THE UNIVERSITY OF HULL

THE INDONESIAN PETROLEUM INDUSTRY : A STUDY OF ITS IMPACT ON THE INDONESIAN ECONOMY

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SUMMARY OF THESIS FOR PH.D.(ECON.)

BY SRITUA ARIEF

THE INDONESIAN PETROLEUM INDUSTRY : A STUDY OF ITS IMPACT ON THE INDONESIAN ECONOMY

The main concern of this thesis is the investigation of the impact of the petroleum industry, the largest export sector, on the Indonesian economy over the period 1967 - 1976. The findings of the study broaden the knowledge on the relationship between primary export sector and economic growth in less developed countries.

The input-output study, using 1971 data, shows a weak linkage of the petroleum mining with the domestic sectors of the Indonesian economy thus confirming Singer's first thesis that, though geographically, the foreign controlled primary export sector is located in less developed countries, the major portions of the household income multiplier effects (direct, indirect and induced) of this sector take place outside the domestic economy. This study also shows that the output multiplier generated by the petroleum mining sector proved to be the lowest compared to that of the other sectors of the economy.

The petroleum refining sector which forms another segment of the Indonesian petroleum industry offered higher effects on the domestic economy both in terms of household income and

aggregate output in comparison with the petroleum mining. This reflected a greater component of payments accrued to domestic factors of production and higher employment opportunities generated directly and indirectly by the petroleum refining.

The estimates of the impact of gross value added in the petroleum sector on gross value added in various other sectors of the economy, reveal that the petroleum sector had a far higher impact on modern sectors of the economy than on traditional sectors and had thus aggravated sectoral income disparities. These findings confirm Singer's second thesis that although the interaction between the enclave primary export sector and the rest of the economy is not absent, this interaction is of such a kind as to lead to polarization or sharpened dualism within the economies of less developed countries.

The solution of the proposed 9-equation macroeconometric model shows that the impact multiplier of the petroleum sector's exports on Gross National Product was far lower than that of the non-petroleum sectors' exports. This was due to a higher leakages caused by the petroleum sector's exports through import and net factor payments abroad.

The correlation test shows that a growing and high level of the petroleum sector's export earnings had not been able to produce a positive significant correlation between the rate of growth of total exports and the rate of growth of

Gross National Product Net of Exports which Maizels had implicitly postulated as a measure of the significant contribution of exports to economic growth in less developed countries. Two economic policies were identified to be partly responsible for the absence of this correlation namely foreign exchange and import policies.

The findings of the study call for policy considerations on expanding the petroleum refining capacity in the sense of reversing the export from the petroleum industry to be more in the form of refined products rather than crude oil. A more realistic external value of the rupiah in order to expand the competitive industry is also called for.

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CHAPTER I

INTRODUCTION

There has been a number of hypotheses advocated by economists on the significance or insignificance of the contribution of primary exports to the economic development of less developed countries[1]. These hypotheses, however, are often too general to be used as a basis upon which formulation of economic policies can be made especially in the context of the recent changes in the relationship between investors and host countries and in the economic, social and political factors prevailing in these countries.

The validity or the relevance of any assertion about the impact of the primary export sector on the economic development of the less developed countries can be better understood only if more empirical research on this area is systematically carried out. Such empirical research may also indicate a basis for solving one of the problems faced by the less developed countries, namely how to achieve a more extensive feedback from their export trade to their domestic economy.

1 These hypotheses are presented and explained in detail in chapter IV.

Purpose of The Study

The main purpose of this study is to establish a better understanding of the impact of the growing petroleum industry, which comprises the largest export sector, on the Indonesian economy for the period 1967 - 1976 which was considered to be the period of oil boom in Indonesia. Specifically, it is proposed to analyze the following :

(1) The inter-industry linkages between the petroleum industry and the other sectors of the Indonesian economy.

(2) The multiplier effects of the growth in demand for the output of the petroleum industry on the economy through household income and aggregate output.

(3) The impact of the petroleum industry's gross value added on the gross value added of the non-petroleum sectors. This is intended to indicate the effect of the petroleum industry on the capacity of the non-petroleum sectors to expand.

(4) The impact of the petroleum sector's exports on Gross National Product and its components.

(5) The impact of the petroleum sector's exports on Gross National Product in contrast to that of the non-petroleum sectors' exports.

(6) The association between the rates of growth of the petroleum sector's output and exports on one hand and the rates of growth of output of other sectors and Gross National Product Net of Petroleum Sector's Exports on the other hand.

(7) The existing economic factors and policies which could be considered as partly responsible for affecting the nature of association mentioned in (6) above.

Methodology

The following analytical approaches were used in this study :

(a) The Descriptive Approach

This approach was used to discuss factors directly related to the historical development of the petroleum industry during the period under study, in order to provide relevant background information and an historical perspective of this industry within the Indonesian economy.

(b) The Input-Output Approach

This approach was used to estimate and analyze the interdependence of the petroleum industry with the rest of the economy, and also to estimate the impact multipliers generated by the growth in the demand for the petroleum sector's output on the economy through household income and total output. This approach was also used to estimate the direct and indirect components of imports which were used for consumption and investment and also to estimate the direct, indirect and induced impact of an increase in the demand for the output of a sector on employment and net foreign exchange earnings.

(c) The Statistical Approach

The impact of the growth in the petroleum industry's output on the output of the other sectors of the economy was analyzed by developing a set of models based on the analytical framework developed by Bos, et.al.[1] giving the impact of private foreign investment on the economies of less developed countries. The impact of the petroleum sector's exports on macro-economic variables was analyzed by designing a small macro-economic model of the type proposed by Klein for economies of less developed countries[2].

The parameters of the models were estimated using regression techniques (simple and multiple). Due to small sample period of the study, a modified two-stage least squares method was used to estimate the proposed macro-economic model. The correlation technique was used to determine the degree of association between the rates of growth of gross value added in the petroleum industry and its exports on one hand, and the rates of

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1 H.C. Bos, et.al, Private Foreign Investment in Developing Countries, Dordrecht, Holland : D. Reidel Publishing Company, 1974, chapters 2 and 3.

2 Lawrence R. Klein, "What Kind of Macroeconometric Model for Developing Economies ?", in A. Zellner, ed. Readings in Economic Statistics and Econometrics, Boston : Little Brown & Co, 1968, pp.559-70 and Lawrence R. Klein and J. Behrman, "Economic Growth Models for the Developing Economy", in W. Eltis, et.al, eds. Induction, Growth and Trade, Oxford : Clarendon Press, 1970, pp.165-87.

growth of gross value added in the non-petroleum sectors and Gross National Product Net of Petroleum Sector's Exports on the other hand.

The statistical approach was also utilized to determine the expenditure elasticity indices for various consumption items. These were used as the basis of the classification of consumer goods into necessities and luxuries and were related to the utilization of foreign exchange. These indices were estimated from the Lorenz function recently developed by Kakwani and Podder[1].

Hypotheses

On the basis of the methodology and models mentioned in the preceding section, this study undertakes to test the following hypotheses :

(1) There were no strong inter-industry linkages of the petroleum industry with the other domestic sectors of the economy.

(2) There were no significant multiplier effects generated by the increase in demand for the output of the petroleum industry on household income and total output.

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1 Nanak C. Kakwani and N. Podder, "Efficient Estimation of The Lorenz Curve and Associated Inequality Measures From Group Observations", Econometrica, vol.44, no.1 (January 1976), pp.137-48.

(3) The gross value added from the petroleum industry made no significant impact on gross value added in the non-petroleum sectors. This indicates that the petroleum industry had no significant effect on the capacity expansion of the non-petroleum sectors.

(4) The petroleum sector's exports had smaller impact on Gross National Product in contrast to that of the exports of the rest of the economy.

(5) There was no association between the rates of growth of gross value added in the petroleum sector and the petroleum sector's exports on one hand and the rates of growth of gross value added in the non-petroleum sectors and Gross National Product Net of Petroleum Sector's Exports on the other hand.

Data Processing

The computations for this study were carried out at the University of Hull Computer Centre on ICL - 1904 S computer by computing system called GEORGE - 3. The following computer packages were used :

(1) SPSS - 5
(2) TSP - 1900
(3) NAG 1900 FORTRAN

SPSS - 5 and TSP - 1900 were used for estimating regression and correlation coefficients while NAG 1900 FORTRAN was used for inverting the Input-Output matrices and constructing the reduced form matrix of the simultaneous equation system of the proposed macro-economic model.

Organization of The Study

This study is divided into two parts. The first part deals with background information i.e. Indonesia's economic policies and growth and the development of the petroleum industry during 1967 - 1976. These are presented respectively in Chapters II and III. The second part contains chapters which concern the theoretical framework and analyses of empirical data.

Chapter IV presents various theories on the impact of international trade in general and primary exports in particular on the economic development of less developed countries. This chapter is considered essential in order to place the present study in a proper theoretical perspective. Chapter V presents the first step in estimating the impact of the petroleum industry on the Indonesian economy by calculating its direct contribution to foreign exchange earnings and balance of payments, public saving and Gross National Product.

In Chapter VI, the input-output theoretical framework is established and the calculated inter-industry linkages of the petroleum industry with the rest of the economy are presented and analyzed. The impact multipliers which were generated by growth in the demand for the petroleum industry's output on household income and aggregate output are also presented and analyzed in this chapter.

The design and testing of partial macro-economic models used to estimate the impact of the petroleum industry's gross value added on gross value added of the other sectors of the economy, plus the impact of the petroleum sector's exports on Gross National Product and its components are presented in Chapter VII. The related correlation analysis is also presented in this chapter.

The analyses of two economic policies which have been identified to have a likely effect on the nature of association of various rates of growth in the correlation analysis presented in Chapter VII are discussed in Chapters VIII and IX. These are first the utilization of foreign exchange earnings or import policy and secondly foreign exchange policy.

Finally, Chapter X gives the conclusions and policy implications of the main findings of the study. Details of sources of data are given in Appendix.

PART I

CHAPTER II

THE INDONESIAN ECONOMY, 1967 - 1976 : A SURVEY

This chapter presents some observations on the Indonesian economy during 1967 - 1976 which are considered relevant and useful as background to the present study. It offers an explanation of economic policies adopted and a statistical summary of growth performance, income distribution, and the profile of social welfare. The profile of social welfare discussed is related to poverty and employment situations.

1. Economic Policies

The overriding objective of Indonesia's economic policies after 1966 within the framework of a private and mixed economic system, has been to achieve a high rate of economic growth. To stimulate faster economic growth, monetary, fiscal and trade policies have sought to affect the composition of real output by increasing public and private sector investment[1].

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1 Sumitro Djojohadikusumo 'Indonesian Economic Policies and Problems' in Ekonomi, 6 (1971), pp.130-36.

Price stability or a low rate of inflation was viewed as the necessary concomitant of the overall economic policy in generating investment which was to be financed by both domestic savings and foreign sources[1]. Consequently deficit financing of government investment as well as frequent adjustments of the exchange rate were not adopted. The rejection of inflationary financing probably was not principally made on the ground that it would lead to an inefficient resource allocation but on the ground that it would lead to a reduction in the domestic saving ratio and be a deterrent to the flow of foreign capital which, it was thought, would eventually lead to a reduction in the rate of economic growth.

Indonesia has consistently adopted a monetarist approach to check inflation using orthodox methods to control the money supply. Money supply has been influenced through changes in the interest rate and the imposition of a credit ceiling on the banking system. Selective credit measures at the same time were implemented in order to stimulate growth in selected sectors.

Trade policy has been based on the principle of protection with the aim of speeding up industrialization[2].

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1 Suhadi Mangkusuwondo, Economic Aspects of Stabilization in Indonesia, Jakarta : Lembaga Penyelidikan Ekonomi Dan Masyarakat, Universitas Indonesia, 1971, pp.5-6.

2 For the discussion of Indonesia's trade policies, see Sumitro Djojohadikusumo, 'Indonesia's Trade Policies' Pacific Community, 3 (October 1971), pp.204-22. See also

The policy has emphasized relatively high tariffs and the development of import-substitute industries. Since 1971 devaluation has been avoided in order to encourage foreign investment and to facilitate the importation of capital goods, raw materials and auxiliary materials by domestic industries[1]. Another main feature of Indonesia's trade policy since 1966 has been the free convertibility of currency and the maintenance of a single exchange rate (pegged to U.S. dollar). Foreign trade has also been directed towards the encouragement of exports. The measures taken were on supply side through incentives offered to exporters in term of credit facilities and various tax exemptions.

Indonesia's economic policies which placed deliberate emphasis on growth, benefited the modern sectors of the economy as will be shown later. These policies have been strongly criticized for they have brought prosperity to a small elite of the society but have almost entirely excluded the rest of the population from the development process. In response to this criticism, the Second Five Year Development Plan which started on 1 April, 1974 placed a certain emphasis on distributional aspects of growth as stated in its five broad goals[2] :

Suhadi Mangkusuwondo, 'Trade Oriented Policies After 1966 in Indonesia', paper presented at the seminar on New Directions in the International Relations of Southeast Asia, Singapore, July 1972, pp.1-15.

1 Richard N. Cooper and Bruce Glassburner, 'Foreign Exchange Policy and the Foreign Trade Sector : Suggestions for Indonesia's Second Five Year Plan', Jakarta : Harvard Advisory Group, mimeo, August 1973, pp.1-2.

2 Rencana Pembangunan Lima Tahun Kedua, 1974/75 - 1978/79.

(1) Adequate supply of food and clothing of better quality and within the people's purchasing power;

(2) Adequate household supplies and facilities ;

(3) Better and more extensive infrastructure ;

(4) Higher and more evenly distributed social welfare ;

(5) Greater employment opportunities.

However, the strategy and policies of the Second Five Year Development Plan are basically the same as those of the First Five Year Development Plan.

2. Growth Performance

Rate of Growth and Sources of Growth

The major dimensions of Indonesian economic growth during 1967 - 1976 are reflected in the growth rates of aggregate and per capita income during this period. Gross Domestic Product, at constant 1960 prices, had grown at an average annual rate of 7.69 per cent[1]. With an average annual growth rate of population of 2.37 per cent, the growth of per capita income during 1967 - 1976 was 5.32 per cent per annum[2]. Table II.1 shows Gross Do-

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1 The average annual rate of change of a given series of variables over a period of time is the difference between the natural logarithms of the terminal and initial values of the series divided by the number of years included in the period. Gross Domestic Product rather than Gross National Product is used throughout this study due to the absence of data on sectoral GNP. Gross National Product, at constant 1960 prices, had grown at an average annual rate of 7.22 per cent during the same period. GNP figures are given in the Appendix.

2 The corresponding per capita income based on GNP had increased at an annual rate of 4.85 per cent. The figures on GNP-per capita are given in the Appendix.

mestic Product at constant 1960 prices during 1967 - 1976 and its sectoral components. Table II.2 shows the development of per capita income during the same period.

An examination of sectoral growth rates indicate growth disparities among sectors of the economy. Mining & Quarrying, Public Utilities, Construction and Transport & Communication were the leading sectors as far as growth is concerned. The average annual compounded growth rates of these sectors between 1967 and 1976 as given in Table II.3 were respectively 25.74 per cent, 20.67 per cent, 10.58 per cent and 9.98 per cent. Agriculture had been the lagging sector with an average annual growth rate of only 2.54 per cent. This was due mainly to the reduction in the growth rate of rice production from about 4 per cent during the period 1969 - 1974 to about 2 per cent in 1975 and 1976 and the stagnation in the production of the principal non-rice food crops such as corn, cassava, sweet potatoes and soybeans[1]. Bad weather conditions and some other technical and institutional supply constraints were the main factors for production instability in the largest segment of agricultural sector[2]. The relative performance of the major sectors in the economy is also reflected in their growth elasticities as estimated by log-regression of the sectoral GDP on GDP. The leading sectors had growth elasties far in excess of unity as also shown in Table II.3.

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1 World Bank "Indonesia : Recent Developments, Short-Term Prospects and Development Issues", Report No. 2026-IND, Washington, April 26, 1978, p.15.

2 Ibid.

Table II.1 Gross Domestic Product and Its Sectoral Components, 1967-1976 At Constant 1960 Market Prices
(in billions of Rupiahs)

Year	GDP (Y)	GDP Attributed To						
		Agriculture (Y_1)	Mining & Quarrying (Y_2)	Manufacturing (Y_3)	Public Utilities (Y_4)	Construction (Y_5)	Transport & Communication (Y_6)	Services (Y_7)
1967	448.0	232.1	16.7	37.5	2.2	7.3	15.6	136.6
1968	496.9	255.2	22.8	40.8	2.3	9.2	15.9	150.7
1969	530.8	260.1	27.7	46.6	2.6	12.1	16.5	165.2
1970	571.0	271.0	32.0	51.0	3.0	15.0	18.0	181.0
1971	611.0	281.0	34.0	58.0	3.0	18.0	22.0	195.0
1972	654.0	287.0	41.0	61.0	4.0	22.0	25.0	214.0
1973	740.0	319.0	50.0	64.0	4.0	26.0	28.0	249.0
1974	792.6	294.7	174.8	65.5	3.8	29.9	32.5	191.4
1975	835.2	302.3	160.8	74.2	4.6	38.9	34.4	220.0
1976	894.8	291.8	169.3	81.9	5.7	46.9	38.3	260.9

Source : LPEM, Universitas Indonesia, Perspektif Perekonomian Nasional Indonesia Tahun 1985, Jakarta, 1976, pp.24-7 and Nota Keuangan 1977/78, Ministry of Finance.
The figures for GDP were available in two series : Series I were available at constant 1960 prices (GDP for 1969-1973) and Series II were available at constant 1973 prices (GDP for 1971-1975). The conversion to 1960 prices was done as follows :
(1) GDP at current prices divided by GDP at 1973 prices to obtain the implicit price index (with base 1973 = 100);
(2) the implicit price index was converted to base 1960 = 1.00 by dividing each year's index by that of 1960;
(3) GDP at current prices was then divided by the implicit price index (with base 1960 = 1.00) to obtain GDP at 1960 prices.

Table II.2 Per Capita Income, 1967 - 1976
At Constant 1960 Market Prices
(in Rupiahs)

Year	Amount
1967	4099.8
1968	4441.6
1969	4634.2
1970	4886.5
1971	5085.4
1972	5315.5
1973	5873.5
1974	6146.6
1975	6320.5
1976	6615.9
Average Rate of Growth (%)	5.32

Source : Derived from Table II.1 and population estimates published by the Central Bureau of Statistics.

Table II.3 Sectoral Annual Growth Rates And Growth Elasticity 1967 - 1976
(based on constant 1960 market prices)

Sector	Annual Growth Rate	Growth Elasticity
Agriculture	2.54	0.3504
Mining & Quarrying	25.74	3.5596
Manufacturing	8.68	1.0633
Public Utilities	10.58	1.2777
Construction	20.67	2.5971
Transport & Communication	9.98	1.4348
All Services	7.19	0.8033

Source : Calculated on the basis of data on sectoral output derived from National Income Accounts.

In order to find out the contribution of each sector in the rate of growth of Gross Domestic Product, the following procedure is adopted.

I express $$Y = \sum_{i=1}^{n} Y_i$$

where, Y is Gross Domestic Product

Y_i is the absolute share of sector i in Gross Domestic Product

The rate of change of Gross Domestic Product over time can be written as

$$\frac{1}{Y}\frac{dY}{dt} = \sum_{i=1}^{n} Z_i \left[\frac{1}{Y_i} \cdot \frac{dY_i}{dt}\right]$$

where $Z_i = Y_i/Y$ is the relative share of sector i in Gross National Product and each term $Z_i \left[\frac{1}{Y_i} \cdot \frac{dY_i}{dt}\right]$ is the contribution of the rate of change of Gross Domestic Product attributed to each sector to the rate of change of Gross Domestic Product. Table II.4 shows the contribution of each sector to the rate of growth of Gross Domestic Product during 1967 - 1976. As shown in this table, the primary source of growth in Gross Domestic Product during 1967 - 1976 was the Mining & Quarrying sector. This sector contributed 36 per cent to the rate of growth of Gross Domestic Product during this period.

Table II.4 Contribution of The Rate of Change in in Each Sectoral Component of Gross Domestic Product to The Rate of Change in Gross Domestic Product, 1967-1976 (Rate of Change Continuously Compounded)

GDP	Agriculture	Mining & Quarrying	Manufac-turing	Public Utilities	Construc-tion	Transport & Communication	Services
7.69	0.6482	2.5733	0.7293	0.0569	0.5768	0.3752	2.3403
	(0.0898)	(0.3564)	(0.1010)	(0.0079)	(0.0799)	(0.0520)	(0.3240)

Note : The figures in the parentheses below the rates corresponding to each sector of the economy indicate the fraction of the total relative change in Gross Domestic Product accounted for by each one of them.

Source : Calculated on the basis of the absolute changes in Gross Domestic Product and sectoral Gross Domestic Product.

Trend Analysis

The average annual rate of growth of Gross Domestic Product and that of its sectoral components and per capita income presented in the previous section are based on two points during the period under study i.e. 1967 as the starting point and 1976 as the terminal point. They do not show the picture of the growth path actually experienced by these variables at every point during the period.

For the purpose of obtaining a better understanding of the growth performance of the Indonesian economy during 1967 - 1976, the following trend curves were fitted to the data on Gross Domestic Product, its sectoral components and per capita income during this period :

(1) The Exponential Curve

(2) The Gompertz Curve

The exponential curve is represented as

$$Y_t^* = a\, b^t$$

or in logarithmic form

$$\text{Log } Y_t^* = \log a + b\, t$$

where Y_t^* denotes the trend values, a and b are parameters and t is time. The exponential fit cannot but gives a constant rate of growth at every point in the period. The values of the parameters are derived by least square method.

The Gompertz curve is written as

$$Y_t^* = k\, a^{b^t}$$

or in the logarithmic-form

$$\text{Log } Y_t^* = \log k + (\log a)\, b^t$$

where k represents the upper asymptote and the lower asymptote is the zero point.

In the fitting of the Gompertz curve, the rate of growth may remain constant, decrease or increase. If log a is negative and b is less than unity, the curve is increasing but with a decreasing rate of growth. If log a is positive and b is greater than unity, the curve is increasing at an increasing rate of growth. If b is unity and log a is positive, the curve is increasing with a constant rate of growth. In order to compute the values of b, a and k of the Gompertz curve, it is essential that the period covered is divided into three equal sub-periods. The year 1968 will be the starting point for the fitting of the Gompertz as well as the exponential curves. The following are the formulae[1] used to determine the values of b, a and k

$$b^n = \frac{\Sigma_3 \log Y - \Sigma_2 \log Y}{\Sigma_2 \log Y - \Sigma_1 \log Y}$$

$$\log a = (\Sigma_2 \log Y - \Sigma_1 \log Y)\, \frac{b-1}{(b^n - 1)^2}$$

1 A detailed derivation of these formulae is given in Frederick E. Croxton and Dudley J. Cowden Applied General Statistics, London : Sir Isaac Pitman & Sons, 1962, pp.852-53.

$$\log k = \frac{1}{n} \quad \Sigma_1 \log Y - [\frac{b^n - 1}{b - 1}] \log a$$

where n is the number of years in each third of the data and $\Sigma_1 \log Y$, $\Sigma_2 \log Y$ and $\Sigma_3 \log Y$ refer to the sum of the logarithms of each third of the observed data beginning from that of the first three years to that of the last three years. To compare the goodness of fit as of between two different curves, the D-value is used. The lower D-value indicates a better fit. The D-value represents the ratio of the sum of squares of deviations of the observed values from the trend values to the total sum of squares. The formula for the D-value is

$$D = \frac{\Sigma [Y_t - Y_t^*]^2}{\Sigma [Y_t^* - \bar{Y}_t]^2}$$

where Y_t denotes the observed values, Y_t^* denotes the corresponding trend value and $\bar{Y}_t$ denotes the mean value of Y_t. The results of the fitting of the exponential and the Gompertz curves to the data on GDP, its sectoral components and per capita income for the period 1968 - 1976 are shown in Table II.5. The results indicate the following :

[1] The exponential trend curve proved to be the better curve as far as closeness of fit when it was fitted to the data on Gross Domestic Product and its sectoral components, except the component represented by manufacturing sector. The fitted exponential trend curve shows the constant annual rate of growth of 7.91 per cent

for GDP, 2.16 per cent for GDP-Agriculture, 32.93 per cent for GDP-Mining & Quarrying, 10.70 per cent for GDP-Public Utilities, 21.69 per cent for GDP-Construction, 12.64 per cent for GDP-Transport & Communication, 5.85 per cent for GDP-Services and 5.37 per cent for per capita income.

(2) The Gompertz curve gave closer fit to the data on manufacturing sector's Gross Domestic Product which showed a declining rate of growth during the period 1968 - 1976. The computed rate of growth of manufacturing sector's Gross Domestic Product for this period following the Gompertz curve are as follows :

Year		Rate of Growth (%)
1969	:	11.26
1970	:	9.73
1971	:	8.51
1972	:	7.35
1973	:	6.39
1974	:	5.58
1975	:	4.88
1976	:	4.13

After establishing the fitness of the exponential trend curve, to the data on Gross Domestic Product and its sectoral components (with the exception of manufacturing sector's component), it is of interest to examine their steadiness of growth by looking at the regression results of this trend curve. Table II.6 shows the results of these exponential trend regressions. The results show that the agricultural sector's Gross Domestic Product experienced not only the lowest rate of growth but also a least steady growth as indicated by the low value of its R^2. The regression results for the period 1967 - 1976 are shown in Table II.7.

Table II.5 The Fitted Exponential and Gompertz Curves To The Data On Gross Domestic Product, Sectoral Components of Gross Domestic Product and Per Capita Gross Domestic Product, 1968 - 1976 (GDP and its sectoral components are in billions of Rupiahs and Per Capita GDP is in thousands of Rupiahs at constant 1960 market prices)

	Exponential	Gompertz
GDP	$Y_t^* = 456.36\,(1.0791)^t$ D = 0.0063	$Y_t^* = 289.07\,(1.2968)^{1.2599^t}$ D = 0.4105
GDP-Agriculture	$Y_{1t}^* = 255.22\,(1.0216)$ D = 0.3492	$Y_{1t}^* = 296.22\,(0.7704)^{0.3135^t}$ D = 0.6649
GDP-Mining & Quarrying	$Y_{2t}^* = 13.82\,(1.3293)^t$ D = 0.2264	$Y_{2t}^* = 22.96\,(1.1135)^{1.5054^t}$ D = 0.4653
GDP-Manufacturing	$Y_{3t}^* = 39.66\,(1.0829)^t$ D = 0.3592	$Y_{3t}^* = 107.01\,(0.3820)^{0.8732^t}$ D = 0.1496
GDP-Public Utilities	$Y_{4t}^* = 2.13\,(1.1070)^t$ D = 0.0839	$Y_{4t}^* = 9.35\,(0.2461)^{0.9055^t}$ D = 0.1959
GDP-Construction	$Y_{5t}^* = 8.01\,(1.2169)^t$ D = 0.0035	$Y_{5t}^* = 16325.01\,(0.0006)^{0.9710^t}$ D = 0.1544
GDP-Transport & Communication	$Y_{6t}^* = 13.47\,(1.1264)^t$ D = 0.0127	$Y_{6t}^* = 304.15\,(0.0478)^{0.9524^t}$ D = 0.1666
GDP-Services	$Y_{7t}^* = 150.54\,(1.0585)^t$ D = 0.2760	$Y_{7t}^* = 222.59\,(0.5653)^{0.4061^t}$ D = 0.6960
GDP-Per Capita	$\bar{y}_t^* = 4.18\,(1.0537)^t$ D = 0.0128	$\bar{y}_t^* = 4.22\,(1.0707)^{1.3804^t}$ D = 0.4203

Table II.6 The Exponential Trend Regressions of Gross Domestic Product and Its Sectoral Components[a] For The Period 1968 - 1976 (based on constant 1960 market prices)

	Regression Results			
	Intercept	Coefficient of t	Standard Error of t	R^2
GDP	6.1233	0.0761	0.0021	0.9945
GDP-Agriculture	5.5421	0.0214	0.0057	0.6667
GDP-Mining & Quarrying	2.6259	0.2847	0.0420	0.8676
GDP-Public Utilities	0.7542	0.1016	0.0104	0.9315
GDP-Construction	2.0811	0.1963	0.0048	0.9958
GDP-Transport & Communication	2.6008	0.1191	0.0054	0.9858
GDP-Services	5.0143	0.0569	0.0127	0.7419

The trend regression fitted was $\text{Log } Y_i = a_i + b_i t$, where Y_i represents GDP and its sectoral components and t represents time.

a) *Excluding GDP-Manufacturing*

Table II.7 The Exponential Trend Regressions of Gross Domestic Product and Its Sectoral Components[a] For The Period 1967 - 1976 (based on constant 1960 market prices)

	Regression Results			
	Intercept	Coefficient of t	Standard Error of t	R^2
GDP	6.056	0.0749	0.0019	0.9951
GDP-Agriculture	5.4831	0.0265	0.0054	0.7168
GDP-Mining & Quarrying	2.4221	0.2736	0.0341	0.8893
GDP-Public Utilities	0.6647	0.0997	0.0084	0.9465
GDP-Construction	1.8404	0.2023	0.0052	0.9947
GDP-Transport & Communication	2.5398	0.1111	0.0063	0.9751
GDP-Services	4.9185	0.0621	0.0106	0.8123

The trend regression fitted was Log $Y_i = a_i + b_i t$, where Y_i represents GDP and its sectoral components and t represents time.

a) *Excluding GDP-Manufacturing.*

Sectoral Income

The sectoral distribution of both Gross Domestic Product and employment serves further to indicate the pattern of Indonesia's economic growth. The information on sectoral distribution of employment were available only for 1971 and 1976. Table II.8 shows the sectoral distribution of Gross Domestic Product and employment for 1971 and 1976. Sectoral Gross Domestic Product attributed to each sector of the economy are at constant 1960 prices.

Table II.8 Sectoral Gross Domestic Product and Employment, 1971 and 1976

Sector	1971		1976	
	Gross Domestic Product [in billion of Rps]	Employment [in thousand of persons]	Gross Domestic Product [in billion of Rps]	Employment [in thousand of persons]
Agriculture	281.0	24,936	291.8	25,418
Mining & Quarrying	34.0	80	169.3	87
Manufacturing	58.0	2,572	81.9	3,458
Public Utilities	3.0	35	5.7	35
Construction	18.0	640	46.9	1,122
Transport & Communication	22.0	901	38.3	1,112
Services	195.0	8,541	260.9	11,366

Source : The sectoral Gross Domestic Product are derived from National Income Accounts.
The employment figures are taken and derived from the employment figures in LPEM, Universitas Indonesia op.cit, p.197a.

Figures in this table can be used to estimate the sectoral average income. The sectoral average income for 1971 and 1976 are shown in Table II.9.

Table II.9 Sectoral Average Income
1 9 7 1 and 1 9 7 6
(in thousands of Rupiahs at constant 1960 prices)

Sector	1971	1976	% change, 1971-1976
Agriculture	11.27	11.48	1.86
Mining & Quarrying	425.00	1945.98	357.88
Manufacturing	22.55	23.68	5.01
Public Utilities	85.71	162.86	90.01
Construction	28.13	41.80	48.60
Transport & Communication	24.42	34.44	41.03
Services	22.83	22.95	0.53

Source : Derived from table II.8.

The figures in Table II.9 indicate that agriculture was the poorest sector with the lowest average income. Its average income increased only slightly during 1971 - 1976, from Rp 11,270 in 1971 to Rp 11,480 in 1976, an increase of 1.86 per cent. Manufacturing sector also experienced a slight increase in average income, an increase by 5.01 per cent. This might reflect the worsening or stagnant productivity in small scale industries which substantially formed the manufacturing sector. Mining and quarrying had experienced more than three-fold increase in its average income between

The absolute real income differentials and relative real income ratios between the rest of the economy and agriculture for 1971 and 1976 are shown in Tables II.10 and II.11 respectively. These tables show that the income gap between agriculture and the rest of the economy had substantially widened during 1971 - 1976. The extent of widening gap was found the highest between the average real income in mining & quarrying and that of agriculture. In absolute terms, it increased from Rp 413.73 in 1971 to Rp 1,934.50 in 1976, representing an increase of 367.58 per cent. In relative terms, the gaps were respectively 37.1 in 1971 and 169.51 in 1976, representing an increase by 349.51 per cent. The next highest gap was re-

Table II.10 Absolute Real Income Differentials Between Non-Agricultural Sector and Agricultural Sector 1971 and 1976
(in thousands of Rps at Constant 1960 prices)

1971		1976		% Change 1971 - 1976
$\bar{y}_2^{71} - \bar{y}_1^{71} =$	413.73	$\bar{y}_2^{76} - \bar{y}_1^{76} =$	1934.50	367.58
$\bar{y}_3^{71} - \bar{y}_1^{71} =$	11.28	$\bar{y}_3^{76} - \bar{y}_1^{76} =$	12.20	8.16
$\bar{y}_4^{71} - \bar{y}_1^{71} =$	74.44	$\bar{y}_4^{76} - \bar{y}_1^{76} =$	151.38	103.36
$\bar{y}_5^{71} - \bar{y}_1^{71} =$	16.86	$\bar{y}_5^{76} - \bar{y}_1^{76} =$	30.32	79.83
$\bar{y}_6^{71} - \bar{y}_1^{71} =$	13.15	$\bar{y}_6^{76} - \bar{y}_1^{76} =$	22.96	74.60
$\bar{y}_7^{71} - \bar{y}_1^{71} =$	11.56	$\bar{y}_7^{76} - \bar{y}_1^{76} =$	11.47	- 0.78

Source ; Derived from table II.9.

Table II.11 <u>Relative Real Income Ratios Between Non-Agricultural Sector and Agri-cultural Sector, 1971 and 1976</u>

1 9 7 1	1 9 7 6	% Change 1971 - 1976
$\bar{y}_2^{71} / \bar{y}_1^{71}$ = 37.71	$\bar{y}_2^{76} / \bar{y}_1^{76}$ = 169.51	349.51
$\bar{y}_3^{71} / \bar{y}_1^{71}$ = 2.00	$\bar{y}_3^{76} / \bar{y}_1^{76}$ = 2.06	3.00
$\bar{y}_4^{71} / \bar{y}_1^{71}$ = 7.61	$\bar{y}_4^{76} / \bar{y}_1^{76}$ = 14.19	86.47
$\bar{y}_5^{71} / \bar{y}_1^{71}$ = 2.50	$\bar{y}_5^{76} / \bar{y}_1^{76}$ = 3.64	45.60
$\bar{y}_6^{71} / \bar{y}_1^{71}$ = 2.17	$\bar{y}_6^{76} / \bar{y}_1^{76}$ = 3.00	38.25
$\bar{y}_7^{71} / \bar{y}_1^{71}$ = 2.03	$\bar{y}_7^{76} / \bar{y}_1^{76}$ = 2.00	- 1.50

Source : Derived from table II.9

vealed by income differential between public utilities and agriculture.

3. <u>Income Distribution, Poverty And Employment</u>

In analyzing the Indonesian growth process further, the following three aspects are here examined :

(a) Income Distribution

(b) Position of The Poor

(c) Employment Situation

Due to the absence of personal income statistics, the data on household consumption expenditure were used to measure income inequality. Consumption expenditure was used as a proxy of income and the concentration ratio of consumption expenditure as recently proposed by Kakwani and Podder[1] was computed to gain an idea of inter-personal income disparities. Household consumption expenditure data of 1970 and 1976 as reported in National Socio-Economic Survey Round IV (January-April 1970) and National Socio-Economic Survey Round V (January-April 1976)[2] were used to compute this inequality measure. The basic data and the inequality indices calculated are shown in Table II.12. The data show that in 1970 the share of the upper 10 per cent of the population in total expenditure was 27 per cent ; but in 1976 their share had risen to 32 per cent. In addition, the concentration ratio of consumption expenditure rose from 0.33 to 0.41 implying a less even income distribution. The Indonesian data for the period 1970-1976 confirm the Kuznets thesis on growth where it is asserted that there will be an inverse U shaped relation between income inequality and GNP per capita[3].

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1 See N.C. Kakwani and N. Podder, "Efficient Estimation of The Lorenz Curve and Associated Inequality Measures From Group Observations", Econometrica, vol.44, no.1 (January 1976), pp.137-48. The description of this method is given in Chapter VIII in the context of classifying consumption expenditure items into luxuries and necessities.

2 Biro Pusat Statistik, Survey Sosial Ekonomi Nasional Tahaf Ke-Empat, Jakarta, 1973 and Survey Sosial Ekonomi Nasional Tahaf Ke-Lima, Jakarta 1977, The household consumption expenditure for 1976 were converted into per capita basis to be comparable with per capita data of 1970 by dividing them by 5 as the average household size.

3 Simon Kuznetz, "Quantitative Aspects of The Economic Growth

Table II.12 Size Distribution of Consumption Expenditure, 1970 and 1976

1970			1976		
Expenditure Category (in Rupiahs)	Percentage of Population	Percentage of Expenditure	Expenditure Category (in Rupiahs)	Percentage of Population	Percentage of Expenditure
01 - 300	1.74	0.31	0 - 1,000	4.35	0.77
301 - 500	8.44	2.64	1,000 - 1,999	19.87	7.18
501 - 750	17.82	8.30	2,000 - 2,999	20.88	12.17
751 - 1000	17.51	11.27	3,000 - 3,999	17.81	14.36
1001 - 1250	13.93	11.50	4,000 - 4,999	11.84	12.29
1251 - 1500	10.58	10.71	5,000 - 5,999	7.80	9.93
1501 - 2000	13.36	17.05	6,000 - 7,999	7.24	11.62
2001 - 2500	6.92	11.40	8,000 - 9,999	4.33	8.97
2501 - 3000	3.65	7.36	10,000 - 14,999	3.50	9.84
3001 and over	6.05	19.46	15,000 and over	2.38	12.88
Concentration Ratio		0.330	Concentration Ratio		0.411

This U - shape relation was described by Kuznets as follows,

> In the process of growth, the earlier periods are characterized by a balance of counteracting forces that may have widened the inequality in the size distribution of total income for a while, because of the rapid growth of the non-agricultural sector and wider inequality within it.1

The second aspect examined here is the position of the poor during the period of growth. Did the fraction of the population classified as poor increase or decrease, i.e. was the incidence of poverty being reduced ? To answer this question, we must begin by establishing a poverty line. Sayogyo proposed Rp 1,000 and Rp 1,500 as the poverty lines respectively in rural and urban Indonesia for early 1970[2]. Taking the average of these figures, Rp 1,250 as the poverty line for urban and rural Indonesia combined, the change in the incidence of poverty between 1970 and 1976 can be determined. Since this involves the effort to measure changing absolute real incomes rather than relative income, it is necessary to

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of Nations VIII : Distribution of Income By Size", Economic Development And Cultural Change, vol.11, no.2 (1963),p.67.

1 ibid

2 Sayogyo, Evaluasi Usaha Perbaikan Gizi Keluarga,1972/1973, Bogor ; Lembaga Penelitian Sosiologi Pedesaan, Institut Pertanian Bogor, 1975, p.71.

take the income bracket [expenditure class] for one year as a base and to approximate the frequency from the other year in each category of income [expenditure]. For this purpose, the method proposed by Fields was used[1]. This method was applied to the Indonesian data of consumption expenditures of 1970 and 1976 as follows :

Let, $\bar{y}_o^{70}$ = mean expenditure of 1970 at 1970 prices

$\bar{y}_o^{76}$ = mean expenditure of 1976 at 1970 prices

$\bar{y}^{70}$ = mean expenditure of 1970 at current prices

$\bar{y}^{76}$ = mean expenditure of 1976 at current prices

λ_1^* = ratio of real means = $\bar{y}_o^{76} / \bar{y}_o^{70}$

λ_2^* = ratio of nominal means = $\bar{y}^{76} / \bar{y}^{70}$

The 1976 expenditure categories were deflated by $\lambda_2^* / \lambda_1^*$ which was an inflation factor. For example, the first expenditure category in 1976 runs from 0 - 339 at constant 1970 prices. Following a linear approximation to the population frequency within each expenditure category, then 301/339 of the population in the 0 - 339 category was assigned to the 0 - 339 category and the remaining 38/339 was

1 Gary S. Fields, "Who Benefits From Economic Development? A Reexamination of Brazilian Growth in the 1960's", The American Economic Review, vol.67, no.4 [September 1977], pp.572-73.

assigned to the subsequent higher category. The same procedure was followed for the rest of the expenditure categories. The comparable expenditure categories for 1970 and 1976 are shown in Table II.13. It is seen from this table that the percentage of the population that was classified as poor [with per capita expenditure below Rp 1,250] was practically constant. However, the percentage of the population which could be regarded very poor, i.e. those with per capita expenditures below Rp 751, increased.

The last aspect examined here is the employment situation. Based on the 1971 population census, it was estimated that out of 43.3 million labour force, only 37.7 million got employment which left 5.5 million unemployed or 12.83 per cent of the total labour force. In 1975, the unemployment rate was estimated to have increased to 13.16 per cent. The low and high estimates of employment for 1980 produced unemployment rates respectively 14.87 per cent and 14.12 per cent. These unemployment rates estimates are shown in Table II.14.

The unemployment rate estimates as shown in Table II.14 are consistent with the lower rate of growth of employment in agricultural sector compared to that in other sectors [secondary and tertiary sectors] and the fact that the non-agricultural sectors were capital intensive which led them to absorb a relatively small quantity of the ever growing number of labour

Table II.13 Size Distribution of Consumption Expenditure, 1970 and 1976 Using 1970 Expenditure Categories as The Base

$\bar{y}_o^{70}$ = Rp 1,357 $\bar{y}_o^{76}$ = Rp 1,449 $\lambda_1^* = 1.07$ $\lambda_2^* / \lambda_1^* = 2.95$

$\bar{y}^{70}$ = Rp 1,357 $\bar{y}^{76}$ = Rp 4,290 $\lambda_2^* = 3.16$

Expenditure Category	Percentage of Population		Cumulative Percentage of Population	
	1970	1976	1970	1976
0 - 300	1.74	3.87	1.74	3.87
301 - 500	8.44	9.94	10.18	13.81
501 - 750	17.82	14.86	28.00	28.87
751 - 1,000	17.51	15.53	45.51	44.40
1,001 - 1,250	13.93	14.99	59.44	59.39
1,250 - 1,500	10.58	11.06	70.02	70.45
1,501 - 2,000	13.36	11.94	83.38	82.39
2,001 - 2,500	6.92	6.25	90.30	88.64
2,501 - 3,000	3.65	4.88	93.95	93.52
3,001 and over	6.05	6.48	100.00	100.00

force from the traditional agricultural sector[1]. The overall unemployment rates shown in Table II.14 however do not

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1 LPEM, Universitas Indonesia, op.cit, p.194. The declining employment opportunities in traditional agricultural sector were reported in various studies. See inter alia William L. Collier, "Masaalah Pangan, Pengangguran Dan Gerakan Penghijauan Di Pedesaan Jawa", Prisma, VII, no.1 (February 1978), pp.20-35; William L. Collier, "Agricultural Evolution in Java : The Decline of Shared Poverty and Involution", Bogor: mimeo, 1978; Suparmoko, et.al. "Penyerapan Tenaga Kerja Pada Intensifikasi Penanaman Padi Dan Pengolahan Padi Di Jawa Dan Bali", Yogyakarta : Universitas Gajah Mada, 1972, and Benjamin White, "Population, Involution and Employment in Rural Java", Development and Change, 7, 1976, pp.267-90.

reveal the widespread extent of underemployment or disguised unemployment in various sectors of the economy, notably in agriculture and small scale industries. Using the length of work of less than 35 hours a week as a criterion, it was estimated that 58 per cent of the working labour in agriculture were classified as disguisedly unemployed[1]. This rate in small scale industries was estimated to be 33.3 per cent[2].

Table II.14 Labour Force and Employment Estimates, 1971, 1975 and 1980 (in million)

	1971	1975	1980 Low	1980 High
Labour Force	43.25	47.79	54.46	
Employment	37.71	41.50	46.36	36.77
Unemployment	5.55	6.29	8.10	7.69
Unemployment as % of labour force	12.83	13.16	14.87	14.12

Source : LPEM, Universitas Indonesia ibid, p.205 and 209.

1 Buyung Syafei, "Kebijaksanaan Tenaga Kerja Di Indonesia", Prisma, vol.8, no.1 [February 1978], p.40, quoting the figure released in Survei Angkatan Kerja Nasional, Ministry of Manpower, September 1976.

2 ibid.

Conclusions

The following are the conclusions of the observations on Indonesia's economic growth during 1967 - 1976 :

(1) During 1967 - 1976 Indonesia had experienced a continuous rise in national and per capita income. The level of Gross Domestic Product and per capita income at constant 1960 prices respectively showed an annual growth rate of 7.69 per cent and 5.32 per cent during this period.

