OPTIMAL UTILIZATION OF OIL REVENUES IN ECONOMIC DEVELOPMENT: AN APPLICATION TO DYNAMIC MULTI-SECTORAL PLANNING FOR NIGERIA

BY

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OPTIMAL UTILIZATION OF OIL REVENUES IN ECONOMIC DEVELOPMENT

TO MY MOTHER AND TO THE MEMORY OF MY FATHER

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ABSTRACT

Since the oil crisis of 1973-74, the problem faced by the typical oil-producing country has been that of developing a production structure with which the excess supplies of financial capital available to it could be transformed into human and physical capital over time. Because the inflows of oil funds were unanticipated, the initial attempt at the utilization of such funds resulted in the haphazard piling up of imports at rates which did not correspond to the absorptive capacity of a non-industrial oil-producing economy, thereby limiting the contribution of these oil revenues to development. This study suggests a framework within which the inflow of oil-funds can be reasonably anticipated and the rate of oil production in each OPEC member-country geared towards its absorptive capacity. The model is applied within the context of dynamic multi-sectoral planning for Nigeria over the period 1974 to 2001.

This study has a distinct two-tier approach to the optimal determination of oil-production and oil-revenue utilization for OPEC as a whole and for Nigeria in particular. First, a dynamic programming model of the world oil market with OPEC as a monopolistic organization trying to maximize the discounted stream of net revenues accruing to its members is developed and solved. Then, the optimal rate of oil extraction determined is allocated to individual OPEC members on the basis of historical market shares. In the second part of the study, the results of the oil sub-model were integrated with a dynamic multi-sectoral planning model with the

anticipated revenues as maximum levels of uncompensated transfers of funds from the oil sector for financing the plan. In this way, Nigeria's capacity to absorb oil revenues can be determined in an optimal way. This procedure was applied to long term planning for Nigeria over nine planning periods from 1974 to 2001 by use of large-scale linear programming techniques. Simulation experiments were also conducted with the planning model in order to determine the effects of changes in the model's basic parameters on the economy's absorptive capacity and the major macroeconomic variables.

Our results indicate that Nigeria's capacity to absorb oil revenues far exceeds the revenue-inflows that could derive from current allocations to it by OPEC. Thus, Nigeria can be expected to agitate for increases in the market share allocated to it by OPEC or to seek further increases in oil price while keeping within OPEC production norms. This would be particularly profitable for Nigeria up to 1986 after which it would probably reach the limit of its absorption capacity. Our computational experience with the planning model also indicates that Nigeria's future prospects will depend on several goals embodied in the model as contraints, the most important of which are - the rate of growth of imports that is permitted by explicit government policy, the savings rate that is set as a target, and the manner in which the export earnings from the oil sector are made available to the domestic economy.

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CHAPTER 1: INTRODUCTION

Among the various problems that have been identified in the process of economic development, the scarcity of foreign exchange resources has generally been assumed to be the most important, since it often constitutes an obstacle to the process of capital formation in developing countries. Based on this assumption, development planning models have often given great emphasis to the determination of foreign exchange resources required for their successful implementation. The most popular among these models is the 'two-gap' model devised by Chenery and Strout in which a country's foreign aid requirement is approximated by its balance of payments gap or the gap between its savings and planned investment, whichever is larger.[1] More sophisticated models applied to planning for India, Chile and Mexico among others[2] have given equal emphasis to estimating the demand for foreign exchange, often financed by foreign aid and international borrowing. However, in the aftermath of the world oil crisis of 1973-1974, there has emerged a new group of nations on the world scene whose peculiar characteristics have posed a challenge to the long-existing dictum that foreign exchange scarcity is the major development problem facing the typical developing country.

Following the steep increases in the price of oil by the Organization of Petroleum Exporting Countries (OPEC) in the wake of the world oil crisis of 1973-1974, there was a massive transfer of financial resources from the oil-consuming nations to the oil-producing nations. This implied

a corresponding increase in the volume of excess financial capital at the disposal of OPEC members. Although these oil-producing nations have as many similar characteristics as different ones, they are generally non-industrial economies with surplus supplies of financial capital but a scarcity of both skilled labour and physical capital. Thus, their problem is not that of the shortage of financial capital; rather, it is one that centers around the need to develop a production structure that will enable them to transform their surplus supplies of financial assets into human and physical capital over time. This problem is best examined within the context of a planning model and this is the major concern of this study. In particular, this study is an attempt to devise a planning model with which Nigeria's future prospects as a member of OPEC can be assessed and compared with its basic needs as a developing country in terms of its revenue-absorption capacity as well as its future development ambitions.

The approach adopted in this study is to focus on Nigeria's development problems and the extent to which the oil sector and the provision of uncompensated transfers of oil-funds can be expected to alleviate them. Although the study attempts in part to develop a model with which an optimum production and export profile can be determined for OPEC as a unified entity, the individual country approach is especially necessary if we recall that individual OPEC members have different economic infrastructures and may therefore arrive at different output profiles that may not be in correspondence with those derived from an OPEC-wide model. Thus, this study adopts a two-tier approach to the determination of the future role of oil in the Nigerian economy. First, an OPEC-wide optimum extraction model is developed and future oil production and anticipated revenues are devised from this on

the basis of a simple market-sharing rule. Next, Nigeria's own future needs are evaluated on the basis of a dynamic multi-sectoral planning model covering the period 1974-2001. Both sub-models are then brought together and their results compared in order to determine Nigeria's present and probable future behaviour with regard to oil production and prices over time.

1.2 The Methodology of the Study

In order to carry out the two aspects of the problem posed above, it has been necessary to adopt a two-tier approach - one based on dynamic programming techniques and the other based on large-scale dynamic linear programming. Both of these are integrated within the framework of an inter-temporal multi-sectoral planning model of the Nigerian economy.

Alternative techniques exist for modeling the world oil industry with special reference to the dominance of world oil production by OPEC and its complete control of the residual demand for oil. The approach adopted here models OPEC as a monolithic organization that seeks to maximize the present-value of the stream of net revenues accruing to its members from the production and export of oil. Once the optimal production profile is determined from the dynamic programming model, it is then allocated to individual OPEC members according to their historical market shares with due consideration given to the availability of reserves and production capacity in each member country. This model is set in the same methodological framework as the classic paper by Hotelling (1931) and the subsequent refinements to the theory of exhaustible resources by Gordon (1967), Smith (1968) and Solow (1974). The actual implementation of the model is

similar to recent models of OPEC behaviour including Blitzer, Meeraus and Stoutjesdijk (1975), Kalymon (1975) and Kyle and Moskowitz (1975) although it is distinct in its two-tier approach to the analysis of OPEC production and market allocation strategies.

