapis (The Philippines)
seraya, melapi, selangan (Indonesian Borneo)
krabak (Thailand)
Douglas-fir (U.S.A.)
Kauri pine (New Zealand and Australia)

Examples: meranti (Shorea species), ramlin (Gonystylus bancanus), jelutong (Dyera costulata), mersawa (Anisoptera species), geronggang (Cratogeomys aborescens).

Sources:

1. The Malaysian Grading Rules for Sawm Hardwood Timber (1968) p 51-71.
2. Desch and Thomas (1940) p 19-27
3. Malaysian Timber Industry Board: Timber Products for Construction, A Survey (1976).

A P P E N D I X 4 A

ESTIMATED COST OF A STEEP HILL LOGGING UNIT - MALAYSIA

(based on 1,000 cubic metres per month at 1976 prices)

	Capital Cost (M \$)	Monthly Operating Cost (M \$)
<u>Plant and Equipment</u>	1 035 000	50 200
bulldozers (3) log loader (1) wagon (1) and a diesel service unit		
<u>Labour and Felling Contracts</u>		64 700
one foreman, four drivers one mechanic felling and cross- cutting contract		
Total Monthly Expenses in maintaining labour and capital		114 900
Harvesting cost per cubic metre (estimated)		115
Source: Warren Ellis : " An Overview of Logging Methods in Malaysia ", printed in National Timber Congress (1976), p. 18-21.		

APPENDIX 5A

AUTOCORRELATION AND THE COCHRANE-ORCUTT TECHNIQUE

The aim is to explain the computational procedure of the Cochrane-Orcutt technique in dealing with the problem of autocorrelation of serial correlation in econometric analysis.¹

The problem of autocorrelation arises in time series data where the temporal independence of the residuals, u_i , is not always valid, especially in data of less developed countries. Hence the endogenous variable is affected not only by the contemporaneous error term, but also errors from the previous period. It could be due to omitted explanatory variables, misspecification of the functional form or errors of measurement. This leads to estimates that are not the best - the variances are biased, and we lose the statistical precision of the statistical tests. (R^2 , t and F statistics are exaggerated).

Assuming a first-order autoregressive relationship, the value of any u depends on its own value in the preceding period alone - similar to a first order Markov process:

$$u_t = \rho u_{t-1} + \varepsilon_t$$

If ρ were known, we could have used the generalised least squares procedure.² However, since ρ is not known, the C-O technique suggests estimating ρ from the O. L. S. residuals as:

$$e_t = \hat{\rho} e_{t-1} + V_t$$

$$\hat{\rho} = \frac{\sum e_t e_{t-1}}{\sum e_{t-1}^2}$$

- 1 See D. Cochrane and G. H. Orcutt, 'Application of Least Squares Regressions to Relationships Containing Autocorrelated Error Terms,' *Journal of the American Statistical Association*. vol. 44, pp. 32-61, 1949.
2. The Generalized Least Squares procedure is explained in most standard econometrics text books. A clear explanation is found in Wonnacott and Wonnacott (1970) p. 140-145.

The first step involves an initial guess of ρ , and the second, running the regression transformed data. The procedure is iterated - we get a new estimate of rho, retransform the variables, and recompute the estimates. We can proceed with this iterative procedure till successive values are approximately the same. (In the E. S. P. (1975) and T. S. P. (1978) programmes when $\hat{\rho}$ changes by less than .005 from one iteration to the next or when 20 iterations have occurred, iteration stops and regression output is produced).

We have used this technique sparingly in view of the small samples we have operated on.³ Furthermore, there is no reason to assume that the true residuals are first-order, and could have a more complicated structure.⁴ We have resorted to the technique when there is obviously the presence of strong serial correlation and respecifying the model did not improve the results.

3. We lose one degree of freedom when estimating the initial value of rho. Also, as P. Rao and Z. Griliches, "Some Small Sample Properties of Several Two-stage Regression Methods in the Context of Autocorrelated Errors," Journal of the American Statistical Association, March 1969, explain that it is not necessarily true that one gains (in terms of mean square error for β) by estimating ρ . Furthermore we do not know how seriously the sampling variances are biased.
4. Robert F. Engle, "Specification of the Disturbance for Efficient Estimation," Econometrica, 1973, suggests that sometimes one can be worse off making the assumption of first-order autocorrelation than ignoring the problem completely.