(2) The manufacturing sector had experienced a declining rate of growth as shown by the fitted Gompertz trend curve which gave a closer fit to the data on this sector's output. This fact had produced a small capacity of manufacturing sector to absorb a substantial labour force. Mining sector, which was dominated by the petroleum mining, was the major source of growth of Gross Domestic Product. The subsequent chapter examines in detail the factors which were directly related to the growth in the petroleum industry during the period under study.

(3) Indonesia's economic growth during 1967 - 1976 had taken place in an environment of worsening income distribution, mass poverty and low level of employment. The worsening income distribution was reflected in the growing disparities in average sectoral income and in the increase in the concentration ratio of per capita consumption expenditure. There had been no decline in the incidence of poverty and the unemployment rate grew.

CHAPTER III

THE DEVELOPMENT OF THE PETROLEUM INDUSTRY, 1967 - 1976

The development[1] of the Indonesian petroleum industry during 1967 - 1976 is presented in this chapter. This chapter describes the structure and the legislations which affects the industry, its resources and production, crude oil pricing and price development and the petroleum industry's infrastructure. These aspects of the industry will be a useful set of information for the core of the study which will be presented in later chapters. Only crude oil and petroleum products are covered here since in the years under study, the role of natural gas and its related products was still negligible.

I. Structure of the Industry and Legal Framework

a. Structure of the Industry

By the end of 1976 there were seventeen crude oil producing companies and twenty-nine companies that were still

1 The development of the Indonesian petroleum industry prior to 1967 is described in Oei Hong Lan, 'Petroleum Resources and Economic Development : Comparative Study of Indonesia and Mexico', Ph.D. dissertation, University of Texas, 1964 and Alex Hunter, 'The Indonesian Petroleum Industry', Australian Economic Papers, June 1966, pp.10-30 and Alex Hunter, 'Indonesian Oil : A New Generation of Explorers', Bulletin of Indonesian Economic Studies, 8 (October 1967), pp. 85-91.

entirely at the exploration stage in Indonesia. In 1967 these figures were respectively four and eight[1]. Oil producing companies and those that were still entirely at the exploration stage by the end of 1976 are shown in Tables III.1 and III.2 along with the location of their ownership. Figure III.1 shows the operation areas of oil companies as of the end of 1976. As shown in tables III.1 and III.2, most of the oil companies operating in Indonesia are the United States based companies.

Table III.1 Petroleum Producing Companies End of 1 9 7 6

Company	Location of Ownership
State Oil Company Pertamina	Indonesia
State Oil Company Lemigas	Indonesia
Caltex	U.S.A.
Calasiatic-Topco	U.S.A.
Stanvac	U.S.A.
Asamera Oil	U.S.A.
Independent Indonesian American Petroleum Company (IIAPCO)	U.S.A.
Atlantic Richfield Oil Company (ARCO)	U.S.A.
Union Oil	U.S.A.
Japex	Japan
Tesoro Petroleum Corporation	U.S.A.
Total Indonesie	France
Roy M. Huffington (HUFFCO)	U.S.A.
Associated Australian Resources	Australia
Petromer Trend Corporation	U.S.A.
Cities Service	U.S.A.
Phillips Petroleum Company	U.S.A.

Source : Ministry of Mining The Petroleum and Natural Gas Industry of Indonesia, August 1977.

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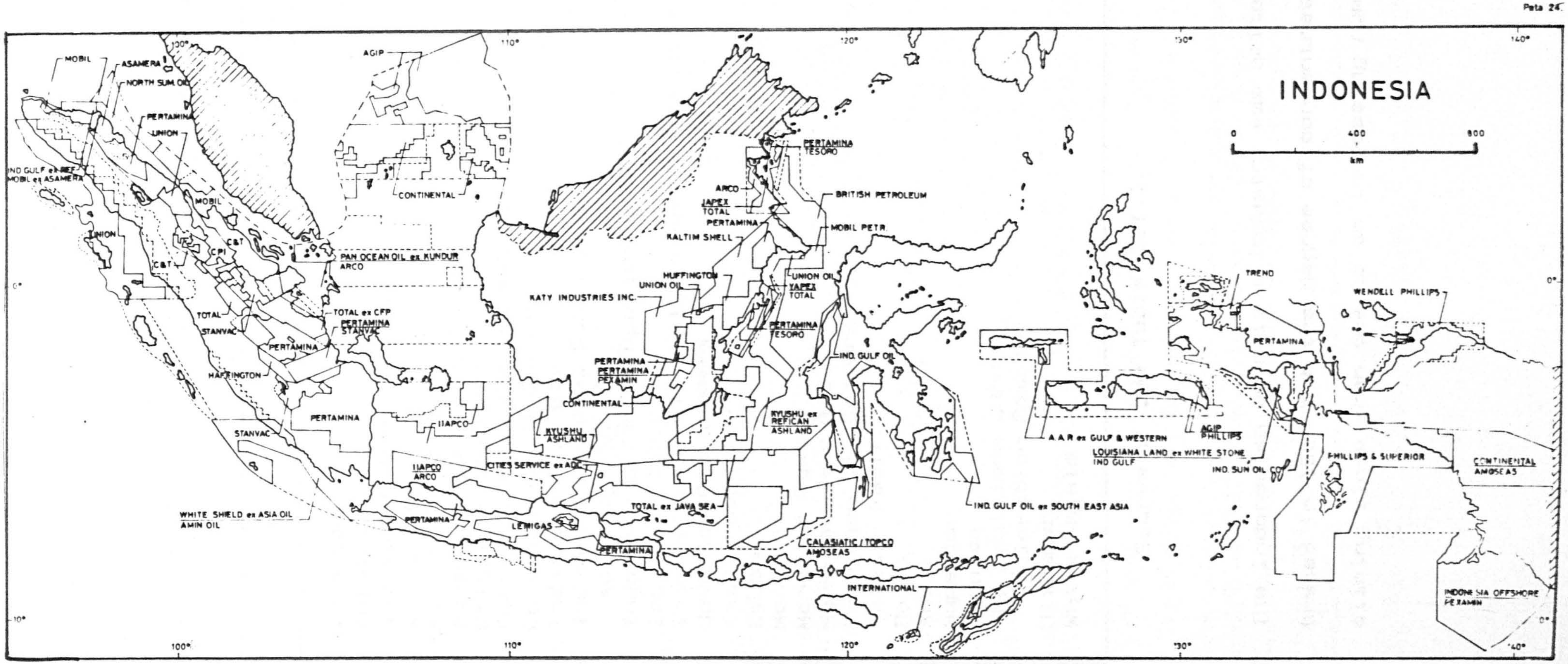
1 Sritua Arief, 'Sektor Minyak : Implikasi Ekonomi dan Pengelolaan Sumber', Prisma, 5, no.4 (May 1976), p.38.

Figure III.1

Oil Operation Map



Source : Ministry of Mining Laporan Tahunan Pertambangan, 1975.

Table III.2 Petroleum Companies Still at The Exploration Stage as of The End of 1976

Company	Location of Ownership
Agip Spa	Italy
Aminoil	U.S.A.
American Overseas (Amoseas)	U.S.A.
Aquitaine	France
Ashland Petroleum	U.S.A.
Australian Drilling Company	Australia
British Petroleum	United Kingdom
Compagnie Francais Des Petrol	France
Continental Oil Company	U.S.A.
Indonesia Gulf Oil	U.S.A.
Indonesia National Consortium Activity (INCA)	U.S.A.
Indonesia Offshore Operators	U.S.A.
Indonesia Sun Oil	U.S.A.
International Oil Exploration	U.S.A.
Java Sea Oil Company	U.S.A.
Katy Industries	U.S.A.
Kyushu	Japan
Mobil Oil	U.S.A.
Moncrief Pexpac	U.S.A.
North Sumatra Oil	U.S.A.
Pan Ocean Oil Corporation	U.S.A.
Pexamin Pacific	U.S.A.
Redco	U.S.A.
Shell	Netherlands
Superior	U.S.A.
Tenneco	U.S.A.
The Louisiana Land & Exploration Company	U.S.A.
Ultramar	U.S.A.
White Shield	U.S.A.

Source : See Table III.1.

The Indonesian petroleum industry was quite highly concentrated in 1967 but the degree of concentration had been declining since then due to an increasing number of producers.

To show this situation, various concentration indices used to measure industrial concentration were applied to the Indonesian petroleum industry. Before applying these measures, it is useful if their explanation is given first. For this purpose, the following symbols are used :

s_i = market share of the i-th firm in an industry

n = number of firms in an industry

s = normalized vector representing a distribution of the firms' market shares in an industry

G = measure of inequality

K^* = measure of concentration

The following mathematical properties should be observed :

(1) If s_i is the market share of the i-th firm where $s_i > 0$, $\sum_{i=1}^{n} s_i = 1$, and s is the normalized vector of a distribution of the market shares of all firms in an industry, then G should be an increasing function of s.

$$G = f(s)$$

where $$\frac{dG}{ds} > 0$$

(2) K^* should be an increasing function of s and a decreasing function of n,

$$K^* = f(s,n)$$

where $$\frac{K^*}{s} > 0$$

$$\frac{K^*}{n} < 0$$

(3) For a given number of firms a measure of concentration will never be less than the reciprocal of that number and a measure of inequality will never exceed $1 - \frac{1}{n}$, i.e.,

$$1/n < K^* < 1$$

and

$$0 < G < 1 - \frac{1}{n}$$

The following measures of concentration which satisfy the above mentioned mathematical properties were adopted:

a. <u>Hirschman-Herfindahl Index</u>[1]

$$H = \sum_{i}^{n} s_i^2$$

Market shares of the individual firms are used as the weights. The squaring of the s_i's means that the smaller the firm the less will be its weight i in H.

b. <u>Rosenbluth Index</u>[2]

Here the ranks of the firms are used as the weights with the firms ranked in descending under. The i-th firm receive rank i. In this case greater weights

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1 Duncan Bailey and Stanley E. Boyle, "The Optimal Measure of Concentration", <u>Journal of the American Statistical Association</u>, vol.66, no.336, December 1971, pp.702-06.

2 Rosenbluth, G. <u>Concentration in Canadian Manufacturing Industries</u>, Princeton : Princeton University Press, 1957.

are assigned to smaller firms because of its ranking order.

$$R = \frac{1}{(2 \sum_{i}^{n} i\ s_i - 1)}$$

c. Marfels' Index[1] (Modified Entropy Index)

Shares of the individual firms are used as the weights in a weighted geometric mean. This index is defined by Marfels as follows,

$$\hat{E} = \frac{1}{\text{antilog } F(\vec{s})}$$

$$\text{where} \quad F(s) = \sum_{i}^{n} s_i \log(\frac{1}{s})$$

d. Comprehensive Concentration Index

This index was proposed by Horvath[2] and is expressed as follows,

$$CCI = s_i + \sum_{j=2}^{n} s_j^{2} \left[1 + (1 - s_j)\right]$$

$$(i = 1;\ j = 2, \ldots, n)$$

Here s_i represents the market share of the largest

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1 Christian Marfels, "Absolute And Relative Measures of Concentration Reconsidered", Kyklos, vol.24, no.4, 1971, pp. 753-64.

2 J. Horvath, "Suggestion for a Comprehensive Measure of Concentration", Southern Economic Journal, 37 (April 1970), pp.446-52.

firm (which is s_1). The market shares of the smaller firms are represented by $s_2, \ldots\ldots, s_n$. The term $\left[1 + 1(1 - s_j)\right]$ indicates a multiplier.

Table II.3 shows the degree of concentration in the Indonesian petroleum industry measured by various indices mentioned above for selected years during 1967 - 1976 which had been consistently declining.

Table III.3 Concentration in The Petroleum Mining Industry, Selected Years 1967 - 1976 Measured by Various Indices

Year	Number of Firm	Hirschman Herfindahl Index	Rosen-bluth Index	Marfels Index	Comprehensive Concentration Index
1967	4	0.6988	0.6597	0.5404	0.8539
1971	8	0.6663	0.6435	0.5097	0.8360
1973	14	0.5304	0.3823	0.3233	0.7443
1976	19	0.4145	0.2407	0.2231	0.6550

b. Legal Framework

The foreign oil companies operating in Indonesia are grouped into two groups according to the arrangements under which they operate in oil production activities. The first group consists of companies operating under a Contract of Work Scheme and the second group consists of those operating under a Production Sharing Scheme. These schemes are described below.

Stanvac, Caltex and its subsidiary Calasiatic Topco are operating under Contract of Work as well as under Production Sharing Schemes. Up to the end of 1976, there were forty-one foreign companies other than Stanvac, Caltex and Calasiatic-Topco that had signed production sharing contracts with the State Oil Company Pertamina.

The foundation of any contract for oil operations in Indonesia is based on the Petroleum Law 1960, which stipulates that[1] :

(1) All mineral oils and natural gas are national assets controlled by the State and their extraction may be undertaken solely by State Enterprises ;

(2) Mining rights are granted only to State Enterprises ;

(3) The Minister of Mining can appoint another party as contractor for the State Enterprise if it is deemed necessary for the completion of a project which has not yet been, or cannot be completed, by the State Enterprise as holder of the mining rights.

<u>The Contract of Work</u>

As for foreign participation in oil and gas exploration and production activities, article 8 of Law No.1,

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1 Sritua Arief, <u>The Indonesian Petroleum Industry : A Study of Resource Management In a Developing Economy</u>, Jakarta: Sritua Arief Associates, 1976, pp.216-20, 454-85 and Sritua Arief, <u>Financial Analysis of The Indonesian Petroleum Industry</u>, Jakarta : Sritua Arief Associates, 1977, pp.12-4.

1967, on foreign investment stipulates that foreign capital investment in the field of mining shall be based on cooperation with the Government through a Contract of Work, or in another form, in line with the existing regulations.

The main elements of such a contract of work are as follows :

(a) The mineral natural resources remain the inalienable property of the State ;

(b) Mining rights remain in the hands of the Government or State Enterprises ;

(c) The foreign participant has the status of contractor ;

(d) Costs incurred by the contractor in implementing the contract are compensated for in the form of the mining product or in foreign currency from the sales of the mining product ;

(e) The Government and the foreign contractor will agree upon the division of the net operating income between both of them ; provision has to be made on the minimum Government profit share from the operation ;

(f) Tools, equipment and installation are recognized as the contractor's property ;

(g) The foreign participant has full responsibility for the assigned areas and installations, including transportation and export of their share of crude oil. Thus the contracting company pays all the exploration, development and operating expenses and bears the risk.

(h) The foreign participant pays 60 per cent of net operating income in foreign exchange to the State Enterprise, to be transferred to the Government. This share is based on the Company Tax Schedule in Indonesia. Beginning from January 1, 1974, a New Deal was set up by the Government with regard to the Government share in the profits of foreign oil companies operating under Contract of Work. This new deal can be explained as follows :

At base price US$ 5.00, the profit split is : 60% for the Government, 40% for foreign oil company. If the export price is higher than the base price, the profit split is 85% for the Government and 15% for the company.

Furthermore if the production level reaches 150,000 barrels per day, the profit split will become 90% for the Government and 10% for the company and if it reaches 250,000 barrels per day the profit split of 95% for the Government and 5% for the company will be adopted.

(i) The foreign participant delivers 25 per cent of the crude (19 per cent "pro rata", 6 per cent in addition) to the State Enterprise on a cost plus fee basis.

Production Sharing Contracts

The production sharing scheme has gone through several modifications since its implementation in 1967.

The following were the main elements of the Production Sharing Contracts and its modifications up to the end of 1975 :

(a) The foreign companies starting exploration are to receive 40 per cent of the crude oil to cover their costs of exploration, development and production.

(b) The production split of the other 60 per cent of the crude oil was 65% (Pertamina) and 35% (Foreign Company).

Beginning in January 1974, in order to compensate for the increase in profits as the results of oil price increase, the production split was modified. The original agreed production split of 65 - 35 in most production sharing contracts now applies only to the first US$ 5.00 a barrel realized in the market (tied to an inflation index).

In 1975 a further modification was made in production sharing contracts in which any amount realized in excess of the US$ 5.00 base barrel the Pertamina's share increases to 85% for production up to 150,000 barrels per day, 90% for production between 150,000 -

250,000 barrels per day and 95% for production over 250,000 barrels per day. The base production split was then changed to 72.5% (Pertamina) and 27.5% (Foreign Company) on new production sharing contracts.

(c) The State Enterprise shall be responsible for the management of the operations.

(d) The foreign company shall carry the risk of the operating cost required for the operation. However, all expenses can be paid when commercial production has begun.

(e) Maxima of 10 years exploration period and 20 years exploitation period are allowed to foreign companies.

(f) To ensure continuous exploration efforts, certain portions of the original area have to be relinquished after certain periods.

(g) The foreign companies are required to state the minimum expenditures they are willing to make.

(h) All assets would be the property of the State Enterprise. This rule, however, would not apply to properties of any subcontractor which may be freely imported and exported from Indonesia.

Depending on the favourable and competitive conditions of the applied area, the Government may request among other things :

(1) Bonus (signature bonus and/or production bonus)

(2) A more favourable share division of oil

(3) Investment in downstream operations after a certain of production is reached (refineries, tankers, etc.)

(4) Increase of minimum expenditures

(5) Service to Indonesian consumers

(6) A maximum amount of expenses which may be charged to the operation annually

(7) The foreign companies have the right to sell, assign, transfer, convey or otherwise dispose of any part of their rights and interests under the contract to parties other than affiliated companies with the prior written consent of the Government, which consent shall not be unreasonably withheld.

(8) There may be direct Indonesian equity participation if the foreign companies commence commercial production

(9) The foreign companies must provide crude oil on a "pro rata" basis for domestic consumption reimbursable at US$ 0.20 per barrel in proportion to their share of total production.

It will be useful to present here more details about the production costs allowed to be reimbursed under Production Sharing Contract which include rental payments to Pertamina for property imported by the foreign oil company, depreciation on such property, any costs incurred by Pertamina to assist and expedite the foreign oil company's execution of the work program, personnel expenses, general and administrative expenses, buildings, rental of equipment from third parties, transportation, contract services, insurance claims, and other expenditures incurred by the foreign oil company for the necessary and proper conduct of its obligations under the contract. Financing costs such as interest charges and other related costs are excluded as these are considered to be Head Office costs of the foreign oil company in view of the fact that the operations are financed by external sources.

Foreign oil companies reportedly circumvent the prohibition against including interest payments as operating cost for borrowing funds from their head offices or affiliates by including the interest charge in the purchase price of goods or services from them[1].

This deliberate inflating of operating costs by the foreign oil companies to get the recoverable sum from the crude oil value was also observed by the World Bank mission in Indonesia when it commented about the payments made to foreign oil companies (production costs and factor payments) in 1973 as follows :

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1 Robert Fabrikant <u>Legal Aspects of Production Sharing Contracts In The Indonesian Petroleum Industry</u>, Singapore: Institute of Southeast Asian Studies, 1973.

> These payments may reach $1.70 per barrel in 1974, far in excess of comparable payments by other countries ....
> ....
> The high apparent "takes" of the foreign companies need thorough investigation to make sure that the incentives being given to those companies are not excessive as compared to those offered by other countries.[1]

These observations on the recoverable costs of production and Pertamina's financial crisis and its solution which had a negative effect on the country's financial position were the main reasons for the review of the production-sharing agreement at the later part of 1975 in order to produce its revised version for a better government's take of the oil revenue. The new model of production sharing agreement was effective as of 1 January 1976.

This new model of production sharing contracts contains, among other things, the following new clauses :

[1] The recoverable operating costs consist of current year's non-capital costs, current year's depreciation for capital costs and current year's allowed recovery

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1 International Bank For Reconstruction And Development, Indonesia : Economic Report, November 30, 1973, p.16. As to similar practices by oil companies in other parts of the world, see for example Zuhayr Mikdashi, A Financial Analysis of Middle Eastern Oil Concessions : 1901-65, New York : Praeger, 1966, p.49; Edith T. Penrose, The Large International Firm in Developing Countries : The International Petroleum Industry, London : George Allen and Unwin, 1968, pp.43-6.

of prior year's unrecovered operating costs.

(2) A reasonable annual allowance for depreciation of capital costs will be allowed as a recoverable operating cost for the current year. The method used to calculate each year's allowable recovery of capital costs is the double declining balance method. The life over which depreciation is to be calculated is the "asset guideline life" set forth in the United States tax regulations, subject to Pertamina modifications. The life to be used for production sharing contractors with reserves having a life of seven years or less is half (50%) of the lives described above. A switchover to the straight line method is allowed whenever it becomes advantageous to the contractor.

(3) Before the beginning of each year of production, the contractor's proven reserves will be divided by the estimated production for the following year to determine the life of reserves.

(4) Interest will be allowed as a recoverable operating cost as long as financing is provided by non-affiliates.

(5) Operating costs incurred for the joint production of both natural gas and oil will be allocated to natural gas and oil based on the relative value of products produced for the current year.

[6] The costs of items purchased for inventory will not be recoverable until those items are actually used up in the operations.

[7] All non-capital costs incurred prior to the year of commercial production will be allowed as recoverable in equal instalments over a ten-year period if the life of reserves is more than seven years. If the life of reserves is seven years or less, the non-capital pre-production costs will be recoverable in equal instalments over five years.

[8] All capital pre-production costs will be capitalized and depreciated over fourteen years on a double declining balance basis if the life of reserves is more than seven years. If the life of reserves is seven years or less, the capital pre-production costs will be depreciated over seven years using the same method of depreciation.

[9] Interest will be paid by Pertamina to the contractor at the rate of eight per cent on the scheduled unamortized non-capital pre-production costs balance at the beginning of each year of amortization.

[10] The oil contractor should pay directly to the Government the Indonesian corporate taxes based on the full value of the output produced minus cost recovery.

[11] The oil contractor should pay the Government through

Pertamina other taxes such as transfer tax, import and export duties on materials, equipment and supplies brought into Indonesia.

[12] The crude oil remaining after deducting operating costs will be divided as follows :

[a] 65.91% to Pertamina

[b] 34.09% to Foreign Contractor

As it was understood that the foreign oil contractor would pay a corporate tax of 45 per cent of the value of the crude minus costs of production as well as a dividend tax amounting to 20 per cent of its share of the crude[1], the final Government/Pertamina take of the net crude oil would be 85 per cent while that of foreign contractor would be 15 per cent. This division of crude can be explained as follows :

X = Value of crude produced after deducting production costs and other deductions.

G^* = Government's/Pertamina's final share of the net crude

X_1 = Foreign contractor's final share of the net crude

p = Pertamina's share of crude after deducting production costs [65.91%]

q = Foreign contractor's share of crude after deducting production costs [34.09%]

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1 Guy Sacerdoti "Paying One's Taxes", Petroleum Economist, December 1976, p.13.

$$d = \text{Dividend tax rate } (20\% \text{ of } q)$$

$$\begin{aligned} G^{*} &= 0.45X + 0.6591\,(X - 0.45X) + 0.20\,[0.3409\,(X - 0.45X)] \\ &= 0.45X + 0.36X + 0.04X \\ &= 0.85X \end{aligned}$$

$$\begin{aligned} X_1 &= 0.3409\,(X - 0.45X) - 0.20\,[0.3409\,(X - 0.45X)] \\ &= 0.19X - 0.04X \\ &= 0.15X \end{aligned}$$

II. Resources and Production

This section deals with the geological aspects of the Indonesian petroleum production, the reserve position of petroleum resources, and the exploration and production activities. The production section covers production trends, location of production and disposition of output.

I. Geological aspects and the reserve position of petroleum resources

a. Geological aspects[1]

Crude oil producing areas in Indonesia are divided geologically into two areas, namely, Western Indonesia

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1 This section is based on the following works :
a) A.Pulunggono, 'Recent Knowledge of Hydrocarbon Potentials in Sedimentary Basins of Indonesia', in Michel J. Halbouty, et.al. eds Circum-Pacific Energy and Mineral Resources, Tulsa, Oklahoma : American Association of Petroleum Geologist, 1976, pp.239-49 and

and Eastern Indonesia. Western Indonesia which includes Sumatra, Java and Kalimantan, is chiefly an area of Tertiary sedimentary deposition while Eastern Indonesia which includes Sulawesi, Halmahera, Seram, Timor, the islands of the Banda area and Irian Jaya, is mainly the site of late Paleozoic and Mesozoic sedimentation.
The chief crude oil production in Western Indonesia is from the sandstones series of Oligocene-Miocene age, except in East Kalimantan, where producing zones range from Eocene to Pliocene. In Eastern Indonesia, the chief crude oil production is in Tertiary basins of miogeosyncline form. Up to the end of 1975, there were twenty eight Tertiary basins which were already identified containing about 15.4 million cubic kilometres of Tertiary sediments. Table III.4 shows the names of Indonesia's Tertiary basins along with their areal extent, average sediment thickness and approximate volume of preserved Tertiary sediments and their age groups.
The Tertiary sedimentary basins of the Indonesian main oil producing areas are classified into the following :

(1) Outer-arc basins ;

(2) Foreland basins ;

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b) G.L. Fletcher and R.A. Soeparjadi, 'Indonesia's Tertiary Basins : The Land of Plenty', paper presented at Offshore Southeast Asia Conference, Singapore, 19 February, 1976, pp.1-54.

(3) Cratonic basins ;

(4) Inner-arc basins

Outer-arc basins are those which form along major crustal plate boundaries adjacent to subduction zones. Foreland basins are those which develop primarily at the edge of cratonic plates. Cratonic basins are those basins which occur entirely on the cration. Inner-arc basins are the youngest Tertiary basins which are formed by foundering or rifting apart on oceanic and/or continental crust. Figure III.2 shows the location of Indonesia's Tertiary basins and Figure III.3 shows the classification of Indonesia's Tertiary basins.

Knowledge of these sedimentary basins is based on the data collected in oil exploration in recent years. The following summarizes the occurence of crude oil deposits in Indonesia :

(a) The Oligocene-Miocene facies of the North Sumatra basins which developed from changes from restricted-marine to carbonate, to deltaic-coastal, to supra-littoral facies. These changes in facies led to possibilities of stratigraphic oil traps.

(b) The pre-Tertiary rocks which constitute the basement of Central Sumatra, South Sumatra and Northwest Java basins which prevailed prior to the time of the major transgression provides favourable sites for sedimentation of hydrocarbons.

(c) The limestone formation in South Sumatra and East Java basins (middle Miocene to Pliocene limestones) had created a favourable situation for hydrocarbon reservoirs.

(d) The late Miocene to early Pliocene extensive deltaic sedimentation system of the East Kalimantan basins is the postulated basis for hydrocarbon occurence in these areas.

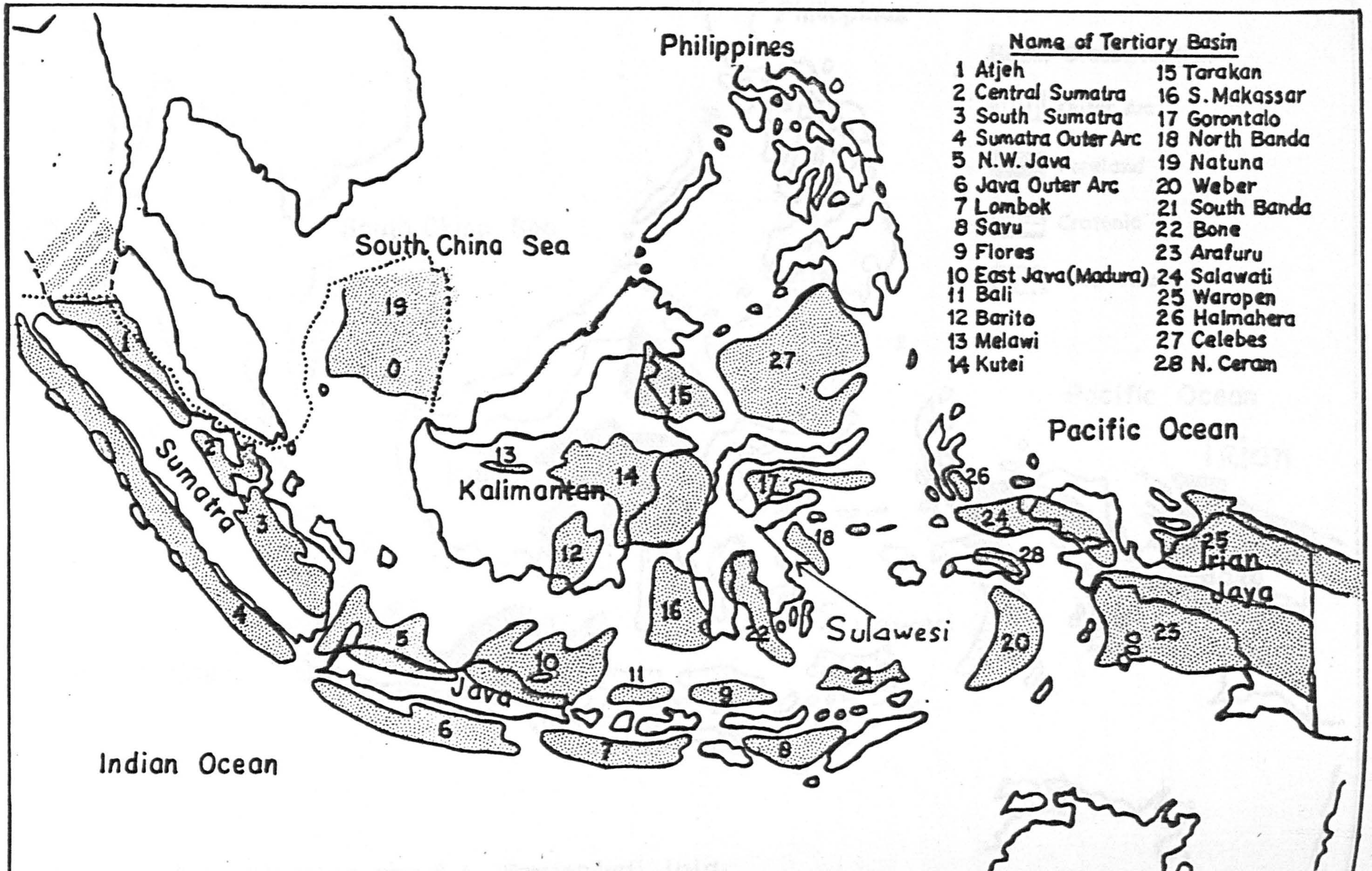
(e) The middle Miocene reefs which developed into carbonate facies in Irian Jaya basins are the foundation for hydrocarbon accumulations.

Based on this hydrocarbon formation analysis, the best prospects for petroleum are in the foreland basins of Sumatra and Java, the extensive delta system of East Kalimantan basins, the Tertiary reefs areas of northwest Irian Jaya and the Tertiary basins within the unstable shelf area southeast of Irian Jaya. In addition to these areas, the Plio-Pleistocene sedimentary basins in Timor and Seram and the Eocene and Miocene sediments of some other islands in the Moluccas are likely to be future areas for petroleum prospecting. Figure III.4 shows the location of hydrocarbon potentials of Indonesian Tertiary basins.

Table III.4 Tertiary Sediment Volume, Distribution & Average Thickness

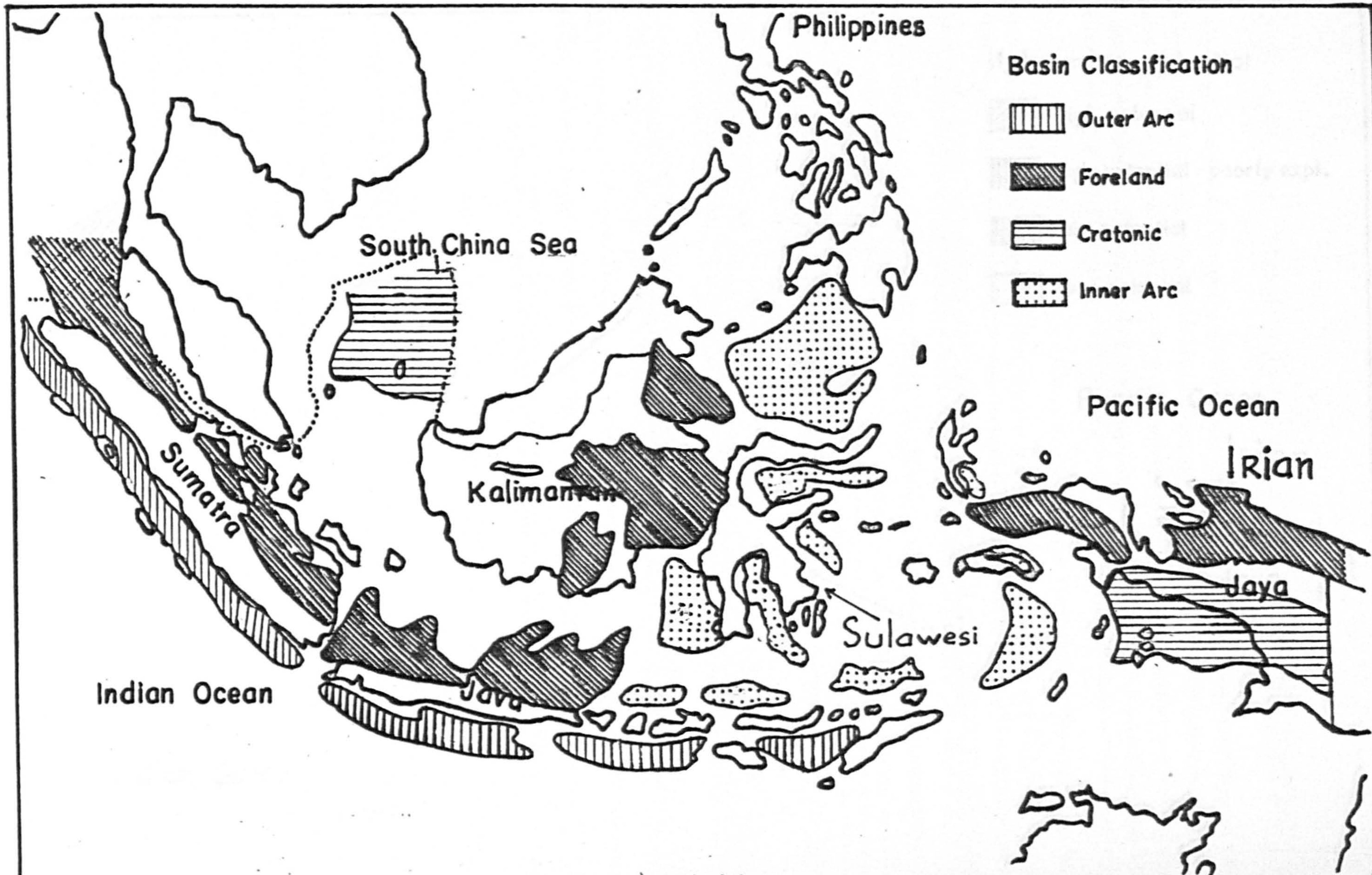
	Basin Name	Ave.thickness of Tertiary sed. (M km)	Areal extent w/1500 M sed. removed(M km2)	Total vol. Tert. sed. (M km3)	Vol. Upper Miocene and younger % section	Vol. Upper Miocene and younger (M km3)	Vol.Middle Miocene and elder % section	Vol.Middle Miocene and elder (M km3)
1	Atjeh (North Sumatra)	3.0	86.9	260.7	40	106.8	60	156.4
2	Central Sumatra	2.0	26.3	52.6	40	21.0	60	31.6
3	Palembang (South Sumatra)	2.5	46.9	111.2	30	35.2	70	82.1
4	Sumatra Outer Arc	3.5	242.8	849.8	30	254.9	70	549.9
5	N. W. Java	2.0	53.2	106.6	45	48.0	55	58.6
6	Java Outer Arc	4.0	117.8	471.2	30	141.4	70	329.8
7	Lombok	0.8	68.9	55.1	100	55.1	0	
8	Savu	3.4	49.2	167.3	60	100.4	40	66.9
9	Florea Bain	0.8	27.4	219.2	100	219.2	0	
10	East Java	2.8	146.8	411.1	30	123.3	70	287.8
11	Bali	3.0	22.9	68.7	100	68.7	0	
12	Barito	3.2	38.1	121.9	30	36.6	70	85.3
13	Melawai	2.5	9.2	23.0	5	1.1	95	21.8
14	Kutei	5.0	165.7	828.5	40	331.4	60	497.1
15	Tarakan	3.0	42.1	126.3	60	75.8	40	50.5
16	South Makasar	1.5	84.2	126.3	40	50.5	60	75.8
17	Gorontalo	2.9	34.7	100.6	100	100.6	0	
18	North Banda	2.2	19.4	42.7	100	42.7	0	
19	Natuna Basis	1.0	7.3	7.3	30	2.2	70	5.1
20	Weber	0.5	38.1	19.0	100	19.0	0	
21	South Banda	2.1	29.0	60.9	100	60.9	0	
22	Bone Basin	3.0	33.1	99.3	90	89.4	10	10.0
23	Arafura	4.0	268.6	1074.4	40	429.8	60	644.6
24	Salawati	3.0	33.1	99.3	20	19.9	80	79.4
25	Waropen	4.0	65.8	263.2	80	210.6	20	52.6
26	Halmahera	4.0	15.5	88.0	100	88.0	0	
27	Celebes	1.5	210.8	316.2	100	316.2	0	
28	North Ceram	2.5	7.3	18.2	100	18.2	0	
				6188.6		3066.9		3128.1

Figure III.2 Index of Indonesian Tertiary Basins



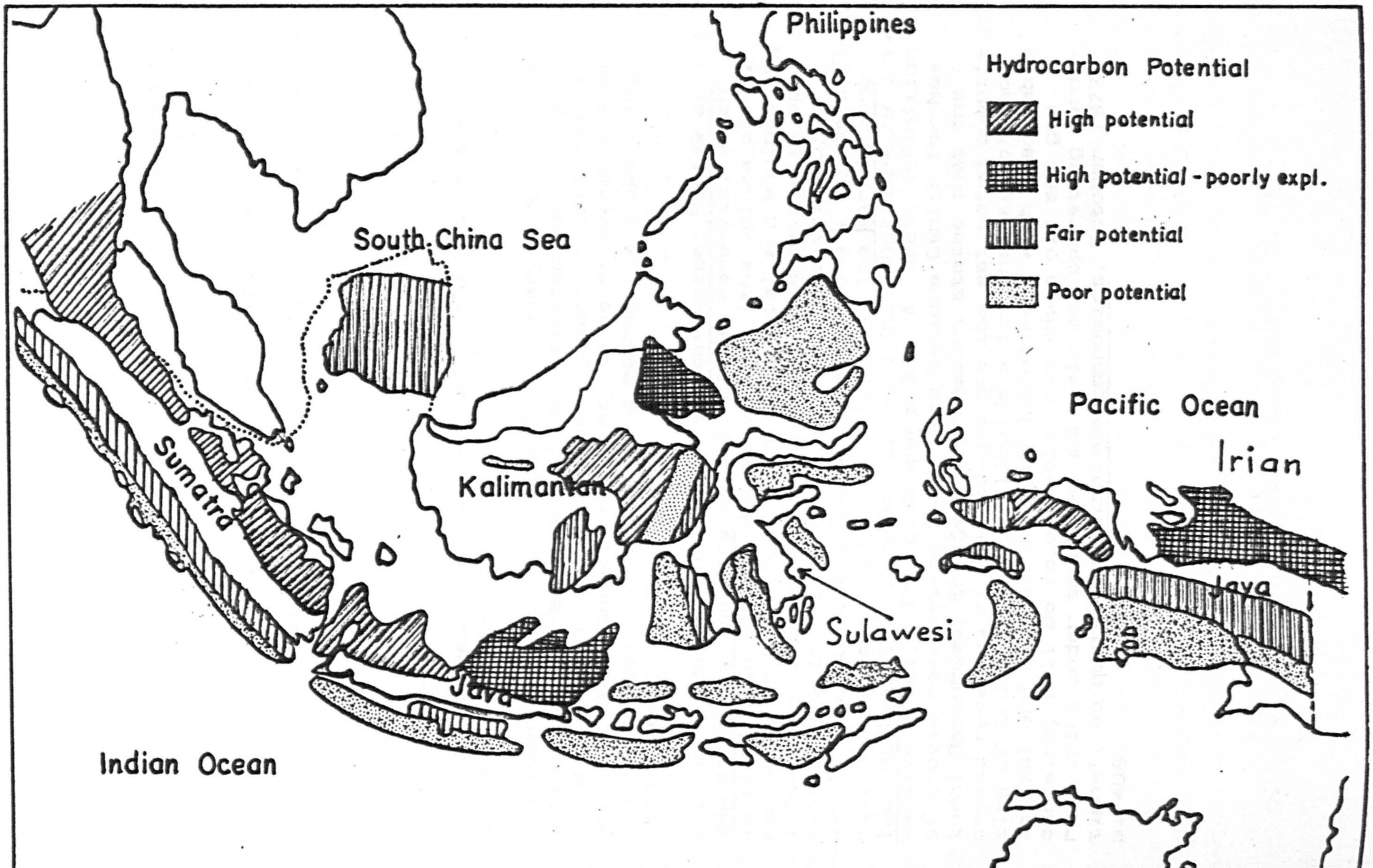
Source : G.L. Fletcher and R.A. Soeparjadi ibid.

Figure III.3 The Classification of Indonesia's Tertiary Basins



Source : G.L. Fletcher and R.A. Soeparjadi ibid.

Figure III.4 Hydrocarbon Potential of Indonesian Tertiary Basins



Source : G.L. Fletcher and R.A. Soeparjadi ibid.

b. Reserve Position

Indonesian crude oil resources are considered to be the largest in the Far East/Pacific Basin but they are small in relation to those in the Middle East or Latin America. In 1969 Indonesia's proved oil reserves[1]

1 Proved reserves have been defined by the authoritative bodies as follows :

American Petroleum Institute in its every Annual Report defines proved reserves as 'the estimated quantities of crude oil which geological and engineering data demonstrate with reasonable certainty to be recoverable from known reservoirs under existing economic and operating conditions'.

British Petroleum in its annual Statistical Review of the World Oil Industry defines proved reserves, which is similar to the API definition, as 'the volume of oil remaining in the ground which geological and engineering information indicates with reasonable certainty to be recoverable in the future from known reservoirs under existing economic and operating conditions'. These definitions are as quoted in M.A. Adelman The World Petroleum Market, Baltimore and London : The Johns Hopkins University Press, 1972, p.26 and p.33. A recent definition of proved reserves by the United Nations Center for Natural Resources, Energy and Transport states that the proved reserves of oil and gas are the estimated quantities of crude oil or gas liquids which analyses of geological and engineering data demonstrate with reasonable certainty will be recoverable from known oil and gas reservoirs under specified economic and operating conditions', as quoted in Petroleum Economist, October 1977, p. 408.

were estimated to be around 9 billion barrels. The sudden increase in exploration and production activities after 1969 have led to a substantial increase in the estimated proved reserves of crude oil which, by the beginning of 1976, were estimated to be 14 billion barrels.

Table III.5 Estimated Proved Reserves of Indonesia's Crude Oil, Beginning of 1969 and 1976

(in billion barrels)

Beginning of Year	Proved Reserves
1969	9
1976	14
Percentage change	56

Source : Oil and Gas Journal, December 1969 and December 1975.

The estimated probable reserves could be substantially higher than the proved reserves figure due to the existence of extensive prospective oil areas which have not yet been explored. Up to the end of 1976 only 20 per cent of the total oil exploration area of 2.9 million square kilometres in Indonesia has been thoroughly investigated[1].

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1 Adimir Adin, "Peranan Minyak Dalam Pembangunan Ekonomi Indonesia', Prisma, 5, no.4 (May 1976), p.9.

c. Exploration

Exploration for hydrocarbons in Indonesia began in the late 1800's and production from Tertiary sediments in various parts of Indonesia started soon after Drake's historic well in the United States. Most of the producing areas found at that time were still producing small amounts of crude oil. It is estimated that about 3 per cent of Indonesia's current crude oil production can be attributed to discoveries made before 1930[1].

A modern "onshore exploration period" which covers the period from 1930 through 1967 resulted in major discoveries in Sumatra, Irian Jaya and Kalimantan. These discoveries, which include such giant fields as Minas and Duri in Central Sumatra, presently contribute almost 50 per cent of the total Indonesia's crude oil production.

The next exploration period known as "offshore period" which is the current phase of exploration encompasses a period from 1967 to the present. Although so named, this period includes also extensive onshore operations in remote areas made possible by transportable modern drilling equipment. This is the era of Production Sharing Contract, under which the number of oil

1 G.L. Fletcher and R.A. Soeparjadi op.cit., p.49.

operating companies in Indonesia proliferated from 12 in 1967 to 46 in 1976. All of this activity had resulted in discovery of substantial amounts of new reserves and new production.