The main methodological problem arising from this part of the study concerns the recognition of the role of socio-economic factors and the relevance of the depletion of oil reserves in determining the long-term behaviour of OPEC. To a large extent, some economic factors such as historical market-shares, existing and future production capacities as well as revenue-absorption capacities have been taken into account in the oil model developed here although it was difficult to find a way in which recent socio-political motivations of some dominant OPEC members could be built into the model. As regards the depletion of oil reserves, recent studies by Bradley (1967), Uhler (1977) and Cox and Wright (1974) among others have tried to impute the augmentation of oil reserves by exploration and secondary recoveries into the structure of their models. Generally, such an approach requires detailed knowledge regarding the pressure characteristics and other geophysical properties of oil wells which is beyond the scope of this study. In its place, the oil model includes both the rate of extraction and cumulative extraction in its cost function so that the marginal cost of extraction increases over time as it becomes more difficult to extract the depleting stock of oil. The model is set as a calculus of variations problem and its resulting equations of motion are solved for the optimal rate of extraction by OPEC. Experiments are then conducted with the model to determine alternative production, price and revenue profiles according to assumptions made regarding different values of the rate

of growth of world demand for OPEC's oil and OPEC's own rate of discount. This model and its results are further discussed in Chapter 5 of this study.

The planning model embodied in this study can be characterized as a large-scale inter-temporal planning model for Nigeria covering nine periods each of three years length spanning the period 1974-2001. The choice of the specific characteristics of the model was not easy. There are several models existing in the planning literature varying from highly aggregated models of the Feldman-Mahalanobis type, through static and dynamic input-output and linear programming models to optimal control models using non-linear constraints. Most of these models were initially developed in order to test the consistency of growth theories or to prove the numerical convergence of solution algorithms devised for the models, but the number of sectors in the real economy was too large to permit any empirical implementation of the models. The advance of computer technology and the knowledge of computation techniques since the early 1970's has made it possible to design large-scale planning models in which as many sectors may be included as the planner may choose. However, the choice of the problem size often depends on the specific country for which the model is being designed, the nature of its major constraints as well as its economic objectives.

This study is based on a 13-sector inter-temporal planning model of the Nigerian economy. An attempt is made to maximize Nigeria's social welfare function, approximated in this case by the sum of the discounted stream of total consumption over the planning period and the value of the economy's terminal capital stock. This maximization is subject to the constraints imposed by material balances, capital and labour resource constraints, the need for investment and capital accumulation as well as other objectives

imposed as constraints. These include the savings constraint, the balance of payments constraint, import growth constraint and the growth of national income and consumption over time. The method by which the nine different planning periods or sub-problems are dynamically coupled is through the structure of investment and capital accumulation equations based on the assumption that investment matures with a three-year lag.

All the foregoing characteristics of the model are not peculiar to this study; the model is similar in structure to the multi-sectoral model developed for India by Eckaus and Parikh (1968) and is comparable to DINAMICO - the multi-sectoral model devised for Mexico by Manne (1973). However, both of these models are strictly planning models and do not take account of the possible dominance of any particular sector of the economy with which they were concerned.[3] Thus, one of the major contributions of this study is its two-tier approach to development planning for an economy that is dominated by a sector whose resources are exhaustible in time. This study is also distinct in the way the optimal programme for the dominant sector is combined with the entire national plan. We hope that this study establishes a new dimension in applications of two-level planning.

1.3 Organization of the Study

Any attempt at designing a planning model remains an abstract construct until the model can be applied to the specific country for which it is designed. Since this study embodies a dynamic multi-sectoral planning model for Nigeria, the logical starting point involves a review of the general developments in the Nigerian economy in the period since the end of the second world war. This is done in Chapter 2. Considering the emphasis given to development planning in this study and the speical role accorded

the oil sector as a source of funds for financing Nigeria's future plans, an attempt is made here to examine the role of planning in general and the oil sector in particular in the Nigerian economy in the past as well as the prospects for the future.

In Chapter 3, the nature of planning in the Nigerian context and its role in the economic development of the country is reviewed and critically evaluated with a view to establishing a rationale for the proposed shift to multi-sectoral planning on the basis of a consistent inter-temporal model suggested in this study.

In Chapter 4, the structure of the dynamic multi-sectoral planning model is outlined. The chapter begins with a review of the literature on planning models, covering the entire spectrum from aggregate Harrod-Domar type models through static input-output and linear programming models to dynamic input-output and multi-period linear programming models. The dynamic multi-sectoral planning model is then outlined and developed on the basis of the observed characteristics of planning models as well as the specific requirements of a planning model that would be adaptable to Nigeria's purposes.

The oil sub-model is presented in Chapter 5. Since the oil sector is expected to be the major source of funds in Nigeria's future developments plans, this chapter begins with a review of the conventional sources of funds for financing Nigeria's development plans. The recent shift from these conventional sources to a reliance on the oil sector as a source of finance in the Third National Development Plan, 1975-1980 is also critically examined; the aim here is to show that, rather than the ad-hoc estimation of oil-revenues as done in the Third National Development Plan, a model in

which the inflow of oil funds can be reasonably anticipated may be developed. This dynamic programming model of the world oil market is then presented and employed in estimating nine alternative patterns of revenue-inflows into Nigeria over the planning horizon.

Chapter 6 presents the results of the empirical application of the multi-sectoral planning model to Nigeria from 1974 to 2001. The sources of the basic data employed in the analysis are identified in detail, especially for the biproportional update of the Nigerian input-output table and the estimation of the capital coefficients matrix from existing disaggregated tables. The results of the base-case solutions are then presented. This is followed by the results of the simulation experiments with the multi-sectoral model as well as a review of the implications for Nigeria's probable behaviour in the future as a member of OPEC.

The last chapter of the study presents an overall review of the study, its main conclusions and qualifications, the policy implications and a review of the scope for future research.

FOOTNOTES

(to Chapter 1)

[1]Chenery, H.B. and A.M. Strout, "Foreign Assistance and Economic Development", American Economic Review, vol. 56, 1966, pp. 679-733.

[2]The reference is to Eckaus, R.S. and K.S. Parikh, Planning for Growth: Multi-Sectoral, Inter-temporal Models Applied to India, (Cambridge, Mass., M.I.T. Press, 1968); Clark, P.B. and L. Taylor, "Dynamic Input-Output with Optimal End Conditions: The Case of Chile", Economics of Planning, vol. 11, no. 1-2, 1971, pp. 10-30, and Goreux, L.M. and A.S. Manne (eds.), Multi-Level Planning: Case Studies in Mexico, (New York, North-Holland/American Elsevier, 1973).

[3]The model by Manne is a part of a larger study in multi-level planning for Mexico and thus has linkages to the other models although this is not the primary concern of the multi-sectoral model itself. See Goreux, L.M. and A.S. Manne, Multi-Level Planning: Case Studies in Mexico, op. cit., pp. 107-150.