APPENDIX 6 A: SOME OF THE DATA USED IN THE ESTIMATIONS IN CHAPTER 6

Note: Data on output, exports, home consumption and prices has been presented in Chapters 2-4.

I) MALAYSIA

Year	GDP at Factor Cost (M\$ million)	Per Capita GDP	Per Capita Income (M\$)	Population (millions)	Value of construction (M\$'000,000)	Exchange Rate (1 US \$)
1960	5654	764	820	7.4	174	3.06
1961	5798	743	778	7.8	191	3.05
1962	6132	713	815	8.6	239	3.05
1963	6534	751	843	8.7	271	3.05
1964	7019	782	869	9.0	291	3.05
1965	7416	806	954	9.2	308	3.06
1966	7904	838	990	9.4	320	3.08
1967	8378	861	997	9.7	343	3.07
1968	8692	874	1025	9.9	347	3.08
1969	9636	949	1081	10.2	351	3.09
1970	10708	1029	1169	10.4	481	3.08
1971	11589	1083	1202	10.7	544	2.90
1972	12348	1123	1240	11.0	569	2.81
1973	13867	1227	1543	11.3	631	2.45
1974	14717	1268	1829	11.6	677	2.31
1975	15315	1287	1822	11.9	711	2.58
1976	17152	1406	2200	12.2	701	2.53

Source: The Treasury, Malaysia, Economic Report (various issues)
 Statistics Department, Malaysia, Annual Bulletin of Statistics, (various issues)
 Bank Negara, Quarterly Economic Bulletin, (various issues)

Year	a	b	c	d	e
Year	GDP of OECD 1970 prices (US\$ millions)	World Trade Exports (US\$ billions)	Price ratio PLYWOOD/ Sawwood	Price ratio PLYWOOD/ Particle-board	Price ratio Particle-board/ Sawwood
1960	1283	113.6	2.57	2.46	1.04
1961	1335	118.6	2.58	2.33	1.11
1962	1411	134.8	2.47	2.36	1.05
1963	1477	136.0	2.48	2.36	1.05
1964	1569	152.7	2.33	2.49	0.93
1965	1657	165.4	2.24	2.43	0.92
1966	1751	181.3	2.29	2.44	0.94
1967	1816	190.6	2.34	2.46	0.95
1968	1921	212.9	2.31	2.39	0.97
1969	2012	244.0	2.30	2.33	0.98
1970	2078	280.4	2.23	2.16	1.03
1971	2159	314.5	2.26	2.23	1.02
1972	2277	375.2	2.08	2.21	0.94
1973	2415	524.4	2.06	2.40	0.86
1974	2418	771.7	1.95	2.41	0.81
1975	2395	795.2	1.82	2.08	0.87
1976	2513	903.6	1.87	2.38	0.78

Sources: a) OECD Main Economic Indicators - various issues

OECD National Accounts - various issues

b) World Bank: International Financial Statistics - various issues

c) d) and e) F.A.O.: Yearbook of Forest Products - various issues

APPENDIX 7A

TABLES OF INCOME, EMPLOYMENT AND WEALTH DISTRIBUTION
IN PENINSULAR MALAYSIAPENINSULAR MALAYSIA: EMPLOYMENT BY SECTOR AND RACE, 1970 and 1975
(expressed in percentage terms)

<u>Sectors</u>	<u>Malays</u>	<u>Chinese</u>	<u>Indian</u>	<u>Others</u>	<u>Total</u>
1970					
Primary ^a	67.6	21.4	10.1	0.9	100.0
Secondary ^b	30.8	59.5	9.2	0.5	100.0
Tertiary ^c	37.9	48.3	12.6	1.2	100.0
All sectors	51.4	37.0	10.7	0.9	100.0
Rate of Unemployment ^d	8.1	7.0	11.0	3.1	8.0
1975					
Primary ^a	67.3	20.7	11.1	0.9	100.0
Secondary ^b	36.5	53.3	9.8	0.4	100.0
Tertiary ^c	42.3	47.3	9.5	0.9	100.0
All sectors	52.6	36.3	10.3	0.8	100.0
Rate of Unemployment ^d	6.9	7.2	12.2	11.3	7.6