Older production, i.e. pre-1930, was largely from Plio-Pleistocene sediments[1]. Discoveries in the modern onshore period were mostly in Miocene sandstones[2]. These discoveries continue but, recently, carbonates had become a significant source of oil[3]. With the commencement of production from carbonates in various parts of Indonesia, it is apparent that a sizeable percentage of Indonesia's future crude oil production, and possibly future discoveries, will come from carbonates[4].

It is useful in this context, to present briefly the success of the exploration activities in the Indonesian petroleum industry since the new exploration era started in 1967. Due to unavailability of complete data on exploration activities, only data from 1969 to 1976 are presented here. In the period 1969 to 1976, there were 1,252 new wells drilled from exploration, mostly offshore. The number of new exploration wells drilled

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1 ibid. p.50.

2 ibid.

3 ibid.

4 ibid.

increased from 52 wells in 1969 to 231 wells in 1974 but declined to 182 wells in 1975 and declined further to 142 wells in 1976. The latter decline was probably due to the fall in the world market for oil in 1975 following economic recession in industrialized countries. The improvement in world demand for oil in 1976 and the revision instituted by Pertamina on Indonesian crude oil prices which restored a measure of competitiveness to Indonesian crude oil seemed not to have caused an expansion in the exploration activities in 1976. The new production sharing scheme introduced by the government in 1976 which might lead to a higher uncertainty in oil operation in Indonesia was probably the reason for a decline in new exploration activities in this year. Table III.6 shows the development of the exploration activities during 1969 - 1976 in terms of number of new exploration wells drilled. Table III.7 shows the cumulative footage of all exploration wells drilled in the same period.

The cumulative exploration drilling totaled 227,058 feet in depth in 1969, increasing to 1,794,483 feet in 1974 but declining to 1,631,671 feet in 1975 and 1,549,699 feet in 1976. In general, changes in total footage drilled were not so much proportional to the number of wells drilled as the drilling capacity of the drilling equipment had increased over time.

Table III.6 New Exploration Wells Drilled, 1969 - 1976

Year	Number of New Wells Drilled
1969	52
1970	109
1971	164
1972	167
1973	205
1974	231
1975	182
1976	142

Source : Pertamina and Ministry of Mining Petroleum & Natural Gas Industry of Indonesia, various issues.

Table III.7 Cumulative Depth of Exploration Wells Drilled, 1969 - 1976

(in feet)

Year	Cumulative Depth (in feet)
1969	227,058
1970	475,949
1971	716,106
1972	729,206
1973	1,176,479
1974	1,794,483
1975	1,631,671
1976	1,549,699

Source : See table III.6.

Before 1970, the average well drilled in Indonesia was less than 10,000 feet deep but after 1970 depths below 13,000 feet were not uncommon[1].

During 1969 - 1976, petroleum and gas exploration showed a remarkable success rate as indicated by the percentage of wells yielding crude oil or gas to total new wells drilled as shown in table III.8.

Table III.8 Success Rates of Oil and Gas Exploration, 1969 - 1976

(in percentage)

Year	Number of Wells Drilled	Number of Successful Exploration & Delineation Wells			Success Rate (in percentage)			
		Oil	Gas	Oil & Gas	Oil	Gas	Oil & Gas	Total
1969	52	4	-	-	7.7	-	-	7.7
1970	109	17	4	-	15.6	3.7	-	19.3
1971	164	26	5	1	15.9	3.1	0.6	19.6
1972	167	33	13	8	19.8	7.8	4.8	32.4
1973	205	43	13	11	21.0	6.3	5.4	32.7
1974	231	26	15	12	11.3	6.5	5.2	23.0
1975	182	33	23	15	18.1	12.6	8.2	38.9
1976	142	31	7	5	21.8	4.9	3.5	30.2

Source : See table III.6.

1 Soediono and C.P. Loucks, "Progress of Oil and Gas Development in Indonesia", paper presented at The Offshore Southeast Asia Conference, Singapore, 19 February 1976, p.2.

Greatest success occurred in 1975 with a 38.9% overall success rate for oil and gas. Taking oil alone the highest success rate was in 1973 and that of gas alone in 1975. The success rates of these findings were respectively 21% and 12.6%. The simultaneous discovery of oil and gas had greatest success in 1975 with a rate of success of 8.2%.

d. Production

Production Trends of Crude Oil

Between 1961 and 1967, the production of crude oil grew at the annual rate of 2.91 per cent. Since 1967

Table III.9 Crude Oil Production, 1961 - 1976
(in thousands of barrels,1961=100)

Year	Production	Index
1961	156,696	100.00
1962	158,219	100.97
1963	164,681	105.10
1964	169,774	108.35
1965	177,006	112.96
1966	170,524	108.82
1967	186,138	118.79
1968	219,864	140,31
1969	270,942	172.91
1970	311,552	198.82
1971	325,649	207.80
1972	395,560	252.44
1973	488,536	311.78
1974	501,838	320.27
1975	476,855	304.32
1976	550,319	351.20

Source : See table III.6.

after the discoveries of new oil fields onshore and off-shore, the production grew at 12.80 per cent. Using 1961 production as the basis, the production of crude oil during 1961 - 1976 had increased more than three folds as shown in Table III.9. The steady growth of production during this period was observed as evidenced from the statistically significant coefficient of time variable and high R^2 in the fitting of the exponential curve to production data. The fitting of the Gompertz trend curve which was superior to the exponential curve showed an increasing rate of growth of crude oil production between 1961 and 1976[1]. Until 1972, more than 90 per cent of Indonesia's crude oil production was located in Sumatra (North, Central and South Sumatra), as shown in Table III.10. After 1972 a regional shift in production occurred and in 1973, Sumatra's crude production declined to 86 per cent of the total Indonesia's crude production, falling further to 79 per cent in 1974, 75 per cent in 1975, and 63 per cent in 1976.

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1 The exponential curve fitted was $\text{Log}_e\, P^c_t = a + b\,t$, where P^c is crude oil production and t is time. The regression results are as follows :

Intercept = 11.6733 Coefficient of t = 0.0964

Standard Error of t = 0.0067 R^2 = 0.9370 D = 0.1899

The following is the fitted Gompertz curve :

$$P^c_t = 67{,}507.906(2.170)^{1.080^t}$$

$$D = 0.1503$$

The rate of growth of crude oil production based on the Gompertz curve increased from 1.46 per cent during 1962-1963 to 19.50 per cent during 1975-1976.

Table III.10 Crude Oil Production By Producing Areas, 1967 - 1976

(in thousands of barrels)

Year	Producing Areas				Total
	Sumatra	Java	Kalimantan	East Indonesia/ Irian Jaya	
1967	181,485 (97.5)	372 (0.2)	4,281 (2.3)	-	186,138
1968	214,367 (97.5)	440 (0.2)	5,057 (2.3)	-	219,864
1969	263,457 (97.2)	535 (0.2)	6,950 (2.6)	-	270,942
1970	302.740 (97.2)	541 (0.2)	7,775 (2.5)	496 (0.1)	311,552
1971	315,232 (96.8)	3,187 (0.9)	7,217 (2.0)	1,013 (0.3)	325,649
1972	375,943 (95.0)	11,194 (2.8)	7,408 (1.9)	1,015 (0.3)	395,560
1973	419,374 (85.8)	31,134 (6.4)	33,602 (6.9)	4,426 (0.9)	488,536
1974	398,307 (79.4)	44,629 (8.9)	46,894 (9.3)	12,009 (2.4)	501,838
1975	358,863 (75.3)	36,211 (7.6)	58,127 (12.2)	23,654 (4.9)	476,855
1976	346,664 (63.0)	79,759 (14.5)	92,207 (16.8)	31,489 (5.7)	550,319

Note : The figures in the parentheses below the production figures corresponding to producing areas indicate the percentage of the total production contributed by each one of them.

Source : Derived from production figures released by Pertamina and Ministry of Mining for various years. See table III.6.

The decline in Sumatra's share occurred because of new oil findings in other areas, i.e. Java, Kalimantan and Irian Jaya.

No production was carried out offshore until 1971. Off-shore crude production constituted 1.2 per cent of total crude production in 1971 and increased to 18.2 per cent in 1974, but declined to 17.4 per cent in 1975 and 14.4 per cent in 1976. This decline was due to the higher increase in onshore production. Table III.11 shows the percentage of crude oil production during 1967 - 1976 from onshore and offshore operations.

Table III.11 Onshore and Offshore Crude Oil Production, 1967 - 1976 (in percentage)

Year	Onshore	Offshore	Total
1967	100.0	-	100.0
1968	100.0	-	100.0
1969	100.0	-	100.0
1970	100.0	-	100.0
1971	98.8	1.2	100.0
1972	93.5	6.5	100.0
1973	86.0	13.1	100.0
1974	81.8	18.2	100.0
1975	82.6	17.4	100.0
1976	85.6	14.4	100.0

Source : Derived from table III.10

It is of interest to see the contribution made by foreign and national companies in Indonesia's total crude oil production. Foreign oil companies have been the largest contributor in Indonesia's total crude oil production. The share of foreign oil companies in total production during 1967 - 1976 has been steadily around 90 per cent. This situation has logically produced substantial repercussions in Indonesia's balance of payments. Table III. 12 shows the contribution made by foreign and national oil companies to total crude oil production during 1967 - 1976. This table shows that the share of foreign oil companies in total crude oil production increased from 85 per cent in 1967 to 94 per cent in 1976.

Disposition of Crude Oil

Indonesia's crude oil has been sold largely for export, but some has been refined in domestic refineries and processed on contract to Indonesia in Singapore. This section, concerns crude oil exporting and refining.

1. Crude Oil Export

About 82 per cent of Indonesia's crude oil production was exported in 1976, having increased from 70 per cent in 1969, and 56 per cent in 1961. The trend has been in favour of export in crude form rather than in refined form. Table III.13 shows the crude

Table III.12 **Contribution By Foreign and National Oil Companies to Total Crude Oil Production, 1967 - 1976**

(in thousands of barrels)

Year	Foreign Oil Companies	National Oil Companies	Total Production
1967	153,967 (85.0)	27,171 (15.0)	181,138
1968	187,104 (85.1)	32,760 (14.9)	219,864
1969	235,300 (86.8)	35,642 (13.2)	270,942
1970	279,327 (89.7)	32,225 (10.3)	311,552
1971	292,909 (89.9)	32,740 (10.1)	325,649
1972	364,231 (92.1)	31,329 (7.9)	395,560
1973	451,488 (92.4)	37,048 (7.6)	488,536
1974	461,333 (91.9)	40,505 (8.1)	501,838
1975	443,959 (93.1)	32,896 (6.9)	476,855
1976	517,483 (94.0)	32,836 (6.0)	550,319

Note : The figures in the parentheses below the production figures corresponding to foreign oil companies and national oil companies indicate the percentage of the total production accounted for by each one of them.

Source : see table III.10.

oil export volume and the percentage of export of crude oil of the total production during 1961-1976. The increasing rate of growth of crude oil was also observed during this period as evidenced in the results of the fitting of the trend curves where the Gomperts curve gave a better fit[1].

Table III.13 Export Volume of Crude Oil, 1961 - 1976
(in thousands of barrels)

Year	Export Volume	Export Volume as % of Crude Oil Production
1961	86,888	55.5
1962	90,269	57.1
1963	92,421	56.1
1964	99.472	58.6
1965	96,329	54.4
1966	94,894	55.7
1967	112,693	60.5
1968	145,475	66.2
1969	188,817	69.7
1970	228,097	73.2
1971	239,585	73.6
1972	299,091	75.6
1973	369,543	75.6
1974	378,905	75.5
1975	363,069	76.1
1976	449,226	81.6

Source : See table III.6.

1 The exponential trend regression fitted was $\text{Log}_e X_t^c = a + bt$, where X^c and t are respectively crude oil export and time. The trend regression results are as follows :

Intercept = 11.0116 Coefficient of t = 0.1250

Standard Error of t = 0.0084 R^2 = 0.9399 D = 0.8481

The fitting of the Gompertz curve which gave better fit to the data showed an increasing growth rate of export. The Gompertz curve fitted was as follows :

$$X_t^c = 75{,}811.100(1.455)^{1.110^t} \qquad D = 0.6236$$

The rate of growth of crude oil export based on the Gompertz curve increased from 9.01 per cent during 1962-1963 to 19.27 per cent during 1975-1976.

The export volume of crude oil in 1975 fell by 4.18 per cent over 1974 due to economic recession in industrialised countries which caused reduction in their demand for oil imports as demonstrated in table III.14.

Table III.14 World Oil Demand and Production, 1 9 7 4 and 1 9 7 5

(in million barrels per day)

Demand and Production	1974	1975
A. World Oil Demand (non-OPEC, non-Communist)	45.3	43.9
United States	16.8	16.3
Japan	5.3	4.7
Western Europe	13.9	13.0
Other	9.3	9.7
B. World Oil Production (non-OPEC)	17.4	17.7
United States	10.4	10.0
United Kingdom	-	-
Norway	-	0.2
Other Western Europe	0.3	0.3
Mexico	5.4	5.9
Brazil	0.6	0.8
Malaysia	0.2	0.2
India	0.1	0.1
Exports from Communist countries	1.3	1.3
C. Demand for OPEC oil exports (A-B)	27.9	26.2

Source : Alexander Caldwell, 'OPEC At End-1975', memo, Morgan Guaranty Trust Company, New York, March 1976.

Indonesia's crude oil exports however rebounded in 1976 which even showed a record high which reflected improvement in worldwide demand for oil. World demand for oil exports from the OPEC countries of which Indonesia was one, was estimated to have declined from 27.9 million barrels per day in 1974 to 26.2 million barrels per day in 1975.

2. <u>Production Trends of Petroleum Products</u>

By the end of 1976, there were eight refineries in Indonesia with a total designed capacity of 425,000 barrels per day (see Table III.15). Table III.16 shows the developments of Indonesia's refinery capacity in selected years between 1961 and 1976. Of eight refineries, seven were operated by Pertamina and one by Lemigas which obtained their crude oil intake from their own sources supplemented by supplies from foreign oil companies who operated under Contract of Work and Production Sharing Schemes, which obliged them to deliver a determined proportion of their production annually.

A small quantity of Middle East crude oil was imported before 1964 for feedstock and since 1974 a small quantity was again imported as feedstock for producing asphalt and certain kinds of lubricants.

Table III.15 <u>The Capacity of Domestic Refineries, As End of 1976</u>

(in barrels of output per day)

Refineries	Location	Owner & Operator	Capacity
Pangkalan Brandan	North Sumatra	Pertamina	3,000
Putri Tujuh	Central Sumatra	Pertamina	100,000
Sungei Pakning	Central Sumatra	Pertamina	50,000
Plaju	South Sumatra	Pertamina	110,000
Sungei Gerong	South Sumatra	Pertamina	79,000
Cepu	East Java	Lemigas	4,000
Wonokromo	East Java	Pertamina	4,000
Balikpapan	East Kalimantan	Pertamina	75,000
Total			425,000

Source : Pertamina

Table III.16 <u>Refinery Capacity, Selected Years, 1961-1976</u>

(in barrels of output per day)

Year	Capacity
1961	273,800
1963	276,800
1969	300,000
1976	425,000

Source : <u>World Petroleum</u>, Annual Refinery Review Issues, vol.32, No.6 (July 1961), pp.83-4 and vol.34, No.8 (July 1963), p.75, <u>Petroleum Times</u>, London. The capacities for 1969 and 1976 are taken from <u>Pertamina's Annual Report</u>, 1970 and <u>Pertamina Bulletin</u>, August 1977.

Although the crude oil production had increased substantially during 1961-1976, the percentage of crude oil processed domestically by domestic refineries declined during this period. There were two main reasons for this situation. First, the high priority given to crude oil export rather than refined products. This was reflected in the decline in utilized capacity of the existing domestic refineries. This decline occurred in spite of their total capacity growth after 1969 which followed the completion of the construction of two new refineries, i.e. Sungai Pakning refinery in Central Sumatra which started production in 1970 and Putri Tujuh refinery also in Central Sumatra which started production in 1971. Secondly, for the period 1973-1976, the processing deal with Shell, Esso and Mobil Oil refineries in Singapore also drew supplies away from domestic refineries. Table III.17 shows the development of crude oil intake by domestic refineries during 1961-1976. The shipment of Indonesia's crude oil as feedstock to Singapore reduced the excess capacity which existed there since 1973[1]. However, this was made at the expense of the capacity of Indonesia's refineries.

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1 See Pauline Khng, 'Excess Capacity in The Refineries', in Singapore Trade and Industry Supplement, February 1976, p.45. Corazon M. Siddayao estimated that in 1975 only 50 per cent of the capacity of Singapore's refineries was

Table III.17 Crude Oil Intake By Domestic Refineries, 1961 - 1976

(in thousand barrels)

Year	Intake[a]	Intake as per cent of[a] total crude production
1961	94,962[b]	60.6
1962	91,785[b]	58.0
1963	84,156[b]	51.1
1964	66,605	39.2
1965	73,131	41.3
1966	72,390	42.5
1967	70,431	37.8
1968	72,374	32.9
1969	76,117	28.1
1970	83,675	26.9
1971	89,970	27.6
1972	100,543	25.4
1973	115,123[c]	23.6[c]
1974	91,924[c]	18.3[c]
1975	75,601[c]	15.9[c]
1976	88,383[c]	14.3[c]

a) Total crude oil production is equal to quantity exported and quantity processed in refineries. This equation may not exactly hold due to loss and depreciation.

b) Before 1964 the intake of refineries also consisted of imported feedstock.

c) Since 1973 a substantial quantity of Indonesia's crude oil has been processed in refineries in Singapore. These figures exclude those quantities processed in these refineries in Singapore. The shipment of crude oil to Singapore refineries totalled 2,647,000 barrels in 1973, 32,997,000 barrels in 1974, 37,778,000 barrels in 1975 and 39,782,000 barrels in 1976.

Source : Pertamina Pertamina Bulletin and Ministry of Mining The Petroleum & Natural Gas Industry of Indonesia, various issues.

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utilized; See Corazon M. Siddayao 'Singapore's Petroleum Sector : A Case Study of the Country's Investment Growth', in Lim Joo-Jock, et.al. eds. Foreign Investment in Singapore : Economic and Socio-Political Ramifications, Singapore : Institute of Southeast Asian Studies, 1977, p.141.

As a result of crude oil exports to Singapore's refineries, Indonesia's refineries became under-utilized. As can be seen from Table III.18, in 1976 only 58 per cent of Indonesia's refining capacity was in use. The capacity utilization factor of domestic refineries, which is measured by dividing daily throughput or crude intake by daily capacity had declined during 1961-1976. It declined from 0.96 in 1961 to 0.58 in 1976. As a result the production of petroleum products produced by domestic refineries showed a very unsteady trend between 1961 and 1976[1]. The coefficient of time in the fitting of the semi-log trend equation was not significant and the related R^2 was very low. Annual output of refineries between 1961 and 1976 fluctuated considerably as shown by its coefficient of variation of 0.15. The output in 1976 was substantially lower than that in 1961 which were respectively 83.3 million barrels and 91.1 million barrels.

A switch-over to the export of crude oil and the decline in capacity utilization of the refineries were

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1 The fitting of the trend regression, $\text{Log}_e P^r_t = a + bt$, where P^r and t are respectively petroleum products production and time, produced the following results :

Intercept = 11.1912 Coefficient of t = 0.0069

Standard Error of t = 0.0079 R^2 = 0.0509 the main factors responsible for the downward trend of the production of the refined products.

The decline in capacity utilization of the refineries had consequently led to the decline in output-capacity ratios. Output-capacity ratio of the refineries which is measured by dividing output per day by capacity per day had dropped from 0.92 in 1961 to 0.55 in 1976 as shown in Table III.18. The development of refinery output during 1961 - 1976 is shown in Table III.19.

Table III.18 Capacity Utilization Factors And Output-Capacity Ratios of Domestic Refineries, Selected Years, 1961-1976

Year	Crude Intake a)	Output b)	Capacity a)	Capacity Utilization Factor	Output Capacity Ratio
1961	263,783	252,950	273,800	0.96	0.92
1963	233,767	206,906	276,800	0.84	0.75
1969	211,436	194,006	300,000	0.70	0.65
1976	245,508	231,514	425,000	0.58	0.55

a) in barrels of crude oil per day
b) in barrels of refinery output per day

Source : Derived from tables III.16 and III.17 (after converting to output per day) and production figures of domestic refineries as released by Ministry of Mining in Petroleum & Natural Gas Industry of Indonesia, various issues.

Table III.19 Output of Domestic Refineries, 1961 - 1976

(in thousand barrels, 1961=100)

Year	Output	Index
1961	91,062	100.00
1962	88,090	96.74
1963	74,486	81.80
1964	64,283	70.59
1965	72,755	79.90
1966	66,425	72.94
1967	63,951	70.23
1968	65,506	71.94
1969	69,842	76.70
1970	73,284	80.48
1971	79,691	87.51
1972	89,508	98.29
1973	103,748	113.93
1974	86,138	94.59
1975	71,268	78.26
1976	83,345	91.53

Source : Pertamina and Ministry of Mining.

Fuels had been the most important products of the domestic refineries, constituting more than 50 per cent of the total refinery output during 1969 - 1976 with the exception of 1973 and 1974 (no data were available prior to 1969) as can be seen in Table III.20.

The energy-mix of local consumption, which was largely oil-based, was reflected in the composition of refinery output which was largely designed for domestic consumption, notably for fuel. However, the share

Table III.20 Domestic Refinery Output By Major Products, 1969 - 1976

(in thousands of barrels)

Year	Fuels	Lubri-cants	Other Products	Total Output
1969	46,797	234	22,811	69,842
	(67.0)	(0.3)	(32.7)	
1970	48,211	917	24,156	73,284
	(65.8)	(1.2)	(33.0)	
1971	47,089	1,030	31,572	79,691
	(59.1)	(1.3)	(39.6)	
1972	47,011	1,181	41,316	89,508
	(52.5)	(1.3)	(46.2)	
1973	45,888	960	56,900	103,748
	(44.2)	(1.0)	(54.8)	
1974	41,863	1,206	43,069	86,138
	(48.6)	(1.4)	(50.0)	
1975	38,627	428	32,213	71,268
	(54.2)	(0.6)	(45.2)	
1976	45.861	750	36,734	83,345
	(55.0)	(0.9)	(44.1)	

Note : The figures in the parentheses below the production figures corresponding to fuels, lubricants and other products indicate the percentage of the total production accounted for by each oneof them.

Source : Ministry of Mining Petroleum & Natural Gas Industry of Indonesia, various issues.

of fuel in total refinery output declined from 67 per cent to 54 per cent between 1969 and 1976. This was probably due to the preference of producing special products, chiefly for export, as they brought more income per unit of output compared to fuel sold domestically which waslargely subject to Government price regulation to protect domestic consumers.

Disposition of Petroleum Products

1. Export

After 1960 the emphasis placed on crude oil export rather than petroleum products was reflected in the export trends. Petroleum products exported dropped from 47.2 million barrels in 1961 to 36.17 million barrels in 1976. The percentage of petroleum products exported to the total export of the petroleum sector's output declined from 35 per cent in 1961 to 8 per cent in 1976 (see Table III.21).

The unsteady trend in refinery output since 1961 had led to the unsteady trend in the export volume of petroleum products[1] as indicated by its coefficient of variation of 0.23. The fitting of the exponential trend curve shows the insignificant time coefficient and very low R^2. Petroleum products exported since 1972 had been entirely non-fuel products such as waxy residue, waxes, white spirits and naptha. No more fuels were exported since 1972 as the output was not sufficient to meet local demand. The production of non-fuel products had been more than sufficient

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1 The following are the results of the fitted regression for petroleum products exports,

$\text{Log}_e X^p_t = a + bt$, where X^p = petroleum products exports and t = time :

Intercept = 10.4113
Coefficient of t = 0.0102
Standard Error of t = 0.0123
R^2 = 0.0473

Table III.21 Export Volume of Petroleum Sector's Output, 1961-1976

(in thousand barrels)

Year	(A) Crude Oil	(B) Petroleum Products	(C) Total Export	B/C
1961	86,888	47,204	134,092	0.35
1962	90,269	43,205	133,474	0.32
1963	92,421	39,227	131,648	0.30
1964	99,472	24,873	124,345	0.20
1965	96,329	30,264	126,593	0.24
1966	94,894	31,700	126,594	0.25
1967	112,693	27,771	140,464	0.20
1968	145,475	27,583	173,058	0.16
1969	188,817	33,881	222,698	0.15
1970	228,097	36,267	264,364	0.14
1971	239,585	33,636	272,727	0.12
1972	299,091	45,979	345,070	0.13
1973	369,543	56,531	426,074	0.13
1974	378,905	44,772	423,677	0.11
1975	363,069	36,654	399,723	0.09
1976	449,226	36,255	485,481	0.08

Source : Table III.13 and Ministry of Mining Petroleum & Natural Gas Industry of Indonesia, various issues.

to meet local market requirements thus making them available for export.

2. Domestic Consumption of Petroleum Products

Fuels, lubricants and asphalt produced in Indonesia and also those processed in Singapore under contract to Indonesia were entirely used for domestic consumption in Indonesia. The demand for these products in Indonesia exceeds the domestically produced supplies. This in recent years had been largely due to the under-utilization of Indonesian refineries. In addition to this, however, not all domestic crude were suitable to produce special products such as asphalt and certain specified lubricants which were highly demanded and most of the existing refineries did not have the facilities to produce oil products in as wide a range of quality and quantity as the local market required. To meet this discrepancy, Indonesia had been importing petroleum products such as kerosene, gas oil, fuel oil, aviation fuel, special lubricants and asphalt in substantial quantities.

The apparent net imports of petroleum products measured by substracting the export volume and the domestic consumption of petroleum products from total output during 1967 - 1976 are shown in Table III.22. This table shows that in 1967, 1968 and 1971, the imports were negative which implies that the export of these products in that year exceeded their imports. Domestic consumption of petroleum products had increased from 35.4 million barrels in 1967 to 93.0 million barrels in 1976, an increase of 11.3 per cent annually. The growth had been steady and the trend growth rate was very close to this average annual

Table III.22 Apparent Net Import Volume of Petroleum Products, 1967-1976 (in thousand barrels)

Year	Total Output	Export	Domestic Consumption	Apparent Net Imports
1967	63,951	27,771	35,394	-786
1968	65,506	27,583	33,134	-9,125
1969	69,842	33,881	37,267	1,306
1970	73,284	36,267	40,368	3,351
1971	79,691	33,636	44,903	-1,152
1972	89,508	45,979	51,576	8,047
1973	103,748	56,531	59,432	12,215[a)]
1974	86,138	44,772	69,012	27,646[a)]
1975	71,268	36,654	80,164	45,550[a)]
1976	83,345	36,255	92,990	45,900[a)]

a) including import from Singapore's refineries in conjunction with processing deal agreements.

Source : Table III.19 and III.21 and consumption figures of petroleum products released by the Ministry of Mining in its publication The Petroleum & Gas Industry of Indonesia, various issues.

growth rate[1]. The main factor responsible for this increase was the increase in demand due to the growth in the transportation, manufacturing and electricity sectors and the increase in household consumption of

1 The trend regression of the semi-log form fitted was

$$\text{Log}_e \; C_t^p = a + b\,t$$

where C^p is domestic consumption of petroleum products and t is time produced the following results :

Intercept = 10.2014 Coefficient of t = 0.1167

Standard Error of t = 0.0082 R^2 = 0.9616 fuel due to population growth. The expansion of the distribution infrastructures to market petroleum products all over the country implemented by the petroleum industry to respond to the increase in demand for these products, was the responsible factor that made the existing effective demand for petroleum products realized[1].

Most of the products of the refineries which were consumed in Indonesia as mentioned before were fuels (gasoline, kerosene, fuel oil, diesel oil, gas oil, etc.) and the rest were lubricants such as aviation turbine oil, automotive and industrial lubs and other products such as asphalt, waxes, solvents, industrial chemicals, agricultural chemicals and plastics. Table III.23 shows the level of domestic consumption of petroleum products in Indonesia during 1967 - 1976 and Table III.24 shows the composition of the domestically consumed petroleum products during 1969 - 1976 (no data were available prior to 1969).

A closer look at the composition of fuels consumed, shows that the share of automotive gasoline in total fuel consumption declined between 1969 and 1976, from

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1 Adimir Adin, loc.cit., p.10.

Table III.23 Domestic Consumption of Petroleum Products, 1967-1976

(in thousand barrels)

Year	Consumption[a]	Change (%)
1967	35,394	-
1968	33,134	-6.4
1969	37,267	12.5
1970	40,368	8.3
1971	44,903	11.2
1972	51,576	14.9
1973	59,432	15.2
1974	69,012	16.1
1975	80,164	16.2
1976	92,990	16.0

a) including consumption by petroleum sector itself.

Source : Ministry of Mining Petroleum & Natural Gas Industry of Indonesia, various issues.

25.8 per cent to 19.8 per cent while the proportion of diesel and gas oil rose from 18.4 per cent to 29.8 per cent. The main reasons for these changes were the start of industrialization and the structural change in power generating plants.

Table III.24 Composition of Petroleum Products Domestically Consumed, 1969-1976

(in thousands of barrels)

Year	Fuel	Lubricants	Others Products	Total
1969	36,096 (96.9)	640 (1.7)	531 (1.4)	37,268
1970	38,560 (95.5)	765 (1.9)	1,043 (2.6)	40,368
1971	42,934 (95.6)	961 (2.1)	1,008 (2.3)	44,903
1972	48,887 (94.8)	1,200 (2.3)	1,499 (2.9)	51,576
1973	56,186 (94.5)	1,658 (2.8)	1,588 (2.7)	59,432
1974	65,227 (94.5)	2,151 (3.1)	1,634 (2.4)	69,012
1975	75,643 (94.4)	2,183 (2.7)	2,338 (2.9)	80,164
1976	87,411 (94.0)	2,697 (2.9)	2,882 (3.1)	92,990

Note : The figures in the parentheses below the consumption figures corresponding to fuels, lubricants and other products indicate the percentage of each one of them represents in total consumption.

Source : See table III.23

Table III.25 Composition of Domestic Fuel Consumption, 1969 - 1976

(in thousands of barrels)

Year	Automotive Gasoline	Diesel & Gas Oil	Fuel Oil	Kerosene	Others	Total
1969	9,329 (25.8)	6,642 (18.4)	3,216 (8.9)	16,785 (46.5)	124 (0.4)	36,096
1970	9,749 (25.3)	7,691 (20.0)	3,847 (10.0)	17,133 (44.3)	140 (0.4)	38,560
1971	10,508 (24.4)	9,260 (21.5)	4,095 (9.5)	18,927 (44.2)	144 (0.4)	42,934
1972	10,980 (22.5)	11,704 (24.0)	5,379 (11.0)	20,697 (42.3)	117 (0.2)	48,877
1973	12,116 (21.6)	14,949 (26.6)	5,852 (10.4)	23,146 (41.2)	123 (0.2)	56,186
1974	13,283 (20.4)	18,207 (27.9)	6,829 (10.5)	26,769 (41.0)	139 (0.2)	65,227
1975	14,945 (19.8)	22,564 (29.8)	7,380 (9.8)	30,623 (40.5)	131 (0.1)	75,643
1976	17,133 (19.6)	26,223 (30.0)	8,566 (9.8)	35,227 (40.3)	262 (0.3)	87,411

Note : The figures in the parentheses below the consumption figures corresponding to automotive gasoline, diesel & gas oil, fuel oil, kerosene and others indicate the percentage each one of them represents in total consumption of fuels.

Source : See table III.23.

III. Pricing And Price Development

a. Crude Oil Pricing And Price Development

First, it is useful to present the pricing methods[1] adopted in the international market of crude oil up to the end of the period covered in this study, since in various ways these affected the pricing method used for Indonesia's crude oil. Prior to the Second World War, the international market prices of crude oil were based on the Gulf of Mexico basing point price system. This system was adopted because the United States (Texas state) and Mexico were the two leading world crude oil exporters.

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1 Crude oil pricing in international trade has been discussed in various works : see for example, Edith T. Penrose, The Large International Firm in Developing Countries : The International Petroleum Industry, London : George Allen and Unwin, 1968; Edith T. Penrose, "The International Oil Industry in The Middle East" commemoration lectures for National Bank of Egypt,Cairo, 1968; Edith T. Penrose, The Growth of Firms, Middle East Oil, and Other Essays, London : Frank Cass, 1971. Helmut J. Frank, Crude Oil Prices in the Middle East : A Study in Oligopolistic Price Behaviour, New York : Praeger, 1966; Zuhayr Mikdashi, A Financial Analysis of Middle Eastern Oil Concessions, 1901-65, New York : Praeger, 1966; W.A. Leeman, The Price of Middle East Oil, Ithaca, N.Y.: Cornell University Press, 1962; Charles Issawi and Mohammed Yeganeh, The Economics of Middle Eastern Oil, New York : Praeger, 1962 and M.A. Adelman, The World Petroleum Market, Baltimore and London ; The Johns Hopkins University Press, 1972.

Under this pricing system, world crude oil prices were determined as if all crude oil had come from the Gulf of Mexico. Thus the base price under this system was equivalent to the price at Gulf of Mexico (f.o.b.) plus the cost of freight from the Gulf of Mexico to point of destination. After the Second World War, the Middle East states especially the Arabian Persian Gulf became a major crude oil exporting area. This led to the formation of another basing point in the world crude oil pricing system and the Persian Gulf emerged as the second basing point[1].

At first, this dual basing point system worked well as the f.o.b. prices at the Gulf of Mexico and those at the Persian Gulf were practically identical. However in the late forties, this dual basing point system failed to stand the test of market realities due to competition from oil companies in different parts of the world which began to penetrate markets[2]. As the result of this competition, both a reduction and a departure from the basing point pricing developed[3]. Since 1950, changes in prices were determined by a number of different factors mainly by competition, by informal but effective commodity agreement in

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1 Zuhayr Mikdashi, op.cit, pp.95-7.

2 M.A. Adelman, op.cit, pp.132-34.

3 ibid.

crude oil, by changes in world crude oil supply as newcomers in crude oil export came into the market and by the intervention of the governments of the oil producing countries[1].

In the early fifties, some of the governments of crude oil-producing countries entered into profit-sharing agreements with the oil companies and thus became directly concerned in pricing. However, a downward movement of crude oil prices followed. This movement was due to decisions by oil companies to sell their crude at unjustifiably low prices to their affiliates and did not arise because of a real supply and demand situation[2]. The fall in prices by the oil companies was deliberately introduced to show lower profits on their operation in the host country which consequently reduced the share of the host governments in the profits without reducing their overall global profits in their operation as internationally integrated companies.

The formation of OPEC in September 1960 was precluded by successive price reductions of crude oil by the international oil companies and the resentment of the governments

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1 M.A. Adelman, ibid., pp.195-98, 204 and 207.

2 Paul H. Frankel and Walter L. Newton, 'Comparative Evaluation of Crude Oils', paper presented at the Institute of Petroleum, London, 5 November 1969.

of the oil producing countries to this reduction[1]. This organization initially took steps to stabilize the "posted price", i.e. the price at which the oil companies were prepared to sell crude oil to any potential buyer[2] - as this price was used as a tax reference price for the computation of the share of the host governments in oil export proceeds. The posted price was not necessarily equal to realized price as allowable discounts were offered by the oil companies to the buyers. Dramatic and substantial price increases of crude oil occurred in 1973, 1974 and 1975 due largely to decisions taken by OPEC, on both economic and political grounds.

Before the late 1940's, Indonesia's crude oil prices were set on the basis of the Gulf of Mexico basing point system and after that they were based on the conditions discussed above. Active intervention by the Indonesian government took place in the early sixties. Unlike other OPEC countries, Indonesia does not adhere to a "posted price policy" but rather to a "realized price policy". Pertamina takes the price leadership in pricing based on the decision by the Ministry of Mining. The main reason for this is the intention of the government to safeguard

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1 Zuhayr Mikdashi, op.cit, pp.32-3.

2 A detailed analysis on this matter is presented in Zuhayr Mikdashi, op.cit, pp.137-95.

the country's foreign exchange earnings. This realized policy involved elaborate market analysis and testing in which the most important considerations were sales and posted price of Middle East crude oil. The Indonesian membership in OPEC, however, forced Indonesia to make dramatic price increases as decided by OPEC in 1973 and subsequently in 1974 and 1975.

As the realized price of Indonesian crude was slightly higher than the Middle East crude due to its lower sulphur content, the buyers of Indonesian crude in Pacific areas had historically paid relatively high premia for lower freight differentials and for the lower sulphur content of most Indonesian crude. Indonesia had been able to maintain a one-price policy for all its crude irrespective of quality differences of crude from different oil fields in Indonesia. The reduction in international demand for crude in late 1974 and especially in 1975 made buyers increasingly cost conscious and less willing to continue paying high premia for Indonesian crude[1]. In Japan, economic recession allowed industries to switch to higher sulphur, cheaper crude and still meet pollution control standards[2]. In 1974 and 1975, crude oil from the People's Republic of China which had been increasingly imported by Japan since 1974, was sold at US$

1 Indonesia's Petroleum Sector (Industry Outlook Report), Jakarta : U.S. Embassy, 1977, p.30.

2 ibid.

12.10 [f.o.b.] per barrel which was US$ 0.50 cheaper than that of Indonesia's crude[1]. By early 1975, crude oil from the Middle East delivered at Yokohama, Japan, was offered US$ 0.70 cheaper than Indonesian crude[2].

In October 1975, this situation plus plummeting worldwide tanker rates made freight differentials substantially narrower[3]. The new pricing arrangement took into consideration the quality differences of crude which originated from various fields, and this led to the reduction of certain prices. This reduction was done in order to maintain the competitiveness of Indonesian crude in the world market but at the same time did not deviate from OPEC's decision on crude oil prices. Table II.27 shows the development of prices of Indonesian crude during the period 1967-1976 and Table II.28 shows the export price index of Indonesia's crude oil calculated on the basis of the unweighted average prices of crude from various fields. The rising crude oil prices since 1973 had not only resulted in the increasing importance of petroleum industry in Indonesia's foreign exchange earnings and public revenues which will be dis-

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1 Sritua Arief, <u>The Indonesian Petroleum Industry : A Study of Resource Management In a Developing Economy</u>, Jakarta : Sritua Arief Associates, 1976, p.163.

2 Ibid.

3 U.S. Embassy, Jakarta, op.cit.

Table III.26 Quality Characteristics of Crude Oil Produced In OPEC Countries

Country	Average Gravity [° API]	Average Sulphur Content [weight %]
Abu Dhabi	39.18	0.71
Algeria	37.90	0.10
Equador	27.50	0.77
Indonesia	34.28	0.12
Iran	31.70	1.92
Iraq	34.32	2.56
Kuwait	31.43	2.37
Libya	37.20	0.47
Nigeria	33.66	0.21
Qatar	38.33	1.43
Saudi Arabia	31.25	2.24
Venezuela	25.15	1.75

Source : Derived from figures released in Pertamina Indonesian Oil Statistics, 1976.

cussed in detail in Chapter V but also had contributed positively to the improvement of the Indonesian terms of trade[1].

1 World Bank Indonesia : Recent Developments And Medium-Term Perspective, Washington D.C. March 7, 1977, p.8.

Table III.27 Export Price of Indonesian Crude Oil, 1967 - 1976

(in US$ per barrel)

Date		CRUDES						
		North Sumatra (Kattapa Rantau, etc.)	Sumatra Light (Minas, Lirik) Duri, etc.	Cinta	Arjuna	Attaka	Kasim Walio	Handil
1967 :		1.62	1.62	-	-	-	-	-
1968 :		1.62	1.62	-	-	-	-	-
1969 :		1.62	1.62	-	-	-	-	-
1970 :		1.62	1.62	-	-	-	-	-
1971 :	First Quarter	2.07	1.60 - 1.67	-	-	-	-	-
	Second Quarter	2.11	2.15 - 2.21	-	-	-	-	-
	Third Quarter	2.05	2.14 - 2.35	2.60	2.60	-	-	-
	Fourth Quarter	2.05	2.60 - 3.35	2.60	2.60	-	-	-
1972 :	First Quarter	2.31	2.57 - 2.60	2.60	2.60	-	-	-
	Second Quarter	2.65	2.92 - 2.96	2.96	2.86	-	-	-
	Third Quarter	2.65	2.92 - 2.96	2.96	2.86	-	-	-
	Fourth Quarter	2.65	2.92 - 2.96	2.96	2.86	2.80	-	-
1973 :	First Quarter	2.65	2.92 - 2.96	2.96	2.86	2.96	-	-
	Second Quarter	3.73	3.66 - 3.73	3.73	3.73	3.73	-	-
	Third Quarter	3.73	3.66 - 3.73	3.73	3.73	3.73	5.00	-
	Fourth Quarter	6.50	4.75 - 6.00	6.00	6.00	6.00	6.00	-
1974 :	First Quarter	10.80	10 10.80	10.80	10.80	10.80	10.80	-
	Second Quarter	11.70	11.70	11.70	11.70	11.70	11.70	-
	Third Quarter	12.60	12.60	12.60	12.60	12.60	12.60	12.60
	Fourth Quarter	12.60	12.60	12.60	12.60	12.60	12.60	12.60
1975 :	Up to September	12.60	12.60	12.60	12.60	12.60	12.60	12.60
	Beginning October	12.60-13.00	12.80	12.40	12.60	12.80	12.00	12.10
1976 :		12.60-13.00	12.80	12.40	12.60	12.80	12.00	12.10

Source : Ministry of Mining.

Table III.28 Export Price Index of Crude Export 1967 - 1976

[1967 = 100]

Year	Average Price[f.o.b.] per barrel	Index
1967	1.62	100
1968	1.62	100
1969	1.62	100
1970	1.62	100
1971	2.38	144
1972	2.73	169
1973	4.41	272
1974	12.08	746
1975	12.38	771
1976	12.49	775

Source : Derived from table III.

IV. Petroleum Industry's Supportive Facilities

The necessary facilities to support the exploration, production and marketing activities of the petroleum sector include mainly transportation, storage and communication facilities. These facilities have been almost entirely provided and maintained by the petroleum sector itself. This fact is important since it relates to the impact of the petroleum sector on the other sectors of the economy that will be presented in chapters VI and VII.

Practically all the facilities required by the petroleum sector in transportation, storage and communication was provided by Pertamina. This involved a huge investment on the part of Pertamina, which apart from its investment in refining facilities, made it the largest investor in the Indonesian petroleum industry. The cumulative value of Pertamina's gross fixed assets as of the end of 1976 was US$ 5.3 billion while this figure for the largest crude oil producer, Caltex, was only US$ 365 million[1]. Since the largest portion of Pertamina's investment were financed by foreign debt capital and public revenues, in one way or another the financing of these investments has diverted and will divert financial resources that could be available in the rest of the economy[2]. On the other hand, these investments which supported the crude oil production for the entire petroleum industry has produced a much lower investment risk borne by the foreign oil companies compared to the situation if these investments

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1 These figures were taken from the 1976 balance sheets of Pertamina and Caltex.

2 It was reported in Pertamina's Annual Account, 1976 that Pertamina's long-term foreign debt as of the end of 1976 excluding interests amounted to US$ 2,082,250,000 with the following maturities :

Year		Amount
1978	US$	266,962,000
1979		295,639,000
1980		324,966,000
1981		246,767,000
1982 and thereafter		947,916,000

on supportive facilities were undertaken by them as was the case in other countries and in Indonesia before 1967.

a. Transportation

Pertamina as an integrated oil company was responsible for the domestic and foreign transportation of Indonesia's crude oil and petroleum products although some foreign tankers had been involved in foreign trade. Petroleum and petroleum products were transported on sea and inland. Sea transportation involved tankers and non-tanker vessels. All these were almost entirely provided by Pertamina. It started developing its tanker fleet intensively in 1971 and the total capacity of tankers serving Indonesia's petroleum industry increased from 1 million DWT in 1971 to 4.4 million DWT in 1975. Of this however, 3.2 million DWT capacity was intended primarily for international operation and shipping oil from other countries.
After Pertamina's financial crisis in March 1975 it was realized that Pertamina's tanker programme had not been very feasible and tankers serving international markets became superfluous and a costly burden. The Indonesian Government appointed a fact-finding commission in 1975 to look into tanker contracts. This commission later charged that the terms of the contracts were far in excess of tan-

ker market prices and the rates prevailing at the time contracts were signed. A series of legal suits arose involving various tanker companies over the question of Pertamina's actual tanker liabilities. In addition to this, the Indonesian Government launched a series of negotiations with several tanker owners to cancel previous tanker contracts. It was estimated after this development, that the remaining Pertamina's tanker fleet of domestic and international tankers would be drastically reduced in 1976. Table III.29 shows the development of Pertamina's tanker capacity during 1971-1975.

Table III.29 Pertamina's Tanker Capacity, 1971 - 1975 (in DWT)

Year	Capacity
1971	1,082,256
1972	1,437,840
1973	1,759,096
1974	3,340,028
1975	4,437,874
1976	n.a.