CHAPTER 2: A GENERAL OVERVIEW OF THE NIGERIAN ECONOMY

2.1. Introduction

In order to understand the recent trends in and the future possibilities of the Nigerian economy, one needs to look back into the past to identify those forces that have, within the last half-century, transformed Nigeria from a colonial trading post into what is now regarded as a dynamic economy that has the potential to be the economic giant of Africa. Within an area of 913,072.64 km^2, Nigeria encloses the largest concentration of human and material resources in Africa. Its population of 70 million[1] also makes Nigeria the most populous country on the continent with half of the population of West-Africa and almost one-quarter of the population of Sub-Saharan Africa. Nigeria has such variety of vegetation that almost every tropical crop can be grown and its endowment of mineral resources is such that Nigeria is not only the largest producer of oil in Africa and a leading exporter of tin, lead, zinc and columbite, but there are also known reserves and/or exploitation of strategic minerals including uranium. The abundance of these agricultural and mineral resources have provided the foundation on which Nigeria's economic progress, especially in the last three decades, has been built as well as the basis of expressed optimism about the country's future.

Although the relevant structural changes in the economy have become increasingly apparent only since the end of the second world war, Nigeria has recorded fairly steady economic progress since the turn of the century.

With the establishment of formal administration by the British in 1914 and subsequent monetization of the economy, Nigeria increasingly became an exporter of major cash crops amongst which were palm oil, cocoa, cotton, groundnuts and rubber. Despite the fact that the inter-war years were dominated by the establishment of democratic rights and the struggle for political independence, the pace of economic activity was never allowed to slow down as farmers responded to incentives and the growth of agricultural exports kept the balance of payments in surplus for most of the first half of the century.[2] Since 1945 Nigeria has grown from the predominantly agricultural export economy of the 1950's through a period of intensive import-substitution in the 1960's to become an increasingly economically independent country in the 1970's.

This chapter presents a review of the overall development of the Nigerian economy in the period since 1945, assesses the current situation and surveys the economy's future prospects. In the next section of the chapter, we examine the major changes outlined above in terms of major macro-economic indices of national product, savings, investment, balance of payments, as well as changes in these indices over time. Since the oil sector currently contributes more than 80% of the country's foreign exchange revenue and considering the fact the prospects for Nigeria's development depend on the extent to which these oil revenues can be employed to lay the foundation for self-sustained growth in the future, the oil-sector is accorded a special role in this study. Accordingly, the third section of this chapter examines the relationship between this vital sector and the entire economy. The last section of the chapter examines briefly the role development planning has played in promoting these observed changes and a survey of

the prospects for the future.

2.2 A General Overview of the Nigerian Economy: 1945-74

(i) The Nigerian Economy Before Independence:

The primary change that took place in the Nigerian economy in the immediate post-war years was the expansion and diversification of agricultural production to include cash crops and the expansion of the country's foreign trade activities. It was a period of post-war reconstruction and recovery in Europe and domestic production was geared towards the production and export of essential raw materials. In these early years, the gross domestic product (GDP) depended mainly on agricultural exports. Thus, the price fluctuations which characterized the world commodity markets and the amplitude of these fluctuations largely dictated the pattern of income, investment and balance of payments as well as the pace of the economy's progress. The economy was particularly vulnerable to these fluctuations as it did not have a domestic economic base that could help cushion the impact of these external shocks.

Despite the vicissitudes of international commodity trade, Nigeria still recorded sizeable surpluses in foreign trade and some growth in the GDP. The total value of exports increased more than nine times between 1944 and 1960[3] and the growth rate of real GDP averaged 4.0% per year. Between 1950 and 1957, the GDP increased 32% in real terms, recording an impressive growth rate of 6.5% in the years of the "Korean boom", up till 1954.[4] In this period, agriculture was the dominant sector contributing more than 65% of the GDP and employing more than 70% of the labour force, although it began to slow down as a result of the dissipation of the war-time excess demand for agricultural products at the end of the Korean war. Whereas the

agricultural sector only grew by 20% between 1950 and 1957, the fastest growing sectors were Manufacturing, Building and Civil Engineering, and Transport and Communications, all of which more than doubled their levels of activity over the 1950 base.

In the late 1950's, the rate of growth of GDP had started to decline as a result of the poor performance in the agricultural sector. However, two significant changes at this time provided the background to the economy's progress in the 1960's. In 1957, the government embarked on a vigorous programme of industrialization by use of incentives embodied in the Industrial Development (Import Duties Relief) Ordinance, 1957, and the Industrial Development (Income Tax Relief) Ordinance, 1958, both of which formed the basis of the government's import-substitution programme. Also, in 1956, oil was discovered in commercial quantities at Oloibiri in the miocene deposits of the Niger delta and oil export has since grown from 1.867 million barrels in 1958 to about 2.4 million barrels per day in 1974. These two factors, to a large extent, have determined the pattern of development in Nigeria in the post-independence period.

(ii) The Growth of the Economy Since 1960

The momentum generated by the discovery of oil and the import-substitution process continued into the immediate post-independence years although there was a steady expansion in all other economic sectors. The real GDP was now growing at 4.4%, slightly above the 4% recorded in the 1950's. The first five years of that decade were necessarily the most produtive since the country was preoccupied with political disturbances and the civil war (1967-1970) in the second half. However, certain structural

changes that were taking place continued throughout the entire decade.

Tables 2.1, 2.2 and 2.3 show the sectoral levels, composition and growth of the GDP at current factor cost from 1959/60 to 1975/76. The evidence shows that the GDP grew at a steady pace in the early sixties, declined in the war years and thereafter surpassed previous records except in 1975/76 when the economy was experiencing part of the world-wide recession.[5] In the period since 1960, the economy has undergone rapid transformation with agriculture, forestry and fishing dominating the GDP in the early 1960's, stagnating between 1965/66 and 1970/71 and thereafter replaced by the oil and manufacturing sectors as the dominant sectors of the economy. Whilst agriculture contributed 55.0% of the GDP (₦ 1.855 billion) in 1966/67 and subsequently declined in its contribution to the GDP to only 24.8% (₦ 3.457 billion) in 1974/75, the oil sector's output increased from ₦ 106.8 million to ₦ 6.2 billion, increasing its share of the GDP from 3.82% to 44.9% over the same period, despite the two-year decline in oil production caused by the war. Table 2.3 also reveals that most of the growth that took place in the economy was experienced mainly between 1968/69 and 1974/75 with the average growth in all the sectors exceeding 10% with Oil, Mining, Manufacturing, and Construction showing the highest growth rates while Agriculture and Transport and Communications showed the lowest rates. These structural changes are mainly explained by the upsurge in the production of oil, the intensification of import-substitution activities by the establishment of medium and large-scale manufacturing plants, the post-war boom in the construction sector, the increased domestic use of raw materials and Nigeria's relative loss of market-shares in some of the traditional markets for her agricultural products.