- a Agriculture, which took 50.3% and 46.2% in 1970 and 1975 respectively of the total employed in Peninsular Malaysia.
- b Mining, manufacturing, construction, utilities and transport, all of which took 20.2% and 21.9% of the total employment in 1970 and 1975 respectively.
- c Wholesale and retail trade, banking, public administration, health, education and defence, all of which took 29.5% and 31.9% of the total employed in 1970 and 1975 respectively.
- d For each racial group and total as a percentage of those above 16 who are seeking work.

Source: Third Malaysia Plan, 1976-1980, p 78-79

Table (1)

a
 OWNERSHIP PATTERN IN KEY SECTORS, 1972 - 1973
 (Percentage Share in each Sector)

<u>SECTOR</u>	<u>Malays</u>	<u>Chinese</u>	<u>Indian</u>	<u>Others</u>	<u>Foreign</u>
Commercial					
Agriculture					
(planted acreage, 1973)					
Rubber and oil palm	21.0	26.3	2.6	7.9	42.2
Cocunut and Tea	0.0	19.9	10.8	0.4	68.9
Industry (value of fixed assets, 1972)					
Mining	0.7	35.2	0.1	9.5	54.5
Manufacturing	6.9	32.5	0.8	14.0	45.8
Construction	2.4	85.6	1.4	3.8	6.8
Trade (turnover value, 1872)					
Wholesale	0.8	55.0	2.7	0.6	40.9
Retail	3.6	75.6	6.5	0.2	14.1
Transport (value of fixed assets, 1972)					
Taxi	40.6	39.7	18.0	1.7	0.0
Bus	18.0	54.3	1.6	16.5	9.6
Haulage	15.3	70.6	5.2	5.8	3.1
Professional c					
Establishments (annual revenue, 1973)	5.3	51.0	11.4	18.4	13.9

a Establishments, both corporate and non-corporate sectors, are categorized on the basis of majority ownership. Government ownership is added to the Malay category as most of the establishments are held in trust by its agencies.

b Includes establishments where no particular group owns more than 50 percent of the assets.

c Private establishments only, including doctors, dentists, lawyers, accountants, architects, engineers, surveyors and veterinarians.

Source: Third Malaysia Plan, 1976-80, p 183

URBAN AND RURAL INCOME DISTRIBUTION, 1957 - 1970

Year	Urban Mean (M\$ per month)	Rural Mean (M\$ per month)	Ratio of Means
1957-58	319	173	1.84
1967-68	360	185	1.95
1970	432	202	2.14

Source: Snodgrass (1975), p 261

Table (iii)

MEAN INCOME BY ETHNIC GROUP, 1957 - 1970

Group	Mean Income Per Household (M\$ per month)		Percentage Growth in Income per month	
	1957-58	1970	1957-58 to 1970	
MALAYS	139	177	\$39	28%
CHINESE	300	399	\$100	33%
INDIANS	237	310	\$74	31%
ALL GROUPS	203	262	\$59	29%

Source: Snodgrass (1975), p 263

Table (iv)

	1970		1971		1972		1973		1974 ¹	
	M\$ mil.	%	M\$ mil.	%	M\$ mil.	%	M\$ mil.	%	M\$ mil.	%
<u>Malays and Malay interests</u>	126.6	2.4	210.1	3.5	286.0	4.2	436.6	5.3	628.4	6.7
Malays ²	84.4	1.6	114.5	1.9	131.1	1.9	173.8	2.1	207.4	2.2
Malay interests ³	41.2	0.8	95.6	1.6	154.9	2.3	262.8	3.2	421.0	4.5
<u>Other Malaysians</u>	1 826.5	34.3	2 104.7	35.8	2 418.3	35.7	3 035.8	36.6	3 451.4	37.1
Chinese	1 450.5	27.2	1 693.7	28.8	1 935.4	28.6	2 308.9	27.8	2 626.4	28.2
Indians	55.9	1.1	71.7	1.2	75.3	1.1	97.4	1.2	111.3	1.2
Others ⁴	320.1	6.0	339.3	5.8	407.6	6.0	629.5	7.6	713.7	7.7
Foreign ⁵	3 377.1	63.3	3 573.1	60.7	4 059.0	60.0	4 813.0	58.1	5 233.3	56.2
Total	5 329.2	100.0	5 887.9	100.0	6 763.3	100.0	8 285.4	100.0	9 313.0	100.0