Source : Pertamina

Non-tanker vessels which consisted of cargo vessels, cargo barges, oil barges, dual purpose barges and tugs which served to meet oil companies' logistical needs and inter-island distribution requirements were also entirely operated by Pertamina. Table II.30 shows the development of Pertamina's non-tanker capacity during 1971-1975.

Table III.30 Pertamina's Non-Tanker Capacity, 1971 - 1975
[in DWT]

Year	Capacity
1971	33,628
1972	38,663
1973	36,617
1974	38,317
1975	37,440
1976	n.a.

Source : Pertamina

In maintaining its transportation facilities, Pertamina has established an integrated docking facility. Dockyard and workshop complexes were established in Pangkalan Susu in North Sumatra, Dumai in Central Sumatra and Balikpapan in East Kalimantan. These dockyards had lifting capacities of 2,000 tons, 20,000 tons and 6,000 tons respectively[1]. Tankers of large tonnage were docked and repaired overseas.

1 Figure as obtained from Pertamina.

The inland transportation of crude oil and petroleum products were executed by pipelines, which were both inland and submarine. Between 1965 and 1975 eleven major oil and gas pipelines were laid in Indonesia with a total length of 1,181.8 kilometres, representing an increase of 83 per cent over the preceding eleven years[1]. With this increase, the total length of oil and gas pipelines in Indonesia as of the end of 1975 was 1,827.6 kilometres[2]. About 90 per cent of this total was oil pipelines. This figure was the same up to the end of 1976.
Railroad tank cars which were also used in transporting petroleum products inland were entirely operated and owned by the Indonesian State Railways. About 1,300 railroad tank cars were in operation as of the end of 1976[3]. Tank trucks were 87 per cent owned and operated by Pertamina while the remaining 13 per cent where owned and operated by petroleum products dealers[4]. No information was available on the number of tank trucks in operation.

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1 Soediono and C.P. Loucks, op.cit, p.2.

2 ibid.

3 Figures as obtained from the Indonesian State Railways.

4 Figure as obtained from Pertamina.

As oil wells and fields were scattered all over the country some of which could not be reached by existing air transportation facilities, Pertamina had maintained a relatively large air transportation fleet . The P.T. Pelita Air Service to serve the petroleum industry. It operated various types of aircrafts ranging from jets and propjets to small conventional aircrafts and helicopters. Table III.31 shows the air transportation fleet of Pertamina as of the end of 1975 and Table III.32 shows the volume goods and passengers transported by Pertamina's air transportation fleet during 1971 - 1975.

Table III.31 Pertamina's Air Transportation Fleet As of The End of 1975

Types	Number
Large aircrafts	4
Medium Size aircrafts	10
Small aircrafts	26
Helicopters	63
T o t a l	103

Source : P.T. Pelita Air Service

Table III.32 Volume of Goods and Passengers Transported by Pertamina's Air Transportation Fleet, 1971-1975

Year	Goods (in kg)	Passengers
1971	1,813,000	60,494
1972	2,560,000	95,287
1973	3,794,000	116,675
1974	5,522,000	136,779
1975	7,904,000	173,077
1976	n.a.	n.a.

Source : P.T. Pelita Air Service

b. Storage

Petroleum products were transported by tankers and other ships to sea-fed installations and depots which at the end of 1976 had a storage capacity of 1,460,000 barrels[1]. At the end of 1976 sea-fed installations and depots numbered 54 and all of them were owned and operated by Pertamina. Their locations are shown in Table II.33. Two major oil terminals were under construction in 1975. Both were constructed and operated by foreign oil companies. The first one was located in Senipah, East Kalimantan, to serve Total Indonesie's operations with a total storage capacity of 2,500,000[2] barrels of crude oil. The

1 Figure as obtained from Pertamina.

2 Figure as obtained from Pertamina.

Table III.33 Sea-Fed Depots and Inland Depots in Operation As of The End of 1976

Location	Sea-Fed Depots	Inland Depots	Total Depots
North Sumatra & Aceh	5	3	8
Central Sumatra	3	2	5
Jambi, South Sumatra & Lampung	3	5	8
West Java	3	4	7
Central Java	3	1	4
East Java	2	2	4
Nusa Tenggara	3	0	3
Kalimantan	3	2	5
Sulawesi	4	0	4
Moluccas and Irian Jaya	6	0	6
Total	35	19	54

Source : Pertamina

second, of similar capacity was in Kasim, Irian Jaya, which was constructed and operated by Petromer Trend and can accommodate tankers up to 120,000[1] DWT capacity.

To serve the aviation industry, Pertamina maintained avia-

1 Figure as obtained from Pertamina.

tion gasoline and aviation turbine oil depots in 18 major airports[1] throughout Indonesia.
For a smooth transfer of petroleum products to and from sea-fed depots and installations, Pertamina maintained loading and unloading facilities in 45 ports throughout Indonesia[2]. These facilities were mostly inside existing harbour areas.

c. Communication

One of the major problems in exploration and production of crude oil in Indonesia is communication which is complicated by both the distance and remoteness of many of the locations.
For practical reasons the petroleum industry maintained its own communication systems which was quite separate from the one operated by the State Telecommunication Corporation and this was maintained by Pertamina.
By the end of 1976, there were nearly 2,000 radio stations operated by Pertamina throughout Indonesia[3]. Each connection through these stations was made up of one radio telephone channel and one telex channel. These stations consisted of transceivers and transmitters of various types with an output power of 100 MW to 21 KW. In addition to

1 Figures as obtained from Pertamina.

2 Figures as obtained from Pertamina.

3 Figures as obtained from Pertamina.

this, Pertamina completed the construction and installation of I.O.C.S. (Integrated Oil Communication System) in 1972 to serve the communication requirements of the oil companies in their offshore operations. For telecommunication requirements in special fields such as geological, seismic topographical investigation, drilling and related activities, there were sufficient telecommunication equipments consisting of transceivers and transmitters of various capacities and types.

Conclusions

The following are the summary and conclusions of this chapter which mainly refer to the growth of the Indonesian petroleum industry during the last decade :

(1) There were four major factors that stimulated the growth of the Indonesian petroleum industry during the period under study namely increased foreign demand, incentives offered by the Indonesian government for encouraging foreign investment in oil operation, resources discovery and widely established infra-structure to support production and exploration.

(2) The growth of the petroleum industry has been largely evidenced by the growth in the export of the petroleum industry's output in crude form rather than in the form of refined products. The percentage of the crude oil export

in the total export of the petroleum industry's output has been increasing at the expense of the petroleum products export. This implies that the position of the Indonesian petroleum mining industry as a primary sector with external orientation has been strengthened.

(3) Indonesia's crude oil output which constituted the largest source of export income for the petroleum industry was largely controlled by foreign companies. This feature makes the Indonesian petroleum industry another classic example of a primary export sector in less developed countries which can be a subject of empirical investigation on investor-host economy relationship.

(4) The increasing domestic demand for petroleum products which to a certain extent indicates the internal dynamics of the Indonesian economy has not been fully met by the domestic petroleum refining section of the petroleum industry. In fact the domestic refining capacity experienced a declining utilized capacity although the technical capacity had increased. To a substantial extent, the refining operation was also externally oriented as a result of processing deal with refineries in Singapore. This processing deal somewhat reduced the idle capacity in Singapore's refineries at the expense of the refineries' capacity in Indonesia.

PART II

CHAPTER IV

THEORETICAL CONSIDERATIONS

In order to lay the theoretical foundations for studying the impact of petroleum sector on the Indonesian economy, a survey of a number of relevant theoretical contributions on the impact of exports or international trade in general on the economic development of a country or a less developed country is presented in this chapter.
These theoretical contributions can be considered in three groups as follows :

1. The International Trade Theories
2. The Staple Export-Led Growth Theories
3. The Development Theories

1. The International Trade Theories

The historical development of the theory of international trade can be traced back to contributions made by classical economists such as Adam Smith, David Ricardo and John Stuart Mill[1]. The classical economists argued that international trade is an agent of economic growth for the following

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1 An excellent survey of the classical theories of international trade is presented in Hla Myint, Economic Theory and The Underdeveloped Countries, London : Oxford University Press, 1971, Chapter 5.

reasons. First, international trade stimulates productivity and therefore becomes a factor that widens the market. Widening the market permits the division of labour, raises the skill of workers, encourages technological improvements, and allows the trading countries to increase returns and therefore, generates growth. Secondly, through the benefit postulated in the "vent for surplus" theory, a country which begins to enter into international trade possesses a surplus over its domestic requirements due to an inelastic domestic demand for the exportable products. International trade overcomes the narrowness of the home market and provides an outlet for this surplus. Thirdly, international trade will enable a country to reallocate its given resources more efficiently between domestic and export production in the light of relative prices now determined through trade. This is known as the theory of "comparative advantage".

The classical theory of international trade though involves discussions on economic growth, it does not discuss economic growth in terms of theories of economic growth but in terms of general economic principles. Three models relating economic development and foreign trade were formulated by Kindleberger[1]. These treat foreign trade respectively as

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1 Charles P. Kindleberger, Economic Development, New York : Mc Graw-Hill, 1965, Chapter 14.

a leading, a lagging and a balancing sector in the economy. The first leading sector model implies that economic growth will be promoted through trade expansion accompanied by technological change. The second model in which foreign trade lags, is a trade contraction model. This is based on an import substitute strategy of growth, which, though decreasing the demand for imports of finished consumer goods, leads to an increase in imports of capital goods and other necessary inputs thus creating an adverse effect on the balance of payments. The third model in which foreign trade is a balancing sector arises when the export sector generates domestic income which increases the demand for imports, thus contributing to the growth of the economy. Here exports are counter-balancing the demand for imports.

Haberler argued that international trade and international division of labour, as prescribed by the classical economists, which enable every trading country to specialize, are one of the basic factors promoting economic growth[1]. He stressed the traditional static gains from trade resulting from more efficient resource allocation which has indirect dynamic benefits. The latter arise because, through specialization, the country earns foreign exchange to purchase

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1 Gottfried Haberler, "International Trade and Economic Development", National Bank of Egypt Fiftieth Anniversary Commemoration Lectures, Cairo, 1959, pp.5-14.

essential commodities such as food, raw materials and semi-finished materials and, by the attraction of international investment, which also develops through trade, there is a transmission of managerial talent, skills and entrepreneurship and the dissemination of technology. The larger the volume of trade, the larger will be the volume of foreign capital that can be expected to become available because with a large volume of trade the transfer of debt-service payments is more easily effected than with a small volume of trade. The indirect dynamic benefits from trade were described by Haberler as an upward shift in the production possibility curve which implies a transformation of the existing production functions. The advantage of trade between countries comes from being able to obtain, with a given amount of labour and capital, a larger quantity of goods. In other words, a country gains when it can purchase more goods, with a given quantity of capital and labour than it could have produced domestically with equivalent capital and labour.

Heckscher and Ohlin who based their trade theory on the comparative advantage doctrine proposed a version known as the Heckscher-Ohlin version. This version states that a country will benefit from trade by producing goods that use more of its relatively abundant factors of production. It will export such goods and import goods which use more of its relatively scarce factors unless its pattern of domestic demand happens to be biased toward goods using domestic factors of production[1].

2. The Staple Export-Led Growth Theories

Harold Innis' historical studies of the Canadian cod and fur industries laid the foundation for the "Staple Theory of Economic Growth"[2]. This considers the staple product as the main catalyst or leading sector in the process of economic growth. Innis used the production function in his theory of Canadian economic growth to discuss the export-led growth concept. Robert Baldwin and Douglas North then employed the production function approach in analysing the primary sector export-led growth in a more rigorous way[3].

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1 See Hollis B. Chenery "Comparative Advantage and Development Policy", American Economic Review, no.1 (March 1960), p.20, also in S.P. Singh, ed. Underdevelopment to Developing Economies, Oxford : Oxford University Press, 1978, p.400.

2 Harold Innis The Fur Trade in Canada : An Introduction to Canadian Economic History, Toronto : The University of Toronto Press, 1930, and The Cod Fisheries : The History of an International Economy, Toronto : The University of Toronto Press, 1954.

3 See Robert E. Baldwin, "Patterns of Development in Newly Settled Regions", Manchester School of Economic and Social Studies, 24 (May 1956), pp.161-79, and Douglas C. North, "Agriculture in Regional Economic Growth", Journal of Farm Economics, 41 (December 1959), pp.943-51.

The staple theory of export-led growth states that if the demand for the export staple increases, the quantity supplied will also increase, which results in GNP growth. Income spent generates investment opportunities in other sectors of the economy through backward and forward linkage effects, in Hirschman's terminology[1]. The backward linkage effect in this respect is a measure of the inducement to invest in the domestic production of inputs for the purpose of expanding the export sector while the forward linkage effect is a measure of the inducement to invest in industries using the outputs of the export industry as inputs.

The actual carry-over from the primary export sector to the rest of the economy is successful if this sector is diversified or if it has certain growth promoting characteristics. If the export commodity is a plantation type commodity characterized as a labour intensive product with significant increasing returns to scale, an unequal distribution of income will result between the owners and management on the one hand and the bulk of the labourers on the other. The former group will tend to spend income on luxury goods and imports. There will be more equitable distribution of income in the case where the export commodity is produced on a family

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1 Albert O. Hirschman <u>The Strategy of Economic Development</u>, New Haven : Yale University Press, 1958, pp.98-116.

size farm with smaller amounts of labour and small returns, and as a result of this there will be a demand for a broad range of goods and services which will induce investment in various domestic economic activities[1]. Baldwin argued that the plantation economy often does not require complex capital and material inputs, the production functions for such capital goods and inputs will use inputs more nearly in the proportions available domestically[2]. This he argued will compensate for the negative effects created with respect to income distribution and conspicous consumption mentioned previously.

3. The Development Theories

The theories presented in the previous two sections, though to a certain extent containing the analyses of the effect of international trade on economic growth of less developed countries, are not sufficiently elaborate to cover a wider scope and the complexities of the development process in these countries since they do not examine their internal economic structure at sufficient depth. The theory of comparative advantage was criticised as not applicable to the situations in less developed countries since it was based on assumptions of full

1 Douglas C. North, loc.cit.

2 Robert E. Baldwin, loc.cit.

employment and perfect competition[1].

The Heckscher-Ohlin version of the comparative advantage theory similarly has been criticized for its assumption of comparable factors of production among countries[2]. The so-called "staple theories" were presented not as general theories of economic growth nor even as general theories about the growth of export-oriented economies, but rather as applicable to the typical case of a new country[3]. The conditions and consequences discussed in the above mentioned theories can be considered to be not customarily identified with less developed countries.

This section presents the theoretical contributions made by development economists to the relationship between exports and economic development in the context of the development process of less developed countries.

Several development economists have put forward critical views on the effect of foreign trade on economic development of less developed countries which stem from the primary production nature of the exports of these countries. Hla Myint argued that the growth in the primary export sector will not neces-

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1 Hollis B. Chenery, loc.cit.

2 Jacob Viner International Trade and Economic Development, Oxford : Oxford University Press, 1953, p.16.

3 Melville H. Watkins, "A Staple Theory of Economic Growth", The Canadian Journal of Economics and Political Science, vol. 29, no.2 (May 1963), p.143.

sarily have a multiplier effect on the per capita income due to the lack of spread effects of this sector[1]. Further, he argued that although international specialization can have an "educative effect" on the people, which helps to develop new wants and needs, it does not help to provide new methods of efficient production[2].

Gunnar Myrdal postulated that the spread effects of the international trade of less developed countries are usually weaker than its backwash effects and this will produce stagnation or impoverishment[3]. Spread effects consist of the external demand for traditional primary products and the backwash effects usually arise from the higher rates of population growth, the inabilities of these countries to build an infrastructure to compensate for the lack of investment incentives resulting from the unfavourable economic conditions, and the weakening of the domestic productive structure due to the competition of cheaper imports from the developed countries[4]. Gerald Meier argued that the primary export sector in less de-

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1 Hla Myint, "The Gain From International Trade and The Backward Countries", Review of Economic Studies, vol.22 [1954-1955], pp.129-42.

2 Ibid., p.140.

3 Gunnar Myrdal Economic Theory and Underdeveloped Regions, London : Gerald Duckworth, 1957, pp.27-35.

4 Ibid.

veloped countries has failed to generate the transmission mechanism for the growth of the rest of the economy in these countries due to weak spillover effects and domestic impediments[1]. Market imperfection due to factor immobility, price rigidity, and a limited knowledge of market and technological conditions are the major reasons which limit the spillover effects of primary exports to the rest of the economy.

Meier formulated the "factors of production" argument and the "demonstration effect" argument to explain his thesis on domestic impediments. He argued that factor inflows in terms of imported cheap labour brought in to expand primary production for export had helped maintain low wages and this had an adverse effect on the economy. The production of primary products under plantation management for export was organized as an enclave which enjoyed a monopsony and a monopoly position in the exchange process[2]. Natives, as labourers, faced the monopsonistic power of the foreign plantations or mining companies in determining their wages. Others who became small producers, faced the competition of large well-established exporting and processing firms which possessed

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1 Gerald H. Meier, International Trade and Development, New York : Harper and Row Publishers, 1963, pp.182-84.

2 This argument was originally presented by Hla Myint in his article "An Interpretation of Economic Backwardness", Oxford Economic Papers, 6 (June 1954), pp.154-55.

monopsonistic powers in determining the price of the products they sold. As consumers, they were faced with the monopolistic powers of traders in buying the commodities they needed. The resulting enclaves did not integrate into the domestic economy but remained attached to the interests of the investing country giving rise to dual economies characterized by a lopsided structure. The income effects of the enclave sector were weak due to leakages of income abroad.

This argument was originally put forward by Singer and known as Singer's thesis which states that "the primary export industries are located in the less developed country only in the geographic sense; they have not become an integral part of the domestic economy and as a result of this the multiplier effects of the original investment have not taken place where the industry is physically located but in the investing country which supply all the inputs"[1]. In his later writing, Singer argued that the interaction between the enclave and the rest of the economy was not absent but this interaction was of such a kind as to lead to polarization or sharpened dualism within

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1 Hans Singer, "The Distribution of Gains Between Investing and Borrowing Countries", American Economic Review Papers and Proceedings, 40 (May 1950), pp.477-79. A similar view was expressed in J. Levin The Export Economies : The Pattern of Development in Historical Perspective, Cambridge : Harvard University Press, 1960, pp.170-77.

the economies of the less developed countries[1]. By raising of incomes of the small elite of the society following the expansion of the primary export sector, the propensity to consume of this group was increased. The integration of the primary export sector into the international economy developed the desire of this small elite to emulate the consumption patterns and habits in the rich countries. As a result, the savings rate on the economies of the less developed countries was constrained and the divergence of export earnings to low priority areas took place[2].

Prebisch argued that the terms of trade of the less developed countries was subject to deterioration and rejected Adam Smith's thesis that gains could be obtained through international division of labour[3]. He put forward that the disparity between economic growth in the advanced countries (which he termed the <u>centre</u>) and that in less developed countries (which he termed the <u>periphery</u>) was due to the deterioration of the terms of trade of the periphery the causes of which

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1 Hans Singer, "The Distribution of Gains Revisited", paper presented at first Inter PAS Conference at the Institute of Development Studies, University of Sussex, May 1971, p.3.

2 See J. Levin, op.cit., pp.177-79.

3 The "Prebisch thesis" is explained in Prebisch's two articles : "The Economic Development of Latin America and Its Principal Problems", Department of Economic Affairs, United Nations, 1950 and "Commercial Policy in Underdeveloped Countries", <u>American Economic Review</u>, 49 (March 1959), pp.251-73.

were associated with cyclical movements of primary products and industrial prices, the rates of increase in demand for imports between the centre and the periphery and the disparity between the productivity of primary products in the periphery and the productivity of manufactured goods in the centre.

The technological role played by the centre and the role of the supplier of raw materials for the centre played by the periphery led to the situation where the periphery did not share in the profits of the technological progress in the centre whilst the increase in productivity in the periphery benefited the centre[1].

The deterioration in the terms of trade also arose from the Engel's law which states that as income rises, a smaller proportion of income is allocated for food consumption and a rising proportion for non-food. This does not imply that the absolute amount of income spent on food will decrease as income rises since better quality of foods will be purchased at the higher income level. Assuming an equal rise in income for developed and less developed countries, the latter, Prebish argued, will tend to spend a larger proportion of their increased income on imports since they import the bulk of

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1 Charles Frakenhoff, "The Prebish Thesis : A Theory of Industrialism for Latin America", Journal of Inter-American Studies, no.4 [1962], pp.185-206. See also Edmar L.Bacha, "An Interpretation of Unequal Exchange from Prebisch-Singer to Emmanuel", Journal of Development Economics, 5, no.4 [December 1978], pp.323-25.

their manufactured products from the former. As a result of this, the primary product export prices relative to the import prices of the manufactured products will be depressed[1]. Other explanations for the deterioration of the terms of trade were the technical progress in the developed countries which decreased the quantity of raw materials used per unit of output[2] and the growth of synthetic materials as inputs in production of various goods[3].

In line with the deterioration of terms of trade hypothesis, a group of economists in Latin America based on Latin American experience proposed what can be labelled as the "dependency hypothesis". Gunder Frank considered the centre-periphery relations as a chain of exploitation, in which a series of economic and social relations transfer surplus value from satellite to metropolitan areas within less developed countries and thence to developed countries[4]. However, Dos Santos did

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1 Raul Prebish "Commercial Policy in Underdeveloped Countries", pp. 261-64.

2 Hans Singer, "The Distribution of Gains Between Investing and Borrowing Countries", pp.477-79.

3 Ragnar Nurkse, "Patterns of Trade and Development", in Gerald M. Meier, <u>Leading Issues in Economic Development</u>, Third Edition, New York : Oxford University Press, 1976, p. 709.

4 Andre Gunder Frank, "The Development of Underdevelopment" in James D. Cockcroft, et.al. (eds), <u>Dependence and Underdevelopment</u>, New York ; Doubleday & Company, 1972, p.6. A similar body of thesis is also advocated by Samir Amin using Africa as a case. See Samir Amin, <u>Accumulation On</u>

not consider that dependence had such an extreme effect on the domestic economy. Santos argued,

> dependence is not the "external factor" which it is often believed to be. A national situation should be approached by determining its own specific movement. The international situation in which this movement occurs is taken as a general condition but not as a demiurge of the national process because it is the elements within a nation which determine the effect of international situations upon the national reality.1

This argument implies that the adverse effect of the centre-periphery economic relations to the domestic economy can be minimized and the development of the domestic economy can take place if suitable changes are made to the internal structure by making appropriate economic and social policies. Singer later argued that whether increased foreign exchange resulting from increased exports would have the desired

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A World Scale : A Critique of The Theory of Underdevelopment, New York and London : Monthly Review Press, 1974, part 2 of Chapter 2 ; and Samir Amin, Unequal Development, New York and London : Monthly Review Press, 1976, Chapter 4.

1 Theotonio Dos Santos, "The Crisis of Development Theory and The Problem of Dependence in Latin America", in Henry Bernstein (ed), Underdevelopment & Development : The Third World Today, Harmondsworth, England ; Penguin Book Ltd, 1976, p.72. In his later writing, Gunder Frank admitted or clarified that dependence should not be considered a purely external relationship imposed on Latin American society; dependence is also an internal element of this society through the process brought about by the national elements. See Andre Gunder Frank, Lumpen Bourgeousie : Lumpen Development, New York and London : Monthly Review Press, 1974, p.3.

effect on the economy depended on whether it led to increased local savings and local investment (which would involve the import mainly of capital goods) or whether it led to increased consumption (which would involve the import of consumer goods)[1]. The additional import capacity in the former case would further add to the employment created directly and through linkages and multipliers, in producing additional exports[2]. The extent of the benefits produced by the primary export sector depends among other things on the ownership of production. It will make a considerable difference whether a commodity is produced by a multinational corporation or a domestic enterprise. The income multiplier of the export sector will be greater if the export commodities are produced by domestic enterprises[3].

The argument for the deterioration of the terms of trade of less developed countries has been criticised by some writers by pointing to the facts that do not provide a sufficiently strong statistical foundation for any generalization

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1 Hans Singer, The Strategy of International Development, London : The Mac Millan Press, 1975, p.94. For the relationship between primary exports and domestic savings, see Alfred Maizels, Exports and Economic Growth of Developing Countries, Cambridge , England ; Cambridge University Press, 1968, p.58. Maizels postulated that there is positive association between exports and savings in primary-exporting countries due to higher propensity to save in the export sector then elsewhere or public savings rely heavily on taxes on export sector.

2 Hans Singer, ibid., p.95.

3 Ibid. p.92.

about the declining terms of trade[1]. On theoretical grounds, Meier questioned the deterioration of the terms of trade of the less developed countries as the factor which inhibited their economic growth. He reasoned as follows :

> Even if it were true that the less developed countries experienced secular deterioration in their commodity terms of trade, the question would still remain whether this constituted a significant obstacle to their development. The answer depends on what caused the deterioration and whether the country's factoral terms of trade and income terms of trade also deteriorated. If the deterioration in the commodity terms is due to increased productivity in the export sector, the single factoral terms of trade (commodity terms corrected for changes in productivity in producing exports) can improve at the same time. As long as productivity in its export industries is increasing more rapidly than export prices are falling, the country's real income can rise despite the deterioration in the commodity terms of trade: when its factoral terms improve, the country benefits from the ability to obtain a greater quantity of imports per unit of factors embodied in its exports. Also possible is an improvement in the country's income terms of trade (commodity terms multiplied by quantity of exports) at the same time as its commodity terms deteriorate. The country's capacity to import is then greater, and this will ease development efforts.2

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1 See inter alia Theodore Morgan, "The Long-Run Terms of Trade Between Agriculture and Manufacturing", Economic Development and Cultural Change, October 1959, pp.6-17; Jagdish Bhagwati, "A Skeptical Note on The Adverse Secular Trend in the Terms of Trade of Underdeveloped Countries", Pakistan Economic Journal, December 1960; and Gerald M. Meier, International Economics of Development, New York : Harper & Row, 1968, Chapter 3.

2 Gerald M. Meier "Conditions of Export-Led Development : Note", in Gerald M. Meier, Leading Issues in Economic Development, Third Edition, New York:Oxford University Press, 1976. pp.718-19.

Balassa contributed to the analysis of the effects of exports on economic growth of the less developed countries by specifically analyzing the trade patterns and policies of these countries. He criticized previous writers who have traditionally limited their attention to trade in final goods, as if all stages of fabrication were undertaken domestically[1]. This implies that the distinction must be clearly made in the composition of trade of less developed countries entering international trade. It was suggested by Balassa that manufacturing should receive preferential treatment vis-a-vis primary production for exports since productivity tends to rise more rapidly in the former than in the latter and that the expansion of manufacturing industries provides more indirect benefits by inducing investments in other branches of industry and improving the quality of the labour force[2]. For this purpose, Balassa proposed that equal incentives need to be given to industrial production for domestic and for foreign markets through the granting of a subsidy to the exports of manufactured goods at a rate equal to the tariff applied to the same goods, or by using differential

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1 Bela Balassa, The Structure of Protection in Developing Countries, Baltimore and London : The John Hopkins Press,Ltd. 1971, p.3.

2 Bela Balassa, "Trade Policies in Developing Countries", American Economic Review, Papers and Proceedings, (May 1971), p.185. See also a similar view in Hans Singer and Javed Ansari, Rich and Poor Countries, Second Edition, London : George Allen & Unwin, 1978, p.68.

exchange rates for the manufacturing sector[1]. He further argued that the import substitute industries can be a source of economic growth in their early stage by replacing the imports of non-durable consumer goods and their inputs by domestic production[2]. However, in the absence of manufacturing exports, the expansion of industries producing non-durable consumer goods and their inputs necessarily slows down after imports have been replaced since domestic production cannot continue to grow faster than domestic demand. At this stage, he postulated that export-oriented policies of countries which have established an industrial base will lead to better growth performance than policies favouring import substitution.

Export-oriented policies which provide similar incentives to sales in domestic and in foreign markets, lead to resource allocation according to comparative advantage, allow for greater capacity utilization, permit the exploitation of economies of scale, generate technological improvements in response to competition abroad and, in labour surplus countries, contribute to increased employment. Once the initial stage of import substitution as described above is over, substitution of imports by domestic production entails rising costs due to the loss of economies of scale in small domestic

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1 Bela Balassa, loc.cit.

2 Ibid., p.181.

markets and the relatively capital intensive nature of production. As a result, the domestic resource cost of saving foreign exchange through continued import substitution under protection will exceed the domestic resource cost of earning foreign exchange through exports and the difference will tend to grow over time[1].

The question often asked is what the level of the exchange rate should be to promote the exports of the manufacturing sector as suggested by Balassa. In this connection, it is of significance to take note of what Ginor postulated with regard to the exchange rate level in less developed countries in relation to the inflow of foreign capital to these countries. According to Ginor, over the short period, an inflow of foreign capital depresses the potential demand for foreign exchange causing exchange rate to become lower than the equilibrium. This affects the internal price system and distorts the allocation of resources, thus shifting the economy from producing tradable goods to importing them[2].

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1 Bella Balassa, "Exports and Economic Growth : Further Evidance", Journal of Development Economics, vol.5, no.2 (June 1978), pp. 181-82.

2 F. Ginor, "The Impact of Capital Imports on The Structure of Developing Countries", Kyklos, 22, no.1, 1969, pp.104-20. See also a similar analysis in Richard R. Nelson, "The Effective Exchange Rate, Employment and Growth in a Foreign Exchange-Constrained Economy", Journal of Political Economy, vol.78, no.3 (May/June 1970), pp. 546-64.

Conclusions

This chapter has presented a brief survey of the relevant theories relating the primary export sector to economic growth in less developed countries. Some writers argued that the external trade of any commodity has direct and indirect benefits and can be considered as an engine of growth. However other writers argued that the primary export sectors in the less developed countries do not produce significant growth effects on the rest of the economy.

The low linkage and multiplier effects and the deterioration of the terms of trade were the major factors put forward for the insignificant effects of the expansion of the primary export sector on the rest of the economy. In view of these factors, the promotion for manufactured exports by the less developed countries was suggested since manufacturing activity will have larger domestic linkages and will produce a better quality of the labour force. To accomplish this, an appropriate exchange rate which will avoid an overvaluation of currency was advised in order to establish an efficient domestic resources allocation in terms of growth and employment. Where the expansion of the primary export sector is pursued, larger effects on the domestic economy would be produced if it is accompanied by a series of appropriate economic and social policies to alter the existing dualistic structure in the economy and pursue a rational utilization of export earnings in order to generate increased investment and employment.

CHAPTER V

THE DIRECT CONTRIBUTION OF THE PETROLEUM INDUSTRY TO THE INDONESIAN ECONOMY

This chapter presents the first step in estimating the impact of the petroleum sector on the Indonesian economy. The direct impact of the petroleum sector on the economy is estimated through its direct impact on balance of payments and public saving[1]. Its direct impact on balance of payments and public saving, which establishes its contribution to investment resources, will then be used as the basis to estimate its direct impact on national income. For this purpose, this chapter is divided into three sections :

(1) The Direct Impact of The Petroleum Industry On Foreign Exchange Earnings and Balance of Payments

(2) The Direct Impact of The Petroleum Industry On Public Saving

(3) The Direct Impact of The Petroleum Industry On Gross Domestic Product and Gross National Product

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1 Ideally the direct impact on private saving should also be given. However due to unavailability of data on this variable, it cannot be presented here. It is expected that this impact will be small as evidenced from the low percentage of wages and salaries in petroleum's gross value added and low linkage with the other sectors of the economy which will be shown in Chapter VI.

1. The Direct Impact of The Petroleum Industry On Foreign Exchange Earnings and Balance of Payments

a. The Direct Impact on Foreign Exchange Earnings

In an analysis of the direct impact of the petroleum industry on Indonesia's foreign exchange earnings, export values alone have relatively little meaning. What really matters in the context of Indonesian petroleum industry are the amounts of foreign exchange that the petroleum industry actually brings into the country. These amounts are known in the literature on the analysis of the primary export sector in less developed countries as the retained values[1] of the petroleum industry.

The method used of arriving at the petroleum industry's retained values deals with international current financial flows. This is to substract from petroleum export proceeds all foreign payments incurred to support the operation i.e. imports of goods and services and net factor payments abroad. In the context of the Indonesian petroleum industry, the retained values are derived as follows :

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1 See interalia Raymond F. Mikesell, et.al. Foreign Investment in the Petroleum and Mineral Industries : Case Studies of Investor-Host Country Relations, Baltimore and London: The John Hopkins Press, 1971, p.131 and Zuhayr Mikdashi, The Community of Oil Exporting Countries : A Study in Governmental Co-operation, London : George Allen & Unwin Ltd., 1972, p.180.

Retained Values of Petroleum Industry's Exports	=	Total Gross Value of Petroleum Output at International Prices - Production Costs in Foreign Exchange incurred by Foreign Petroleum Companies and Pertamina - Factor Payments to Foreign Petroleum Companies - Foreign Exchange Costs Related to Domestic Consumption of Oil Products - Foreign Exchange Expenditures by Pertamina for Other than its Direct Petroleum Production, Refining and Marketing Operations

Table V.1 shows the development of the Indonesian petroleum industry's retained values during 1967 - 1976. Retained values had increased from US$ 116 million in 1967 to US$ 3,321 million in 1976 at current prices or from US$ 116 million to US$ 429 million at 1967 export prices.

It is of interest to consider briefly the expenditure components of the petroleum industry's balance of payments i.e. imports of goods and services and net factor payments abroad. Except for the period 1971 - 1973, imports of goods and services had been the component commanding the greatest expenditure of foreign exchange. In recent years of the period under study i.e. 1974 - 1976, imports of goods and services constituted 23 - 26 per cent of the gross export proceeds. In 1968 and 1969, imports of goods and services were even higher than the retained values. In these years, imports of goods and services respectively totalled US$ 138 million and US$ 146 million while retained values were respectively US$ 91 million and US$ 115 million. In all years during 1967 - 1972, the sum of imports of goods and services and factor payments abroad were substantially higher than the retained values going to the Indonesian economy. This sum after 1972 however was smaller than the retained values which probably reflected the development and stage of the production and exploration activities in this period which largely determined the import requirements of the industry.

b. The Direct Impact on The Balance of Payments

The direct impact of the petroleum industry's operation on the balance of payments is measured as the sum of petroleum industry's retained values and the net capital inflows to this industry. Since retained earnings had been the major source of fund used by the major producing companies during 1967 - 1976 as indicated by the ratio of cumulative retained earnings to cumulative value of capital as of the end of 1976[1], the amortization of investment by these major

1 Sritua Arief Financial Analysis of The Indonesian Petroleum Industry, Jakarta : Sritua Arief Associates, 1977, p.127 and Sritua Arief Associates, Financial Performance of Indonesia's Petroleum Companies, Jakarta, Special Report, 1978.

companies abroad had produced the negative net foreign capital inflow to the petroleum industry. Under these circumstances, the negative net foreign capital inflow to the petroleum industry as stated in Indonesia's balance of payments for the period 1967 - 1976 did not indicate the presence of disinvestment in this industry as expressed in some reports[1]. The fact that a lot of foreign funds were borrowed by Pertamina for its own use without being channelled through Indonesia's balance of payments system is another factor for rejecting this disinvestment notion[2]. The direct balance of payments impact made by the petroleum industry during 1967 - 1976 is given in Table V.2. This impact, at current prices, increased from US$ 106 million in 1967 to US$ 3279 million in 1976. Between these two years, at constant 1967 prices, this impact had increased by nearly four times.

In order to see the contribution of the petroleum industry to the entire system of Indonesia's balance of payments, the comparison is made here between the petroleum

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1 See for instance International Monetary Fund, Balance of Payments Year Book, various years.

2 The detail for this practice by Pertamina is presented in Sritua Arief, The Indonesian Petroleum Industry : A Study of Resource Management in a Developing Economy, Jakarta : Sritua Arief Associates, 1976, Chapter V.

industry's direct balance of payments impact with the entire Indonesia's balance of payments for the years under study. To measure the significance of the petroleum industry's contribution to the entire system of Indonesia's balance of payments, the percentage of the petroleum industry's balance of payments impact of Indonesia's total foreign exchange availability was used. Foreign exchange availability in Indonesian context is defined as the petroleum industry's balance of payments impact plus the sum of non-petroleum exports, capital flows outside the petroleum sector and errors and omissions. Table V.3 indicates that the petroleum industry's balance of payments impact expressed as a percentage of total foreign exchange availability had increased substantially between 1967 and 1976. It increased from 11.6 per cent in 1967 to 47.0 per cent in 1976, demonstrating that the Indonesian economy had become increasingly dependent on its petroleum industry to provide foreign exchange.

Table V.1 Retained Values of The Petroleum Industry, 1967 - 1976
(at current and constant 1967 prices in millions of US dollars)

Item	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Gross Export Proceeds	244	303	366	434	517	913	1603	5065	5068	6081
Imports of Goods & Services	-66	-138	-146	-146	-152	-248	-337	-1370	-1152	-1608
Factor Payments Abroad	-62	-74	-105	-128	-162	-285	-432	-1003	-970	-1152
Petroleum Industry's Retained Values (at current prices)	116	91	115	160	203	380	840	2692	2946	3321
Petroleum Industry's Retained Values (at constant 1967 prices)	116	91	115	160	141	225	308	361	382	429

Source : International Monetary Fund Balance of Payments Year Book for various years and Balance of Payments, June and July 1978. All items in these publications are expressed in terms of SDR (Special Drawing Rights composing of a basket of hard currencies). The conversion from SDR to US dollars is done using the following conversion rates as given by IMF.

Year	Conversion Rate
1967-70	US$ 1.0000
1971	1.0030
1972	1.0857
1973	1.1921
1974	1.2026
1975	1.2142
1976	1.1545

Table V.2 Direct Balance of Payments Impact of The Petroleum Industry, 1967 - 1976 (at current and constant 1967 prices in millions of US dollars)

Item	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Petroleum's Retained Values	116	91	115	160	203	380	840	2692	2946	3321
Petroleum Industry's Net Capital Inflows[a]	-10	-12	-12	-14	-13	-51	-274	-522	-21	-42[b]
Direct Balance of Payments Impact (at current prices)	106	79	103	146	190	329	566	2170	2925	3279
Direct Balance of Payments Impact (at constant 1967 prices)	106	79	103	146	132	195	208	291	379	423

a) The reinvestment of undistributed profits is not included here because complete data are not available. The borrowed foreign funds made by Pertamina for its own use which were not accounted for because they were channelled outside the control system of Indonesia's monetary authorities are also not included here. Since the focus here is to examine the contribution of the petroleum sector to the availability of foreign exchange for use by the other sectors of the economy, these items are actually not important in this context.

b) Estimated.

Source : See the source and explanation for table V.1

Table V.3 Foreign Exchange Availability, 1967-1976
(at current prices in millions of US dollars)

I t e m	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Petroleum Industry's alance of Payments Impact	106	79	103	146	190	329	566	2170	2925	3279
Non-Petroleum Exports	527	569	629	739	794	879	1606	2199	1820	1901
Net Capital Inflows (in non-petroleum sector)	307	214	273	293	437	233	149	405	355[a]	1980
Errors and Omissions	-30	-4	50	-6	-94	56	77	-315	-103	-182
Total Foreign Exchange Availability	910	858	1055	1172	1327	1497	2398	4459	4997	6978
Petroleum Indsutry's Balance of Payments Impact as Per cent of Total Foreign Exchange Availability	11.6	9.2	9.8	12.5	14.3	22.0	23.6	48.7	58.5	47.0

a) In these particular years, the repayments of Pertamina's debt were included in Net Capital Inflows of non-petroleum sector since these payments were taken out of the country's foreign exchange reserves.

Source : See table V.1

2. The Direct Impact of The Petroleum Industry On Public Saving

The government current revenues derived from the petroleum industry consisted of corporate tax payments, sales tax payments and other related payments, royalties, signature bonus, production bonus and other payments. These payments are lumped together as Petroleum Revenues in Indonesia's National Budget. Current revenues in Indonesia's national budget are grouped into two major categories : petroleum revenues and non-petroleum revenues. Table V.4 shows the development of these two sources of revenues during 1967-1976. It shows that petroleum revenues had started to dominate total current revenues in Indonesian public finance since 1974. Petroleum revenues expressed as a percentage of total current revenues had increased from 15 per cent in 1967 to 60 per cent in 1976. The current and the future importance of petroleum revenues to government is clearly established.

The sum of petroleum revenues and non-petroleum revenues must exceed total government current expenditures during a given fiscal year if there is to be any public saving. Based on the contribution of petroleum revenues to total domestic revenues as indicated in Table V.4, public saving will increase to the extent that petroleum revenues grow faster than the rate of growth of current expenditures. In this way the petroleum industry can contribute to public saving and hence to total investment resources. Table V.5 shows the public saving achievements of the Indonesian government during 1967 - 1976. It can be deduced from these data that public saving in general, other things being equal, would have been negative in the absence of petroleum revenues which indicates that petroleum revenues did contribute substantially to public saving and hence to total investment resources which are a scarce factor in the Indonesian economy.

Before concluding this section, it is useful to present here some of the negative direct impact of Pertamina's financial crisis in 1975 on Indonesia's balance of payments and national budget. This information might be useful for gauging some possible positive direct impact of petroleum industry to the Indonesian economy if this crisis did not happen.

Indonesia's foreign exchange reserves which totaled around US$ 1.4 billion[1] at the end of fiscal year 1974 had to be replenished by borrowing money from foreign commercial banks at commercial terms because the government used this reserve to settle some of Pertamina's loans. This action obviously caused an extra cost to the Indonesian economy. In the past, maintaining foreign exchange reserves only cost the Indonesian economy an amount equal to the opportunity costs of these financial resources if these resources were just tied up in the

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1 Bank Indonesia, Weekly Report, May 7, 1976.

reserves. If these reserves produced a yield then the annual costs to the Indonesian economy were determined by the difference between this yield and the inflation rate of currencies held as reserves. By having foreign exchange reserves derived from borrowed external funds, the annual costs to the Indonesian economy were not only the opportunity costs (expressed as a percentage of the principal) or the difference between yield and inflation rate of this reserve but also the interest charges paid for maintaining it. This is therefore not an altogether healthy situation from the national economic point of view.

The budget effect of Pertamina's financial crisis had been created by the US$ 800 million short-fall in Pertamina's payment to the government and the US$ 900 million as payment to be made by the government on behalf of Pertamina to Pertamina's suppliers and contractors[1]. The following moves were made by the government which affected the national budget which in turn adversely affected public welfare :

(1) Raising the prices of petroleum products for domestic consumption[2].

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1 Ministry of Mining's report to Parliament, May 21, 1976.

2 It is useful to note here that the prices of petroleum products for domestic consumption are subject to government control and have been generally kept relatively low and in fact being subsidized.

(2) Raising the prices of imported fertilizers, rice, sugar, wheat-flour and pesticides.

The raising of the prices of petroleum products for domestic consumption was announced on April 3, 1975 and the raising of the prices of imported fertilizers, rice and sugar was anmounced on October 29, 1975. The prices of these products were raised in order to remove or minimize the government subsides on these products. In 1974/75 fiscal year, the government directly subsidized the domestic petroleum products consumers since the domestic sales revenues of petroleum products fell short of the amounts paid for production and distribution of these products by Pertamina. The amount of this subsidy amounted to Rp 15.9 billion or US 38 million in 1974/75 fiscal year[1]. Direct subsidies on imported fertilizers, rice, sugar, wheatflour and pesticides in the sense of charging consumers less than their purchase prices at international market were estimated at about US$ 1.05 billion for the 1974/75 and 1975/76 fiscal year combined[2].

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1 World Bank <u>Indonesia : Development Prospects And Needs</u>, April 1975, p.21.

2 Ibid.

Table V.4 Current Revenues by Sources,
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(in billions of Rupiahs)

Fiscal Year	Non-Petroleum Revenues	Petroleum Revenues	Total Current Revenues	Petroleum Revenues as % of Total Current Revenues
1967	51.2	9.0	60.2	14.95
1968	116.6	33.2	149.8	22.16
1969	178.1	65.8	243.9	26.98
1970	245.4	99.2	344.6	28.79
1971	287.3	140.7	428.0	32.87
1972	360.1	230.5	590.6	39.03
1973	585.5	382.2	967.7	39.50
1974	789.1	957.2	1,746.3	54.81
1975	993.9	1,248.0	2,241.9	55.67
1976	1,129.0	1,674.2	2,803.2	59.72

Source : Rencana Anggaran Pembangunan Dan Belanja Negara, Ministry of Finance, various years.