Apart from the broad trends outlined above, the Nigerian economy seems to have undergone several structural changes and it would require a separate study to describe these in detail. However, because these changes constitute the basis of some assumptions made later, especially the special role accorded to the oil sector and to economic planning in this study, they are discussed here in terms of their impact on capital formation as well as indices of foreign trade and balance of payments.

The pattern of capital formation in Nigeria has to a large extent been influenced by the country's development programmes. In the period covered by the Ten-Year Plan (1946-56), Gross Fixed Capital Formation (GFCF) grew at a steady pace, increasing from ₦ 83.6 million in 1951 to ₦ 256.6 million in 1956, with its ratio to the GDP increasing from 7% to 15% over this period at an average annual rate of 13%. This upward trend in the pace of capital formation continued throughout the 1950's although there was a marked decline in the productivity of investment at the same time.[6] Throughout the 1950's, building and construction constituted the major components of GFCF, taking up about 40% of gross investment. However, it is noteworthy that apart from the early years (1951-54) when trade surpluses were recorded, gross national savings were insufficient to finance domestic investment. Much of the capital formation that took place at this time was financed by colonial grants-in-aid as well as direct foreign investment, especially in the second half of the decade. This period marked the beginning of the economy's dependence on foreign sources of finance.

The early 1960's witnessed some significant changes in the capital formation picture. Although the ratio of investment to the GDP remained between 13% and 15%, certain changes were beginning to take place in the

structure and composition of investment. Transport Equipment and Machinery and Equipment took up increasing shares of total investment as the economy embarked on a vigorous import-substitution industrialization programme. As Table 2.4 shows, the investment ratio never attained the 20% target throughout the period except for 1975/76 when the level of GFCF was more than double the previous year's level. Up to 1969/70, this could be blamed on the lack of funds since gross national savings continued to be inadequate to finance foreign investment. However, since 1970, the foreign savings component of gross savings has consistently been positive mainly as a result of increases in exports. Thus, the problem since the early 1970's has been a shortage of absorptive capacity as gross domestic savings has constantly been in excess of gross investment and was actually double its value in 1974/75. It can be seen that despite the rapid growth in the value of GFCF, especially since 1970/71, its ratio to the GDP has remained fairly constant since the GDP has grown equally rapidly under the momentum of oil exports.

These structural changes in the composition of GFCF are to a large extent indicative of the progress of national economic planning in Nigeria at this time. The pattern of capital formation since the early 1960's has been largely determined by the size of the capital programmes embodied in the First and Second National Development Plans, 1962-68 and 1970-74 respectively. Whilst Building Construction remained the dominant component of GFCF, investment in Other Construction, Transport Equipment, and Machinery and Equipment were growing faster. From about half of the Building Construction's share of the GFCF in 1962/63, Other Construction, Transport Equipment, and Machinery and Equipment attained parity with Building

Construction in their shares of the GFCF in 1967/68. The record during the period of the second National Development Plan has also been impressive but as a result of the massive reconstruction program, Building and Construction accounted for about 55% of the GFCF in 1975/76.

A major factor which underlies the foregoing trends is the amount of foreign savings the economy has been able to accumulate over the years. This indicator has gone through three phases with the first continuing up to the end of the Korean boom of the mid-fifties, followed by a second stage which featured continued trade deficits throughout the late 1950's and the sixties and culminating in the massive trade surpluses of the 1970's, largely attributable to increased production and export of oil. We have already noted the dynamic impacts of foreign trade on the economy up to the period of independence especially its role in stimulating increases in domestic output and income as well as the economy's capacity to save, invest and embark on purposeful economic expansion. However, domestic demand and imports have grown at very rapid rates. At the same time, the export prices for some of the country's major cash crops have faced declining prices so that the country's foreign trade performance has gone through a period of large surpluses into one of successively large deficits. The immediate implication of this in the late 1950's and early 1960's was that the country's accumulated foreign exchange reserve was eroded and that Nigeria had to rely on the inflow of foreign investment in order to fulfil its development ambitions.

Between 1959 and 1966, exports increased at an average annual rate of 9.9% whilst imports had begun to slow down, growing only at about 6.1% per annum. On the eve of the Nigerian civil war, these upward trends had slowed down with exports growing at only 5.5% while imports actually

declined by 6.9%. The cumulative effect of these changes, which were further induced by war-time stringent measures, was an absolute decline of 14.8% and 12.5% respectively in exports and imports over the war period. Since 1970, the upward trends in both exports and imports have resumed largely because of the oil exports, the post-war liberalization of trade and the government's development program. Total exports increased from only ₦ 877.0 million in 1970 to ₦ 5783.9 million in 1974 and then declined to ₦ 4914.4 million in 1975. During this period, revenues from oil exports have risen on account of increased production capacity and export prices from ₦ 509.8 million in 1970 to ₦ 4563.1 million in 1975, with an all-time high of ₦ 5365.7 million in 1974.

An examination of the structure and composition of Nigeria's exports since 1960 further highlights the prominence of oil in the export picture. Table 2.5 shows the major commodities in Nigeria's export trade and it can be seen that, in contrast to the dominance of agricultural exports in the sixties, oil has accounted for more than 50% of the export revenue since 1970 with this share of total export trade currently averaging about 90%. At the same time, all the traditional exports except cocoa have continued to decline both in absolute terms and percentage shares; this can be explained by the continued declines in export prices of agricultural crops as a result of the emergence of synthetic substitutes in world commodity markets.

Imports, on the other hand, have grown at moderate rates over the entire period albeit under highly restrictive trade policies. As Table 2.5 shows, Nigeria's imports have undergone certain structural changes that are indicative of the success of the import-substitution industrialization

policy, the impact of comprehensive national planning effort since the early 1960's as well as the government's objective of making the economy self-reliant. It can be seen that during the period 1965-1975, the share of consumer goods in total imports declined steadily from 37.3% in 1965 and an all-time high of 38.5% in 1967 to barely above 30% in the 1970's.

At the same time, imports of capital goods have continued to increase to meet the requirements of the capital programmes embodied in the national development plans. Imports of capital equipment and transport equipment have increased their combined share of total imports from 35.8% in 1965 to about 40% in the early 1970's and about 40.6% in 1975. As expected, imports of fuels have continued to decline since the establishment of the refinery at Port-Harcourt in 1965. However, the imports of raw materials still constitute a fairly high proportion of total imports while imports of passenger cars have grown more than proportionately over the years. These trends could be reversed by the establishment of assembly plants for passenger cars in Nigeria as well as the government's policy of encouraging the utilization of domestic raw materials.

These observed trends are perhaps better understood if we were to examine the nature of government policies and strategies for managing the Nigerian economy. For a long time, the basic policy instruments employed in dealing with the foreign sector were embodied in the Exchange Control Act, 1962 and the annual revisions of the import tariffs both of which were aimed at generating government revenue, promoting import-substitution and conserving foreign exchange. The government's industrialization strategy at this time was essentially shortsighted as it focussed more on

on creating a conducive environment for foreign venture capital and less on the long-term implications of the dependence on foreign investment.