- 1 Estimated
- 2 Includes institutions channeling private Malay funds such as Amanah Saham MARA.
- 3 Shares considered to be held in trust by government or government-backed agencies.
- 4 Includes nominee companies and third-company minority holdings.
- 5 Non-residents. Shares held by individuals and net assets, in 1970 prices, of companies incorporated abroad.

Source: Third Malaysia Plan, 1976-1980, p 184

Table (v)

APPENDIX 7B

Methods of measuring instability of time series data

Useful surveys of methods of measuring instability can be found in Cuddy and Della Valle (1978) and P. R. D. Wilson (1977). Here, only the methods used in the study are outlined.

1. Coefficient of Variation (CV) or Relative Dispersion

The CV could be defined as the ratio of a time series' standard deviation to its mean. By its use the dispersion of different frequency distributions can be compared.

$$CV = \frac{\sigma}{\mu} = \frac{100}{\bar{X}} \sqrt{\frac{\sum(X - \bar{X})^2}{N-1}} \quad \begin{array}{l} \text{where } X - \text{variable} \\ \bar{X} - \text{its mean} \\ N - \text{number of} \\ \text{years} \end{array}$$

It is a relatively easy method of measuring the average variation of a non-trended data series. However, if a trend exists, the use of the CV would overestimate the fluctuations in the variable under consideration. The CV can nevertheless be useful if the series is first detrended.

2. Coppock's Instability Index (II)

Often called the Log-variance Method, this approach takes account of trend influences. It was originally developed by Coppock (1962).

$$II = \sqrt{V \log}$$

$$\text{where } V \log = \frac{\sum (\log \frac{X_{t+1}}{X_t} - m)^2}{N-1}$$

where X - variable m - arithmetic mean of the differences between

the logs of X_t and X_{t+1} , X_{t+1} and X_{t+2} , and so on.

$V \log$ - the arithmetic variances of the series.

The resulting Instability Index is a close approximate of the average year to year percentage variations, adjusted for trend. It is basically an ordinal measure, but since it employs a logarithmic trend, the standard error is a multiplicative factor, and hence the index is difficult to compare with an index derived from a linear trend function.

3. Cardinal Measure of Instability Index (Ix)

Formally formulated by Cuddy and Della Valle, the index is basically a trend corrected coefficient of variation, the multiplicative factor being $\sqrt{(a - \bar{R}^2)}$

$$Ix = CV \sqrt{(1 - \bar{R}^2)}$$

Ix is bounded, with a lower limit of zero, and an upper limit of the CV of the series. When \bar{R}^2 is equal to 1, the Ix is zero, i.e. the actual values of X show no deviation about the estimated regression line, and thus the X's are not at all unstable. When \bar{R}^2 is equal to zero, the Ix is equal to the CV. Between these limits, the correction factor reduces Ix relative to CV: the better the 'fit' of the regression model, the lower Ix since there is less variation about the regression model to be counted.

A restriction of this method is that the regression equations must be statistically significant either in the linear or loglinear form, otherwise we have to fall back on the coefficient of variation.

All the above methods are strongly influenced by the choice of the initial and terminal values of the series, and are hence sensitive to the period chosen.

References:

1. Coppock, J. D. (1962): International Economic Instability - the Experience After World War 2, McGraw Hill, New York.

2. Cuddy, J. D. A. and Della Valle, P. A. (1978): Measuring the Instability of Time Series Data, Oxford Bulletin of Economics and Statistics, Vol. 40, No. 1, p. 79-85.
3. Wilson, P. R. D. (1977): Export Instability and Economic Development - A Survey, Part 2, Warwick Economic Research Papers, University of Warwick.
4. Yamane, T. (1973): Statistics, Harper International Edition, New York, p. 77-79.