Table V.5 Indonesian Government Public Saving, 1967 - 1976
(in billion Rupiahs)

Fiscal Year	Total Current Revenues	Total Current Expenditure	Public Saving
1967[a)]	n.a.	n.a.	n.a.
1968	149.8	149.8	0
1969	243.7	216.5	27.2
1970	344.6	288.2	56.4
1971	428.0	349.1	78.9
1972	590.6	438.1	152.5
1973	967.7	713.3	254.4
1974	1,753.7	1,016.1	737.6
1975	2,241.9	1,332.6	909.3
1976	2,906.0	1,629.8	1,276.2

a) No distinction was made in this year between current revenue and development fund received in revenue side as well as between current expenditures and development expenditures in expenditure side of the budget.

Source : See table V.4.

3. The Direct Impact of The Petroleum Industry On Gross Domestic Product and Gross National Product

The magnitude of the petroleum industry's gross value added is determined by the export and local sales values of the petroleum industry's output. To find value added as a residual, various deductions can be made from the industry's total proceeds. The following notations and definitional relationships were used to describe the calculation of the petroleum industry's direct contribution to Indonesia's Gross Domestic Product and Gross National Product.

Notations

H = total receipts

E = export proceeds

L = local sales proceeds

K_F = net foreign capital inflows

C = total expenditures

M = imports of goods and services

G = total payments to the government

O = other local payments including wages and salaries

F_o = other net factor payments abroad

F = total net factor payments abroad

R = profits transferred abroad

V_1 = value added using domestic accounting concepts

V_2 = value added using national accounting concepts

Definitional Relationships

$$H = E + L + K_f \qquad (1)$$

$$C = M + G + O + F_o + R \qquad (2)$$

$$H = C \qquad (3)$$

$$F = R + F_o \qquad (4)$$

Value added as a residual using domestic accounting concepts will be as follows,

$$V_1 = H - (M + O) \qquad (5)$$

or

$$V_1 = E + L - K_f - (M + O) \qquad (6)$$

Value added as a residual using national accounting concepts is expressed as follows,

$$\begin{aligned} V_2 &= H - (M + O + R + F_o) \\ &= E + L + K_f - (M + O + R + F_o) \\ &= E + L + K_f - (M + O + F) \qquad (7) \end{aligned}$$

For a less developed economy with a significant foreign-controlled export sector, Gross National Product is generally a more useful national accounting measure than Gross Domestic Product. Gross Domestic Product exceeds Gross National Product by the amount of net factor payments made abroad. These payments may often be very large which make Gross Domestic Product gives an inflated view of the amount of goods and services actually available to domestic owners of factors of production. This bias is shown in Table V.6, where contributions of the Indonesian petroleum industry to Gross Domestic Product and to Gross National Product are compared.

Table V.6 Petroleum Sector's Contribution to Gross Domestic Product and Gross National Product (at constant 1960 market prices)

Year	Contribution to Gross Domestic Product	% of GDP	Contribution to Gross National Product	% of GNP
1967	13.55	3.02	7.74	1.74
1968	18.23	3.67	11.36	2.30
1969	22.24	4.19	15.41	2.93
1970	27.43	4.80	18.88	3.34
1971	31.07	5.09	19.92	3.29
1972	38.29	5.85	15.51	2.39
1973	44.05	5.95	17.23	2.45
1974	154.00	19.43	116.68	15.45
1975	141.66	16.96	104.93	13.21
1976	149.15	16.67	124.20	14.60

Source : Calculated on the basis of data on the components of petroleum industry's value added and data given in National Income Accounts and Balance of Payments.

The figures in this table indicate that the direct contribution of the petroleum industry in Gross National Product had been increasing during this period which was due both to increase in production volumes and prices. The share of domestic value added attributed to the petroleum sector in Indonesia's Gross National Product had increased from 2.98 per cent in 1967 to 11.41 per cent in 1976 and the corresponding decline of the share of non-petroleum sectors. The share of domestic value added attributed to non-petroleum sectors had declined from 97.02 per cent in 1967 to 88.59 per cent in 1976.

Conclusions

The above general discussion of the historical development of the petroleum industry, as measured by a number of indicators directly related to the level of foreign exchange, public saving and national output, points to the importance of this industry in the Indonesian economy. This discussion is useful in putting the petroleum industry in the perspective of the rest of the economy and in showing the direct contributions of this industry to a number of macro-economic variables.

However for the purpose of measuring the direct and indirect impact of the petroleum industry on other industries and on national income through its components, the approach presented in the fore-going discussion is not sufficient. A better understanding of the structural characteristics of an economic system and its response to the growth in a particular sector, such as petroleum, can be gained by using an input-output analysis and the macro-economic model. These approaches are presented in the subsequent two chapters.

CHAPTER VI

THE IMPACT OF THE PETROLEUM INDUSTRY ON THE INDONESIAN ECONOMY : THE INPUT-OUTPUT APPROACH

This chapter deals with the application of the input-output model to assess the impact of the petroleum industry on the Indonesian economy. Two quantitative measures of this impact are presented and analyzed :

(1) The petroleum sector's interindustry linkages with the rest of the economy.

(2) The economic multipliers generated by the growth in the final demand for petroleum sector's output.

The data used for the impact estimates were taken from the Indonesian input-output table of 1971. This table is of three dimensions : 175 x 175 sectors, 66 x 66 sectors and 19 x 19 sectors. For the purpose of inter-sectoral comparison of the impact of each sector on the economy, the 19 x 19 sector model was chosen since it is sufficient to cover the major sectors of the economy. However since in the 19 x 19 sector model, the petroleum mining is lumped together with the other types of mining, an attempt was made to segregate the petroleum & natural gas mining from the rest of the mining

sector. This was done on the basis of data given on petroleum mining in the 66 x 66 sector model where petroleum mining is given separately. The traditional agricultural sectors which appear in two separate sectors in the 19 x 19 sector model, i.e. paddy and other farm products, were aggregated into one sector called "farm products". Also public administration and other services were aggregated into "Other Services". As a result of this reduction and aggregation the 19 x 19 sector model is still retained although in slightly revised form.
In this model, the petroleum industry is represented by two sectors : petroleum mining and petroleum refining which produce two different types of commodities i.e. crude oil and petroleum products.

The following are the classification of sectors used in this study :

Sector 1 : Farm Products
Sector 2 : Other Agricultural Crops
Sector 3 : Livestock & Products
Sector 4 : Forestry
Sector 5 : Fisheries
Sector 6 : Food, Beverage & Tobacco Industries
Sector 7 : Miscellaneous Industries
Sector 8 : Petroleum Refining
Sector 9 : Public Utilities

Sector 10 : Construction

Sector 11 : Trade

Sector 12 : Restaurants & Hotels

Sector 13 : Transport & Communication

Sector 14 : Financing, Real Estate & Business Services

Sector 15 : Other Services

Sector 16 : Petroleum & Natural Gas Mining

Sector 17 : Coal & Metal Ore Mining

Sector 18 : Other Mining & Quarrying

Sector 19 : Unallocated Industries

The Input - Output Model

The balance equation between output and final demand in the input-output model is formulated as follows,

$$X_i = \sum_{j=1}^{n} x_{ij} + Y_i \qquad (1)$$

where X_i is the vector of gross output of sector i [i = 1,2, ... n]

x_{ij} is total output of sector i used as input by sector j [j = 1,2, ... n]

Y_i is vector of final demands for output of sector i

Following Leontief's assumption that the input used in a sector is a unique function of the level of output in that sector, we can then specify the technical coefficients [a_{ij}] to be as follows,

$$a_{ij} = \frac{x_{ij}}{X_j} \qquad (2)$$

It follows from equation (2) that

$$x_{ij} = a_{ij} X_j \qquad (3)$$

Substituting equation (3) into equation (1) we obtain

$$X_i = \sum_{i,j}^{n} a_{ij} X_j + Y_i \qquad (4)$$

Given the level of final demand, the open input-output system of balance equation depicted by equation (4) can be solved for n unknown levels of output of producing sectors in terms of known final demand for each sector's output. This general solution can be derived as follows :

Equation (4) can be expressed in the following multi equations,

$$\begin{array}{lllllll} X_1 & = & a_{11}X_1 + & a_{12}X_2 + & \cdots\cdots + & a_{1n}X_n + & Y_1 \\ X_2 & = & a_{21}X_1 + & a_{22}X_2 + & \cdots\cdots + & a_{2n}X_n + & Y_2 \\ \vdots & & \vdots & \vdots & & \vdots & \vdots \\ X_n & = & a_{n1}X_1 + & a_{n2}X_2 + & \cdots\cdots + & a_{nn}X_n + & Y_n \end{array} \qquad (5)$$

Transferring all the X's to the left-hand-side we obtain the following set of simultaneous equations,

$$\begin{aligned}
X_1 - [a_{11}X_1 + a_{12}X_2 + \cdots\cdots + a_{1n}X_n] &= Y_1 \\
X_2 - [a_{21}X_1 + a_{22}X_2 + \cdots\cdots + a_{2n}X_n] &= Y_2 \\
\vdots \qquad \vdots \qquad \vdots \qquad\qquad \vdots \quad &\quad \vdots \\
X_n - [a_{n1}X_1 + a_{n2}X_2 + \cdots\cdots + a_{nn}X_n] &= Y_n
\end{aligned} \tag{6}$$

Equation system (6) can be written in matrix form after factoring out X_i .

$$\begin{bmatrix} (1-a_{11}) & -a_{12} & - \cdots\cdots & -a_{1n} \\ -a_{21} & (1-a_{22}) & - \cdots\cdots & -a_{2n} \\ \vdots & \vdots & & \vdots \\ -a_{n1} & -a_{n2} & & (1-a_{nn}) \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}$$

This matrix system can then be written in abbreviated form :

$$[\, I - A \,]\, X = Y \tag{7}$$

where I is identity matrix

A matrix containing a_{ij} as its elements

Solving X in terms of Y following matrix rule we obtain

$$X = [I - A]^{-1}\, Y \tag{8}$$

where $[I - A]^{-1}$ is the inverse of matrix $[I - A]$.

The balance equation (8) implies that all intersectoral flows are considered as being of domestic origin and imports are treated as non-competitive. This balance equation is not appropriate for the analysis of intersectoral linkages in the economies of the less developed countries which exhibit a substantial persistent dependence on import of input for their domestic industries. For this matter, the inverse matrix net of imports is determined under the following conditions[1] :

(a) imports are treated as competitive,

(b) the level of competitive imports is determined outside the system of sectoral interdependence.

(c) imports have proportional relationship with gross domestic output.

In this case, adjustments have to be made to the previous balance equation to take account of the imported component in determining the proper level of output from the sectoral interdependence system if we want to measure the intersectoral linkages among domestic productive sectors since imports constitute linkages which produce linkages in the exporting countries.

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1 This is known as Model III in the treatments of import in input-output model developed by Matuszewski et.al. which was adopted in determining the Leontief's inverse net of imports for the Indonesian input-output table. See T.I. Matuszewski, et.al "Alternative Treatments of Imports in Input-Output Models ; A Canadian Study", Journal of the Royal Statistical Society, Series A, 126, Part 3, 1963, pp.417-19.

These adjustments are made by subtracting the values of competitive imports from the final demand before multiplying the vector so obtained by the Leontief's inverse matrix thus :

$$X = (I - A)^{-1} (Y - M) \qquad (9)$$

where M is imports vector.

The proportionality relationship between imports and gross domestic output level is given by

$$M = m^{*} X \qquad (10)$$

where m^{*} is the factor of proportionality. On the basis of this proportionality relationship, each m_i^{*} ($i = 1, 2, \ldots\ldots n$) is an import coefficient which is given in the following relationship (based on equations (4) and (10)) :

$$m_i^{*} = \frac{M_i}{\sum\limits_{i,j}^{n} a_{ij} X_j + Y_i} \qquad (11)$$

Equation (11) forms a diagonal matrix of import coefficients. The following system of simultaneous equations then can be written,

$$\begin{array}{lllllll}
X_1 & = & a_{11} X_1 + & a_{12} X_2 + & \ldots\ldots\ldots + & a_{1n} X_n + Y_1 - & m_1^{*} X_1 \\
X_2 & = & a_{21} X_1 + & a_{22} X_2 + & \ldots\ldots\ldots + & a_{2n} X_n + Y_2 - & m_2^{*} X_2 \\
\vdots & & \vdots & \vdots & & \vdots & \vdots \\
X_n & = & a_{n1} X_1 + & a_{n2} X_2 + & \ldots\ldots\ldots + & a_{nn} X_n + Y_n - & m_n^{*} X_n
\end{array} \qquad (12)$$

Transferring all the X's to the lefthand-side we obtain the following new set of simultaneous equations :

$$\begin{array}{l} X_1 - (a_{11}X_1 + a_{12}X_2 + \dots\dots\dots + a_{1n}X_n) + m_1^* X_1 = Y_1 \\ X_2 - (a_{21}X_1 + a_{22}X_2 + \dots\dots\dots + a_{2n}X_n) + m_2^* X_2 = Y_2 \\ \vdots \\ X_n - (a_{n1}X_1 + a_{n2}X_2 + \dots\dots\dots + a_{nn}X_n) + m_n^* X_n = Y_n \end{array} \qquad (13)$$

Equation system (13) can then be written in matrix form after factoring out X_i as follows,

$$\begin{bmatrix} (1 - a_{11} + m_1^*) & - a_{12} & - \dots\dots & - a_{1n} \\ - a_{21} & (1 - a_{22} + m_2^*) & - \dots\dots & - a_{2n} \\ \vdots & \vdots & & \vdots \\ - a_{n1} & - a_{n2} & - \dots\dots & (1 - a_{nn} + m_n^*) \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}$$

This matrix system can then be written in the following short form,

$$(I - A + M^*) X = Y \qquad \text{so that}$$

$$X = (I - A + M^*)^{-1} Y \qquad (14)$$

where M^* is matrix of import coefficients.

Inter-Sectoral Linkages in The Indonesian Economy

The degree of the petroleum sector's interdependence with the rest of the sectors in the Indonesian economy can be deduced from the input-output table of Indonesia. Interdependence of an industry with the rest of the economy is known in development literature as backward and forward linkages of this particular industry[1]. There are two main methods that have been widely used in a calculating these linkages :

(1) Chenery - Watanabe's Method[2]

(2) Rasmussen's Method[3]

Chenery and Watanabe define backward linkage of an industry as the ratio of its inter-industry purchases (intermediate inputs) to its total gross output. An industry is considered to have high backward linkage if inputs purchased from other industries constitute a large share of the value of its gross output. Forward linkage is defined as the ratio of interme-

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1 These are based on the ideas proposed in Albert Hirschman The Strategy of Economic Development, New Haven, Connecticut : Yale University Press, 1958, pp.98-116.

2 Hollis B. Chenery and Tsunehiko Watanabe, "International Comparison Production Structure", Econometrica, vol.26 (1958), p.492.

3 Norreghard P. Rasmussen, Studies in Inter-Sectoral Relations, Amsterdam:North-Holland Publishing Company, 1956, Chapter 8, p.133. See also Siegfried Schultz, "Intersectoral Comparison As An Approach To The Identification of Key Sectors", in Karen R.Polenske and Jiri V.Skolka, Advances in Input-Output Analysis, Cambridge, Massachusetts : Ballinger Publishing Company, 1976, pp.144-47.

diate demand to total demand for the output of an industry. An industry has high forward linkage with the rest of the economy if a large share of its output is purchased by other industries.

In the input-output notation, backward linkage index [u_j] is defined as

$$u_j = \frac{U_j}{X_j}$$

where U_j is the total purchase of inputs by industry j, and forward linkage [w_i] is defined as

$$w_i = \frac{W_i}{Y_i}$$

where W_i is the total amount of intermediate demand for output of sector i.

The linkage indices developed by Chenery - Watanabe relate only to the direct effects of an increase in the output of different industries on the whole economy. A more appropriate index of the interindustry linkages is to calculate both the direct and indirect repercussions of the growth in a particular sector on the rest of the economy. Rasmussen's method serves this purpose and therefore it was adopted in this study.

Rasmussen's indices of power of dispersion and sensitivity of dispersion were used to measure respectively Hirschman's backward and forward linkages. The indices of power of dispersion and sensitivity of dispersion were obtained by normalizing respectively the average inverse matrix of column j (j = 1,2, ... n) and the average inverse matrix of row i (i = 1,2, ... n) of an input-output model.

The normalizing factors proposed by Rasmussen for each of these indices are $\frac{1}{n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} b_{ij}$ for the index of power of dispersion and $\frac{1}{n^2} \sum_{j=1}^{n} \sum_{i=1}^{n} b_{ij}$ for the index of sensitivity of dispersion. Here b_{ij} is the element of the Leontief's inverse matrix. This normalizing procedure was proposed in order to make these indices suitable for making intersectoral comparisons. Thus the following definitions of backward and forward linkages were adopted :

$$u_j = \frac{\frac{1}{n} \sum_{i=1}^{n} b_{ij}}{\frac{1}{n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} b_{ij}} \qquad \text{(index of power of dispersion)}$$

$$w_i = \frac{\frac{1}{n} \sum_{i=1}^{n} b_{ij}}{\frac{1}{n^2} \sum_{j=1}^{n} \sum_{i=1}^{n} b_{ij}} \qquad \text{(index of sensitivity of dispersion)}$$

Using the basic data given in tables VI.1 and VI.2, the intersectoral linkages in the Indonesian economy along with their respective ranks are shown in tables VI.3 and VI.4.

Table VI.1 The Input Coefficients Matrix

Sector / Sector	1	2	3	4	5	6	7	8	9	10
1	0.24519	0.00010	0.01028	0.00000	0.00125	0.33728	0.00096	0.00000	0.00000	0.00215
2	0.00015	0.22659	0.00400	0.00000	0.00000	0.19440	0.02361	0.00000	0.00000	0.00001
3	0.00222	0.00166	0.22788	0.00000	0.00000	0.00106	0.00198	0.00000	0.00000	0.00000
4	0.00108	0.00463	0.00001	0.05967	0.00204	0.00204	0.02049	0.00000	0.00001	0.11233
5	0.00000	0.00000	0.00021	0.00000	0.16191	0.00334	0.00001	0.00000	0.00000	0.00000
6	0.00060	0.00001	0.00382	0.00000	0.00153	0.02937	0.01081	0.00000	0.00000	0.00000
7	0.02249	0.03489	0.00388	0.03441	0.01825	0.03048	0.21920	0.04072	0.03065	0.24982
8	0.00021	0.00587	0.00033	0.02194	0.00715	0.00863	0.01359	0.02301	0.25938	0.00660
9	0.00029	0.00242	0.00032	0.00747	0.00045	0.02022	0.01898	0.00854	0.02802	0.00191
10	0.00258	0.00720	0.00376	0.01401	0.00007	0.00206	0.00439	0.00477	0.00750	0.00143
11	0.01072	0.04322	0.02470	0.03635	0.02959	0.04820	0.08466	0.01540	0.07310	0.13793
12	0.00062	0.00569	0.00022	0.00712	0.00734	0.00786	0.00588	0.00648	0.01355	0.00743
13	0.00693	0.03048	0.01398	0.02804	0.01802	0.04153	0.03382	0.01455	0.05641	0.06322
14	0.00219	0.01142	0.00166	0.00885	0.00446	0.00895	0.01613	0.02015	0.01192	0.01266
15	0.00018	0.00095	0.00003	0.00083	0.00039	0.00235	0.00189	0.00616	0.00150	0.00164
16	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00292	0.52290	0.00000	0.00000
17	0.00000	0 00000	0.00000	0.00000	0.00000	0.00026	0.00355	0.00000	0.00000	0.00000
18	0.00000	0.00000	0.00000	0.00000	0.00000	0.00040	0.00000	0.00006	0.00000	0.00000
19	0.00090	0.00421	0.00028	0.00368	0.00425	0.00754	0.01147	0.00220	0.02455	0.00318

Table VI.1 (Continued)

Sector / Sector	11	12	13	14	15	16	17	18	19
1	0.00018	0.10658	0.00268	0.00000	0.00704	0.00000	0.00000	0.00000	0.03815
2	0.00076	0.04712	0.00019	0.00000	0.00052	0.00000	0.00000	0.00000	0.05788
3	0.00000	0.10639	0.00447	0.00000	0.00290	0.00000	0.00000	0.00000	0.00000
4	0.00087	0.00327	0.00067	0.00007	0.00116	0.00000	0.00048	0.00418	0.00187
5	0.00000	0.09870	0.00105	0.00000	0.00188	0.00000	0.00000	0.00000	0.04618
6	0.00211	0.17669	0.00698	0.00009	0.00641	0.00000	0.00000	0.00000	0.19331
7	0.02619	0.01731	0.16856	0.04326	0.08813	0.00440	0.03579	0.04826	0.20798
8	0.01927	0.01565	0.09300	0.00448	0.01075	0.00560	0.08081	0.00931	0.03675
9	0.00630	0.01838	0.00655	0.00726	0.01985	0.02029	0.08414	0.00009	0.00288
10	0.00331	0.00495	0.00487	0.08245	0.00721	0.00127	0.00525	0.00240	0.00000
11	0.01057	0.07013	0.03023	0.00910	0.02587	0.00193	0.02820	0.01494	0.10370
12	0.00510	0.00256	0.00346	0.01061	0.00212	0.00416	0.01140	0.00159	0.06138
13	0.02090	0.03862	0.03796	0.03519	0.01540	0.00545	0.03590	0.00899	0.04350
14	0.02830	0.01434	0.01044	0.04752	0.01109	0.01006	0.01423	0.00814	0.03465
15	0.00010	0.01119	0.00322	0.00000	0.01733	0.00133	0.00282	0.00151	0.06677
16	0.00000	0.00000	0.00000	0.00000	0.00000	0.00563	0.00000	0.00000	0.00000
17	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00030	0.00000	0.00000
18	0.00000	0.00000	0.00000	0.00000	0.00011	0.00000	0.00000	0.00000	0.00209
19	0.00984	0.00136	0.00010	0.00038	0.01887	0.00016	0.00298	0.02883	0.10290

Table VI.2 <u>The Leontief Inverse Matrix</u>

Sector \ Sector	1	2	3	4	5	6	7	8	9	10
1	1.32641	0.00469	0.02066	0.00402	0.00664	0.36681	0.01655	0.00432	0.01068	0.01135
2	0.00273	1.29843	0.00898	0.00468	0.00411	0.25621	0.04528	0.00505	0.01027	0.01755
3	0.00425	0.00469	1.29554	0.00180	0.00172	0.00584	0.00636	0.00198	0.00368	0.00365
4	0.00322	0.01009	0.00124	1.06742	0.00394	0.00774	0.03513	0.00338	0.00442	0.12016
5	0.00035	0.00171	0.00056	0.00158	1.19483	0.00655	0.00308	0.00174	0.00440	0.00252
6	0.00232	0.00507	0.00600	0.00439	0.00596	1.03766	0.02481	0.00463	0.01232	0.01085
7	0.04135	0.04319	0.00889	0.03896	0.02614	0.04902	1.23694	0.03751	0.04905	0.18902
8	0.00346	0.01813	0.00419	0.02375	0.01427	0.02892	0.03282	1.03870	0.27999	0.03353
9	0.00189	0.00687	0.00151	0.01155	0.00270	0.02678	0.03408	0.02345	1.03910	0.01474
10	0.00433	0.01240	0.00574	0.01734	0.00159	0.00870	0.01202	0.00943	0.01333	1.00931
11	0.02087	0.06145	0.03683	0.04316	0.04348	0.07567	0.13612	0.03197	0.09211	0.18020
12	0.00163	0.00973	0.00102	0.00973	0.01019	0.01319	0.01353	0.01113	0.02074	0.01405
13	0.01299	0.04978	0.02185	0.03919	0.02713	0.04743	0.05737	0.02757	0.06789	0.08405
14	0.00508	0.02121	0.00441	0.01509	0.00900	0.02127	0.03504	0.03193	0.02868	0.03060
15	0.00061	0.00248	0.00032	0.00205	0.00138	0.00462	0.00541	0.00822	0.00663	0.00424
16	0.00197	0.00981	0.00226	0.01798	0.00764	0.01553	0.02698	0.53647	0.12282	0.01887
17	0.00018	0.00033	0.00007	0.00028	0.00017	0.00065	0.00539	0.00031	0.00039	0.00149
18	0.00015	0.00078	0.00018	0.00143	0.00061	0.00165	0.00185	0.03340	0.01218	0.00143
19	0.00237	0.00855	0.00126	0.00662	0.00701	0.01386	0.02297	0.00648	0.03252	0.01243

Table VI. 2 (Continued)

Sector \ Sector	11	12	13	14	15	16	17	18	19
1	0.00524	0.21948	0.01176	0.00499	0.01880	0.00147	0.00575	0.00670	0.17018
2	0.00593	0.10287	0.01329	0.00603	0.01167	0.00116	0.00589	0.00798	0.14471
3	0.00137	0.13082	0.00802	0.00253	0.00535	0.00079	0.00274	0.00109	0.01408
4	0.00318	0.00844	0.00829	0.01343	0.00627	0.00066	0.00383	0.00721	0.01553
5	0.00162	0.11015	0.00263	0.00188	0.00450	0.00067	0.00240	0.00254	0.06280
6	0.00693	0.17792	0.01353	0.00504	0.01501	0.00138	0.00603	0.00897	0.20597
7	0.02847	0.03740	0.12226	0.05855	0.06945	0.01347	0.05900	0.04261	0.18294
8	0.02721	0.03775	0.10160	0.01678	0.02580	0.01304	0.05583	0.01580	0.06551
9	0.00917	0.02769	0.01621	0.01186	0.02579	0.02188	0.08212	0.00321	0.02478
10	0.00693	0.01130	0.00959	0.07861	0.01058	0.00269	0.00961	0.00447	0.01245
11	1.02171	0.10079	0.05439	0.03749	0.04024	0.00643	0.04110	0.03009	0.16589
12	0.00734	1.00874	0.00782	0.01367	0.00616	0.00500	0.01564	0.00501	0.06899
13	0.02853	0.05851	1.05744	0.04207	0.02931	0.00888	0.04238	0.01730	0.08026
14	0.03338	0.02722	0.02246	1.05598	0.01899	0.01198	0.02375	0.01337	0.09522
15	0.00149	0.01342	0.00538	0.00110	1.02012	0.00169	0.00496	0.00431	0.07020
16	0.01448	0.02011	0.04951	0.00917	0.01403	1.01255	0.05117	0.00858	0.03098
17	0.00021	0.00036	0.00101	0.00042	0.00057	0.00005	1.00062	0.00033	0.00160
18	0.00117	0.00167	0.00468	0.00071	0.00125	0.00055	0.00486	1.00074	0.00562
19	0.01251	0.00810	0.00572	0.00327	0.02516	0.00115	0.00828	0.03409	1.08877

Table VI.3 Backward Linkage Indices in The Indonesian Economy, 1971

Sector	u_j	Rank
1. Farm Products	0.92237	10
2. Other Agricultural Crops	0.99409	8
3. Livestock & Products	0.84341	15
4. Forestry	0.83043	16
5. Fisheries	0.86685	12
6. Food,Beverage & Tobacco Industries	1.25931	3
7. Miscellaneous Industries	1.10959	7
8. Petroleum Refining	1.15136	4
9. Public Utilities	1.14732	5
10. Construction	1.11485	6
11. Trade	0.77080	17
12. Restaurants & Hotels	1.33193	2
13. Transport & Communication	0.96001	9
14. Financing,Real Estate & Business Services	0.86373	13
15. Other Services	0.85452	14
16. Petroleum & Natural Gas Mining	0.70024	19
17. Coal & Metal Ore Mining	0.90324	11
18. Other Mining & Quarrying	0.76923	18
19. Unallocated Industries	1.56233	1

Table VI.4 Forward Linkage Indices In The Indonesian Economy, 1971

Sector	w_i	Rank
1. Farm Products	1.40399	3
2. Other Agricultural Crops	1.23696	5
3. Livestock & Products	0.94779	9
4. Forestry	0.83839	13
5. Fisheries	0.89092	11
6. Food,Beverage & Tobacco Industries	0.98484	8
7. Miscellaneous Industries	1.47855	1
8. Petroleum Refining	1.16365	6
9. Public Utilities	0.87753	12
10. Construction	0.78571	16
11. Trade	1.40626	2
12. Restaurants & Hotels	0.78754	15
13. Transport & Communication	1.14012	7
14. Financing,Real Estate & Business Services	0.92775	10
15. Other Services	0.73390	17
16. Petroleum & Natural Gas Mining	1.24842	4
17. Coal & Metal Ore Mining	0.64256	19
18. Other Mining & Quarrying	0.68087	18
19. Unallocated Industries	0.82416	14

A perusal of Table VI.3 reveals that petroleum and natural gas mining sector had the lowest value of backward linkage index which implies that this sector drew relatively little from domestic productive sectors, directly and indirectly. The low backward linkage of the petroleum and natural gas mining was likely due to the capital intensive nature of operation and the capital equipment required had been largely imported and not supplied by the domestic productive sectors in the Indonesian economy.

Although backward linkage index of the petroleum refining was quite high 1.15136, the index should not be taken by itself to indicate a high interdependence of this sector with the rest of the Indonesian economy because a large portion of its intermediate input was drawn from the petroleum industry itself. Of the 126.8 million rupiahs value of petroleum refining's intermediate inputs, 104.1 billion rupiahs or 82 per cent were drawn from the petroleum industry itself. It is also of interest to know that of the 16.8 billion rupiahs value of the petroleum and natural gas mining's intermediate inputs, 3.1 billion rupiahs or 18.5 per cent constituted the inputs supplied by the petroleum industry itself. Taking these into account, the reported backward linkage indices for the two segments of the Indonesian petroleum industry in Table VI.3 are substantially overstated if it is used in estimating the petroleum industry's backward linkage with non-petroleum industries. Table VI.5 shows the sources of intermediate inputs used by the petroleum industry.

Table VI.5 Sources of Intermediate Inputs Used By The Petroleum Industry, 1971 (in billions of Rupiahs)

	Inputs From Petroleum Industry	Inputs From Non-Petroleum Industries	Total
Petroleum & Natural Gas Mining	3.1 (18.5)	13.7 (81.5)	16.8
Petroleum Refining	104.1 (82.1)	22.7 (17.9)	126.8
Petroleum Industry	107.2 (74.7)	36.4 (25.3)	143.6

Note : Figures in the parentheses indicate the relative shares of the total.

Source : Biro Pusat Statistik, Tabel Input-Output Indonesia, 1971.

Another observation that can be made in this backward linkage context is the similarities between the total interindustry use of the Indonesian petroleum industry and that of the petroleum industry in the United States as reported by Chenery and Watanabe[1]. The United States was taken for comparison

1 Hollis B. Chenery and Tsunehiko Watanabe loc.cit., p.502.

since this is the country where most of the investors and technology in the Indonesian petroleum industry come from and also it is also a major crude oil producing country. The extent of similarity in the use of intermediate product is measured using the following formula as suggested by Chenery-Watanabe[1],

$$\hat{S}_i^{fg} = \frac{\sum_j a_{ij}^{f}\; X_j^{g}}{\sum_j a_{ij}^{g}\; X_j^{g}}$$

Here $\hat{S}_i^{fg}$ denotes the intermediate use of output of sector i and the supercripts f and g denote the countries studied which are respectively Indonesia and the United States. Similarity in the intermediate use of a product is indicated when the value of $\hat{S}_i^{fg}$ is equal to unity.

In order to make the Indonesian input-output table comparable with that of the United States as used by Chenery - Watanabe in their study, the Indonesian input-output table was aggregated and reduced to size 29 x 29 sectors following Chenery - Watanabe's classification of sectors. Table VI.6 shows the comparison of total interindustry use in selected industries between Indonesia and the United States. Two comparisons were made since the country used as the base affects the results. The results indicate that the patterns of the use

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1 Ibid.

of intermediate inputs in the two segments of the Indonesian petroleum industry i.e. petroleum & natural gas mining and petroleum refining were quite similar to those in the United States. This imply that the backward linkage of the Indonesian petroleum industry is expected not to differ very much with the growth of the Indonesian economy in the future. In this particular industry, the notion of similarity of production structure irrespective of differences in the level of economic growth might clearly apply and the discussion on the linkages in the primary export sector and related sectors in less developed countries which are technologically determined by the developed countries actually should only focus on forward linkage as will be shown later.

The forward linkage index of the petroleum and natural gas mining was among the highest in the Indonesian economy. It reached 1.24842 in 1971. This high index, however, should be analyzed further whether it really indicates a high interdependence of this sector with the rest of the domestic productive sectors. For this purpose, an examination of the final disposition of the petroleum mining's output should be made.

Since all production is for the purpose of satisfying final demand, output of all industries will eventually be consumed, invested or exported, directly and/or indirectly. The ultimate disposition of petroleum mining's output is found by multiplying the petroleum mining row in the inverse matrix by the final demand matrix of the input-output table.

Table VI.6 Comparison of Total Interindustry Use By Sectors Between Indonesia and the United States Using Chenery-Watanabe Classification of Sectors

Sector	Indonesia-U.S.A.	U.S.A. - Indonesia
(1) Apparel	1.225	0.816
(2) Shipbuilding	1.322	0.757
(3) Leather & Products	0.843	1.187
(4) Processed Foods	0.838	1.193
(5) Fishing	1.184	0.845
(6) Grain Mill Products	1.126	0.888
(7) Transport	1.590	0.629
(8) Miscellaneous Industries	1.724	0.580
(9) Transport Equipment	0.624	1.602
(10) Rubber Products	1.132	0.884
(11) Textiles	1.301	0.769
(12) Machinery	1.096	0.923
(13) Iron & Steel	1.222	0.859
(14) Non-Metallic Mineral Products	0.773	1.294
(15) Lumber & Wood Products	1.665	0.601
(16) Chemicals	1.025	0.976
(17) Printing & Publishing	1.139	0.878
(18) Agriculture & Forestry	0.624	1.548
(19) Non-Metallic Minerals	0.444	2.255
(20) Petroleum Refining	0.898	1.107
(21) Non-Ferrous Metals	0.872	1.147
(22) Metal Mining & Quarrying	2.380	0.431
(23) Coal Products	1.425	0.702
(24) Trade	0.486	2.056
(25) Paper & Products	0.868	1.152
(26) Electric Power	1.752	0.571
(27) Coal Mining	6.784	0.147
(28) Services	1.449	0.690
(29) Petroleum & Natural Gas Mining	1.128	0.914

Source : Sritua Arief, "The Production Structure of The Indonesian Economy: An International Comparison", SANKHYA, The Indian Journal of Statistics(forthcoming).

Of the total 280.8 billion rupiahs value of petroleum mining's outputs, 104.4 billion rupiahs or 37.2 per cent constituted the intermediate and domestic final demand created by the petroleum industry's itself and 173.6 billion or 61.8 per cent was disposed directly for exports. Only 2.8 billion rupiahs or 1 per cent of petroleum mining's output was contained in other industries' outputs.

The share of other industries' outputs in petroleum refining's output shows a different situation. Of the total 199.8 billion rupiahs value of petroleum refining's outputs, only 8.3 billion rupiahs or 4.2 per cent constituted the intermediate and domestic final demand created by the petroleum industry itself and 10.1 billion rupiahs or 5.1 per cent was disposed for exports. The remaining components of total demand for petroleum refining's outputs were made of intermediate demand created by non-petroleum industries (126.6 billion rupiahs or 63.4 per cent) and domestic consumption (54.8 billion rupiahs or 27.4 per cent). The conclusion that can be derived here is that the forward linkage index of the Indonesian petroleum industry is expected to grow as the economy is more diversified and produce positive effects to domestic productive sectors (which will make the high forward linkage index more meaningful from development point of view), the less of exports of petroleum industry's outputs are in the form of crude oil and more in the form of refined products. Table VI.7 shows the ultimate disposition of petroleum industry's outputs by purchasing industries and final demand categories.

Table VI.7 Ultimate Disposition of Petroleum Industry's Outputs by Components of Total Demand, 1971
(in billions of Rupiahs)

	Total Demand	Intermediate Demand by Petroleum Mining	Intermediate Demand by Petroleum Refining	Intermediate Demand by Non-Petroleum Industries	Domestic Consumption	Change of Stock	Investment	Exports
Petroleum Mining	280.8	1.6 (0.57)	99.8 (35.54)	2.7 (0.96)	-	3.1 (1.10)	-	173.6 (61.83)
Petroleum Refining	199.8	1.6 (0.80)	4.4 (2.20)	126.6 (63.36)	54.8 (27.43)	2.3 (1.15)	-	10.1 (5.06)
Total Petroleum Industry	480.6	3.2 (0.67)	104.2 (21.68)	129.3 (26.90)	54.8 (11.40)	5.4 (1.12)	-	183.7 (38.23)

Note : Figures in parentheses indicate the relative shares of the components of total demand in total demand.

Source : Biro Pusat Statistik Tabel Input-Output Indonesia, 1971.

The preceding analysis of inter-sectoral linkages using Rasmussen's technique has one important limitation. These linkages are of a technological kind derived from the inverted input-output table and thus are estimated solely on the basis of per unit change in final demand for the output of any sector. As such they do not take into consideration the relative sizes of the sectors in the economy. Because of this, these measures may give an incomplete and sometimes a distorted picture.

The sectoral backward and forward linkage indices weighted by their respective final demands are respectively shown in tables VI.8 and VI.9 These final demands were normalized to fit the Rasmussen's interpretation of linkage indices around a basis of unity while at the same time allowing consistent inter-sectoral comparisons. Table VI.8 shows that petroleum refining which ranked as fourth when the backward linkages were not weighted dropped to the thirteenth when it was ranked according to the weighted backward linkages. The petroleum & natural gas mining sector which ranked as nineteenth in the unweighted backward linkages, ranked as eleventh in the weighted backward linkages. In terms of linkage indices, the ranks of petroleum refining and petroleum & natural gas mining dropped from respectively the sixth and the fourth in the unweighted forward linkages to respectively fourteenth and ninth in the weighted forward linkages. These modified linkages, however, do not invalidate the analysis presented previously on the comparative linkages of these segments of the petroleum industry with the domestic sectors of the economy.

Table VI.8 Weighted Backward Linkage Indices In The Indonesian Economy, 1971

Sector	Weighted Backward Linkage Index	Rank
1. Farm Products	5.99550	3
2. Other Agricultural Crops	2.34943	9
3. Livestock & Products	0.75519	14
4. Forestry	0.57756	15
5. Fisheries	1.31068	10
6. Food,Beverage & Tobacco Industries	6.72308	2
7. Miscellaneous Industries	8.66701	1
8. Petroleum Refining	0.77440	13
9. Public Utilities	0.22579	16
10. Construction	5.60859	4
11. Trade	4.50363	5
12. Restaurants & Hotels	3.00830	8
13. Transport & Communication	3.53639	7
14. Financing, Real Estate & Business Services	1.23090	12
15. Other Services	3.79791	6
16. Petroleum & Natural Gas Mining	1.23795	11
17. Coal & Metal Ore Mining	0.17017	17
18. Other Mining & Quarrying	0.11215	19
19. Unallocated Industries	0.14014	18

Table VI.9 Weighted Forward Linkage Indices In The Indonesian Economy, 1971

Sector	Weighted Forward Linkage Index	Rank
1. Farm Products	9.12608	2
2. Other Agricultural Crops	2.92343	8
3. Livestock & Products	0.84865	13
4. Forestry	0.58310	15
5. Fisheries	1.34707	11
6. Food,Beverage & Tobacco Industries	5.25777	4
7. Miscellaneous Industries	11.54895	1
8. Petroleum Refining	0.78267	14
9. Public Utilities	0.17270	16
10. Construction	3.95275	6
11. Trade	8.21650	3
12. Restaurants & Hotels	1.77874	10
13. Transport & Communication	4.19986	5
14. Financing, Real Estate & Business Services	1.32214	12
15. Other Services	3.26182	7
16. Petroleum & Natural Gas Mining	2.20708	9
17. Coal & Metal Ore Mining	0.12106	17
18. Other Mining & Quarrying	0.09927	18
19. Unallocated Industries	0.07393	19

Inter-Sectoral Economic Multipliers

The impact of the growth of demand for petroleum industry's output on the economy using input-output analysis is presented below by estimating two types of sectoral multipliers : household income multiplier and output multiplier. Before presenting the results, the methodology of estimating these multipliers is in order.

Household Income Multiplier

The Keynesian income multiplier in macro-economics indicates the overall total of direct and indirect effect on income of one unit increase in final demand. The overall total effect here means the sum of direct, indirect and induced effects.

The input-output model can be used to evaluate the income effect due to changes in final demand for output of a particular sector of the economy using the income multiplier concept of economic theory. For this purpose, the derivation of partial income multiplier (measuring only the direct and indirect effects) is described first which then will be used to derive the total income multiplier which measures the direct, indirect and induced effects on income of a unit increase in the final demand for output of a sector.

Denoting the elements of the Leontief's inverse matrix net of imports by b_{ij}'s and if only one particular sector of the economy is producing, the total direct and indirect output requirements of this producing sector can be calculated from the following equation,

$$\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & \cdots & b_{1n} \\ b_{21} & b_{22} & \cdots & b_{2n} \\ \vdots & \vdots & & \vdots \\ b_{n1} & b_{n2} & \cdots & b_{nn} \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ \vdots \\ 0 \end{bmatrix} = \begin{bmatrix} b_{11} \\ b_{21} \\ \vdots \\ b_{n1} \end{bmatrix} \qquad [15]$$

If v_i is the value added per unit value of output in sector i , then the output of b_{ij} contributes $v_i b_{ij}$ to the value added in the economy. Following the above equation, the total income added by a unit increase in the final demand for output of sector 1 [partial multiplier denoted by r^*] will be,

$$r^* = v_1 b_{11} + v_2 b_{21} + \cdots\cdots + v_n b_{n1}$$

The above partial income multiplier takes into account only the income generated by the total output requirements of one unit demand for output of sector 1. In the economic process, the repercussions of the initial change in final demand for the output of sector 1 do not end here. The additional income initially generated is bound to induce more consumption, more investment and consequently more income. For this matter, income multiplier that takes into account the successive rounds of consumption expenditure is more useful. This income multiplier is called the total income multiplier.

The total income multiplier can be derived by treating household sector (private consumption) as production sector (input) in addition to the existing ones. To do this, the household row in the input-output table is created and its values are derived from the value added entries which indicate the household income. The following are the new input-output relations where subscript k indicates household and Y_i^* indicates the remaining final demand components.

$$
\begin{aligned}
X_1 &= X_{11} + X_{12} + \ldots\ldots\ldots + X_{1n} + X_{1k} + Y_1^* \\
X_2 &= X_{21} + X_{22} + \ldots\ldots\ldots + X_{2n} + X_{2k} + Y_2^* \\
&\vdots \\
X_n &= X_{n1} + X_{n2} + \ldots\ldots\ldots + X_{nn} + X_{nk} + Y_n^* \\
X_k &= X_{k1} + X_{k2} + \ldots\ldots\ldots + X_{kn} + X_{kk} + Y_k^*
\end{aligned}
\qquad (16)
$$

In terms of technical coefficients, the system of equations (16) can then be written as follows,

$$
\begin{aligned}
X_1 &= a_{11}X_1 + a_{12}X_2 + \cdots\cdots + a_{1n}X_n + a_{1k}X_k + Y_1^* \\
X_2 &= a_{21}X_1 + a_{22}X_2 + \cdots\cdots + a_{2n}X_n + a_{2k}X_k + Y_2^* \\
&\vdots \\
X_n &= a_{n1}X_1 + a_{n2}X_2 + \cdots\cdots + a_{nn}X_n + a_{nk}X_k + Y_n^* \\
X_k &= a_{k1}X_1 + a_{k2}X_2 + \cdots\cdots + a_{kn}X_n + a_{kk}X_k + Y_k^*
\end{aligned} \qquad (17)
$$

Denoting c_{ij}'s as elements of the Leontief's inverse matrix net of imports after including household row and column in the system (the inverse matrix here is therefore augmented) with final demand vector consisting the values of all the components of final demand with only one producing sector (sector 1), then the total direct, indirect and induced output requirements of this producing sector, denoted by vector d, can be written as follows,

$$
\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \\ X_k \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} & \cdots & c_{1n} & c_{1k} \\ c_{21} & c_{22} & \cdots & c_{2n} & c_{2k} \\ & & & & \\ c_{n1} & c_{n2} & \cdots & c_{nn} & c_{nk} \\ c_{k1} & c_{k2} & \cdots & c_{kn} & c_{kk} \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ \vdots \\ \vdots \\ 0 \end{bmatrix} = \begin{bmatrix} d_{11} \\ d_{21} \\ \vdots \\ d_n \\ d_k \end{bmatrix} \qquad (18)
$$

$$k = n + 1$$

Here c_{kl} indicates the output that households must produce per unit of final demand for output of sector l. Since the output of household is the income earned by households, c_{kl} indicates the total additional income generated by an additional unit increase in final demand for the output of sector l. It includes not only the direct and indirect income effects but also the induced income effect.