The government's industrialization policy was backed by a series of liberal industrial incentives including import-duties relief, pioneer industry concessions, tax-holidays as well as assurances against the explicit nationalization of business enterprises. As a result of this "open-door" policy, the import-substitution process in Nigeria has not only succeeded as far as consumer goods and light industries are concerned but has also raised manufacturing to a second rank to oil production in promoting Nigeria's economic growth. Manufacturing output increased from only ₦ 91.0 million in 1958 to ₦ 225.8 million in 1967, growing at an average of 17% between 1958 and 1963 and as high as 15.8% in the period 1963-68 despite the political instability and the disruptions of economic activity caused by the war. The post-war record has been equally impressive. However, manufacturing still remains highly concentrated in the light industries in which area an average of 80% of domestic consumption is locally produced. In 1970, 36.1% of the manufacturing value-added originated from the Food, Drinks and Tobacco sector whilst Textiles and Apparel took another 24.0%. On the other hand, Basic Industrial Chemicals, Metal and Metal Products, and Machinery and Non-Electrical Equipment contributed 0.4%, 6.5% and 0.2% respectively; these figures are low compared with the rates recorded elsewhere.[7] Apparently, the type of "industrialization" involved only the local assembly or processing of imported raw materials.

The low contribution of the manufacturing sector coupled with the

large outflows of funds through profit remittances as well as the declining ratio of GNP to the GDP caused the government to modify its industrialization strategy. It was felt that if the benefits of the country's economic prosperity were to remain in the country, the economy must be indigenized in terms of both the ownership of industry and the increased utilization of local raw materials and manpower in all phases of industrial activity. The first of these was dealt with by the Nigerian Enterprises Promotion (Indigenization) Decree, 1972, which required that selected manufacturing, service and commercial activities be reserved exclusively for Nigerians after 1974 with the remaining activities required to acquire at least 40% Nigerian participation. A subsequent modification of this decree in 1977 has increased the required Nigerian equity participation in these activities to 60% and the government has increased the indigenous ownership of banking institutions and oil companies to an average of 65%. At the same time, manpower quotas were set to ensure the employment of Nigerian high-level manpower in equitable proportions at the executive level. Furthermore, the government has tried to institute policies under the Third National Development Plan to increase the degree of backward integration in the industrial sector by progressively accelerating duties on imported raw materials as domestic industries grow older. Also, the government attempts to stimulate the use of local raw materials by reducing excise taxes for industries using local raw materials.

These trends in exports, imports and industrialization strategy have far-reaching balance of payments implications. Moreover, considering the upsurge of oil exports and its massive contribution to foreign exchange availability since 1970, the analysis of Nigeria's balance of

payments require more than a cursory examination. Thus, in the next section of this chapter, we conduct a more detailed investigation of the role of oil in the Nigerian economy with a view to assessing its overall impact on the economy in the past, its contributions in the present and the prospects for the future.

2.3. Petroleum and the Nigerian Economy: Past, Present and the Future

Oil exploration began in Nigeria in 1938 but it took 18 years before oil was discovered in commercial quantities at Oloibiri near Port-Harcourt in 1956. Production for export started in 1958 and has since grown very rapidly, rising from a mere 5,000 barrels per day in 1958 to an average of 2.0 million barrels per day in 1976 with an all-time high of 2.4 million barrels per day in 1974. The oil sector currently contributes about 90% of total export earnings, about 60% of total government revenue and, although its dominant share of the GDP is expected to decline from the 45% maintained in the early 1970's to about 35% at the end of the decade, it will continue to be the major source of Nigeria's economic growth throughout the 1980's.[8]

The rapid growth of petroleum production and Nigeria's success as an oil-producer can be attributed to Nigeria's high quality oil as well as the country's proximity to the major markets in Europe and North America along with the security of supply this implies. At current levels of production, Nigeria is the world's largest producer of low-sulphur oil (0.2% sulphur content at an average of API 32° crude) followed by Libya and Indonesia. The location of Nigeria's major oil fields along the Atlantic coast as well as the existence of berthing facilities for super oil-tankers

provides Nigeria a cost-advantage over most producers, especially those in the Middle-East.

This section of the chapter is devoted to an examination of the importance of the oil sector to the Nigerian economy, considering the role it is expected to play as the major source of uncompensated fund-transfers for financing Nigeria's future development plans. We therefore start by tracing the growth of the petroleum industry in Nigeria with an emphasis on the industry's contribution to the Nigerian economy. An attempt is made here to outline those factors that have influenced the level of oil production in Nigeria in the past as well as recent shifts in government policy that are likely to determine the future role of oil in the economy.

2.3.1. The Growth of the Nigerian Petroleum Industry

The initial attempt at exploration of oil in Nigeria dates back to 1908 when a German company, The Nigerian Bitumen Corporation, drilled 14 wells in the Lagos State area but abandoned its efforts at the outbreak of the First World War.[9] However, it was not until 1937 that interest was revived in the venture when the Royal Dutch Shell and British Petroleum Company formed the Shell/D'Arcy Consortium that later became the Shell-BP Petroleum Development Company. This company was granted its Oil Exploration License covering the entire mainland area of Nigeria in 1938. After a series of geological reconnaissance exercises between 1938 and 1941 followed after the war by geophysical surveys from 1946 to 1951, actual exploration was limited to a 58,000 square mile area dominated by cretaceous sediments and miocene deposits around the Niger delta. From 1951 to 1956, a total of 18 exploration and appraisal and development wells were drilled

in this area and most of these had promising crude oil accumulations. In 1956, the efforts paid off when oil was discovered at Oloibiri; the closeness of this field to Port-Harcourt, Nigeria's second largest port, encouraged the escalation of drilling efforts and oil export started in December, 1957.

One major factor that explains the rapid growth of petroleum activity in Nigeria is the high success rate recorded in the years immediately after the discovery of oil.[10] In the period up to 1957, the combined success rate for all wells drilled was only 41.7%, a low figure compared with the exploration activities in other parts of Africa and the Middle-East. Much of this low success rate is explained by the hazardous conditions involved in oil-prospecting in tropical conditions. However, exploration activity expanded very rapidly between 1960 and 1965 as the number of wells drilled increased from 32 in 1960 to 163 in 1965. Over the same period, the success rate increased from 46.9% to 76.1%. This remarkably high rate has been maintained over the years with an average of 80% of successful wells drilled resulting in new fields.