APPENDIX 7B

INSTABILITY INDICES OF OUTPUT, EXPORTS, HOME CONSUMPTION AND
PRICES OF MAJOR MALAYSIAN COMMODITIES - 1960 - 1976

		Coefficient of Variation	Coppock's Index	Cardinal Instability Index
<u>OUTPUT - volume</u>				
Sawlogs	Malaysia	0.46	17.2	0.44
	World	0.14	5.0	0.13
Sawnwood	Malaysia	0.46	13.0	0.44
	World	0.10	3.1	0.10
Plywood	Malaysia	0.99	42.9	0.97
	World	0.30	8.6	0.28
<u>EXPORTS - volume</u>				
Sawlogs	Malaysia	0.44	16.7	0.43
	World	0.42	14.1	0.39
Sawnwood	Malaysia	0.59	18.3	0.55
	World	0.31	16.5	0.29
Plywood	Malaysia	1.10	77.2	1.01
	World	0.45	14.1	0.43
<u>EXPORTS - value</u>				
Sawlogs	Malaysia	0.68	32.8	0.64
Sawnwood		0.98	34.9	0.85
Plywood		1.24	125.0	1.10
Rubber		0.31	27.7	0.21
Oil Palm		1.20	54.1	1.12
Tin		0.33	30.4	0.29
Petroleum		1.30	45.0	1.14
Total Exports		0.54	33.1	0.49
<u>HOME CONSUMPTION</u>				
- volume				
Sawlogs	Malaysia	0.52	25.1	0.18
Sawnwood	Malaysia	0.35	10.9	0.34
Plywood	Malaysia	0.74	43.8	0.36
<u>PRICES - unit values</u>				
(export - free on board)				
Sawlogs	Malaysia	0.28	18.3	0.23
	World	0.31	14.7	0.27
Sawnwood	Malaysia	0.37	15.1	0.34
	World	0.48	11.1	0.46
Plywood	Malaysia	0.28	15.4	0.24
	World	0.27	9.5	0.25

continued at the next page....

		Coefficient of Variation	Coppock's Index	Cardinal Instability Index
Rubber	Malaysia	0.23	22.1	0.23
Oil Palm	Malaysia	0.31	26.8	0.31
Tin	Malaysia	0.32	17.1	0.26
Petroleum	Malaysia	0.85	30.7	0.76

O T H E R M A C R O
I N D I C A T O R S

Malaysia

Exchange Rate (Ringgit= U.S. dollar)		0.09	4.6	0.08
Gross Domestic Product at Factor Cost		0.37	30.1	0.37
Value of Construction		0.45	35.5	0.45

Note: For all indices, the higher the value the greater the degree of instability.

In terms of ranking instability, all three methods give more or less similar results.