The explanation of household income multiplier for this particular sector (sector l) can be used as the basis for general definitions of sectoral household income multipliers which are as follows :

a) <u>Partial Household Income Multiplier</u> (${}_{1}Z_{jp}$)

$$ {}_{1}Z_{jp} = \sum_{i=1}^{n} b_{ij} \cdot \frac{v_{hi}}{X_i} $$

where v_{hi} is the value added by final payment to household sector.

b) <u>Total Household Income Multiplier</u> (${}_{1}Z_{jt}$)

$$ {}_{1}Z_{jt} = \sum_{i=1}^{k} c_{ij} \cdot \frac{v_{hi}}{X_i} $$

where $k = n + 1$ and c_{ij} is the elements of the augmented inverse matrix.

These sectoral total multipliers are also found, as explained before, in the household row of the augmented inverse matrix.

Sectoral partial and total household income multipliers are respectively shown in tables VI.12 and VI.13 which were calculated on the basis of data given in tables VI.2, VI.10 and VI.11. These tables show that the petroleum industry represents the production sectors with the lowest household income multipliers, either partial or total. Petroleum & natural gas mining has partial household income multiplier of 0.02882 and total household income multiplier of 0.05502. The figures for petroleum refining are respectively 0.05996 and 0.15008.

Output Multiplier

Sectoral output multipliers are merely the sums of columns in the inverse matrices. The partial output multiplier for sector j is the sum of cells in column j of the Leontief inverse matrix :

$$_2Z_{jp} = \sum_{i=1}^{n} b_{ij}$$

The total output multiplier for sector j is the sum of cells in column j of the augmented Leontief inverse matrix ;

$$_2Z_{jt} = \sum_{i=1}^{k} c_{ij}$$

Tables VI.14 and VI.15 show respectively the partial and total output multipliers by sectors calculated on the basis of data given in tables VI.2 and VI.10 and primary inputs. Table VI.14 shows that the partial output multiplier of the petroleum & natural gas mining is the lowest due to the low value of its indirect component which indicates its small impact on the rest of the economy.

The total output multiplier of this sector is also the lowest as shown in Table VI.15. On the other hand, the petroleum refining's partial and total output multipliers are relatively high. This different magnitude of the output multipliers between these two segments of the petroleum industry reflects the differences in their interindustry linkages.

<u>Sectoral Total Contributions To The Indonesian Economy</u>

Tables VI.16 and VI.17 summarize the direct, indirect and induced contributions of each sector to the Indonesian economy through household income and total output in 1971. The relative shares of each sector reported in these tables were calculated on the basis of absolute contributions made by each sector to total household income and total output which were determined by multiplying the total final demand placed on each sector by their respective total multipliers presented in the previous section. An examination of Table VI.16 indicates that both segments of the petroleum industry were among the least contributor to household income. Petroleum refining contributed only 0.50 per cent of the total household income while petroleum & natural gas mining contributed only 0.48 per cent. In total output, the relative total contributions made by the petroleum industry proved to be relatively low. The relative contributions made by petroleum refining and petroleum & natural gas mining to total output were respectively 1.13 per cent and 1.65 per cent.

Table VI.10 The Augmented Leontief Inverse Matrix

Sector \ Sector	1	2	3	4	5	6	7	8	9	10
1	1.45441	0.14564	0.09480	0.09893	0.06308	0.49779	0.15670	0.05762	0.13813	0.17162
2	0.04050	1.34002	0.03086	0.03268	0.02076	0.30486	0.09663	0.02078	0.04787	0.06484
3	0.02056	0.02265	1.30499	0.01390	0.00891	0.02253	0.02422	0.00877	0.01992	0.02408
4	0.00927	0.01676	0.00475	1.07191	0.00661	0.01393	0.04176	0.00590	0.01045	0.13774
5	0.02331	0.02699	0.01386	0.01861	1.20496	0.03005	0.02822	0.01130	0.02726	0.03127
6	0.06705	0.07634	0.04349	0.05239	0.03449	1.10389	0.09568	0.03158	0.07677	0.09189
7	0.12320	0.14433	0.04209	0.10706	0.06664	0.12300	1.33751	0.09576	0.13005	0.30403
8	0.02036	0.03674	0.01398	0.04628	0.02172	0.04621	0.06132	1.04574	0.30682	0.05469
9	0.00926	0.01499	0.00578	0.01702	0.00594	0.03432	0.04215	0.02652	1.04644	0.02397
10	0.00848	0.01698	0.00815	0.02042	0.00342	0.01295	0.01656	0.01116	0.01747	1.01451
11	0.09637	0.15459	0.08057	0.10915	0.07677	0.16293	0.22880	0.06342	0.17740	0.28474
12	0.02849	0.03931	0.01657	0.02964	0.02203	0.04067	0.04294	0.02231	0.04749	0.04768
13	0.05643	0.09761	0.04700	0.07140	0.04628	0.11187	0.11493	0.04566	0.12115	0.14844
14	0.02839	0.04689	0.01791	0.03238	0.01928	0.04513	0.06057	0.04164	0.05190	0.05980
15	0.02735	0.03192	0.01580	0.02188	0.01317	0.03198	0.03469	0.01936	0.03325	0.03772
16	0.01113	0.01989	0.00756	0.02477	0.01168	0.02490	0.03700	0.55028	0.16193	0.03033
17	0.00053	0.00071	0.00027	0.00054	0.00032	0.00100	0.00577	0.00045	0.00073	0.00192
18	0.00145	0.00220	0.00093	0.00239	0.00118	0.00298	0.00326	0.04393	0.01347	0.00305
19	0.00668	0.01330	0.00376	0.00982	0.00891	0.01828	0.02769	0.00827	0.03681	0.01783
20	0.36039	0.39687	0.20874	0.26724	0.15890	0.36877	0.39462	0.15008	0.35888	0.45127

Table VI.10 [Continued]

Sector \ Sector	11	12	13	14	15	16	17	18	19	20
1	0.10481	0.34751	0.12505	0.12487	0.36726	0.02101	0.12290	0.23104	0.31730	0.48856
2	0.03531	0.14770	0.04671	0.04140	0.11448	0.00693	0.04045	0.07417	0.20516	0.14414
3	0.01406	0.15586	0.02246	0.01780	0.04976	0.00328	0.01767	0.02968	0.03155	0.06226
4	0.00789	0.01402	0.01364	0.01910	0.02274	0.00159	0.00937	0.01781	0.02201	0.02310
5	0.01948	0.14132	0.02295	0.02338	0.06701	0.00418	0.02342	0.04278	0.09740	0.08764
6	0.05728	0.24761	0.07081	0.06566	0.19122	0.01127	0.06527	0.12241	0.31531	0.24705
7	0.10992	0.11210	0.20355	0.14457	0.15950	0.02749	0.14967	0.12360	0.28133	0.25058
8	0.04035	0.05334	0.12655	0.03260	0.07180	0.01562	0.13130	0.04542	0.09361	0.06450
9	0.01490	0.03449	0.02273	0.01876	0.04585	0.02301	0.09887	0.01613	0.03267	0.02813
10	0.01016	0.01513	0.01326	0.09250	0.02189	0.00333	0.01342	0.01175	0.01690	0.01585
11	1.08044	0.18042	0.13122	0.10820	0.25580	0.01796	0.12020	0.16243	0.27677	0.28819
12	0.02824	1.03351	0.03159	0.03883	0.07928	0.00910	0.04023	0.05209	0.10776	0.10252
13	0.06232	0.10857	1.09588	0.09275	0.14757	0.01551	0.09214	0.09343	0.14679	0.16580
14	0.05152	0.04872	0.04310	1.07781	0.08246	0.01554	0.04509	0.05424	0.09020	0.08900
15	0.02229	0.03808	0.02904	0.02614	1.09291	0.00577	0.02944	0.05118	0.10885	0.10206
16	0.02160	0.02855	0.06762	0.01775	0.03896	1.01395	0.06955	0.02463	0.05079	0.03495
17	0.00048	0.00067	0.00131	0.00074	0.00150	0.00010	1.00093	0.00093	0.00197	0.00131
18	0.00217	0.00286	0.00582	0.00192	0.00477	0.00075	0.00604	1.00300	0.00701	0.00494
19	0.01587	0.01208	0.00953	0.00731	0.03691	0.00181	0.01223	0.04165	1.13339	0.01646
20	0.28037	0.33235	0.31898	0.33753	0.98115	0.05502	0.32986	0.63168	0.38607	1.37560

Table VI.11 Household Direct Input Coefficients, 1971

Sector	Coefficient
1. Farm Products	0.18475
2. Other Agricultural Crops	0.18640
3. Livestock & Products	0.10097
4. Forestry	0.14444
5. Fisheries	0.07497
6. Food,Beverage & Tobacco Industries	0.07160
7. Miscellaneous Industries	0.13717
8. Petroleum Refining	0.03299
9. Public Utilities	0.17189
10. Construction	0.18258
11. Trade	0.17246
12. Restaurants & Hotels	0.07562
13. Transport & Communication	0.14584
14. Financing, Real Estate & Business Services	0.17915
15. Other Services	0.64489
16. Petroleum & Natural Gas Mining	0.02607
17. Coal & Metal Ore Mining	0.17371
18. Other Mining & Quarrying	0.42604
19. Unallocated Industries	0.00000

Table VI.12 Sectoral Partial Household Income Multipliers

Sector	Direct Effect Component	Indirect Effect Component	Partial Multiplier
1. Farm Products	0.18475	0.08420	0.26903
2. Other Agricultural Crops	0.18640	0.10613	0.29253
3. Livestock & Products	0.10097	0.03347	0.13444
4. Forestry	0.14444	0.04492	0.18936
5. Fisheries	0.07497	0.02763	0.10260
6. Food, Beverage & Tobacco Industries	0.07160	0.07075	0.14235
7. Miscellaneous Industries	0.13717	0.10311	0.24028
8. Petroleum Refining	0.03299	0.02697	0.05996
9. Public Utilities	0.17189	0.13945	0.31134
10. Construction	0.18258	0.13877	0.32135
11. Trade	0.17246	0.03740	0.20986
12. Restaurant & Hotels	0.07562	0.08339	0.15901
13. Transport & Communication	0.14584	0.07519	0.22103
14. Financing, Real Estate & Business Services	0.17915	0.06514	0.24429
15. Other Services	0.64489	0.22510	0.86999
16. Petroleum & Natural Gas Mining	0.02607	0.00275	0.02882
17. Coal & Metal Ore Mining	0.17371	0.07399	0.24770
18. Other Mining & Quarrying	0.42604	0.09134	0.51738
19. Unallocated Industries	0.00000	0.00000	0.00000

Table VI.13 Sectoral Total Household Income Multipliers

Sector	Partial Multiplier	Induced Effect Component	Total Multiplier
1. Farm Products	0.26903	0.09136	0.36039
2. Other Agricultural Crops	0.29253	0.10434	0.39687
3. Livestock & Products	0.13444	0.07430	0.20874
4. Forestry	0.18936	0.07788	0.26724
5. Fisheries	0.10260	0.05630	0.15890
6. Food, Beverage & Tobacco Industries	0.14235	0.22642	0.36877
7. Miscellaneous Industries	0.24028	0.15434	0.39462
8. Petroleum Refining	0.05996	0.09012	0.15008
9. Public Utilities	0.31134	0.04754	0.35888
10. Construction	0.32135	0.12992	0.45127
11. Trade	0.20986	0.07051	0.28037
12. Restaurant & Hotels	0.15901	0.17334	0.33235
13. Transport & Communication	0.22103	0.09795	0.31898
14. Financing, Real Estate & Business Services	0.24429	0.09324	0.33753
15. Other Services	0.86999	0.11116	0.98115
16. Petroleum & Natural Gas Mining	0.02882	0.02620	0.05502
17. Coal & Metal Ore Mining	0.24770	0.08216	0.32986
18. Other Mining & Quarrying	0.51738	0.11430	0.63168
19. Unallocated Industries	0.00000	0.38607	0.38607

Table VI.14 Sectoral Partial Output Multipliers

Sector	Direct Effect Component	Indirect Effect Component	Partial Multiplier
1. Farm Products	0.69041	0.77575	1.45616
2. Other Agricultural Crops	0.57601	0.99338	1.56939
3. Livestock & Products	0.69433	0.63718	1.33151
4. Forestry	0.73954	0.57148	1.31102
5. Fisheries	0.71768	0.65083	1.36851
6. Food, Beverage & Tobacco Industries	0.25406	1.73404	1.98810
7. Miscellaneous Industries	0.40244	1.34929	1.75173
8. Petroleum Refining	0.33513	1.48254	1.81767
9. Public Utilities	0.48695	1.32435	1.81130
10. Construction	0.35792	1.40212	1.76004
11. Trade	0.86620	0.35067	1.21687
12. Restaurant & Hotels	0.26679	1.83595	2.10274
13. Transport & Communication	0.62521	0.89038	1.51559
14. Financing, Real Estate & Business Services	0.75022	0.61336	1.36358
15. Other Services	0.85812	0.49093	1.34905
16. Petroleum & Natural Gas Mining	0.93974	0.16575	1.10549
17. Coal & Metal Ore Mining	0.69772	0.72824	1.42596
18. Other Mining & Quarrying	0.87176	0.34264	1.21440
19. Unallocated Industries	0.00000	2.46648	2.46648

Table VI.15 Sectoral Total Output Multipliers

Sector	Partial Multiplier	Induced Effect Component	Total Multiplier
1. Farm Products	1.45616	0.93745	2.39361
2. Other Agricultural Crops	1.56939	1.07534	2.64473
3. Livestock & Products	1.33151	0.63035	1.96186
4. Forestry	1.31102	0.73739	2.04841
5. Fisheries	1.36851	0.42654	1.79505
6. Food, Beverage & Tobacco Industries	1.98810	1.00994	2.99804
7. Miscellaneous Industries	1.75173	1.00929	2.85102
8. Petroleum Refining	1.81767	0.44286	2.26053
9. Public Utilities	1.81130	1.01289	2.82419
10. Construction	1.76004	1.24138	3.00142
11. Trade	1.21687	0.76320	1.98007
12. Restaurants & Hotels	2.10274	0.95215	3.05489
13. Transport & Communication	1.51559	0.88621	2.40180
14. Financing, Real Estate & Business Services	1.36358	0.92604	2.28962
15. Other Services	1.34905	2.48377	3.83282
16. Petroleum & Natural Gas Mining	1.10549	0.14773	1.25322
17. Coal & Metal Ore Mining	1.42596	0.99209	2.41805
18. Other Mining & Quarrying	1.21440	1.61565	2.83005
19. Unallocated Industries	2.46648	1.25636	3.72284

Table VI.16 Total Contributions of Various Sectors To The Indonesian Economy Through Household Income, 1971

Sector	Absolute Contribution (in million Rps)	Relative Contribution
1. Farm Products	234.26	11.67
2. Other Agricultural Crops	93.80	4.67
3. Livestock & Products	18.69	0.93
4. Forestry	18.59	0.92
5. Fisheries	24.03	1.20
6. Food,Beverage & Tobacco Industries	196.88	9.81
7. Miscellaneous Induestries	308.24	15.35
8. Petroleum Refining	10.09	0.50
9. Public Utilities	7.06	0.35
10. Construction	227.02	11.31
11. Trade	163.81	8.16
12. Restaurants & Hotels	75.06	3.74
13. Transport & Communication	117.50	5.85
14. Financing, Real Estate & Business Services	48.10	2.40
15. Other Services	436.07	21.72
16. Petroleum & Natural Gas Mining	9.73	0.48
17. Coal & Metal Ore Mining	6.21	0.31
18. Other Mining & Quarrying	9.21	0.46
19. Unallocated Industries	3.46	0.17
Total	2007.81	100.00

Table VI.17 Total Contributions of Various Sectors To The Indonesian Economy Through Total Output, 1971

	Absolute Contribution (in million Rps)	Relative Contribution
1. Farm Products	1555.87	11.59
2. Other Agricultural Crops	625.06	4.66
3. Livestock & Products	175.66	1.31
4. Forestry	142.47	1.06
5. Fisheries	271.41	2.02
6. Food,Beverage & Tobacco Industries	1600.56	11.93
7. Miscellaneous Industries	2226.93	16.60
8. Petroleum Refining	152.04	1.13
9. Public Utilities	55.58	0.41
10. Construction	1509.95	11.25
11. Trade	1156.92	8.62
12. Restaurants & Hotels	689.98	5.14
13. Transport & Communication	884.75	6.59
14. Financing, Real Estate & Business Services	326.29	2.43
15. Other Services	1703.50	12.69
16. Petroleum & Natural Gas Mining	221.56	1.65
17. Coal & Metal Ore Mining	45.56	0.34
18. Other Mining & Quarrying	41.26	0.31
19. Unallocated Industries	33.39	0.23
Total	13418.74	100.00

Conclusions

The conclusions that can be derived from the calculations of the petroleum industry's interindustry linkages, disposition of petroleum industry's outputs and the impact analysis of the growth in the petroleum industry's outputs are the following :

(1) The data support the general hypothesis that the export of primary products from the less developed countries slip out of the country without leaving much of a trace in the rest of the economy in terms of linkages with the domestic sectors.

(2) The backward linkage effects of the Indonesian petroleum industry is expected not to alter very much in the future because of the technological determinism by the country having capital intensive technology which led to the rigidity of the pattern of its interindustry use.

(3) The forward linkage index of the Indonesian petroleum industry on the other hand is expected to grow and become more related to domestic productive sectors, the less the exports of petroleum industry's outputs are in the form of crude oil and the more they are in the form of refined products. It is in this type of linkage actually the relevance of the discussions on linkages in development literature might lie. A higher forward linkage index

of the petroleum mining with larger components of its final demand in the form of crude oil exports is less meaningful from the view-point of well integrated domestic economic sectors.

(4) The data also support the general hypothesis that the foreign-controlled primary export sector in less developed countries does not produce a significant income multiplier in the economy where it operates. The household income and output multipliers produced by petroleum & natural gas mining proved to be the lowest in relation to those of other sectors.

CHAPTER VII

THE IMPACT OF THE PETROLEUM INDUSTRY ON THE INDONESIAN ECONOMY : THE MACRO-ECONOMIC APPROACH

This chapter presents the estimate of the impact of the petroleum sector on the Indonesian economy using the partial macro-economic models. The models used were based on the theoretical framework developed by Bos et.al.[1] and that by Maizels[2] giving respectively the impact of private foreign investment and primary exports on the economies of less developed countries.

The macro-economic approach differs from the input-output approach in the sense that the latter contains specific industry groups with particular production functions. The macro-economic approach provides a complementary method since it enables a statistical test to be made of the impact of a particular sector on the rest of the economy. Before formulating the estimating models for statistical analysis, the framework of the relationship is first presented.

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1 H.C. Bos et.al, Private Foreign Investment in Developing Countries, Dordrecht, Holland : D.Reidel Publishing Company, 1974, Chapters 2-3.

2 Alfred Maizels, Exports and Economic Growth of Developing Countries, Cambridge, England : Cambridge University Press, 1978, Chapter 2.

The Framework

The retained values of the petroleum sector as described in Chapter V was the basis for establishing the impact of this sector on the rest of the economy. The components of these retained values are those that actually accrue to the rest of the economy which can be derived from the aggregates of payments to households and net payments to the government (after taking into account the public expenditure required by the petroleum sector) made by the petroleum sector, plus local purchase payments made by the petroleum sector to other sectors. Payments to households and net payments to government made by the petroleum sector are the source of its direct contribution to household savings and public savings which partly constitute the investment resources available in the economy.

The interindustry linkages of the petroleum sector with the other sectors of the economy will generate the indirect contribution of this sector to the sectoral gross value added in the rest of the economy[1]. The sectoral gross value

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1 The determination of inter-sectoral purchases of output in this context can be shown in the following input-output framework :

a. Amount of output of non-petroleum sectors purchased by the petroleum sector

Let the subscript 1 refers to the petroleum sector.

X_1 = gross output of the petroleum sector.

added affected by the petroleum sector through interesectoral linkages consists of a portion of sectoral payments to households, sectoral payments to the government and sectoral gross profits. These portions form the basis of the indirect contribution of the petroleum sector to household savings, public savings and business savings in the rest of the economy. These indirect savings together with those generated directly, as described above, constitute the total domestic private and public savings in the economy generated by the petroleum sector. After taking into account part of domestic savings

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X_{i1} = amount of output of sector i purchased by the petroleum sector [$i = 1, \ldots\ldots., n$]. The petroleum sector is one of the sectors in sector i.

X_{j1} = amount of non-petroleum sectors' output purchased by the petroleum sector [$j = 2, \ldots\ldots\ldots, n$].

X_{11} = the petroleum sector's purchase of its own output.

V_1 = value added of the petroleum sector.

Y_i = deliveries to final demand of sector i. [$i = 1, \ldots\ldots, n$]

b_{ij} = the element of the i-th row and the j-th column of the n x n Leontief inverse matrix.

The amount of output of the non-petroleum sectors purchased by the petroleum sector can be derived as follows,

$$X_1 = b_{11} Y_1 + b_{12} Y_2 + b_{13} Y_3 + \ldots . + b_{1n} Y_n \quad [1]$$

$$\sum_{i=1}^{n} X_{i1} = X_1 - V_1 \quad [2]$$

$$\sum_{j=2}^{n} X_{j1} = X_1 - V_1 - X_{11} \quad [3]$$

taken away to finance the investment in the petroleum sector, the petroleum sector's contribution to foreign debt repayments in non-petroleum sectors and the increase in foreign exchange reserves, it is possible to derive the total investment resources available in the rest of the economy. Given the average capital-output ratio in the rest of the economy, it is possible to determine the additional income in the rest of the economy which is due to the presence of the petroleum sector. Figure VII.1 shows the schematic description of the macro-economic effects of the petroleum sector on the rest of the economy.

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b. <u>Amount of the petroleum sector's output purchased by non-petroleum sectors</u> (subscript 1 refers to the petroleum sector)

Let, X_{ij} = amount of output of sector i purchased by non-petroleum sectors

$$(i = 1, \ldots\ldots, n)$$
$$(j = 2, \ldots\ldots, n)$$

X_j = gross output of non-petroleum sectors.

V_j = value added of non-petroleum sectors.

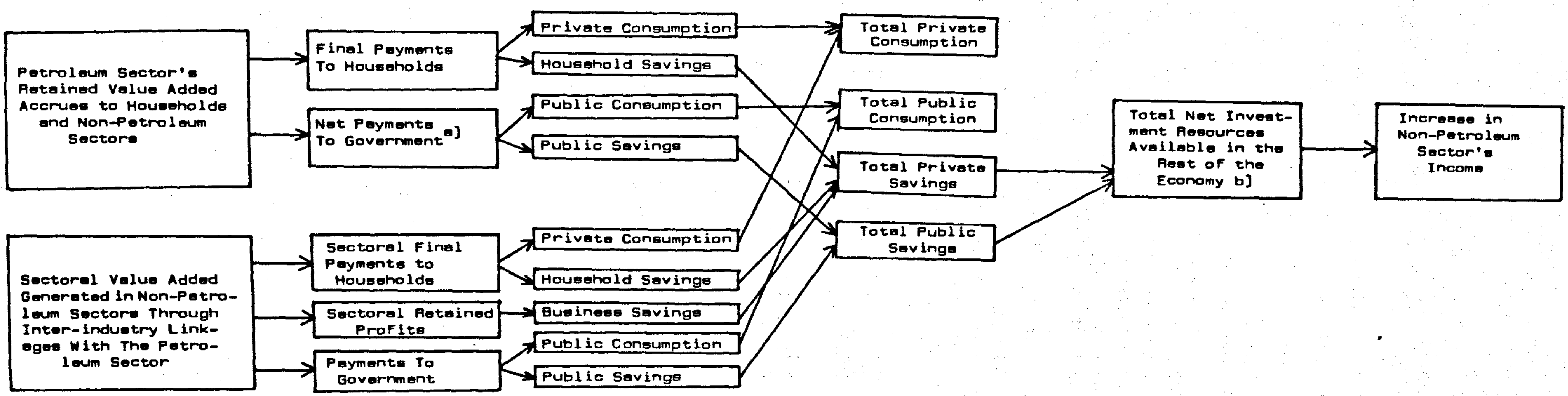
Y_i = deliveries to final demand of sector i.

X_{jj} = non-petroleum sectors' purchase of their own output.

X_{1j} = amount of the petroleum sector's output purchased by non-petroleum sectors.

Figure VII-1

Schematic Description of The Macro-Economic Effects of The Petroleum Sector on The Rest of The Economy



a) After deducting government expenditures utilized for petroleum sector.

b) After deducting part of domestic savings taken away from the rest of the economy to finance the petroleum sector's investment, the contribution of petroleum sector to foreign-debt repayments in non-petroleum sectors and to the increase in foreign exchange reserves.

The above analytical description, can be reduced to the following simple models which are adapted from the models, developed by Bos and his associates, on the impact of private foreign investment on the economy of the less developed countries[1]. The relevant models adapted are the private savings effect model, the public savings effect model and the income effect model[2].

The amount of the petroleum sector's output purchased by non-petroleum sectors can be derived as follows,

$$X_j = b_{j1}Y_1 + b_{j2}Y_2 + b_{j3}Y_3 + \ldots\ldots + b_{jn}Y_n \qquad (4)$$

$$\sum_{i=1}^{n} X_{ij} = \sum_{j=2}^{n} X_j - \sum_{j=2}^{n} V_j \qquad (5)$$

$$\sum_{j=2}^{n} X_{ij} = \sum_{j=2}^{n} X_j - \sum_{j=2}^{n} V_j - \sum_{j=2}^{n} X_{jj} \qquad (6)$$

1 H.C. Bos et.al. <u>Private Foreign Investment in Developing Countries</u>, Dordrecht, Holland : D. Reidel Publishing Company, 1974, Chapters 2-3.

2 The indirect income effect of foreign private investment, according to Bos and his associates, is the summation of the balance of payments effect, private savings effect and public savings effect. Since the analysis starts with the retained value produced by the petroleum sector, the balance of payments effect is dropped from the model. The increase in foreign exchange reserve which accrues from the petroleum sector is taken into consideration because it is not available for investment purposes.

The Models

Notations and Definitions

U_t^p = gross profits of the petroleum sector at time t

H_t^p = total payments to households made by the petroleum sector at time t

G_t^p = petroleum sector's requirement of public expenditures at time t

T_t^p = total direct and indirect contribution of petroleum sector to public revenue at time t

Y_t^p = petroleum sector's gross value added at time t

U_t^* = non-petroleum sectors' total gross profits indirectly generated by the petroleum sector at time t

H_t^* = non-petroleum sectors' total payments to households indirectly generated by the petroleum sector at time t

T_{Ut}^p = direct taxes on petroleum sector's gross profits at time t

T_{Ht}^p = direct taxes on payments to households made by the petroleum sector at time t

T_{Qt}^p = indirect taxes paid by the petroleum sector at time t

T_{Ot}^p = other payments made by the petroleum sector to the government at time t

$T^*_{U_t}$ = direct taxes on U^*_t

$T^*_{H_t}$ = direct taxes on H^*_t

T^*_{Qt} = indirect taxes paid by non-petroleum sectors at time t

I^*_t = gross investment in non-petroleum sectors at time t

D^p_t = part of the domestic saving taken away from the rest of the economy to finance petroleum sector's investment at time t

K^p_t = capital stock in the petroleum sector at time t

Y^*_t = gross value added of non-petroleum sectors at market prices at time t without the presence of petroleum sector

Y^*_o = gross value added of non-petroleum sector at market prices at base period without the presence of petroleum sector

$\hat{Y}^*_t$ = gross value added of non-petroleum sectors at market prices at time t with the presence of petroleum sector

J^p_t = petroleum sector's contribution to foreign-debt repayments of non-petroleum sectors and the increase in foreign-exchange reserve (exogenously determined).

S^p_t = private savings effect created by the petroleum sector in the rest of the economy at time t

S^{p}_{Gt} = public savings effect created by the petroleum sector in the rest of the economy at time t

π_U = taxation coefficient of petroleum sector's gross profits

π_H = average taxation coefficient for payments to households made by the petroleum sector

π^*_U = average taxation coefficient on gross profits in non-petroleum sectors

π^*_H = average taxation coefficient on payments to households made by non-petroleum sectors

λ = capital-output ratio in non-petroleum sectors

γ = rate of private savings

Private Savings Effect

The effect of the presence of the petroleum sector on private savings as defined above is determined by the payments to households made the petroleum sector, the increase in sectoral gross value added due to intersectoral linkages with the petroleum sector and the rate of private savings prevailing in the rest of the economy. The variables that affect the petroleum sector's contribution to private savings are given in the following relationships :

$$H^{p}_{t} = h^{p} \quad Y^{p}_{t} \qquad [1]$$

$$H^{*}_{t} = \delta^{p} \quad Y^{*}_{t} \qquad [2]$$

$$U_t^* = u^p \; Y_t^* \qquad [3]$$

Payments to households made by the petroleum sector is given as the proportion of petroleum sector's gross value added. Non-petroleum sectors' payments to households and gross profits affected through intersectoral linkages with the petroleum sector are given as the proportions of the non-petroleum sectors' gross value added as indicated in equations [2] and [3]. The coefficients of proportionality of these components are determined by the petroleum sector's relevant output multipliers. The effect of the petroleum sector on private savings in non-petroleum sectors and households can be given as follows,

$$S_t^p = \gamma \, [h^p \, Y_t^p + \delta^p \, Y_t^* + u^p \, Y_t^* \,] \qquad [4]$$

<u>Public Savings Effect</u>

The effect of the petroleum sector on public savings consists of direct and indirect components. The direct component is produced by all direct and indirect taxes and other payments made directly by the petroleum sector to the government. The indirect component is produced by all taxes paid by the rest of the economy which result from its relationship with the petroleum sector.

The variables that affect the petroleum sector's contribution to public savings are given in the following equations :

$$U_t^p = \theta^p K_{t-1}^p \qquad [5]$$

$$H_t^p = h^p Y_t^p \quad \text{as given in equation [1]}$$

$$G_t^p = g^p K_{t-1}^p \qquad [6]$$

$$T_{Ut}^p = \pi_U U_t^p \qquad [7]$$

$$T_{Ht}^p = \pi_H H_t^p \qquad [8]$$

$$T_{Qt}^p = q^p Y_t^p \qquad [9]$$

$$T_{Ot}^p = \text{given}$$

$$T_{U_t}^* = \pi_U^* U_t^* \qquad [10]$$

$$T_{H_t}^* = \pi_H^* H_t^* \qquad [11]$$

$$T_{Q_t}^* = q^* Y_t^* \qquad [12]$$

The Gross profit of the petroleum sector is given by its rate of profit with respect to the existing capital stock [Equation 5]. Payments to households made by the petroleum sector are a certain proportion of its gross value added [Equation 1]. The petroleum sector's requirement of public expenditures is assumed to be a proportion of its existing capital stock [Equation 6].

Direct taxes on the petroleum sector's gross profits are given by its total gross profits and by the taxation co-efficient on gross profits [Equation 7]. Direct taxes on the petroleum sector's payments to households are given by its total payments to households and by the average taxation coefficient on these payments (Equation 8). Indirect taxes paid by the petroleum sector are given as a fraction of its gross value added (Equation 9). Other payments made by the petroleum sector to the government are assumed to be given.

Direct taxes on gross profits of the non-petroleum sectors and their payments to households which arise due to the relationship of these sectors with the petroleum sector are respectively given in equations (10) and (11). Indirect taxes paid by non-petroleum sectors due to the relationship of these sectors with the petroleum sector are given as a certain fraction of the gross value added of these sectors.

The total direct and indirect contribution of the petroleum sector to public revenue will be,

$$T_t^P = T_{Ut}^P + T_{Ht}^P + T_{Qt}^P + T_{Ot}^P + T_{U_t}^* + T_{H_t}^* + T_{Q_t}^* \qquad (13)$$

Subtracting the petroleum sector's requirement of public expenditures, the effect of the petroleum sector on public savings becomes,

$$S_{G_t}^P = T_t^P - G_t^P \qquad (14)$$

In terms of parameters and variables given in equations (5) to (12) and equations (1) to (3), equation (14) will be expressed as,

$$S^P_{Gt} = \pi_U \; \theta^P \; K^P_{t-1} + \pi_H \; h^P \; Y^P_t + q^P \; Y^P_t + T^P_{Dt}$$
$$+ \pi^*_U \; u^P \; Y^*_t + \pi^*_H \; \delta^P \; Y^*_t + q^* \; Y^*_t \qquad [15]$$

Rearranging terms, equation [15] becomes,

$$S^P_{Gt} = [\pi_H \, h^P + q^P] \, Y^P_t + \pi_U \, \theta^P \, K^P_{t-1} +$$
$$[\pi^*_U \; u^P + \pi^*_H \; \delta^P + q^*] \; Y^*_t \qquad [16]$$

Income Effect

The effects of the petroleum sector on private savings and public savings are the basis for determining the petroleum sector's direct and indirect contribution to investment resources available in the rest of the economy after taking into account part of the domestic savings taken away from the rest of the economy to finance petroleum sector's investment and the petroleum sector's contribution to foreign-debt repayments of non-petroleum sectors and to the increase in foreign exchange reserves.

The increase in income in non-petroleum sectors due to the petroleum sector is determined by comparing the increase in income with the petroleum sector and that without the petroleum sector. The increase in income in non-petroleum sectors caused by the presence of the petroleum sector then can be derived as follows [with one year gestation period], Let, $$Y_t^* = Y_o^* + \frac{\sum_{i=o}^{t-1} I_i^*}{\lambda} \tag{17}$$

to be the level of income in non-petroleum sectors at time t without the presence of petroleum sector.

With the presence of petroleum sector, the level of income in non-petroleum sectors (denoted by $\hat{Y}^*$) at time t then becomes,

$$\hat{Y}_t^* = Y_o^* + \frac{\sum_{i=o}^{t-1} \hat{I}_i^*}{\lambda} \tag{18}$$

Here $\hat{I}_i^* > I_i^*$ since $\hat{I}_i^*$ is positively affected by the presence of petroleum sector.

By subtracting equation (17) from equation (18), the increase in income in non-petroleum sectors due to the presence of the petroleum sector in the economy will be

$$\hat{Y}_t^* - Y_t^* = \frac{\sum_{i=o}^{t-1} \hat{I}_i^*}{\lambda} - \frac{\sum_{i=o}^{t-1} I_i^*}{\lambda} \tag{19}$$

Denoting $\left[\frac{\sum_{i=o}^{t-1} \hat{I}_i^*}{\lambda} - \frac{\sum_{i=o}^{t-1} I_i^*}{\lambda}\right]$ as $\frac{\sum_{i=o}^{t-1} I_i^{**}}{\lambda}$

then equation (19) becomes,

$$\hat{Y}^*_t - Y^*_t = \frac{\sum_{i=o}^{t-1} I^{**}_i}{\lambda} \qquad (20)$$

Since I^{**}_i refers to the increase in investment resources available in the rest of the economy as a result of the presence of the petroleum sector which is determined by the petroleum sector's effects on private and public savings after taking account part of domestic savings taken away from the rest of the economy to finance petroleum sector's investment and petroleum sector's contribution to foreign-debt repayments of non-petroleum sectors and to the increase in the foreign exchange reserves, equation (20) can also be expressed as,

$$\hat{Y}^*_t - Y^*_t = \frac{\sum_{i=o}^{t-1} (S^P_t + S^P_{G_t} - D^P_t - J^P_t)}{\lambda} \qquad (21)$$

In terms of equations for private savings effect and public savings effect, equation (21) then is expressed as follows,

$$\hat{Y}^*_t - Y^*_t = \frac{\sum_{i=o}^{t-1} \Big[\gamma \, (h^P Y^P_t + \delta^P Y^*_t + u^P Y^*_t) + (\pi_H h^P + q^P) \, Y^P_t + \pi_U \, \theta^P \, K^P_{t-1} + (\pi^*_U u^P + \pi^*_H \delta^P + q^*) \, Y^*_t - D^P_t - J^P_t \Big]}{\lambda} \qquad (22)$$

The relationship between petroleum sector's gross value added and that of the rest of the economy is established by equation (22).

The framework developed by Maizels on the impact of primary exports on economic growth of less developed countries which face foreign exchange constraint and are heavily dependent on export sector for their public revenues actually lies within the context of the framework developed by Bos et.al as presented above. The general hypothesis proposed by Maizels can be summarized as follows: Gross domestic investment is a function of the capacity to import. The capacity to import is dependent on exports. Gross domestic investment and Gross National Product are related via incremental capital-output ratio[1].

The following section presents the statistical estimates of the impact of gross value added in the petroleum sector on gross value added in the non-petroleum sectors and the impact of the petroleum sector's exports on Gross National Product and its components.

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1 Alfred Maizels, op.cit., p.71.

Statistical Estimates

a. The Impact of Gross Value Added in The Petroleum Sector On Gross Value Added in The Non-Petroleum Sectors

The following estimating model of double logarithmic form was used :

$$\mathrm{Log}_e\, Y_i^* = a_i + b_i\, \mathrm{Log}_e\, Y^p + u_i$$

Y_i^* represents the gross value added of the non-petroleum sectors which consists of the following :

Y_i^* = gross value added of the agricultural sector

Y_2^* = gross value added of the non-petroleum mining & quarrying sector

Y_3^* = gross value added of the manufacturing sector

Y_4^* = gross value added of the public utilities sector

Y_5^* = gross value added of the construction sector

Y_6^* = gross value added of the transportation & communication sector

Y_7^* = gross value added of the services sector

Y_8^* = gross value added of all non-petroleum sectors

Y^p refers to gross value added ofpetroleum sector and u_i is the error term.

The data of sectoral gross value added were derived from the Indonesian national income accounts and these were at constant 1960 prices covering the period 1967 - 1976.

The hypotheses tested were as follows :

(1) There was no significant contribution made by the petroleum sector to the agricultural sector.

(2) There was no significant contribution made by the petroleum sector to the non-petroleum mining & quarrying sector.

(3) There was no significant contribution made by the petroleum sector to the manufacturing sector.

(4) There was no significant contribution made by the petroleum sector to the public utilities sector.

(5) There was no significant contribution made by the petroleum sector to the construction sector.

(6) There was no significant contribution made by the petroleum sector to the transport & communication sector.

(7) There was no significant contribution made by the petroleum sector to the services sector.

(8) There was no significant contribution made by the petroleum sector to non-petroleum sectors as a whole.

In economic terms, the test was conducted on the null hypothesis :

$$H_o \; : \; b_i = 0$$

against the alternative hypothesis :

$$H_1 \; : \; b_i \neq 0$$

The b_i's in the estimating model could indicate the output elasticities of sector i in terms of output of petroleum sector[1]. The regression coefficinets of the estimating models indicate the responsiveness of the output of sector i to changes in output of petroleum sector. The regression results for the estimating models are as follows

---

1 The proof for b_i's as elasticity is as follows :

By the definition of elasticity

$$\eta_{Y_i^* Y^P} = \frac{dY_i^*}{dY^P} \cdot \frac{Y^P}{Y_i^*}$$

The derivative of the Y_i^* function with respect to Y^P gives

$$\frac{\partial Y_i^*}{\partial Y^P} = b \frac{Y_i^*}{Y^P}$$

Substituting $b \frac{Y_i^*}{Y^P}$ for $\frac{dY_i^*}{dY^P}$ in the elasticity definition we get

$$\eta_{Y_i^* Y^P} = b \frac{Y_i^*}{Y^P} \frac{Y^P}{Y_i^*} = b$$

(Figures in parentheses are t - values and the constant term is $\log_e a$) :

$$\mathrm{Log}_e\ Y_1^* = 5.3396 + 0.0765\ \mathrm{Log}_e\ Y^P$$
$$(57.3385)\quad(3.1839)$$
$$R^2 = 0.5589 \qquad D.W. = 1.4217$$

$$\mathrm{Log}_e\ Y_2^* = -1.1569 + 0.8019\ \mathrm{Log}_e\ Y^P$$
$$(-2.0651)\quad(5.5470)$$
$$R^2 = 0.7937 \qquad D.W. = 0.8045$$

$$\mathrm{Log}_e\ Y_3^* = 3.0606 + 0.2569\ \mathrm{Log}_e\ Y^P$$
$$(19.0797)\quad(6.2070)$$
$$R^2 = 0.8281 \qquad D.W. = 1.3365$$

$$\mathrm{Log}_e\ Y_4^* = 0.0735 + 0.3021\ \mathrm{Log}_e\ Y^P$$
$$(0.3354)\quad(5.3428)$$
$$R^2 = 0.7811 \qquad D.W. = 1.7749$$

$$\mathrm{Log}_e\ Y_5^* = 0.5510 + 0.6358\ \mathrm{Log}_e\ Y^P$$
$$(1.7392)\quad(7.7773)$$
$$R^2 = 0.8832 \qquad D.W. = 1.5307$$

$$\mathrm{Log}_e\ Y_6^* = 1.7977 + 0.3582\ \mathrm{Log}_e\ Y^P$$
$$(11.7000)\quad(9.0348)$$
$$R^2 = 0.9107 \qquad D.W. = 1.5557$$

$$\mathrm{Log}_e\ Y_7^* = 4.6214 + 0.1691\ \mathrm{Log}_e\ Y^P$$
$$(21.6220)\quad(3.0666)$$
$$R^2 = 0.5403 \qquad D.W. = 1.6969$$

$$\mathrm{Log}_e\ Y_8^* = 5.7315 + 0.1696\ \mathrm{Log}_e\ Y^P$$
$$(43.4941)\quad(4.9864)$$
$$R^2 = 0.7566 \qquad D.W. = 1.7261$$

The results show that there was significant impact of the petroleum sector on each other sectors of the economy and non-petroleum sectors as a whole. The null hypothesis is therefore rejected. However, agriculture was the least affected sector. Not only was its output elasticity relatively low but also the R^2 for this sector was low. Services sector was also not very much affected by the petroleum sector. The R^2 for this sector was also relatively low. Non-petroleum mining & quarrying proved to be a sector which was highly affected by the petroleum sector's output.

The Durbin-Watson statistics in all regressions except in the second regression do not show the presence of autocorrelation of the disturbance term[1]. The Cochran-Orcutt technique of correcting the autocorrelation in the second regression produced the following new regression results along with the value of ρ used in the autoregressive correction :

$$\text{Log}_e\, Y_2^* = -\,2.0580 + 1.0012\ \text{Log}_e\, Y^P$$
$$(-1.8204)\quad (3.9676)$$

$$R^2 = 0.8661 \qquad \text{D.W.} = 1.5102 \qquad \rho = 0.6196$$

The corrected regression shows that the output elasticity of the non-petroleum mining & quarrying with respect to petro-

1 The criteria used here are the lower and upper limits of the Durbin-Watson statistics for the smallest sample size given in the D.W. table (15 observations) with one explanetory variable at 1 per cent significance level which are respectively 0.81 and 1.07.

leum sector's output becomes higher and no sign of autocorrelation of the disturbance term. Table VII.1 shows the output elasticities of non-petroleum sectors with respect to the output of the petroleum sector along with their respective ranks. The summary of the final estimates of the regression coefficients and their significance levels are given in Table VII.2.

Table VII.1 Output Elasticities of Non-Petroleum Sectors With Respect To Petroleum Sector's Output

Sector	Output Elasticity	Rank
Agriculture	0.0765	7
Non-Petroleum Mining & Quarrying	1.0012	1
Manufacturing	0.2569	5
Public Utilities	0.3021	4
Construction	0.6358	2
Transport & Communication	0.3582	3
Services	0.1691	6
All Non-Petroleum Sectors	0.1696	

Table VII.2 Summary Results of Regression Coefficients Estimates and Their Significance Level

Sector	Regression Coefficient	t - value	R^2	Significance Level of Regression Coefficient for 9 degrees of freedom (one tail test)
Agriculture	0.0765	3.1839	0.5589	Significant between 0.01 and 0.005 levels
Non-Petroleum Mining & Quarrying	1.0012	3.9676	0.8661	Significant between 0.005 and 0.0005 levels
Manufacturing	0.2569	6.2070	0.8281	Significant at 0.0005 level
Public Utilities	0.3021	5.3428	0.7811	Significant at 0.0005 level
Construction	0.6358	7.7773	0.8832	Significant at 0.0005 level
Transport & Communication	0.3582	9.0348	0.9107	Significant at 0.0005 level
Services	0.1691	3.0666	0.5403	Significant between 0.01 and 0.005 levels
All Non-Petroleum Sectors	0.1691	4.9864	0.7566	Significant at 0.0005 level

b. The Impact of The Petroleum Sector's Export On Gross National Product and Its Components

In order to estimate the impact of the petroleum sector's exports on Gross National Product and its components during 1967 - 1976, a small macro-economic model of the type proposed by Klein was designed for Indonesia[1]. After going through some experiments of the data, which will be described later, the following system of structural equations is proposed.