The production of oil in Nigeria is mainly in the hands of the "Seven Sisters" or the "international majors",[11] dominated in this case by the Shell-BP consortium and followed by a group of other oil companies including Safrap, Agip, Phillips Oil Company and the Japan Petroleum Corporation. In recent years, the latter groups have, in conjunction with the Nigerian National Oil Corporation (NNOC), increased their share of oil production and feature prominently in downstream operations. It can be seen that the oil industry in Nigeria is largely foreign in both character and ownership and for a long time remained so without any structural

integration with the rest of the economy apart from its massive contributions to government revenue and its contribution to balance of payments surpluses. The industry operated essentially as an enclave industry. As Usoro put it:

> "...its demand for production inputs in the form of equipment, manpower, etc. is always met from abroad. Thus the possibility of the industry generating effective demand leading to the stimulation of economic activities within other sectors of the economy becomes restricted to rudimentary contract awards and the creation of only a handful of temporary employment opportunities."[12]

Over the years, the government has become very sensitive to the foreign control and ownership of this strategic industry and attempts have been made to increase Nigerian ownership of the industry mainly through direct government equity participation in the oil companies. However, the oil industry has continued on its rapid growth path. Within the first ten years following the first export of oil, all the international majors were producing oil in Nigeria. The major factor that spurred this rapid growth was the form and content of the colonial mining legislation which was exclusively designed to further British interests. At a time when political conflict pervaded the Middle-East in the late 1950's and there was growing concern about pollution control in the consuming nations of the Western world, the quality of Nigeria's crude oil, its closeness to the markets and the security of supply routes as well as the attractiveness of the country's petroleum legislation made the country a very profitable area for oil production. The Petroleum Profits Tax Ordinance of 1959 not only stipulated that the profit-sharing arrangements and the payment of royalties be based on realized prices rather than posted prices but was also to remain in force for 30 years. In addition, high depreciation allowances

were set and these, along with the royalties, were fully tax-deductible. For the first seven years, the oil companies exported all their production and were allowed to accumulate the earnings from the sale of crude oil abroad, reporting only what was needed to meet total costs of operations. and their obligations to the Nigerian government.

These attractive conditions encouraged the oil companies to expand their exploration and production activities in the delta area as well as in additional areas secured by oil prospecting, exploration and mining licenses. Thus, production increased by 300% from 1.876 million barrels in 1958 to 4.095 million barrels in 1959. The 1961 production of 16.801 million barrels was again 300% more than the output recorded two years earlier. Perhaps the rapid growth in production is best illustrated by the fact that the daily output of 2.4 million barrels in 1974 was more than the total output for 1958 and the 1961 annual production came to less than one week's production in 1975.[13]

Up to 1965, an average of 95% of the crude oil produced was being exported annually. In 1965, the Nigerian Petroleum Refining Company started operation at Alese-Eleme near Port-Harcourt as a joint venture of the Nigerian Government and Shell-BP. A second refinery located at Warri started operation in September, 1978 and a third will open at Kaduna in 1980; all these three refineries will increase the domestic refining capacity from the 60,000 barrels per day to over 250,000 barrels per day and this will be sufficient to meet domestic demand throughout the 1980's.[14]

Although the production and export of crude oil have grown very rapidly in the past, it was only recently that the government introduced legislation to ensure that the country obtains its fair share of the

proceeds from petroleum activities. Despite the feeling that the existing petroleum legislation did not work in the country's favour, initial government policy was mainly handicapped by lack of experience and limited knowledge about the complexities of the international oil industry. However, in late 1966 and early 1967 major changes were introduced into the financial arrangements between the Nigerian government and the oil companies. The Federal Government of Nigeria Decree No. 65 of 1966 reduced the capital allowance rate by 50%. In January, 1967, the government executed its rights under the "most-favoured nation" clause of the 1962 Deeds of Covenant by imposing OPEC-like terms and conditions on companies operating in both Nigeria and Libya since Libya had hiked its taxes in 1965. As a result, profit taxes and royalties were to be paid on the basis of posted rather than realized prices. Moreover, royalties were to be treated as an expense item and was therefore to be borne equally by the government and the oil companies on the basis of the "fifty-fifty" profit-sharing agreements. These changes led to a substantial increase in the government's revenue from oil. Since the oil companies were not exempt from the Companies Decree of 1968, the requirement that they all become incorporated in Nigeria exposed them to further government regulation.[15]

Soon after Nigeria became a member of the OPEC in July, 1971 the laws relating to petroleum operations were further realigned to OPEC norms with substantial changes in prices, royalties, petroleum profits tax and other dues. As a result of the 1971 OPEC negotiations in Teheran and a "new deal" between the oil companies and the Nigerian government, the tax-reference price was increased from its pre-war level of $2.13 to $3.21 for API 34^{o} crude and, for the first time, premia were to be paid for Nigeria's

low-sulphur oil and for the closeness of Nigeria's export facilities to the markets in Europe and North America, when the Suez Canal was closed. The 1971 agreement also provided for an acceleration of payments of royalties and profit taxes, shortening the lag in payments from six to nine months to only three months.

These major changes in Nigerian petroleum legislation provide us with a better understanding of the factors that account for the rapid increases in the oil production and revenues and the increasing contributions of this sector to the Nigerian economy in terms of balance of payments, foreign exchange availability and its significant contributions to government revenue and export earnings.

2.3.2. The Impact of Petroleum on the Nigerian Economy

The contribution of the oil sector to the Nigerian economy, especially in the last decade, is subject to different interpretations. Whilst the inflow of oil-funds has exceeded all expectations and has induced major changes in the country's development plans, the actual impact of the petroleum sector on the structural transformation of the economy still remains subject to careful scrutiny since its spill-over effects to the rest of the economy are still minimal. Up to the late 1960's, the profit sharing agreement between the government and the oil companies was largely in favour of the latter and the structure of the economy was such that the country could not derive full benefits from the external economies associated with the production of oil. The oil sector thus remained a very insignificant factor in the prospects of the economy as the proceeds from oil production were drained away through complex financial arrangements between the oil companies and the government.

The series of legislations introduced between 1966 and 1971 transformed the sector into the motive force behind the economy's growth. Up to 1966, export of oil was a relatively unimportant item in Nigeria's export picture as can be seen in Table 2.5, with oil being second to agricultural products as a major commodity group. Whereas the oil sector accounted for only 33.0% of Nigeria's exports in 1966, yielding ₦ 184.0 million, oil exports in 1971 totalled ₦ 953 million or about 74.5% of total exports in that year. The percentage contribution of the oil sector to total exports has increased from this 1971 level to 92.8% in 1975, which is a slight decline from the peak ratio of 93.6% in 1974. Much of the changes since 1973 are directly attributable to the OPEC price-hikes of 1973.