APPENDIX 7C

MAIN RESULTS OF EMPLOYMENT DEMAND FUNCTIONS

SPECIFICATION	DEPENDENT VARIABLE: $\log E_t$							\bar{R}^2	D.W. (h)	$\hat{\lambda}$	$\hat{\beta}$	S.E.R.
	Constant	$\log Q_t$	$\log Q_{t-1}$	$\log E_{t-1}$	$\log X_t$	$\log HC_t$	Time Trend					
U B B E R												
	-7.18 (-1.02)	0.43 (0.97)	-	1.24 (4.09)	-	-	-0.01 (-0.28)	0.91 (-0.73)	2.37	-0.24	-1.79	0.061
th $\log Q_{t-1}$	-3.90 (-0.52)	0.59 (1.30)	-0.42 (-1.18)	1.27 (4.24)	-	-	-0.01 (0.44)	0.92 (-0.74)	2.37	-0.27	-0.63	0.060
th $\log T$	-3.25 (-0.66)	0.34 (1.47)	-	0.79 (1.94)	-	-	-0.17 (-1.52)	0.92 (0.25)	1.88	0.21	1.62	0.056
th $\log T$ and $\log Q_{t-1}$	-3.98 (-0.79)	0.61 (1.61)	-0.26 (-0.91)	0.87 (2.08)	-	-	-0.15 (-1.29)	0.92 (0.34)	1.83	0.13	2.69	0.057
non-linear th T	-0.60 (-1.26)	-	-	0.999 (0.31)	3.44 (2.36)	5.15 (2.49)	-49.33 (-0.36)	2.56 (-)	0.00	0.00*	0.00*	0.054
non-linear th $\log T$	1.26 (0.49)	-	-	0.54 (1.34)	0.30 (0.25)	0.98 (2.97)	-1.00 (-1.99)	2.23 (-0.45)	0.46	0.65*	0.65*	0.050
I L P A L M												
	1.75 (2.57)	-0.08 (-0.63)	-	0.43 (1.76)	-	-	0.08 (2.48)	0.97 (-0.44)	2.22	0.57	-0.14	0.088
th $\log Q_{t-1}$	1.82 (2.51)	-0.02 (-0.10)	-0.07 (-0.44)	0.42 (1.68)	-	-	0.08 (2.43)	0.97 (-0.50)	2.25	0.58	-0.16	0.088
th $\log T$	0.40 (1.50)	0.07 (0.57)	-	0.70 (3.14)	-	-	0.16 (1.51)	0.96 (-0.60)	2.30	0.30	0.23	0.099
th $\log T$ and $\log Q_{t-1}$	0.44 (1.53)	-0.03 (-0.12)	0.10 (0.50)	0.67 (2.85)	-	-	0.18 (1.54)	0.96 (-0.63)	2.32	0.33	0.21	0.102
D G G I N G												
	2.49 (0.85)	-0.04 (-0.12)	-	0.77 (3.15)	-	-	0.05 (0.16)	0.37 (0.55)	1.73	0.23	-0.17	0.12
th $\log Q_{t-1}$	4.96 (1.76)	0.12 (0.41)	-0.59 (-2.14)	0.84 (3.89)	-	-	0.05 (1.39)	0.52 (-0.58)	2.29	0.16	-2.94	0.11
th $\log T$	0.25 (0.10)	0.36 (0.24)	-	0.70 (3.30)	-	-	-0.28 (-1.56)	0.52 (0.02)	1.99	0.30	1.20	0.11
th $\log T$ and $\log Q_{t-1}$	1.10 (0.40)	0.47 (1.73)	-0.23 (-0.81)	0.71 (3.28)	-	-	-0.18 (-0.78)	0.46 (-0.10)	2.05	0.29	0.83	0.12
non-linear th $\log T$	0.67 (0.37)	-	-	0.68 (1.44)	0.78 (1.63)	0.56 (2.25)	-0.44 (-0.72)	-	1.44 (1.11)	0.32	2.43*	0.12

* $\hat{\beta}_1$: Employment-Export Elasticity* $\hat{\beta}_2$: Employment-Home Consumption Elasticity