The Model

Behavioural Equations

$$C_t^{+} = \alpha_1 + \beta_1 Y_t^d + w_{1t} \tag{1}$$

$$C_t^{++} = \alpha_2 + \beta_2 T_t + w_{2t} \tag{2}$$

$$I_t^{+} = \alpha_3 + \beta_3 Y_{t-1} + w_{3t} \tag{3}$$

$$I^{++} = \alpha_4 + \beta_4 T_t + w_{4t} \tag{4}$$

$$M_t = \alpha_5 + \beta_5 C_t^{+} + \emptyset_1 E_t^P + w_{5t} \tag{5}$$

$$T_t = \alpha_6 + \beta_6 Y_t + w_{6t} \tag{6}$$

$$F_t = \alpha_7 + \beta_7 E_t^P + w_{7t} \tag{7}$$

Identities

$$Y_t^d = Y_t - T_t \tag{8}$$

$$Y_t = C_t^{+} + C_t^{++} + I_t^{+} + I_t^{++} + E_t^P + E_t^{*} - M_t - F_t \tag{9}$$

---

1 Lawrence R. Klein, "What Kind of Macroeconometric Model for Developing Economies ?" in A.Zellner,(ed.), Readings in Economic Statistics and Econometrics, Boston : Little Brown & Co, 1968, pp.559-70 and Lawrence R. Klein and J. Behrman, "Economic Growth Models for the Developing Economy", in W. Eltis, et.al (eds.), Induction, Growth and Trade, Oxford : Clarendon Press, 1970, pp.165-87.

where C_t^{+} = private consumption at time t

C_t^{++} = public consumption at time t

I_t^{+} = private investment at time t

I_t^{++} = public investment at time t

M_t = total imports at time t

T_t = total taxes at time t

F_t = factor payments transferred abroad at time t

Y_t^d = disposable income at time t

Y_t = gross national product at time t

E_t^p = petroleum sector's exports at time t

E_t^* = non-petroleum sectors' exports at time t

w_{1t}, w_{2t}, w_{3t}, w_{4t}, w_{5t}, w_{6t} and w_{7t} are error terms

The above estimating model has 9 equations and 9 endogenous variables [C^+, C^{++}, I^+, I^{++}, M, T, F, Y^d and Y]. All other variables enter as exogenous. The simultaneous equations of the model were estimated using a modified two stage least squares method[1] and all variables are at constant 1960 prices deflated by an implicit GNP-deflator.

---

1 Under this method, using the given set of predetermined variables, various subsets are formed containing as many variables as permissible for the given sample size. And each time at the first stage of estimation, only one particular set which is more directly and closely relevant to the relationship under consideration is used.

Model Formulation Experiments

Private Consumption

In examining the behaviour of private consumption expenditure, the relative income hypothesis which suggests that the past peak level of consumption is an important determinant of current consumption was first tested. Taking the previous year's consumption as the "previous peak", the following estimating model was used :

$$C_t^{+} = \alpha_1 + \beta_1 Y_t^d + \gamma_1^{*} C_{t-1}^{+}$$

The results of testing this model were not satisfactory in the sense that the regression coefficient of C_{t-1}^{+} was not statistically different from zero.

Testing the absolute income hypothesis by omitting the previous level of consumption as an exogenous variable produced satisfactory results which led to the adoption of the following model :

$$C_t^{+} = \alpha_1 + \beta_1 Y_t^d$$

Public Consumption

Two alternative forms of public consumption function were estimated :

(1) Public consumption as a function of total taxes collected :

$$C_t^{++} = \alpha_2 + \beta_2 T_t$$

(2) Public consumption as a function of total taxes collected and the previous level of public consumption :

$$C_t^{++} = \alpha_2 + \beta_2 T_t + \gamma_2^{*} C_{t-1}^{++}$$

The results showed that the first estimating model gave better fit to the data on public consumption expenditure and therefore was adopted.

<u>Private Investment</u>

Due to unavailability of data on capital stock and profits, only two forms of private investment function were estimated namely :

(1) Private investment as a direct function of aggregate income :

$$I_t^{+} = \alpha_3 + \beta_3 Y_{t-1}$$

(2) Private investment function which incorporates in it the acceleration principle :

$$I_t^{+} = \alpha_3 + \beta_3 (Y_t - Y_{t-1})$$

The experiments indicated that the private investment function relating private investment to aggregate income gave better fit.

<u>Public Investment</u>

The best equation for public investment is that which relates public investment to total taxes collected. $(I_t^{++} = \alpha_4 + \beta_4 T_t)$

The inclusion of Net Foreign Capital Transfer in the equation showed that its coefficient was not statistically different from zero. This may be due to the following reasons :

(1) Wide variation in the size of net foreign capital transfer to Indonesia.

(2) Overlapping of net foreign capital transfer with public investment.

Imports

Two forms of import function were tried :

(1) Imports as a function of current private consumption, the petroleum sector's exports and the non-petroleum sectors' exports :

$$M_t = \alpha_5 + \beta_5 C_t^{+} + \emptyset_1 E_t^{p} + \gamma_3^{*} E_t^{*}$$

(2) Imports as a function of current private consumption and the petroleum sector's exports :

$$M_t = \alpha_5 + \beta_5 C_t^{+} + \emptyset_1 E_t^{p}$$

The experiment with the first function produced a regression coefficient of the non-petroleum sectors' exports not statistically significant from zero. Discarding the non-petroleum sectors' exports produced satisfactory results. Therefore the second function was adopted to describe total imports.

Total Taxes

Three forms of total taxes function were tried :

(1) Total taxes as a function of Gross National Product :

$$T_t = \alpha_6 + \beta_6 Y_t$$

(2) Total taxes as a function of Gross National Product Net of Exports, Total Exports and Total Imports :

$$T_t = \alpha_6 + \beta_6(Y_t - E_t) + \gamma_4 E_t + \hat{\lambda}_1 M_t$$

(3) Total taxes as a function of Gross National Product and Total Imports :

$$T_t = \alpha_6 + \beta_6 Y_t + \hat{\lambda}_1 M_t$$

The experiments indicated that the first function gave a much better performance and therefore was adopted.

Net Factor Payments Abroad

A relatively large leakage in the national accounts and the balance of payments of countries with a large control of domestic resources by foreign interests is represented by net factor payments to the rest of the world. These payments consist of net profits made by foreign investors which are not retained in the domestic economy net of any similar receipts from abroad. In Indonesia, during the period under study, net factor payments abroad were dominated by those made by the petroleum sector. The function for Net Factor Payments Abroad is represented by the following model which showed a good fit to the data :

$$F_t = \alpha_7 + \beta_7 E_t^p$$

Derivation of The Impact Multipliers

The method of estimating the effect of current changes in certain pre-determined or exogenous variables on certain current endogenous variables in the economy is known in econometric theory as an impact analysis which is a part of structural analysis. Goldberger[1] formulated the estimation of the impact multipliers from a set of structural equations which is briefly described below.

The general macro-econometric model of linear stochastic nature with m endogenous (jointly dependent) variables $y_1, y_2, \ldots\ldots, y_m$ and n predetermined variables $x_1, x_2, \ldots, x_n$ can be written

$$
\begin{array}{l}
y_1\alpha_{11} + y_2\alpha_{21} + \ldots + y_m\alpha_{m1} + x_1\beta_{11} + x_2\beta_{21} + \ldots + x_n\beta_{n1} = e_1 \\
y_1\alpha_{12} + y_2\alpha_{22} + \ldots + y_m\alpha_{m2} + x_1\beta_{12} + x_2\beta_{22} + \ldots + x_n\beta_{n2} = e_2 \\
\quad\vdots \qquad\qquad\qquad \vdots \qquad\qquad\qquad\qquad\qquad\qquad \vdots \\
y_1\alpha_{1m} + y_2\alpha_{2m} + \ldots + y_m\alpha_{mm} + x_1\beta_{1n} + x_2\beta_{2n} + \ldots + x_n\beta_{nm} = e_m
\end{array}
\qquad (10)
$$

where $e_1, e_2, \ldots, e_m$ are m stochastic disturbance terms, the α's are coefficients of endogenous variables, and β's

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1 Arthur S. Goldberger, Impact Multipliers and Dynamic Properties of the Klein - Goldberger Model, Amsterdam ; North Holland Publishing Company, 1959, chapter 3. An analogous approach is given in Michael D. Intriligator Econometric Models, Techniques and Applications, Amsterdam : North-Holland, 1978, chapter 2.

are coefficients of predetermined variables. The system of structural equations (10) can also be written in abbreviated vector-matrix notation

$$y A + x B = \varepsilon \qquad (11)$$

Here y is a row vector of an endogenous variables, x is a row vector of n predetermined variables and ε is a row vector consisting of m additive stochestic disturbance terms. The matrices A and B are the matrices of structural coefficients.

If the matrix of coefficients of endogenous variables A is non-singular, the structural equation system (11) can be solved for the endogenous variables as functions of all predetermined variables and stochastic disturbance terms. The solution is as follows :

Postmultiplying equation (11) by the inverse of A yields

$$y A A^{-1} + x B A^{-1} = \varepsilon A^{-1} \qquad (12)$$

Thus solving for y,

$$y = - x B A^{-1} + \varepsilon A^{-1} \qquad (13)$$

Denoting
$$\Pi = - B A^{-1}$$
$$\hat{u} = \varepsilon A^{-1}$$

equation (13) can be written as

$$y = x \Pi + \hat{u} \qquad (14)$$

Equation [14] is the reduced form of the structural equation system [10]. In summation form, the reduced form equation [14] can be expressed as

$$y_h = \sum_{j=1}^{n} x_j \prod_{jh} + \hat{u}_h \quad [\, h = 1,2,\ldots\ldots, m] \quad [15]$$

Defferentiating equation [15] we obtain

$$\frac{\partial y_h}{\partial x_j} = \prod_{jh} \quad \begin{array}{l} [\, j = 1,2,\ \ldots\ldots\ n] \\ [\, h = 1,2,\ \ldots\ldots\ m] \end{array}$$

This result is known as the impact multiplier or short-run multiplier since it indicates the impact of the change in the j-th predetermined variable, with all other predetermined variables being held constants, on the h-th endogenous variable. This multiplier shows the effect of current exogenous variable on current endogenous variable.

The determination of impact multipliers in the structural analysis as given above is analogous to the determination of impact multipliers in input-output framework. The coefficients of the endogenous variables correspond with the technical coefficients, and the exogenous variables correspond with the final demand. In terms of the balance equation of the input-output system, the intention discussed in the above structural analysis is equivalent to desiring to know the effect upon total output of an exogenous increase in final demand.

Solution of the Model

The following are the regression results of the model (figures in parentheses are the t-values) :

$$C_t^{+} = \underset{(4.9405)}{153.6422} + \underset{(11.4245)}{0.6155}\, Y_t^d$$

$$\bar{R}^2 = 0.9418 \qquad D.W. = 1.6892$$

$$C_t^{++} = \underset{(6.3314)}{25.2446} + \underset{(10.9644)}{0.4412}\, T_t$$

$$\bar{R}^2 = 0.9371 \qquad D.W. = 1.9728$$

$$I_t^{+} = \underset{(-0.1729)}{-4.2724} + \underset{(2.7139)}{0.1071}\, Y_{t-1}$$

$$\bar{R}^2 = 0.8792 \qquad D.W. = 1.2766$$

$$I_t^{++} = \underset{(-1.5942)}{-24.7165} + \underset{(6.8092)}{0.8464}\, T_t$$

$$\bar{R}^2 = 0.9551 \qquad D.W. = 1.2123$$

$$M_t = \underset{(-2.3530)}{-125.8555} + \underset{(3.7095)}{0.4452}\, C_t^{+} + \underset{(3.5449)}{0.3878}\, E_t^p$$

$$\bar{R}^2 = 0.9712 \qquad D.W. = 1.2805$$

$$T_t = \underset{(-13.5246)}{-144.8268} + \underset{(22.2416)}{0.3543}\, Y_t$$

$$\bar{R}^2 = 0.9841 \qquad D.W. = 1.4619$$

$$F_t = \underset{(1.7254)}{5.5986} + \underset{(5.5436)}{0.1959}\, E_t^p$$

$$\bar{R}^2 = 0.8880 \qquad D.W. = 1.2975$$

The regression results which show a good fit of the model and the absence of serial correlation of the disturbance term[1] were then used as the basis for estimating the impact multipliers of various exogenous variables on endogenous variables. Tables VII.3 and VII.4 contain the basic data of constructing the reduced form matrix as shown in table VII.5. The elements of this matrix which appear under each exogenous variable are the impact multipliers which indicate the direct, indirect and induced effect of a change in these variables on various endogenous variables in the model after taking account of their interdependences.

Table VII.5 shows that the impact multipliers generated by the petroleum sector's exports on Gross National Product during the period under study was 1.2876 which was far less than that generated by the non-petroleum sectors' exports which was 3.0930. The main reason for this as can be seen from this table is that

---

1 The regression on public investment showed a presence of serial correlation in the first run. The above regression results are those after applying the Cochran-Orcutt procedure of correcting this autocorrelation. The value of ρ for the corrected regression is 0.5502. The regression results before applying the Cochran-Orcutt procedure are as follows :

$$I_t^{++} = -17.1499 + 0.7729\, T_t$$
$$[-2.8620] \quad [12.7818]$$
$$\bar{R}^2 = 0.9530 \qquad D.W. = 0.9627$$

the non-petroleum sectors' exports had a higher effect on consumption, investment and taxes while the petroleum sector's exports had higher effect on imports and factor payments abroad which both represented leakages from the economy.
These findings are quite similar to those obtained in the input-output analysis of the previous chapter where the total multiplier of the petroleum & natural gas mining which dominated exports from the petroleum sector was 1.25322 while those of the other sectors of the economy were generally higher than 2. It is worth noting here that the impact multiplier generated by the petroleum & natural gas mining on household income obtained in the input-output study which was 0.0550 cannot be compared with the impact multiplier of the petroleum sector's exports on disposable income reported in table VII.5 because the former did not include the net profits of the petroleum sector while the latter did. In addition to this, Gross National Product which was used to determine disposable income was at market prices rather than at factor costs. Gross National Product at market prices included a substantial amount of depreciation allowances[1] which to considerable extent caused the overstatement of disposable income.

1 Due to unavailability of data on capital stock, the equation on depreciation could not be presented in the model.

Table VII.3 <u>Matrix of Endogenous Variables Coefficients</u>

$$
\begin{array}{c}
\\ C_t^{+} \\ C_t^{++} \\ I_t^{+} \\ I_t^{++} \\ M_t \\ T_t \\ F_t \\ Y_t^d \\ Y_t
\end{array}
\begin{array}{c}
\begin{array}{ccccccccc}
[1] & [2] & [3] & [4] & [5] & [6] & [7] & [8] & [9]
\end{array} \\
\left[\begin{array}{ccccccccc}
1.0000 & 0 & 0 & 0 & 0 & 0 & 0 & -0.6155 & 0 \\
0 & 1.0000 & 0 & 0 & 0 & -0.4412 & 0 & 0 & 0 \\
0 & 0 & 1.0000 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1.0000 & 0 & -0.8464 & 0 & 0 & 0 \\
-0.4452 & 0 & 0 & 0 & 1.0000 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1.0000 & 0 & 0 & -0.3543 \\
0 & 0 & 0 & 0 & 0 & 0 & 1.0000 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1.0000 & 0 & 1.0000 & -1.0000 \\
-1.0000 & -1.0000 & -1.0000 & -1.0000 & 1.0000 & 0 & 1.0000 & 0 & 1.0000
\end{array}\right]
\end{array}
$$

Table VII.4 Matrix of Exogenous Variables Coefficients

	Constant	E_t^p	E_t^*	Y_{t-1}
C_t^+	153.6422	0	0	0
C_t^{++}	25.2446	0	0	0
I_t^+	-4.2724	0	0	0.1071
I_t^{++}	-24.7165	0	0	0
M_t	-125.8555	0.3878	0	0
T_t	-144.8268	0	0	0
F_t	5.5986	0.1959	0	0
Y_t^d	0	0	0	0
Y_t	0	1.0000	1.0000	0

Table VII.5 Reduced Form Matrix

Endogenous Variables	Constant	E_t^p	E_t^*	Y_{t-1}
C_t^+	322.3522	0.5117	1.2293	0.1317
C_t^{++}	-7.3569	0.2013	0.4835	0.0518
I_t^+	-4.2724	—	—	0.1071
I_t^{++}	-87.2590	0.3861	0.9275	0.0993
M_t	17.6560	0.6156	0.5473	0.0586
T_t	-73.8930	0.4562	1.0959	0.1174
F_t	5.5986	0.1959	—	—
Y_t^d	274.1011	0.8314	1.9972	0.2139
Y_t	223.4391	1.2876	3.0930	0.3313

Correlation Analysis

For a better understanding of the impact of the growth of the petroleum sector's output on the output of the other sectors of the Indonesian economy, it is of interest also to test whether there had been a close correlation between the rate of growth of gross value added in the petroleum sector and that in the rest of the economy. Spearman rank correlation was used for such a test. This test shows whether there had been a tendency towards the monotonicity between these growth rates in view of the fact that the petroleum sector had been the largest contributor to domestic investment resources.

Table VII.6 shows that there was no correlation between the rate of growth of gross value added in the non-petroleum sectors and that of the petroleum sector. Although the Spearman rank correlation between the rate of growth of gross value added in the non-petroleum mining & quarrying and that in the petroleum sector is positive, however, it is not significant. The rank correlation coefficients for the remaining sectors are all negative.

The Spearman correlation test also shows that there was no correlation between the rate of growth of the petroleum sector's exports and the rate of growth of Gross National Product Net of Petroleum Sector's Exports[1]. The Spearman correlation

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1 Gross National Product Net of Petroleum Sector's Exports rather than Gross National Product Net of Total Exports was used in order to obtain a meaningful correlation.

coefficient calculated for this possible association is -0.2167. The correlation test between the rate of growth of exports as a whole and the rate of growth of Gross National Product Net of Total Exports[1] produced the Spearman correlation of -0.8001. These findings suggest that the petroleum sector's exports had not been able to create a positive correlation between exports growth and the growth in income in the Indonesian Economy.

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1 Gross National Product Net of Exports rather than Gross National Product as a whole was taken in order to avoid misleading relationship since exports are a part of Gross National Product. It was recently argued that the major fault of the past studies on the relationship between exports and economic growth was that the growth of exports was correlated with the growth of Gross National Product. See M. Michaely, "Exports and Growth : An Empirical Investigation", Journal of Development Economics, vol.4, no.1 (March 1977), pp.49-54. See also Peter S. Heller and Richard C. Porter, "Exports And Growth : An Empirical Re-Investigation", Journal of Development Economics, vol.5, no.2 (June 1978), pp.191-93. This fault was revealed in the models proposed in a recent study on the impact of primary exports on the economies of some countries in Latin America, see Tahany R. Naggar, "The Role of The Iron, Copper, Lead and Petroleum Export Sectors In The Economic Development of Brazil, Chile, Mexico and Venezuela : An Empirical Macroeconomic Analysis", Doctoral Dissertation, The University of Oklahoma, 1976.

Table VII.6 <u>Spearman Rank Correlation Coefficients of The Rate of Growth of Gross Value Added of Petroleum Sector and Those of Other Sectors</u>

Sector	Spearman Rank Correlation Coefficient
Agriculture	- 0.0167
Non-Petroleum Mining & Quarrying	0.4667
Manufacturing	- 0.6167
Public Utilities	- 0.3766
Construction	- 0.1667
Transport & Communication	- 0.0167
Services	- 0.5667
All Non-Petroleum Sectors	- 0.3833

Conclusions

The findings presented in this chapter indicate that during the period under study, gross value added in the petroleum sector had made a significant impact on gross value added in the other sectors of the economy. The findings also indicate that the agricultural sector was the least affected by the growth of the petroleum sector's output. The sectors which were substantially more affected by the petroleum sector were largely the urban-based sectors or the modern sectors of the economy; and it can therefore be concluded that the petroleum sector in fact had strengthened these sectors vis-a-vis the traditional sector, largely represented by agriculture. The increasing income disparity between the modern sectors and the traditional sector as reported in Chapter II was to a certain extent contributed by the growth of the petroleum sector.

The solution of the proposed macro-economic model indicates that the impact multiplier of the petroleum sector's exports on Gross National Product was far lower than that of the non-petroleum sectors' exports. The estimate also shows a substantially higher impact multiplier of the non-petroleum sectors' exports on disposable income than that of the petroleum sector's exports. This different magnitude of the impact multipliers between these two export sectors was due to their different impact on the leakage items of the economy i.e. imports and factor payments abroad. The petroleum sector's exports had substantially higher effects on these items compared to the non-petroleum sectors.

The absence of association between the rate of growth of gross value added of the petroleum sector and that of the other sectors of the economy and also the absence of association between the rate of growth of the petroleum sector's exports and that of Gross National Product Net of the Petroleum Sector's Exports might imply that the increasing amount of financial resources provided by the petroleum sector for the rest of the economy might not have been utilized rationally. Also in addition to this, the growth of the output in the rest of the economy might have been hindered by some factors other than the availability of financial resources. The subsequent two chapters attempt to analyse the relevant factors within the Indonesian economy which could be partially considered responsible for the above absence of association.

CHAPTER VIII

UTILIZATION OF FOREIGN EXCHANGE EARNINGS

This chapter presents an analysis of the utilization of Indonesia's foreign exchange earnings which have been largely contributed by the petroleum sector in order to examine further the impact of this sector on the rest of the economy. To a certain extent, this can also be used to test the general hypothesis that the integration of primary export sector of less developed countries into the international economy and the inflow of foreign capital to these countries have produced certain characteristic elite consumption patterns which are strongly oriented towards a demand for imported consumer goods particularly those produced by the developed countries[1].

The analysis of the utilization of foreign exchange earnings presented here is divided into the following aspects :

1. Import Intensity of Consumption
2. Comparison of Imports for Consumption and Investment

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1 Apart from the analyses presented by some authors cited in chapter IV , this argument is also given in the following recent studies ; H.C. Bos,et.al. Private Foreign Investment in Developing Countries, Dordrecht, Holland : D.Reidel Company, 1974, p.94 ; Sanjaya Lall and Paul Streeten Foreign Investment, Transnationals and Developing Countries, London : The Mac Millan Press, 1977, p.76.

Import intensity of consumption is analyzed by the identification of imported items classified as necessities, essentials and luxuries. Together with the allocation of foreign exchange earnings to imported consumer and capital goods, the breakdown into imported necessities, essentials and luxuries will indicate whether there had been a diversion of scarce financial resources to supposedly low priority areas in Indonesia.

The Leontief input-output model applied to the Indonesian input-output table of 1971 was used to estimate both direct and indirect imports for consumption and investment. The classification of consumer goods into necessities and luxuries was based on criterion recently developed by Kakwani as discussed later[1], while the classification of essentials was based on certain considerations in relation to public welfare. The approach used in this study is different from the approach used in earlier studies[2], in three ways as follows :

(a) Imports include not only the direct but also indirect imports.

(b) Imported consumption goods not only related to those by the consumers in the industry under study but to those for the country as a whole since all foreign exchanges are largely controlled by the Central Bank.

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1 Nanak C. Kakwani, "Application of Lorenz Curves in Economic Analysis", <u>Econometrica</u>, vol.45, no.3 (April 1977), pp.721-22.

2 See for example a recent study on Malaysia's primary export sector by John T. Thoburn <u>Primary Export and Economic Development</u>, London : John Wiley & Sons, 1976.

(c) The objective criterion of classifying consumer goods into necessities and luxuries was used as distinct from the rather vague and undefined classification used in earlier studies.

Before presenting the empirical results, the methodology used is first described.

Methodology

Let, A = Leontief's input-output coefficients matrix.

F_c = Consumption vector of the final demand.

F_v = Investment vector of the final demand.

M^* = Diagonal matrix of import coefficients.

M_c^d = Vector of direct import associated with F_c.

M_v^d = Vector of direct import associated with F_v.

The import vector (indirect and direct) associated with consumption and investment can be expressed as follows,

$$M_c = M^*A\,(I - A + M^*)^{-1}(F_c - M_c^d) + M_c^d \qquad (1)$$

$$M_v = M^*A\,(I - A + M^*)^{-1}(F_v - M_v^d) + M_v^d \qquad (2)$$

The comparison of the import requirements of consumption and investment was made by comparing the imports required in order to support consumption with those to support investment. The total imports required to support consumption and investment are respectively given in the following equations :

$$F_{c_m} = \frac{M_c}{\sum_{i=1}^{n} M_i} \qquad [3]$$

$$F_{v_m} = \frac{M_v}{\sum_{i=1}^{n} M_i} \qquad [4]$$

where $\sum_{i=1}^{n} M_i$ is total imports [indirect and direct] to support final demand.

The classification of consumer goods into necessities and luxuries was based on the concentration ratios of these goods which were derived from the assumed Lorenz curve. This curve relates the cumulative proportion of income [or expenditure] units to the cumulative proportion of income received [or expenditure incurred] when units are arranged in ascending order of their income [or expenditure].

In practice, the Lorenz curve equation is derived from some well-known density functions of the income distribution, usually lognormal or Pareto distributions. However, since these density functions do not usually give a good fit on the actual data, Kakwani and Podder[1] have suggested an alternative approach by finding an equation of the Lorenz curve which does fit actual data reasonably well.

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1 See N.C. Kakwani and N. Podder, "Efficient Estimation of The Lorenz Curve and Associated Inequality Measures From Group Observations", Econometrica, vol.44, no.1 [January 1976], pp. 137-48.

The following is the summary of Kakwani-Podder's formulation of computing concentration ratios of consumption expenditure based on grouped data. Let X be the total per-capita expenditure of a household with distribution function of X which is defined as,

$$F(x) = \int_0^x f(X)\, dX \qquad (5)$$

The distribution function as indicated by equation (5) shows the proportion of households having total per-capita expenditure less than or equal to x. The proportion of total per-capita expenditure of these households is given by,

$$F_1(x) = \frac{1}{\mu} \int_0^x X\, f(X)\, dX \qquad (6)$$

where μ is the mean total per-capita expenditure of the households. The Lorenz curve is formed by the relationship between F(x) and $F_1(x)$ and the Gini index derived from this curve is defined as,

$$G \doteq 1 - 2 \int_0^\infty F_1(x)\, dx \qquad (7)$$

The use of consumption expenditure as a proxy for income leads us to look at the Engel function of the commodities consumed. Let $g_i(x)$ be the Engel function of the i-th commodity. Then the distribution function of $g_i(x)$ can be defined as,

$$F_i \left[g_i(x) \right] = \frac{1}{y_i} \int_0^x g_i(x)\, f(x)\, dX \qquad (8)$$

where y_i is the mean per-capita expenditure of the households on the i-th commodity. Equation (8) is equal to the proportion of expenditure on the i-th commodity by households having total per-capita expenditure less than or equal to x. The relationship between $F_i\left[g_i(x)\right]$ and $F(x)$ is called the concentration curve of the i-th commodity which is defined as follows,

$$CR_i = 1 - 2 \int_0^\infty F_i\left[g_i(x)\right] f(x)\, dx \qquad (9)$$

The concentration ratio of consumption expenditure as specified by equation (9) is then computed from the Lorenz function of consumption expenditure[1]. The Lorenz function of consumption expenditure from grouped data is specified as,

$$\Omega = a\, \pi^{\alpha}(\sqrt{2} - \pi)^{\beta} \qquad (10)$$

$$a > 0, \quad \alpha > 0 \quad \text{and} \quad \beta > 0$$

where,

$$\pi = \frac{(f_i + f_i^*)}{\sqrt{2}} \quad \text{and} \quad \Omega = \frac{(f_i - f_i^*)}{\sqrt{2}}$$

f_i is the proportion of households by expenditure class and f_i^* is the proportion of households' total per-capita expen-

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1 It should be noted that the concentration curve is not the same as the Lorenz curve. See N.C. Kakwani, loc.cit., p.722.

diture by expenditure class (i = 1,2, ..., n). The concentration ratio is then computed using the following formula,

$$CR = \sqrt{2} \int_0^{\sqrt{2}} a\, \pi^{\alpha} (\sqrt{2} - \pi)^{\beta}\, d\pi$$

$$= 2\, a(\sqrt{2})^{1+\alpha+\beta}\; B(1+\alpha,\ 1+\beta) \qquad (11)$$

$B(1+\alpha,\ 1+\beta)$ is the Beta function which can be computed by using tables of the Beta function[1] or tables of the Gamma function[2].

Kakwani proposed the following corollary of the relationship between the concentration curve of a commodity for the Engel function g(x) and the Lorenz curve of consumption expenditures on commodities for the distribution function f(x), where x is the consumption expenditure :

> The concentration curve of a commodity for the Engel function g(x) lies above (below) the Lorenz curve of expenditures on this commodity for the distribution function f(x) if its expenditure elasticity is less (greater) than unity for all x equal to or greater than zero.3

It follows from this corollary that if the concentration curve

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1 E.S. Pearson and N.L. Johnson, Tables of The Incomplete Beta Function, Cambridge, England : Cambridge University Press, 1968.

2 E.S. Pearson, Tables of Logarithms of The Complete Gamma Function, Cambridge, England : Cambridge University Press, 1922.

3 Nanak C. Kakwani, loc.cit., p.721.

of a commodity lies below the Lorenz curve, this commodity is classified as a luxury and if it lies above the Lorenz curve, this commodity is classified as a necessity. In other words, a commodity is classified as a luxury if its concentration ratio is higher than the Gini coefficient related to it and a necessity if its concentration ratio is lower than its Gini coefficient. The Gini coefficient here refers to that of aggregate consumption expenditures of which this commodity is one item.

Goods classified as essentials have no objective criterion for measurement. Those goods necessary to support public welfare such as infrastructure requirements, education, health facilities, etc. are considered essentials.

Empirical Results

a. The Data

The input-output table of Indonesia for the year 1971 was used for the estimates of the direct and indirect import intensity of the consumption and investment vectors. The 66 x 66 sector table was chosen because it adequately covers the major commodity groups. The computations of commodity concentration ratios which enable consumer goods to be classified as luxuries and necessities, were based on the National Socio-Economic Survey on Household Consumption

Expenditures conducted during January-April 1970[1].

The following definitions of commodity groups adopted in the household consumption survey were used for identification of commodities for classification into luxuries and necessities ;

Food

1. Cereals and Cassava ; Rice, glutinuos rice, rice products, green corn with peel, dried corn with peel, corn, corn flour, wheat flour, cassava [root], dried cassava, cassava flour, sweet potatoes, taros and sago.
2. Fish and Sea Food : Fresh sea fish, fresh water fish, salted and dried fish, canned fish, shrimps, crabs and other sea foods.
3. Meat : Various fresh meats, preserved meats and chicken.
4. Eggs and Milk : Eggs, fresh milk, condensed milk and powdered milk.
5. Vegetables : All kinds of vegetables.
6. Fruits and Peas : All kinds of fruits.
7. Tobacco and Alcohol : Alcoholic beverages, cigarettes, clove cigarettes, cigars and tobacco.
8. Other Foods ; Salt, pepper and spices, fish preserves, vinegar, soya sauce, brown sugar, coconut, vegetable

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1 Biro Pusat Statistik, Survey Sosial Ekonomi Nasional, January-April 1970, Jakarta ; Biro Pusat Statistik, 1973.

cooking oils, butter, animal cooking oils, refined sugar, tea, coffee, chocolate powder, syrups and soft drinks.

Non-Food

9. Housing and Utility : House rent, imputed rent, maintenance costs, electricity, kerosene, firewood, charcoal and water supply.
10. Miscellaneous Goods and Services : Toilet soap, other toilet articles, movies and theatres, school fees, contribution to school, stationery, newspapers, periodicals, books, medicines, barber, domestic servants, transport, postage and telegrams and other nice goods and services.
11. Clothing : Ready-made clothes, materials for clothes, charges for tailoring and repair, footwear, headwear, sewing thread and other sewing materials, laundry soap and powder and laundry.
12. Durables and Semi-Durables : furniture, household appliances, cars, motorcycles, bicycles, household utensils, kitchen and eating utensils, watches, clocks, jewelry, entertainment equipment, sport articles, repair and maintenances of durables and semi-durables.
13. Other Non-Food : Property taxes, all kinds of licenses, insurance, wedding, religious festivals and other ceremonies.

b. The Results

Table VIII.1 shows the estimate of the imported consumption vector in Indonesia's final demand for 1971 which was calculated on the basis of equation (1). This table shows that the total imported consumer goods (indirect and direct) amounted to Rp 415.8 billion. The major shares in this amount were taken by Electrical & Non-Electrical Equipment, Chemical Industries, Textiles, Leather & Wearing Apparel, Rice Milling, Cleaning & Polishing, Transport Equipment, Paper, Paper Products & Printing, Spining Industries, and Fertilizers and Pesticides. These sectors respectively took 15.8 per cent, 9.8 per cent, 8.1 per cent, 7.9 per cent, 7.5 per cent, 5.7 per cent, 5.0 per cent and 4.5 per cent of the total imported consumer goods.

For computing concentration ratio from expression (11) above, the following model for the Lorenz function given in equation (10) was suggested by Kakwani and Podder[1] :

$$\text{Log } y_t = a + \alpha \log r_t + \beta \log (\sqrt{2} - r_t) + w_t \qquad (12)$$

where $a = \log a$, w_t is the disturbance term and

$r_t = \dfrac{p_t + q_t}{\sqrt{2}}$ and $y_t = \dfrac{p_t - q_t}{\sqrt{2}}$. Here r_t and y_t

1 Nanak C. Kakwani and N. Podder loc.cit.

are consistent estimators of π_t and Ω_t respectively; and symbols p_t and q_t are consistent estimates of $F[x_t]$ and $F_1[x_t]$ respectively. p_t and q_t in terms of sample mean expenditure for the t-th expenditure class, x_t^*, and relative frequency of a household belonging to the t-th expenditure class, f_t, are written as,

$$p_t = \sum_{\gamma=1}^{t} f_\gamma \quad \text{and} \quad q_t = \frac{1}{Q} \sum_{\gamma=1}^{t} x_\gamma^* f_\gamma$$

where $Q = \sum_{\gamma=1}^{T+1} x_\gamma^* f_\gamma$ [being the mean expenditure of all the households, t = 1,2,..... T+1] and $f_t = \frac{n_t}{N}$

where n_t is the number of households incurring expenditure in the interval x_{t-1} and x_t and N is the total number of households grouped into [T+1] expenditure classes. Equation [12] above was estimated by using the method of ordinary least squares to obtain the values of a, α and β. Once these values were obtained, equation [11] was used to get the concentration ratio. Beta function was derived from the Gamma function using the following equation,

$$B[1+\alpha,\ 1+\beta] = \frac{\Gamma[1+\alpha]\ \Gamma[1+\beta]}{\Gamma[2 + \alpha + \beta]}$$

Table VIII.2 shows the estimates of the Lorenz function for 13 commodity groups and for total consumption expenditures. The basic data for computation of concentration ratios are given in tables VIII.3 and VIII.4. Table VIII.5 shows the calculated concentration ratios.

The indirect and direct imports of commodities classified as luxuries amounted to about Rp 108 billion (see Table VIII.6) and those classified as necessities and essentials amounted to about Rp 308 billion (see Table VIII. 7). The criterion presented in previous section was not strictly followed for certain commodities i.e. housing and clothing. The imported materials for these two items which were believed to be of high quality and expensive such as structural metal and clay products for housing,and ready-made clothes, mattresses, towels, blankets and bedsheets which fall under clothing items, were treated as luxuries. However, all fabrics and textile raw materials were considered necessities since they were eventually to be largely used for the production of clothing for the masses. The imported vegetables were considered luxuries although they were grouped in a commodity group which had a relatively low concentration ratio. These products were relatively expensive and the mass of population could not afford to buy. It can be concluded from tables VIII.6 and VIII.7 that

25.95 per cent of the imported consumer goods were in the form of commodities classified as luxuries while 74.05 per cent were in the form of necessities and essentials. The total imports required to support consumption and investment were calculated with the help of equation (3) and (4). The imported investment vector is given by equation (2) while the total import is given in the input-output table. Table VIII.8 shows that 51.6 per cent of total imports in 1971 were required for consumption in that year and 45.1 per cent for investment. The figure for consumption then can be broken down to 13.0 per cent for luxuries and 38.6 per cent for necessities and essentials. The figures in this table suggest that if the imports of the luxuries were restricted, the allocation of foreign exchange earnings for investment might have been greater than that for consumption. This indicates that in 1971 and possibly throughout the years under study, there had been possibilities for Indonesia to execute a rational policy of allocating foreign exchange earnings without disturbing the inflow of necessities and essential goods for the population and at the same time allowing higher domestic capital formation.

Table VIII.1 Indirect and Direct Import Content of Indonesia's Domestic Consumption, 1971 (in millions of Rupiahs)

Sector	Imported Component of Consumption
1. Paddy	0.22
2. Handpounding of Rice	0.00
3. Maize	0.00
4. Root Crops	10.85
5. Vegetables & Fruits	1059.18
6. Other Farm Food Crops	16.74
7. Rubber	5.55
8. Sugar Cane & Brown Sugar	0.00
9. Coconut	0.00
10. Coconut & Palm Oil	0.00
11. Tobacco Leaves & Processed	965.99
12. Roasted Coffee	0.06
13. Tea Leaves & Farm Processed Tea	0.00
14. Cloves	14167.88
15. Nutmeg	0.00
16. Other Spices	52.01
17. Other Crops	6238.29
18. Livestock	7.42
19. Slaughtering	511.73
20. Poultry & Products	588.05
21. Logging & Sawmilling	11.26
22. Other Forest Products	67.19
23. Fisheries	143.35
24. Coal & Metal Ore Mining	121.28

Table VIII.1 (Continued)

Sector	Imported Component of Consumption
25. Petroleum & Natural Gas Mining	1027.77
26. Other Mining & Quarrying	396.66
27. Processing & Preserving of Foods	6445.02
28. Oils & Fats	785.31
29. Rice Milling, Cleaning & Polishing	32860.88
30. Wheat Flour & Products	6066.18
31. Sugar Refinery	9816.66
32. Food Products n.e.c.	2137.72
33. Beverages	1525.84
34. Cigaretts	52.17
35. Spining Industries	20588.08
36. Textile, Leather & Wearing Apparel	33847.20
37. Wood & Wood Products	856.13
38. Paper, Paper Products & Printing	23855.49
39. Fertilizers & Pesticides	18517.06
40. Chemical Industries	40756.60
41. Petroleum Refinery	6946.23
42. Rubber Products	3308.74
43. Non-Metallic Mineral Products	2104.80
44. Cements	823.03
45. Iron & Steel	10764.04

Table VIII.1 (Continued)

Sector	Imported Component of Consumption
46. Non-Ferrous Metal	1994.37
47. Fabricated Metal Products	9205.38
48. Electrical & Non-Electrical Equipment	65687.36
49. Transport Equipment	31107.20
50. Miscellaneous Industries	7407.47
51. Electricity, Gas & Water Supply	0.00
52. Construction	0.00
53. Trade	0.00
54. Restaurants & Hotels	0.00
55. Railways	2688.21
56. Road Transport	3077.21
57. Water Transport	0.00
58. Air Transport	8955.17
59. Services Allied to Transport	7764.93
60. Communication	5155.84
61. Financial Services	4726.71
62. Real Estate & Business Services	10588.96
63. Public Administration & Defence	0.00
64. Social & Community Services	0.00
65. Recreational, Cultural, Personal and Household Services	411.43
66. Unspecified & Provisional Sector	9591.58
Total	415810.48

Table VIII.2 Estimates of The Lorenz Function by Commodity for Indonesia,1970

Commodity	a	α	β	R^2
Cereals & Cassava	0.18463	0.78177	0.82940	0.99888
Fish & Sea Foods	0.46137	0.93144	0.94487	0.99996
Meat	0.65385	0.98244	0.99024	0.99994
Eggs & Milk	0.64591	0.98576	0.98918	0.99991
Vegetables	0.28233	0.90712	0.87837	0.99889
Fruits & Peas	0.43052	0.92221	0.93318	0.99964
Tobacco & Alcohol	0.41363	0.92736	0.92997	0.99995
Other Foods	0.42497	0.93150	0.93284	0.99987
Housing & Utilities	0.31104	0.88708	0.88989	0.99910
Miscellaneous Goods & Services	0.54802	0.96917	0.96661	0.99996
Clothing	0.29331	0.87663	0.86047	0.99993
Durables & Semi-Durables	0.67520	1.01189	0.99474	0.99998
Other Non-Foods	0.35953	0.92225	0.90932	0.99901
Total Expenditures	0.34999	0.91098	0.90725	0.99971

Table VIII.3 Gamma Function For Each Commodity's Lorenz Function

Commodity	$\Gamma(1 + \alpha)$	$\Gamma(1 + \beta)$
Cereals & Cassava	0.92667	0.93952
Fish & Sea Foods	0.97293	0.97793
Meat	0.99270	0.99591
Eggs & Milk	0.99406	0.99547
Vegetables	0.96422	0.95454
Fruits & Peas	0.96957	0.97357
Tobacco & Alcohol	0.97143	0.97239
Other Foods	0.97295	0.97344
Housing & Utilities	0.95741	0.95834
Miscellaneous Goods & Services	0.98735	0.98634
Clothing	0.95721	0.95829
Durables & Semi-Durables	1.00509	0.99779
Other Non-Foods	0.96958	0.96499
Total Expenditures	0.96557	0.96427

Table VIII.4 Beta Function For Each Commodity's Lorenz Function

Commodity	$B\ [1+\alpha,\ 1+\beta]$
Cereals & Cassava	0.23127
Fish & Sea Foods	0.18482
Meat	0.18039
Eggs & Milk	0.17019
Vegetables	0.19950
Fruits & Peas	0.18809
Tobacco & Alcohol	0.18778
Other Foods	0.18668
Housing & Utilities	0.20091
Miscellaneous Goods & Services	0.17584
Clothing	0.20043
Durables & Semi-Durables	0.16576
Other Non-Foods	0.19189
Total Expenditures	0.17420

Table VIII.5 Concentration Ratios By Commodity Group, 1970

Commodity	Concentration Ratio	Classification
Cereals & Cassava	0.21109	Necessity
Fish & Sea Food	0.46211	Luxury
Meat	0.66091	Luxury
Eggs & Milk	0.61645	Luxury
Vegetables	0.29579	Necessity
Fruits & Peas	0.43567	Luxury
Tobacco & Alcohol	0.41817	Luxury
Other Foods	0.42815	Luxury
Housing & Ustilities	0.32720	Necessity
Miscellaneous Goods & Services	0.53310	Luxury
Clothing	0.32193	Necessity
Durables & Semi-Durables	0.63456	Luxury
Other Non-Foods	0.36813	Luxury
Total Expenditures	0.32982	

Table VIII.6 Indirect and Direct Imports of Commodities Classified as Luxuries for Consumption, 1971 (in millions of Rupiahs)

Sector No.	Name of the Sector	Commodities	Import Value
5	Vegetables & Fruits	Various foreign vegetables	459.97
		Various foreign fruits	599.21
6	Other Farm Food Crops	Other farm food crops	16.74
12	Coffee	Roasted Coffee	0.06
16	Other Spices	Other spices	52.01
18	Livestock	Various animals	7.42
19	Slaughtering	Meat	511.73
20	Poultry & Products	Poultry	2.14
21	Logging & Sawmilling	Forest wood	5.74
22	Other Forest Products	Teak wood	5.52
		Other forest products	67.19
23	Fisheries	Fish	9.34
		Dried fish	134.01
26	Other Mining & Quarrying	Flints,gypsum,diamonds	238.74
27	Processing & Preserving of Food	Canned meat	122.22
		Milk & cream	5208.74
		Dried & frozen vegetables & fruits	441.79
		Canned fish & sea food	672.27
28	Oils & Fats	Margarine and vegetables oils & fats	782.44

Table VIII.6 (Continued)

Sector No.	Name of the Sector	Commodities	Import Value
32	Food Products n.e.c.	Cocoa powder, chocolate and products	480.29
		Coffee powder	21.31
		Tea	9.79
		Soya-bean products	1087.40
		Other food products	5130.52
33	Beverages	Alcoholic beverages	1091.86
		Soft drinks	433.98
34	Cigarettes	Cigarettes	52.17
36	Textile, Leather & Wearing Apparel	Ready-made clothing	464.38
		Mattresses, towels, blankets, bed-sheets, etc.	1286.09
		Carpets and Rugs	4062.47
		Leathers	13.69
		Leather products	67.22
		Shoes and slippers	153.55
37	Wood & Wood Products	Luxurious furniture	147.50
38	Paper, Paper Products & Printing	Printed matters	9588.15
40	Chemical Industries	Soaps and cleaning preparation	965.76

Table VIII.6 (Continued)

Sector No.	Name of the Sector	Commodities	Import Value
42	Rubber Products	Tyres and tubes for cars and motorcycles	1110.01
43	Non-Metallic Mineral Products	Glass, glass products and clay products	1943.81
47	Fabricated Metal Products	Metal furniture	525.69
		Other fabricated metal products	6887.41
48	Electrical and Non-Electrical Equipment	Radio,television sets, tape-recorders,casettes,sound-systems	16849.83
		Electric fans, electric stoves, refrigerators, freezers, cookers and airconditioners	3382.07
		Accumulators and Batteries for cars and motorcycles	2280.26
49	Transport Equipment	Cars	19040.33
		Motorcycles,Scooters,etc.	7834.67
50	Miscellaneous Industries	Photographic equipment	251.74
		Jewelry	440.79
		Musical instruments	46.96
		Sporting goods	276.29
62	Real Estate & Business Services	Business services	8141.84
65	Recreational,Cultural and Personel Services	Motion pictures	414.85
	T o t a l		*107883.51*

Table VIII.7 Indirect and Direct Imports of Commodities Classified as Necessities and Essentials for Consumption, 1971
(in millions of Rupiahs)

Sector No.	Name of the Sector	Commodities	Import Value
1	Paddy	Paddy for seeds	0.22
4	Root Crops	Root crops	10.85
7	Rubber	Smoked and remilled rubber	5.55
11	Tobacco Leaves & Processed	Tobacco leaves & processed	965.99
14	Cloves	Cloves	14167.88
17	Other Crops	Other crops	6238.29
24	Coal & Metal Ore Mining	Coal of various kinds	70.33
		Iron sand	0.30
25	Petroleum & Natural Gas Mining	Petroleum	1027.77
26	Other Mining & Quarrying	Quarrying products	26.77
		Sulphur,iodine,phosporus	122.67
		Salt crude	8.35
		Asphalt	0.13
28	Oils & Fats	Coconut oil & cooking oil	2.87
29	Rice Milling, Cleaning & Polishing	Polished rice	32860.88

Table VIII.7 (Continued)

Sector No.	Name of the Sector	Commodities	Import Value
30	Wheat Flour & Products	Wheat flour	6066.18
31	Sugar Refinery	Refined sugar	9816.66
35	Spinning Industries	Textile raw materials	20588.08
36	Textile, Leather & Wearing Apparel	Apparel fabrics	26827.72
		Other fabrics	5.89
37	Wood & Wood Products	Wood products	143.82
		Cork products	564.81
38	Paper,Paper Products & Printing	Pulp,paper and cardboard	12659.96
		Paper products	1607.38
39	Fertilizers & Pesticides	Fertilizers and pesticides	18517.06
40	Chemical Industries	Basic industrial chemicals	21599.72
		Drugs and medicines	7213.25
		Paints	7.72
		Matches	4.24
		Other chemical products	4253.82
		Coal products	247.30
		Plastic ware	2887.15

Table VIII.7 (Continued)

Sector No.	Name of the Sector	Commodities	Import Value
41	Petroleum Refinery	Petroleum products	6946.23
42	Rubber products	Tyres and tubes for trucks, buses and other public transport	541.60
43	Non-Metallic Mineral Products	Rubber products	1657.13
		Non-metallic mineral products	160.99
44	Cements	Cements	823.03
45	Iron & Steel	Iron and steel products	10764.04
46	Non-Ferrous Metal	Non-ferrous basic metals	2045.02
47	Fabricated Metal Products	Cutlery, handtools and general hardware	1792.28
48	Electrical and Non-Electrical Equipment	Non-electrical machinery	26946.80
		Industrial electrical machinery and apparatus	8514.86
		Accumulators and batteries for trucks and buses	570.07
		Other electrical apparatus & supplies	7143.47
49	Transport Equipment	Equipment for public transport	4232.20

Table VIII.7 (Continued)

Sector No.	Name of the Sector	Commodities	Import Value
50	Miscellaneous Industries	Scientific equipment	82.56
		Pencils, pens and buttons	3307.93
		Other products	2831.67
51	Railways	Facilities for railways	3428.86
58	Air Transport	Facilities for air transport	8893.68
59.	Services Allied to Transport	Services related to transport	8416.39
60	Communication	Postal services	5130.31
61	Financial Services	Insurance and other services for necessities	4620.47
66	Unspecified Products	Unspecified products and secondhand articles	9591.58
	T o t a l		307926.75

Table VIII.8 Total Imports Required To Support Consumption, Investment and Exports, 1971

(Value in billions of Rupiahs)

Vector	Imports (A)	Total Imports (B)	A/B
Consumption			
Luxuries	107.88		13.40 %
Necessities & Essentials	307.93		38.20 %
Investment	363.64		45.10 %
Exports	26.91		3.30 %
Total	806.36	806.36	100.00

Conclusions

The results presented in this chapter show that the imports of luxuries formed quite a substantial proportion of the total imported consumer goods. Bearing in mind that only a small elite of the population, i.e. the top 5 - 10 per cent, were the consumers of luxuries, the results lead one to conclude that imports had largely served the wealthy. Indonesia's consumption pattern has been affected by the international demonstration effect which has been able to spread through trade liberalization and the inflow of foreign investments which were substantially concerned with the production of consumer goods.