Tables 2.7 and 2.8 reveal the contributions of the oil sector to Nigeria's gross domestic product and the balance of payments before and after the 1971 Agreement. It is evident from Table 2.7 that whilst oil exports were growing fairly rapidly, the contribution of this sector to the national value-added remained very low, being less than 10% of the GDP throughout the 1960's. This was relatively poor compared to the record of agriculture in the late-fifties and up to 1965. Furthermore, the petroleum sector's value-added ratio up to 1970 is very low compared to the ratios expected for the Third National Plan Period. As shown in Table 2.9 the ratio of the oil sector's value-added to the GDP was expected to be as high as 43.0% in 1974/75 and then slightly decline throughout the plan period to 34.9% in 1979/80. This anticipated decline in the oil sector's value-added ratio is, however, not an indication that the oil sector is expected to undergo any major declines. Rather, it is an indication that the other sectors are expected to begin to generate their own momentum as the

benefits of oil production are diffused throughout the economy, thereby keeping the relative share of oil in national value-added low.

As a result of the changes in petroleum legislation between 1966 and 1971, the oil sector's share of GDP increased from 9.26% in 1970/71 to 14.12% in 1971/72 and, in the process, increased the growth rate of GDP at constant 1962/63 factor cost from 9.6% to 12.0% over the same period. The oil sector is estimated to have contributed 5.7% of this 12.0% growth rate within the one-year interval. Following the price-changes negotiated by OPEC in 1973, the oil sector's share of the GDP doubled from 21.9% in 1973/74 to 44.9% in 1974/75, during which period the economy's growth rate increased from 17.7% to 64.0%.

As regards the oil sector's contribution to the balance of payments, the nature of the petroleum industry was such that its contribution was severely limited in the early years. Unlike the other highly domestic sectors of the economy, oil production requires massive imports of foreign capital, technology and skilled labour for which disbursements have to be made via remittances of wages, salaries, investment income as well as non-factor services. Thus, the balance of payments sections of Tables 2.7 and 2.8 and Table 2.10 require more careful analysis.

It is noteworthy that since 1963 and up to the present, the oil sector has consistently recorded a trade surplus on the merchandise account. In the period up to 1966, the oil sector exerted a moderating effect on the total trade deficit, keeping it as low as ₦ 5.6 million in 1965 and turning it into a surplus of ₦ 62.0 million in 1966; in this year, the oil trade balance attained its highest pre-war level of ₦ 144.8 million. However, the service account was also piling up deficits at a fast rate. Between 1960

and 1964, the oil sector's service account which represented 17.6% of the service deficits in 1960 increased to 25% in 1964 and to about 50% in 1967. As a result of the slow-down of petroleum production due to the civil war, the oil sector recorded severe declines in export trade balance and deficits in the current account in 1967 and 1968.[16] Over the period 1970-1973, the deficits continued to increase despite the changes in the financial arrangements and the oil sector's share of these deficits averaged 68%. The rapid growth of service deficits and the decreases in oil production were, however, concealed in the overall petroleum sector balance as a result of steady inflow of direct foreign investment that kept the oil capital account in surplus.

As can be seen in Table 2,11, the oil sector's direct contribution to foreign exchange availability more than doubled from ₦ 106.6 million in 1969 to ₦ 253.2 million in 1970. In 1973, the foreign exchange inflow from oil exceeded one billion Naira and almost quadrupled the next year to ₦ 5.2 billion. Over the 1970-73 period, the oil sector's foreign exchange receipts increased from 51.8% in 1970 to 68.2% in 1972 and then fell marginally to 67.2% in 1975 as a result of the government's acquisition of shares in the oil companies and the consequent outflow of capital when compensation was made. It is noteworthy, however, that apart from clearing up the massive backlog of deficits in the non-oil accounts, the oil sector has consistently retained a high proportion of its gross proceeds as overall contributions to the balance of payments. This overall balance ratio was as high as 78.4% in 1964. It declined to 40.7% at the peak of the war in 1969 and has since grown steadily to an all-time high of 91.4% in 1974 and 89.1% in 1975. It is expected that, despite the net outflow of capital

expected to result from the payment of compensation for interests acquired in the oil companies, this ratio will remain at about 80% throughout the period of the Third National Plan, as can be seen in Table 2.9.

One of the most significant contributions of the oil sector to the Nigerian economy is in terms of direct contributions to government income. In the early years when oil production was only beginning to yield returns to the massive amounts of investment in exploration, the series of agreements between the government and the oil companies was such that oil was an insignificant item in the government's revenue. This was the period when the Petroleum Profits Tax Ordinance of 1959 was in force in the government depended more on excise duties, import tariffs and corporation tax for its revenue. Up to 1966/67, petroleum company operations included the marketing of imported petroleum and most of the potential revenue sources were tied up under profit sharing agreements that allowed all accelerated depreciation allowances, royalties and other dues to be deducted from a meagre profit calculated on the basis of realized prices. As can be seen in Table 2.12 the oil sector contributed only 5.4% of total government recurrent revenue in 1964/65, a figure which increased to only 13.2% in 1966/67. However, the changes in the financial arrangements in 1966 and 1967 led this ratio to more than double within the next year to about 27.0% in 1967/68.

The major sources of government income from oil are in the form of royalties and profits tax. Since these two major items were drastically re-negotiated in 1970, we are not surprised that both of them almost doubled their respective levels in 1971/72 over the previous year's level, increasing their combined share of direct revenue from oil production from

less than 70% in 1970/71 to more than 85% in 1971/72. It is remarkable too that in this short interval, petroleum became the dominant source of government revenue increasing its share from 37.6% in 1970/71 to 59% in 1971/72. The oil sector currently contributes more than 65% of the government revenue and the proportion is expected to increase following increased government participation in the oil industry.

2.4 Petroleum Production and Nigeria's Future

What emerges from all the foregoing is the fact that the oil sector has played an increasingly significant role in determining the progress of the Nigerian economy especially since 1971 and will continue to play this vital role in the foreseeable future. However, the extent to which this sector will be strategic to the economy's prospects in the future will depend on the extent to which the government's attempt at increased ownership and control of the oil-related activities is successful.

In furtherance of this aim, the government set up a two-tier policy with respect to oil companies operating in Nigeria in 1971. Within this framework, the government acquired 40% interest in the existing oil companies and required that all new entrants since 1971 enter into partnership arrangements with it for all exploration, production and downstream operations. Since then, the government has vigorously pursued its policy of increased indigenization and ownership of the oil industry, mainly through the Nigerian Enterprises Promotion Decree, 1974, and subsequent amendments to it. The average indigenous equity participation in this sector now stands at about 65% whilst certain oil-related services (transportation and distribution) are exclusively reserved for Nigerians. Along these

lines, the government established the Nigerian National Oil Corporation (NNOC) not only to compete with the foreign oil companies in all phases of oil production from exploration to refining and marketing but also to manage all federal government's acquisitions in the oil companies following the Indigenization Decree. The NNOC also has exclusive exploration rights in all areas (especially off-shore) except those for which concessions have already been awarded and the long-term expectation is that the NNOC will eventually employ the oil companies as contractors or minority partners. Obviously, the acquisition of shares in the oil companies will yield only marginal benefits to the country in the short run since increased state participation in the oil industry is bound to lead to further repatriation of funds as compensation is paid. This is currently showing up in the balance of payments but the consolation is that the increased participation is expected to increase the country's take from oil export trade considerably and this should be adequate to meet the financial requirements for development as well as improve the country's balance of payments position.