DEPENDENT VARIABLE: $\log E_t$

SPECIFICATION	Constant	$\log Q_t$	$\log Q_{t-1}$	$\log E_{t-1}$	$\log X_t$	$\log HC_t$	Time Trend	\bar{R}^2	D.W. (h)	$\hat{\lambda}$	$\hat{\beta}$	S.E.R.
A W N W O O D												
	2.94 (0.97)	0.61 (1.96)	-	0.21 (0.90)	-	-	-0.01 (-0.19)	0.93	1.74 (0.52)	0.79	0.77	0.087
with $\log Q_{t-1}$	5.06 (1.68)	0.68 (2.35)	-0.49 (-1.79)	0.29 (1.30)	-	-	0.02 (0.70)	0.94	2.07 (-0.13)	0.71	0.26	0.080
with $\log T$	5.81 (3.01)	0.50 (3.50)	-	0.03 (0.12)	-	-	0.16 (1.25)	0.94	1.57 (0.86)	1.03	0.49	0.082
with $\log T$ and $\log Q_{t-1}$	4.74 (2.35)	0.74 (3.35)	-0.34 (-1.38)	0.16 (0.57)	-	-	0.12 (0.08)	0.95	1.86 (0.28)	0.84	0.48	0.079
non-linear with T	3.25 (1.33)	-	-	0.01 (4.00)	0.72 (5.20)	0.43 (0.87)	-0.01 (-0.15)	-	1.79 (0.43)	0.99	0.73*	0.085
non-linear with $\log T$	4.09 (2.34)	-	-	-0.10 (-4.01)	0.65 (4.01)	0.40 (0.95)	0.08 (0.73)	-	1.62 (0.78)	1.10	0.59*	0.083
L Y W O O D												
	-1.30 (-1.27)	0.37 (2.51)	-	0.69 (3.58)	-	-	-0.04 (-1.33)	0.99	1.65 (0.70)	0.31	1.19	0.093
with $\log Q_{t-1}$	-1.29 (-1.21)	0.39 (2.49)	-0.09 (-0.62)	0.79 (3.01)	-	-	-0.05 (-1.37)	0.99	1.68 (0.64)	0.21	1.43	0.097
with $\log T$	-0.85 (-0.82)	0.41 (2.40)	-	0.64 (2.90)	-	-	-0.46 (-0.76)	0.99	1.43 (0.99)	0.36	1.14	0.100
with $\log T$ and $\log Q_{t-1}$	-0.78 (-0.67)	0.41 (2.26)	-0.03 (-0.18)	0.67 (2.49)	-	-	-0.43 (-0.65)	0.98	1.41 (1.17)	0.33	1.15	0.091
non-linear with T	0.47 (1.33)	-	-	0.71 (1.83)	0.92 (6.84)	0.52 (1.21)	-0.16 (-0.83)	-	1.92 (0.16)	0.29	3.17*	0.085
non-linear with $\log T$	1.47 (2.87)	-	-	0.77 (1.47)	1.10 (4.49)	0.80 (1.79)	-4.52 (-0.85)	-	2.11 (-0.22)	0.23	4.78*	0.080

FOR KEY TO VARIABLES SEE SECTION 7.4.4

* $\hat{\beta}_1$: Employment-Export Elasticity● $\hat{\beta}_2$: Employment-Home Consumption Elasticity

APPENDIX 7 D STATISTICS USED TO CALCULATE EMPLOYMENT FUNCTIONS

Table (1)
EMPLOYMENT STATISTICS, FORESTRY, RUBBER AND OIL PALM (1960-76)

Year	Logging*	Sawmills	Plywood Mills	Rubber	Oil Palm
1960	11 090	6 500	4	285 300	15 600
1961	11 574	7 460	-	285 600	16 000
1962	12 389	8 300	-	242 885	17 400
1963	12 522	10 166	-	237 829	17 600
1964	12 427	10 243	1 120	229 908	18 200
1965	12 925	10 284	1 646	209 410	18 000
1966	13 320	10 529	2 095	200 771	26 300
1967	12 573	11 185	2 391	184 650	27 800
1968	10 456	13 375	3 778	165 349	34 500
1969	8 734	14 813	5 540	167 211	38 200
1970	8 631	16 598	7 334	159 393	40 900
1971	9 388	16 896	9 607	159 559	41 800
1972	9 425	19 532	11 754	155 031	47 500
1973	11 916	17 000	13 302	156 259	48 200
1974	10 339	18 954	12 807	155 953	54 400
1975	12 449	17 070	12 929	150 150	66 500
1976	13 578	24 240	13 785	174 400	72 800

* For Logging, data relates to Sabah only; rest is for Peninsular Malaysia
Source: As at Table 6.2, and

Department of Statistics, Peninsular Malaysia; Monthly Statistical
Bulletin, various issues
Department of Statistics, Rubber Monthly Statistics of Malaysia

Table (ii)

RUBBER STATISTICS, PENINSULAR MALAYSIA

(1960 - 1976)