The results also show that aggregate imports to Indonesia included more consumer goods than investment goods. In the context of the Indonesian economy which is characterized by a low per capita income and disguised and open unemployment, these findings cannot be viewed without concern since they indicate that there has been a diversion of scarce financial resources to what may be considered a low priority area.

Assuming that the inter-industry import coefficients remain stable or increase after the year of the study, (which is very likely to happen owing to the liberal nature of the import policy), the import-dependent nature of import substitute industries (which are largely oriented towards consumer goods) and the increasing income of the wealthy who derive their consumption standards from abroad, the following proposition could be put forward : "In an open less developed economy in which imports are substantially determined by the consumption patterns of a small elite, a relative rise in the income of this group will lead to a rise in the share of imports of consumer goods in relation to total consumption".

In the context of the Indonesian economy, the petroleum sector which has been the largest contributor to foreign exchange earnings, was to a certain extent, responsible for this situation. This can be considered as not conducive to economic development at a national level.

CHAPTER IX

ANALYSIS OF EXCHANGE RATE

This chapter presents the analysis of the level of Indonesia's exchange rate in terms of its implications on domestic resource allocation. Rapid increases in foreign exchange earnings which were attributable mostly to exports from the extractive industries (the most important of which was petroleum) may conceal the fact that non-extractive exports were receiving barely adequate or even inadequate price incentives for their expansion. These non-extractive exports are far more important than the extractive sector from the point of view of employment and their growth might be affected by the prevailing rate of exchange.

Exchange Rate and Resource Allocation

In chapter IV, a theory on the effect of foreign capital inflow on the exchange rate as proposed by Ginor was briefly presented. According to Ginor, apart from official exchange rates, tariff systems and import restrictions, the foreign capital inflow itself decisively affects the exchange rate. Relatively large capital imports over a prolonged period will tend to cause an especially low rate of exchange which implies an overvaluation of currency of the capital receiving country. This overvaluation of currency will seriously limit the quantity of goods and services that can profitably be produced domestically and also inhibit the production of tradable goods and services which can enter foreign trade competitively[1]. On the other hand, where the exchange rate is higher, which implies an undervaluation of currency, more labour and capital would be allocated to the production of tradable goods and services. This occurs in an "outward-looking" industrialization strategy which has been widely advocated[2]. The crucial aspect of such a strategy is the provision of an exchange rate which provides strong price incentives to existing or prospective exporters of goods which require heavy labour input. The internal markets in less developed countries are not large enough, nor growing fast enough, to meet the challenge of labour absorption posed by these countries' population growth. Import substitution, while helpful in the short-run, has limited long-run prospects for growth of output and employment.

Within this context, Black[3] categorized five exchange rate policies namely :

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1 F. Ginor "The Impact of Capital Imports on The Structure of Developing Countries", Kyklos, vol.22, no.1, 1969, pp. 104-20.

2 See interalia Little, Scitovsky and Scott Industry and Trade in Some Developing Countries, Oxford : Oxford University Press, 1970; and Bela Balassa, "Trade Policies in Developing Countries", American Economic Review, May 1971, pp.178-87.

3 Stanley Black, "Exchange Policies For Less Developed Countries in a World of Floating Rates", Essays in International Finance, No.119, New Jersey, Princeton : Department of Economics, Princeton University, December 1976, p.23.

(1) A policy which utilizes exchange controls or import quotas and capital controls and pegs the local currency to a single foreign currency.

(2) A policy which exercises the pegging of local currency to a single foreign currency by means of reserves or borrowing.

(3) A policy where the local currency is pegged to Special Drawing Rights of the International Monetary Fund.

(4) The managed float foreign exchange policy designed to stabilize the effective exchange rate or move it in the direction indicated by differential inflation rates.

(5) A free floating exchange rate policy.

According to Black, the first two policies will tend to create relatively higher degree of misallocation of domestic resources compared to the last three policies, due to exchange control that leads to the existence of a black market in foreign exchange. Also fluctuations in the foreign currency to which the local currency is pegged will in turn lead to an inappropriate exchange rate[1]. Indonesia is known to have adopted largely the second policy during 1967 - 1976 and since August 23, 1971 the Rupiah had been officially pegged to the United States dollar.

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1 Ibid., p.24.

The following section presents an evaluation of Indonesia's exchange rate policy in terms of its implications to domestic resource allocation. The evaluation is relevant in this study since the foreign exchange earnings derived from the petroleum industry contribute substantially in producing an import surplus which, in turn, affects the exchange rate.

Indonesia's Exchange Rate Policy ; An Evaluation

The high level of foreign exchange earnings derived from the petroleum industry, together with an inflow of foreign capital and a relatively high level of tariff protection, seem to be the main factors that led Indonesia to maintain a relatively overvalued rate of exchange. This assertion is well supported by the empirical studies so far made in Indonesia[1]. Cooper and Glassburner's study shows that although a series of devaluations were executed between 1966 - 1971, the benefits of these measures as reflected in the purchasing power of exporters' proceeds were very modest. This was due to the fact that sometimes, during this period, when the general domestic price level was stabilized, wholesale prices of non-petroleum

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1 See Richard N. Cooper and Bruce Glassburner, "Foreign Exchange Policy and The Foreign Trade Sector ; Suggestions for Indonesia's Second-Five-Year-Plan", Jakarta ; Harvard Development Advisory Service, 1973, p.9 and Douglas S. Paauw, "Exchange Rate Policy and Non-Extractive Exports", Ekonomi Dan Keuangan Indonesia, vol.26, no.2 (June 1978), pp.206-18.

exports were dampened by weak international markets and when export prices were rising, domestic inflation was reducing the real value of Rupiah prices received by exporters. Between 1968 and 1972, the exchange rate applied to major non-petroleum exports rose by 44 per cent. However, during the same period, the wholesale price index for major non-petroleum exports rose by only 34 per cent while the cost-of-living index rose by 62 per cent[1]. This suggests that exporters of these export products lost ground, measured in terms of purchasing power of their Rupiah proceeds. In other words, the devaluations implemented during 1966 - 1971 had not made a substantial net contribution to exporters' incentives. These devaluations failed to compensate for domestic inflation. Table IX.1 shows the non-oil exporters' effective exchange rates corrected for domestic inflation during 1966 - 1971 for non-petroleum exports. The non-oil exporters' effective exchange rates calculated and corrected for domestic inflation were the free rates discounted for export taxes and adjusted for overprice[2] divided by the cost of living index, September 1966 = 100.

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1 Richard N. Cooper and Bruce Glassburner op.cit.

2 Overprice is the difference between the official check price [the price on the basis of which the foreign exchange earnings must be surrendered to the Central Bank] and the actual price received by the exporter.

Table IX.1 Non-Oil Exporters' Effective Exchange Rates Corrected For Inflation, 1966 - 1971
(1966 rupiah per U.S. dollar)

Year	Effective Exchange Rate
1966	
February	53.6
May	79.1
November	44.6
1967	
I	41.8
II	47.1
III	58.1
IV	52.9
1968	
I	52.8
II	56.8
III	55.7
IV	63.7
1969	
I	56.9
II	56.7
III	56.0
IV	54.2
1970	
I	49.8
II	56.1
III	56.0
IV	55.3
1971	
I	51.9
II	53.3
III	60.2
IV	62.7

Source : Richard N. Cooper and Bruce Glassburner op.cit., p.12.

Douglas Paauw's study[1] of the impact of Indonesia's exchange rate policy on the profitability of non-extractive exports covering the period since Indonesia's last exchange rate adjustment in August 23, 1971 up to 1976, gives further evidence of the overvaluation of Indonesia's currency. The period between August 23, 1971 to 1976 is very relevant for our purpose since during this period the rupiah was pegged to the US dollar at a fixed rate of Rp 415= US$1.00 and also the depreciation of the US dollar took place during this period. Paauw's study shows the degree of rupiah devaluation in terms of third countries' currencies (countries other than the United States which maintained trade relations with Indonesia) as a result of the appreciation of these third countries' currencies vis-a-vis the US dollar. Further, Paauw's study shows to what extent Indonesia's implicit devaluation against third countries' currencies had reduced the existing overvaluation as reflected in the competitiveness of Indonesia's non-extractive exports. Also it shows the extent to which the new level of exchange rate produced an adequate comparative advantage by being able to equilibriate changes in domestic price levels.

To obtain measures of relative cost changes in Indonesia compared to her major trading partners and competitors,

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1 Douglas S. Paauw, loc.cit., pp.206-18.

the following common purchasing power formula was used ;

$$\frac{P^a_{76} \,/\, P^a_{71}}{P^b_{76} \,/\, P^b_{71}}$$

where P^a_{76} and P^a_{71} represent the Indonesian cost of living indices in 1976 and 1971 respectively and P^b_{76} and P^b_{71} represent trading partner's consumer price indices in 1976 and 1971 respectively. Table IX.2 shows the parity price ratios between Indonesia and her five major trading partners for 1976.

Table IX.2 Parity Price Ratios, 1976

Trading Partner	Parity Price Ratio
U.S.A	1.80
Singapore	1.57
Japan	1.46
Netherlands	1.67
West Germany	1.87
Average	1.67

Source : Douglas S. Paauw, ibid, p.214.

Figures in Table IX.2 show that Indonesia's general price level rose significantly relative to those in her major trading partners. The Indonesian general price level rose by the largest ratio relative to West Germany (1.87) followed next by the ratio relative to the United States (1.80). The ratios of Indonesian general price level increases relative to those of the other trading partners are 1.67 (Netherlands), 1.57 (Singapore) and 1.46 (Japan).

The fixing of rupiah value to the United States dollar at Rp 415 since August 1971 and the fact that the United States dollar depreciated between 1971 and 1976, had caused a substantial devaluation in the rupiah's effective export rate against third country currencies. Table IX.3 shows the degree of rupiah devaluation with respect to currencies of Indonesia's major trading partners.

Table IX.3 Devaluation of Rupiah With Respect To Currencies of Indonesia's Major Trading Partners, 1976 (August 1971 = Base)

Trading Partners' Currencies	Rupiah Devaluation (in per cent)
United States Dollar	0
Singapore Dollar	21.0
Japanese Yen	12.3
Netherlands Guilder	27.2
West German Mark	33.2

Source ; Derived from table III in Douglas S. Paauw, ibid., p.212.

The substantial devaluation in the rupiah's effective export rate against currencies of Indonesia's major trading partners had caused an improvement in nominal terms for exports to Indonesia's major trading partners with the exception of the

United States, which was the largest importer of Indonesia's non-extractive exports in 1976[1]. The question that may arise from this improvement is "to what extent did the real benefits accrue to these non-extractive exports which might have been the stimulating factor for their growth ?" To answer this question, the analysis is complemented with the calculation of the parity loss of Indonesia's currency over time in comparison with that of Indonesia's competitors in international trade. Parity loss is the difference between the parity export rate and the actual export rate. The parity export rate is the effective export rate which would have equilibrated relative domestic general price levels to maintain parity with the effective export rate of the base year. Table IX.4 shows parity losses of Indonesia's rupiah export rate in 1976 with respect to currencies of Indonesia's major trading partners. These parity losses indicate a measure of the cost discrimination

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1 The following are Indonesia's non-extractive exports by countries of destination in 1971 and 1976 (in percentage of US dollar value) :

Country	1971	1976
United States	19.7	28.7
Singapore	28.9	23.4
Japan	9.6	12.1
Netherlands	11.5	9.6
West Germany	11.9	9.4
Others	18.4	16.8
Total	100.0	100.0

Source : Biro Pusat Statistik *Indikator Ekonomi*, selected issues.

against Indonesian exporters. This cost discrimination shows the extent to which the Indonesian exporters' internal cost increases had not been compensated by changes in actual export earnings. The cost discrimination was most serious for exports to the United States which was 44 per cent relative to 1971 as shown below. The cost discrimination for exports to Singapore was 23 per cent, for exports to Japan 23 per cent, for exports to the Netherlands 24 per cent and for exports to West Germany 29 per cent. The weighted average cost discrimination for exports to these five countries (weighted by the 1976 market shares) was 31 per cent.

Table IX.4 Parity Losses of Indonesia's Rupiah Export Rate a),1976
(1971 = Base)

Trading Partner	Parity Export Rate	Actual Export Rate	Parity Loss (in %)
United States	687	381.8	44.4
Singapore	199	153.4	22.9
Japan	164	126.5	22.9
Netherlands	185	141.2	23.7
West Germany	210	149.6	28.8

a) in Rupiah per unit of foreign currency, except for Japan per 100 Yen.

Source ; Douglas S. Paauw ibid, p.214.

Comparing the parity loss in Indonesia with that in competing countries e.g. Malaysia, Philippines and Thailand, it was shown that the Indonesian exporters had lost ground vis-a-vis these competitors. Table IX.5 shows the comparison of the parity loss for Indonesia with that of Malaysia, Philippines and Thailand using the United States as a basis for comparison for 1976. Figures in this table indicate that the parity losses in the export rates of Malaysia, Philippines and Thailand were respectively 9 per cent, 8 per cent and 6 per cent, i.e. they were very much lower than that of Indonesia. This comparison indicates a clear deterioration in Indonesia's competitive position in non-extractive exports.

Table IX.5 Comparison of Parity Loss Using United States as The Base Country, 1976 (1971 = 100)

Country	Parity Loss (in %)
Indonesia	44.4
Malaysia	9.0
Philippines	8.3
Thailand	6.3

Source : Douglas S. Paauw ibid, p.215.

The adverse effect on the competitive position of Indonesia's non-extractive exports as a result of the overvalued currency is reflected in the essentially stagnant physical volume of these exports during 1971 - 1976 as indicated in Table IX.6. During the same period, non-extractive exports value fell sharply relative to total exports value. In 1971, non-extractive exports represented 38.7 per cent of total exports and this figure dropped to 18.0 per cent in 1976 as shown in Table IX.7. This implies that although non-extractive exports also enjoyed some increase in prices during this period, this increase had little or no effect on capacity expansion which might lead to employment expansion in this sector. The development of the international prices of the principal non-extractive export products during 1970 - 1976 is given in Table IX.8.

Table IX.6 <u>Volume Index of Non-Extractive and Extractive Exports, 1971 - 1976 (1971 = 100)</u>

Fiscal Year	Non-Extractive	Extractive
1971/72	100	100
1972/73	89	123
1973/74	92	157
1974/75	101	164
1975/76	101	155
1976/77	100	173

Source : Bank Indonesia, <u>Indonesian Financial Statistics</u>, various issues.

Table IX.7 Export Values, 1969 - 1976
[in millions of US dollars]

Fiscal Year	Extractive	Non-Extractive	Total
1971/72	842 [61.28]	532 [38.72]	1374
1972/73	1342 [69.21]	597 [30.79]	1939
1973/74	2603 [72.05]	1010 [27.95]	3613
1974/75	6064 [84.39]	1122 [15.61]	7186
1975/76	6057 [84.76]	1089 [15.24]	7146
1976/77	7555 [82.00]	1658 [18.00]	9213

Note : Figures in parentheses indicate relative shares in the total values.

Source : Bank Indonesia, Weekly Reports, various issues.

The stagnant situation of non-extractive exports which was due to disincentive created by the overvaluation of the rupiah can be considered as one of the evidences of resource misallocation as a result of the inappropriate level of the exchange rate as argued by Paauw :

> As the profitability of non-extractive exports declined substantially, ceteris paribus, two resources dislocation effects may have arisen;

(a) A shift of productive factors from non-extractive export activity to domestically oriented industries or to non-productive sectors.

(b) A shift from exporting non-extractive products to supplying them to domestic market 1)

The resources dislocation effects mentioned above must have produced substantial costs to the Indonesian economy in view of the fact that the non-extractive export sectors did offer large opportunities for foreign exchange earnings accumulation and employment expansion as evidenced by the calculated sectoral total net foreign exchange earnings multipliers and employment multipliers as shown respectively in tables IX.9 and IX.10.

The sectoral total net foreign exchange earnings multipliers were derived by multiplying sectoral total output multipliers by sectoral net foreign exchange earnings ratios while the sectoral total employment multipliers were derived by multiplying sectoral total output multipliers by sectoral labour-output ratios. Sectoral labour-output ratios were calculated by dividing sectoral outputs by their labour requirements after these ratios were normalized around a basis of unity. Sectoral net foreign exchange earnings ratios were calculated using the following formula,

$$\frac{E_i - M_i^e}{E_i}$$

where E_i = exports.

M_i^e = imports required to produce exports.

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1 ibid.

Table IX.8 International Prices of Principal Non-Extractive Export Products, 1 9 7 0 - 1 9 7 6

Product	1970 (December)	1971 (December)	1972 (December)	1973 (December)	1974 (December)	1975 (December)	1976 (December)
Rubber III c & f (US$ cent/Lb)	17¼	16¼	19½	47½	28¼	33¾	35¾
Palm Oil c i f (US$ / ton)	276	219	213	575	680	397.50	460
Robusta Coffee cif (Sing. $/pikul)	113	98	90	90	134	183	600
Tea c i f (£/kg)	0.33	0.39	0.29	0.39	0.59	0.48	0.83
White Pepper cif (US$ cent/Lb)	50	65	68	115	100	88	105
Black Pepper cif (US$ cent/Lb)	55	50	52	61	93	80	102
Copra (US$/ton)	178	133	140	600	375	180	370

Source ; Bank Indonesia *Weekly Reports*, various issues.

Table IX.9 Sectoral Total Net Foreign Exchange Earnings Multipliers

Sector	Total Net Foreign Exchange Earnings Multiplier
1. Farm Products	2.34095
2. Other Agricultural Crops	2.47282
3. Livestock & Products	1.93636
4. Forestry	1.97027
5. Fisheries	1.75376
6. Food, Beverage & Tobacco Industries	2.78518
7. Miscellaneous Industries	2.23520
8. Petroleum Refining	2.13846
9. Public Utilities	0.00000
10. Construction	0.00000
11. Trade	1.91869
12. Restaurants & Hotels	0.00000
13. Transport & Communication	2.11599
14. Financing, Real Estate & Business Services	0.00000
15. Other Services	0.00000
16. Petroleum & Natural Gas Mining	1.24319
17. Coal & Metal Ore Mining	2.30198
18. Other Mining & Quarrying	2.74798
19. Unallocated Industries	2.84797

Source ; Derived from total output multipliers reported in table VI.16 and sectoral net foreign exchange earnings ratios given in Tabel Input-Output Indonesia, 1971.

Table IX.10 Sectoral Total Employment Multipliers

Sector	Total Employment Multiplier
1. Farm Products	4.84684
2. Other Agricultural Crops	1.15696
3. Livestock & Products	0.63566
4. Forestry	0.32315
5. Fisheries	0.68067
6. Food,Beverage & Tobacco Industries	2.75361
7. Miscellaneous Industries	1.39996
8. Petroleum Refining	0.32088
9. Public Utilities	0.77290
10. Construction	0.96535
11. Trade	0.91054
12. Restaurants & Hotels	3.06109
13. Transport & Communication	0.69847
14. Financing, Real Estate & Business Services	0.28957
15. Other Services	3.39948
16. Petroleum & Natural Gas Mining	0.04235
17. Coal & Metal Ore Mining	0.40889
18. Other Mining & Quarrying	0.75110
19. Unallocated Industries	24.48516

Source : Derived from total output multipliers reported in table VI.16 and sectoral labour-output ratios given in *Tabel Input-Output Indonesia, 1971*.

Conclusions

The conclusions that can be derived from the exchange rate analysis presented in this chapter are as follows ;

(1) The growth in extractive export earnings which were mainly from petroleum exports seems to be the main factor which had led the Indonesian government to adopt an exchange rate policy which was considered to be relatively higher than the equilibrium level.

(2) Indonesian non-extractive exports had suffered a serious decline in profitability as a result of the exchange rate policy adopted during 1971 - 1976. The devaluation prior to August 1971 seems to have had only limited benefits to non-extractive exports.

(3) The overvalued currency that prevailed during 1971 - 1976 led to misallocation of resources as partially shown by the stagnant non-extractive exports. This situation produced substantial costs to the Indonesian economy as sectors producing non-extractive export products have relatively high net foreign exchange earnings and employment multipliers.

(4) The absence of correlation between the rate of growth in petroleum sector and that in the rest of the economy, can also be explained partly by the disincentive created

by the exchange rate policy for the growth in non-extractive exports together with the irrational utilization of foreign exchange earnings as discussed in the previous chapter.

CHAPTER X

CONCLUSIONS AND POLICY IMPLICATIONS

The main concern of this study has been the examination of the impact of the petroleum industry, which forms the largest export sector, on the Indonesian economy over the period 1967 - 1976. The investigation was done first by reviewing the historical development of the Indonesian economy and in particular the growth of the petroleum industry during the period under study. At the outset, a brief review of the literature on the impact of international trade in general and primary exports in particular on the economic development of less developed countries were presented in order to place this study in a proper theoretical perspective.

The review of Indonesia's economic growth during 1967 - 1976 produced the following conclusions :

(1) The growth policy pursued in Indonesia can be considered as following a leading sector strategy. This had resulted in a capital-intensive form of growth to the detriment of employment and income distribution. For example, the unemployment rate was estimated to have risen from 12.8 per cent in 1971 to 13.2 per cent in 1975 and income inequality, measured by the concentration ra-

tio of consumption expenditure, increased from 0.330 in 1970 to 0.411 in 1976.

(2) As well as a high level of unemployment and a somewhat high degree of inequality of income, mass poverty remained a crucial problem. With the largest segment of the population still dependent on production in the traditional agricultural sector, the much higher growth in the modern capital-intensive sectors of the economy had resulted in the benefits from growth bypassing the majority of the population.

By looking at these phenomena of growth alone, the growth of the petroleum industry, which was the dominant component of the highest growing sector in the Indonesian economy i.e. the mining sector, can be considered as directly or indirectly reinforcing these phenomena. This implies that in spite of the high level of foreign exchange earnings and public revenue derived from the petroleum sector, this sector did not produce a sound basis for economic growth in Indonesia.

The input-output model, using 1971 data, was used to measure first, the extent of the petroleum industry's backward and forward linkages with the domestic sectors of the economy, and secondly, the impact multipliers of the growth of demand for the output of the petroleum industry on household income and aggregate output. The findings of the input-output study which indicate the weak linkages of the petroleum mining with the domestic sectors of the economy, confirm Singer's first thesis that, though geographically, the foreign-controlled primary export sector is located in the less developed countries, the main multiplier effects (direct, indirect and induced effects on income) of this sector take place outside the domestic economy. The total household income multiplier generated by the petroleum mining in Indonesia was very small (0.055) which was the lowest in relation to those of other sectors. The main factor responsible for this situation, apart from low linkages, was the low component of payments accrued to domestic factors of production as shown by the small share of the household component in gross value added of the petroleum mining sector. Its total output multiplier proved also to be the lowest.

However, in petroleum refining a quite different situation was found. Not only had it higher technological linkages with the domestic sectors of the economy but also it generated higher impact multipliers with respect to household income and aggregate output. This indicates the policy which should be followed in Indonesia. The petroleum industry, which will continue to be maintained as the largest foreign exchange earner, will be more integrated to the domestic economy the less its exports are in the form of crude oil and the more they are in the form of refined products.

In order to take into account the dynamic effects of the petroleum sector on the other sectors of the economy, which included also its effect on the capacity for expansion of these sectors through investment resources provided by the petroleum sector, a set of partial macro-economic models was used. The findings confirm Singer's second thesis that although the interaction between the enclave primary export sector and the rest of the economy is not absent, this interaction is of such a kind as to lead to polarization or sharpened dualism within the economies of the less developed countries. The petroleum industry in Indonesia was shown to have a far higher impact on modern sectors of the economy than on traditional sectors and had thus aggravated sectoral income disparities. In this context, the merit of the prolonged unbalanced growth policy may be questioned.

The solution of the proposed macro-economic model indicates that the petroleum sector's exports had substantially lower impact multipliers on disposable income and Gross National Product in comparison with those of the exports of the rest of the economy. This indicates that the expansion of the non-petroleum export sectors should also become the policy to be pursued. These sectors proved to be the sectors that produced much smaller leakages out of the domestic economy which possibly makes them the backbone of the Indonesian economy.

The correlation test shows that there was no positive significant correlation between the rate of growth of the petroleum industry's gross value added and the rate of growth of gross value added in each sector and all sectors in the rest of the economy. The test also shows a similar absence of correlation between the rate of growth of petroleum exports and the rate of growth of Gross National Product Net of Petroleum Exports. The steady growing petroleum exports had not been able to produce a positive significant correlation between the rate of growth of total exports and the rate of growth of Gross National Product Net of Exports which Maizels had implicitly postulated as a measure of the significant contribution of exports to economic growth in less developed countries.

A positive correlation between the rate of growth of exports and the rate of economic growth in less developed countries may arise after a certain threshold of development has been passed. However in Indonesia, the relatively overvalued currency and the large allocation of foreign exchange used for consumption (which substantially consisted of luxuries) rather than for investment, were identified as the factors which were partly responsible for the absence of the growth rate correlations mentioned above. A lower external value for the rupiah[1] and a greater allocation of foreign

1 On November 15, 1978, the Indonesian government decided to devalue the Rupiah by 33⅓ per cent and abolish the pegging of the Rupiah to the United States dollar. This

exchange for investment could have led to a higher growth in non-petroleum sectors (especially non-extractive exports) and a higher level of domestic capital formation. In the final analysis the maximum and meaningful contribution of the export sector, such as the petroleum sector in Indonesia, to the domestic economy, was largely a function of government policy decisions, especially the decisions with regard to how revenues derived from the sector were utilized and what incentives were designed to expand competitive industry.

The policy problem of establishing investment criteria for allocating resources among alternative investments remains unresolved in economic development planning in less developed countries, given the structural constraints faced by these countries. Taking sectors which had total weighted linkage indices higher than unity to be the important sectors in the economy and assessing them in terms of possible alternative policy objectives, such as maximization of output, maximization of employment and maximization of net foreign exchange earnings, the following results are presented (see Table X.1). In this Table, only sectors having total output multipliers (as given in Chapter VI) higher than 2 and both total employment and total net foreign exchange earnings multipliers (as given in Chapter IX) higher than unity, are considered to have met all alternative policy objectives mentioned above.

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policy decision can be used as a proof of the relevance of the policy implication argued on this line as presented in this study.

Table X.1 Important Sectors Showing Their Linkages and Contributions To Three Alternative Policy Objectives

Sector	Total Weighted Linkages > 1	Policy objectives: Maxi-mize Output	Maximize Employ-ment	Maximize Net Foreign Exchange Earnings
1. Farm Products	15.12158	Yes	Yes	Yes
2. Other Agricultural Crops	5.27286	Yes	Yes	Yes
3. Livestock & Products	1.60384	No	No	Yes
4. Forestry	1.16006	Yes	No	Yes
5. Fisheries	2.65775	No	No	Yes
6. Food, Beverage & Tobacco Industries	11.98085	Yes	Yes	Yes
7. Miscellaneous Industries	20.21596	Yes	Yes	Yes
8. Petroleum Refining	1.55707	Yes	No	Yes
10. Construction	9.56134	Yes	No	No
11. Trade	12.72013	No	No	Yes
12. Restaurants & Hotels	4.78704	Yes	Yes	No
13. Transport & Communication	7.73625	Yes	No	Yes
14. Financing, Real Estate & Business Services	2.55304	Yes	No	No
15. Other Services	7.05973	Yes	Yes	No
16. Petroleum & Natural Gas Mining	3.44503	No	No	Yes

Table X.1. shows the magnitude of the policy problems posed by the present structure of the Indonesian economy. Not only were there few sectors which allowed maximum dispersion of impact in any of these policy objectives, but there appeared to be a certain degree of incompatibility between these objectives and inter-sectoral linkages. For example, some sectors with high total weighted inter-sectoral linkages did not have maximum effect on all these policy objectives.

This table also shows that petroleum refining offered an opportunity of achieving two alternative policy objectives, maximizing the impact on output and net foreign exchange earnings, in contrast to petroleum & natural gas mining which offered an opportunity of achieving only one policy objective namely maximization of net foreign exchange earnings. The fact that the total employment multiplier of petroleum refining was higher than that of petroleum mining (0.32088 for petroleum refining and 0.04235 for petroleum mining as given in Chapter IX), the policy preference for expanding refining capacity is thus established in view of the policy objectives given here.

To conclude this chapter, it is useful to restate the following explanations with regard to the interpretation of Table X.1 especially on alternative policy objectives of net foreign exchange earnings and employment maximization by sectors :

(1) The total net foreign exchange earnings multiplier, which was used as the basis for assessing the ability of a sec-

tor to contribute to net foreign exchange earnings, as explained in Chapter IX, was determined by its total output multiplier and net foreign exchange earnings ratio of the product which was exported from this sector. In this context, only products which were exported from a particular sector were analyzed and their effect on net foreign exchange earnings per unit of output exported comprised direct, indirect and induced components which were determined by their inter-sectoral linkages and their payments to households which form the basis for computing their total output multipliers. The following export products from various sectors of the Indonesian economy given in Table X.1, with the exception of those from the petroleum industry, had high net foreign exchange earnings ratios. These sectors which produced these products were classified as sectors that meet the policy objective of maximizing net foreign exchange earnings although some of them may not be considered as the important export sectors :

Sector	Export Products Having High Net Foreign Exchange Earnings Ratio
Farm Products	Maize, tapioca, soya beans, peanuts, other beans & nuts.
Other Agricultural Crops	Estate and cash crops (rubber, palm oil, tobacco, coffee, pepper, copra, etc.)
Livestock & Products	Cattle, hides
Forestry	Logs, timber
Fisheries	Marine fishes (fresh & dried), other marine products

Food, Beverage & Tobacco Industries	Processed foods
Miscellaneous Industries	Molasses, Food products
Trade	Export trade
Transport & Communication	Shipping, air transport and related services

Sectoral net foreign exchange earnings ratios are given in Table A-10 of the Appendix.

(2) The total employment multiplier which was used as the basis for assessing the ability of a sector to produce direct, indirect and induced effects on employment, as also explained in Chapter IX, was determined by its total output multiplier and normalized labour-output ratio. Sectoral labour-output ratios were mathematically normalized in order to fit the Rasmussen's interpretation of linkage indices around a basis of unity while at the same time allowing consistent inter-sectoral comparisons. In this way, a sector which had a relatively high labour-output ratio may not necessarily have high total employment multiplier if this sector had a relatively low inter-sectoral linkage and a low share of household component in its gross value added, which produced a relatively low total output multiplier. For example, although the fisheries sector (sector 5) had a labour-output ratio of 3.7919, which was not very much far below the labour-output ratio of other agricultural crops sector (sector

2) (which was 4.3746), the "other agricultural crops sector" offered an opportunity of meeting the policy objective of maximizing employment while the fisheries sector did not. This was due to the fact that the "other agricultural crops sector" had a higher total weighted linkage index (as shown in Table X.1) and a higher share of household component in its gross value added and therefore had a higher total output multiplier.

The following are the household direct input coefficients and total output multipliers of fisheries and other agricultural crops sectors as given in Chapter VI :

Sector	Household Direct Input Coefficient	Total Output Multiplier
Fisheries	0.07497	1.79505
Other Agricultural Crops	0.18640	2.64473

Sectoral labour-output ratios are given in Table A-10 of the Appendix.

It is generally agreed that all Input-Output tables in less developed countries are biased towards the modern sectors of the economy, because the traditional sectors are inadequately identified and recorded as far as their inputs and outputs are concerned. This indicates that an Input-Output table would not yield a satisfactory scheme of investment priorities. In spite of this, the findings given here, especially on the petroleum sector, which is one of the modern sectors in the Indonesian economy, may show that Input-Output analysis still be useful for formulating economic policy on this sector.

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A P P E N D I C E S

A-1 <u>Indonesia : Estimates of The Lorenz Function of Consumption Expenditure And Associated Concentration Ratio, 1970 and 1976</u>

	1970	1976
a	0.34999	0.40894
α	0.91098	0.94221
β	0.90725	0.92539
R^2	0.99971	0.99917
CR	0.32982	0.41137

Source : Computed on the basis of data given in household consumption expenditure surveys, 1970 (January - April) and 1976 (January - April) published by the Central Bureau of Statistics.

A-2 Gross National Product and Per Capita Gross National Product At Constant 1960 Market Prices

Year	GNP (in billion Rps)	GNP Per Capita (in Rupiahs)
1967	444.3	4042.77
1968	492.7	4378.09
1969	526.5	4568.73
1970	566.0	4796.20
1971	606.0	5014.90
1972	649.9	5252.22
1973	701.0	5550.15
1974	755.3	5821.12
1975	800.3	5979.08
1976	857.2	6254.69

Source : Derived from National Income Accounts published by the Central Bureau of Statistics and Ministry of Finance and population figures published by the Central Bureau of Statistics.

A-3 Private and Public Consumption At Constant 1960 Market Prices

[in billion Rupiahs]

Year	Private Consumption	Public Consumption
1967	456.0	37.0
1968	442.4	36.2
1969	461.2	42.1
1970	465.0	49.0
1971	476.0	58.0
1972	502.6	63.3
1973	514.0	78.0
1974	525.3	75.0
1975	575.0	88.0
1976	591.1	94.1

Source : See table A-2.

A-4 **Private and Public Investment At Constant 1960 Market Prices**

(in billion Rupiahs)

Year	Private Investment	Public Investment
1967	31.25	8.28
1968	33.16	10.20
1969	39.15	22.76
1970	49.36	28.42
1971	64.12	32.39
1972	80.00	42.78
1973	83.10	49.07
1974	61.75	70.52
1975	78.80	91.10
1976	66.45	118.64

Source : See table A-2.

A-5 Total Taxes At Constant 1960 Market Prices

(in billion Rupiahs)

Year	Total Taxes
1967	20
1968	32
1969	52
1970	51.5
1971	62
1972	81
1973	102
1974	125
1975	139
1976	162

Source : Departemen Keuangan *Nota Keuangan*, various years.

A-6 <u>Disposable Income At Constant 1960 Market Prices</u>

(in billion Rupiahs)

Year	Disposable Income
1967	424.3
1968	460.7
1969	474.5
1970	514.5
1971	544.0
1972	568.9
1973	599.0
1974	630.3
1975	661.3
1976	695.2

Source : See table A-2.

A-7 Petroleum Sector's Exports and Non-Petroleum Sectors' Exports At Constant 1960 Market Prices

(in billion Rupiahs)

Year	Petroleum Sector's Exports	Non-Petroleum Sectors' Exports
1967	24.97	18
1968	21.54	32
1969	21.45	26
1970	28.04	45
1971	35.70	52
1972	54.28	54
1973	73.06	75
1974	154.72	74
1975	138.96	49
1976	145.74	52

Source : See table A-2.

A-8 Total Imports At Constant 1960 Market Prices

(in billion Rupiahs)

Year	Total Imports
1967	83.14
1968	77.49
1969	78.71
1970	90.43
1971	101.66
1972	123.50
1973	143.98
1974	168.85
1975	183.51
1976	186.07

Source : See table A-2.

A-9 Net Factor Payments Made Abroad At Constant 1960 Market Prices

(in billion Rupiahs)

Year	Net Factor Payments Abroad
1967	5.8
1968	6.9
1969	6.8
1970	9.0
1971	11.0
1972	23.0
1973	27.0
1974	37.0
1975	36.7
1976	25.0

Source : See table A-2.

A - 10 Sectoral Final Demand, Labour-Output Ratios and Net Foreign Exchange Earnings Ratios, 1971

Sector	Final Demand (in billion Rps)	Labour-Output Ratio	Net Foreign Exchange Earnings Ratio
1. Farm Products	650.01	20.2491	0.978
2. Other Agricultural Crops	236.34	4.3746	0.935
3. Livestock & Products	89.54	3.2401	0.987
4. Forestry	69.55	1.5778	0.962
5. Fisheries	151.20	3.7919	0.977
6. Food, Beverage & Tobacco Industries	533.87	9.1847	0.929
7. Miscellaneous Industries	781.10	4.9104	0.784
8. Petroleum Refining	67.26	1.4195	0.946
9. Public Utilities	19.68	2.7367	0.000
10. Construction	503.08	3.2163	0.000
11. Trade	584.28	4.5985	0.969
12. Restaurants & Hotels	225.86	12.0020	0.000
13. Transport & Communication	368.37	2.9081	0.881
14. Financing, Real Estate & Business Services	142.51	1.2647	0.000
15. Other Services	444.45	8.8694	0.000
16. Petroleum & Natural Gas Mining	176.79	0.3379	0.992
17. Coal & Metal Ore Mining	18.84	1.6910	0.952
18. Other Mining & Quarrying	14.58	2.6540	0.971
19. Unallocated Industries	8.97	65.7701	0.765

Source : Tabel Input-Output Indonesia, 1971.

A-11 NAG 1900 FORTRAN COMPUTER COMMAND STATEMENTS FOR COMPUTING LEONTIEF INVERSE MATRIX

```
JOB INV,:ARIEF,JD(MZ33K,JT30)
FORTRAN LIB NAGF,COMPRESS,TRACE,PMD
      MASTER INVERT
      REAL A(19,19), UNIT(19,19), WKSPCE(20)
      INTEGER N
      N = 19
      READ (1,999) ((A(I,J), J=1,N), I=1,N)
      DO 30 I = 1,N
         DO 20 J = 1,N
            A(I,J) = -A(I,J)
            IF(I.EQ.J) A(I,J)=A(I,J)+1.0
20       CONTINUE
30    CONTINUE
      CALL F01AAF(A, N, N, UNIT, N, WKSPCE, 0)
      WRITE (2,9999) ((UNIT(I,J), J=1,N), I=1,N)
      STOP
999   FORMAT (19G0.0)
9999  FORMAT (1H, 10F10.5)
      END
      { DATA
FINISH
```

A- 12 NAG 1900 FORTRAN COMPUTER COMMAND STATEMENTS FOR COMPUTING LEONTIEF AUGMENTED INVERSE MATRIX

```
JOB INVAUG,:ARIEF,JD(MZ33K,JT30)
FORTRAN LIB NAGF,COMPRESS,TRACE,PMD
      MASTER INVERT
      REAL A(20,20), UNIT(20,20), WKSPCE(21)
      INTEGER N
      N = 20
      READ (1,999) ((A(I,J), J=1,N), I=1,N)
      DO 30 I=1,N
         DO 20 J = 1,N
            A(I,J) = -A(I,J)
            IF(I.EQ.J) A(I,J)=A(I,J)+1.0
20       CONTINUE
30    CONTINUE
      CALL F01AAF(A, N, N, UNIT, N, WKSPCE, 0)
      WRITE (2,9999) ((UNIT(I,J), J=1,N), I=1,N)
      STOP
999   FORMAT (20G0.0)
9999  FORMAT (1H, 10F10.5)
      END
      { DATA
FINISH
```

A-13 Sources of Data

The following sources of data were utilized for this study :

1. Published Official Publications

   These consisted of :

   a. National Income Accounts, The Input-Output Table and Household Consumption Expenditure Surveys published by the Central Bureau of Statistics (Biro Pusat Statistik).

   b. Monthly Reports on the Petroleum & Natural Gas Industry and Annual Mining Reports published by the Ministry of Mining.

   c. Government budgets and related financial statistics published by the Ministry of Finance.

   d. Foreign trade, balance of payments and other financial statistics published by Bank Indonesia (Indonesia's central Bank).

   e. Monthly bulletins and annual reports published by The Indonesian State Oil Company Pertamina.

2. Other Publications

   The following were the sources of data aside from the official publications which were also utilized for this study :

a. Magazines and journals.

b. Seminar papers.

c. Reports

d. Publications by the International Monetary Fund and the World Bank.

3. <u>Unpublished Materials</u>

Various unpublished materials available in Indonesia and elsewhere where access would be made were also utilized. These materials, among others, were the following :

a. Oil companies' records, financial statements and other documents.

b. Studies and other works made by, or on behalf of, governmental agencies or other organizations.

c. Information from industries serving the petroleum sector.