YEAR	OUTPUT '000 tons	Annual Change %	EXPORTS Volume '000 tons	Annual Change %	EXPORTS Value M \$ mil,	Annual Change %	HOME DEMAND '000 tons	Annual Change %	ACREAGE '000 acres	Annual Change %
1960	685.4	-	766.8	-	1 829.1	-	6.5	-	3 848	-
1961	706.7	3.1	790.6	3.0	1 442.4	-21.1	6.7	3.1	3 905	1.5
1962	714.9	1.2	791.0	0.1	1 367.6	-5.2	7.1	6.0	3 991	2.2
1963	753.0	5.3	841.5	6.0	1 373.9	0.5	9.4	32.4	4 064	1.8
1964	791.2	5.1	847.8	0.7	1 303.4	-5.1	11.5	22.3	4 103	1.0
1965	835.5	5.6	886.9	4.4	1 363.3	5.0	14.4	25.2	4 328	5.2
1966	900.3	7.8	939.8	5.6	1 395.8	2.0	15.2	5.6	4 384	1.3
1967	923.3	2.6	974.6	3.6	1 216.0	-12.9	14.5	-4.6	4 394	0.2
1968	1 034.0	12.0	1 104.8	11.8	1 300.9	7.0	17.1	17.9	4 284	-2.6
1969	1 180.5	14.3	1 264.9	12.7	1 904.1	46.4	18.4	7.6	4 276	-0.2
1970	1 196.5	1.4	1 271.3	0.5	1 663.3	-12.6	20.0	8.7	4 260	-0.4
1971	1 250.4	4.5	1 321.0	3.8	1 417.3	-14.8	22.0	10.0	4 245	-0.4
1972	1 238.3	-1.0	1 298.1	-1.8	1 260.5	-11.1	22.4	1.8	4 206	-0.9
1973	1 442.0	16.5	1 536.6	15.5	2 396.2	90.1	25.3	12.9	4 186	-0.5
1974	1 461.7	1.4	1 482.1	-3.7	2 785.8	16.3	27.9	10.3	4 153	-0.8
1975	1 394.2	-4.6	1 376.6	-7.7	1 949.8	-30.0	30.1	8.0	4 188	0.8
1976	1 538.9	10.5	1 519.6	9.4	2 990.5	53.4	32.6	8.0	4 212	0.1

SOURCE : DEPARTMENT OF STATISTICS:

ANNUAL BULLETIN OF STATISTICS, various issues 1968 - 1977

MONTHLY BULLETIN OF STATISTICS, various issues

MONTHLY BULLETIN OF RUBBER STATISTICS, various issues.

Table (iii)

OIL PALM STATISTICS: PENINSULAR MALAYSIA
(1960 - 1976)

YEAR	OUTPUT '000 tons	Annual Change %	EXPORTS Volume '000 tons	Annual Change %	EXPORTS Value M \$ mil.	Annual Change %	ACREAGE '000 acres	Annual Change %
1960	90.3	-	96.0	-	60.5	-	99.0	-
1961	93.3	3.2	93.4	-2.8	61.2	1.1	141.0	29.9
1962	106.5	12.3	105.7	11.6	65.1	6.0	153.0	7.8
1963	123.6	13.9	114.9	8.0	69.0	5.7	176.0	13.1
1964	120.1	-2.9	123.3	6.8	80.6	14.4	187.0	5.9
1965	146.3	17.9	139.2	11.5	106.0	24.0	240.0	22.1
1966	183.4	20.2	178.4	22.0	118.1	10.2	303.0	20.8
1967	213.4	14.1	177.2	-0.7	110.7	-6.7	396.0	23.5
1968	260.7	18.1	263.7	32.8	116.8	5.2	490.0	19.2
1969	320.9	18.8	325.6	19.0	142.8	18.2	592.0	17.2
1970	395.9	19.0	526.8	38.2	246.2	42.0	667.0	11.2
1971	646.6	38.8	612.4	14.0	356.1	30.9	758.0	12.0
1972	1 001.9	35.5	615.4	0.5	325.2	-9.5	903.0	16.1
1973	1 105.7	9.4	713.3	13.7	428.1	24.0	1 077.0	16.2
1974	1 163.9	5.0	800.2	10.9	979.3	56.3	1 360.0	20.8
1975	1 098.6	-5.9	816.1	1.9	961.5	-1.9	1 430.0	4.9
1976	1 233.0	10.9	737.3	-10.7	674.5	-42.5	1 676.0	17.2

SOURCE: DEPARTMENT OF STATISTICS:
ANNUAL BULLETIN OF STATISTICS, 1968 - 1977
MONTHLY BULLETIN OF STATISTICS, PENINSULAR MALAYSIA.
OIL PALM STATISTICS, PENINSULAR MALAYSIA.

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