It should be remembered, however, that despite its prominence in the country's exports, government revenue, balance of payments and foreign exchange availability, the oil sector has remained largely autonomous, with limited linkages with the rest of the economy. Thus, the sector's dominance and the fact that the country's performance is closely tied to oil export could pose some danger in the future since any declines in this sector will lead to drastic consequences for the progress of the economy. It is therefore necessary that while the oil reserve lasts, a means should be found

for transforming the oil funds into physical capital through carefully planned investment and application of such funds to increase the country's productive capital in an attempt to put the economy on the path to self-sustaining growth. Although this need is recognized by the Nigerian planning authorities,[17] there has been no attempt to systematically model the inflow of oil-funds and specifically incorporate such inflows into the planning process. However, attempts have been made in the Third National Development Plan to establish projects that could increase the oil industry's linkage to the rest of the economy. Among the projects proposed in the Third Plan are a Nitrogenous Fertilizer Plant, a Petro-Chemical Complex, a Liquefied Natural Gas Plant as well as the establishment of two more refineries in Warri and Kaduna. These projects are expected to boost agricultural production, supply an increasing proportion of synthetic raw materials to Nigerian industries and, most importantly, increase the national value-added over time. Unfortunately, most of them are still in the feasibility stage and may not be completed during the current plan period.

In the light of all these developments, especially the increased government participation in the oil industry, we expect that the oil sector will continue to be a major source of funds for Nigeria's future development plans. However, recent experience has shown that the absence of a detailed model of the inflow of oil funds has limited the country's capability of transforming the abundant supply of oil funds into productive capital over time. This study suggests a way in which the oil sector can be systematically modelled and specifically incorporated into the planning process. The model is such that the time pattern of the inflow of oil-funds is known and the consequences of deviations from this pattern can be evaluated within the

framework of the dynamic inter-temporal planning model. The basic issues in the formulation of this model are further discussed in Chapters 4 and 5.

TABLE 2.1

GROSS DOMESTIC PRODUCT OF NIGERIA AT CURRENT FACTOR COST 1958/59 - 1974/75

(₦ million)

	1958-59	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68+	1968-69+	1969-70+	1970-71	1971-72	1972-73	1973-74	1974-75*	1975 76*
1. Agriculture, Forestry and Fishing	1,256.4	1,283.6	1,414.6	1,453.2	1,605.8	1,673.8	1,676.4	1,691.6	1,855.0	1,527.8	1,415.2	1,711.7	2,495.2	2,972.6	3,004.4	3,097.8	3,457.8	4,048.8
2. Mining except Oil	15.4	20.6	22.6	26.8	25.0	26.0	31.8	36.2	34.8	31.8	28.6	34.9	52.1	69.7	80.6	87.5	100.0	126.5
3. Oil	1.4	1.2	3.2	16.4	29.0	28.8	42.2	106.8	129.0	71.8	43.0	230.5	489.6	944.8	1,144.8	1,899.2	4,252.3	4,147.2
4. Manufacturing and Crafts	80.4	95.6	107.6	123.4	146.4	163.0	173.6	214.6	233.8	194.2	198.6	261.8	378.6	415.8	511.5	662.4	911.2	1,164.7
5. Electricity and Water Supply	5.7	6.6	9.2	10.8	11.6	14.6	17.2	18.0	19.6	14.0	14.8	24.8	34.8	45.2	48.4	54.2	59.9	68.4
6. Building and Construction	87.2	103.8	107.6	105.0	112.8	117.8	137.6	178.2	180.4	154.8	133.4	191.5	364.5	445.8	548.4	578.9	643.5	861.5
7. Distribution	233.8	246.0	278.6	287.4	313.0	346.6	380.6	406.2	435.4	356.6	342.2	456.9	673.5	799.1	804.4	905.6	1,161.2	1,649.7
8. Transport and Communication	91.0	98.8	109.8	126.8	125.4	132.6	155.0	152.4	151.6	126.5	135.8	158.8	146.9	164.8	223.7	294.5	311.4	498.2
9. General Government	50.6	65.4	74.4	76.8	77.6	79.6	93.8	101.4	104.8	88.6	145.6	270.5	329.2	364.8	452.8	656.6	519.9	1,059.2
10. Education	45.6	54.6	63.2	70.2	77.8	82.6	95.8	100.2	113.8	92.4	94.4	84.8	131.7	161.6	172.8	191.2	210.5	328.7
11. Health	7.8	9.4	11.6	14.2	16.8	18.2	21.0	23.8	27.4	20.8	19.8	24.1	34.6	41.2	51.8	66.5	72.5	127.9
12. Other Services	36.6	36.6	44.8	49.4	56.4	62.2	73.8	80.6	91.6	76.2	86.8	98.8	128.4	146.1	166.3	189.2	215.5	265.8
TOTAL	1,905.4	2,022.4	2,247.4	2,359.6	2,597.6	2,745.8	2,896.4	3,110.8	3,374.8	2,752.6	2,658.2	3,549.3	5,205.1	6,570.7	7,208.5	8,482.6	11,915.1	14,455.8
Simple Growth Rate (%)		6.14	11.11	4.99	10.09	5.70	5.41	7.45	8.51	-18.44	-3.50	33.60	46.65	26.24	9.70	17.68	40.44	5.32

Source: Federal Office of Statistics, National Accounts of Nigeria 1958/59 - 1973/74 (FOS, Lagos, June, 1976).

Notes: +Excludes figures for the former Eastern States.
*Preliminary estimates.

TABLE 2.2

SECTORAL CONTRIBUTIONS TO GDP AT CURRENT FACTOR COST

(Percentages)

	1958-59	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68+	1968-69+	1969-70+	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
1. Agriculture, Forestry and Fishing	65.96	63.47	62.94	61.59	61.62	60.96	57.93	54.39	54.97	55.50	53.28	48.23	48.78	45.96	42.55	37.41	26.85	27.62
2. All Mining Except Oil	0.81	1.03	1.02	1.02	0.96	0.95	1.07	1.17	1.01	1.16	1.08	0.98	0.97	1.04	1.10	1.00	7.19	0.87
3. Oil	0.07	0.06	0.14	0.78	1.12	1.05	1.46	3.43	3.87	2.60	1.62	6.50	9.26	14.12	15.57	21.90	44.93	50.45
4. Manufacturing and Crafts	4.22	4.73	4.79	5.23	5.64	5.94	6.00	6.90	6.90	7.06	7.48	7.94	7.15	6.22	6.96	7.64	6.55	7.97
5. Electricity and Water Supply	0.37	0.35	0.41	0.46	0.45	0.53	0.59	0.59	0.58	0.51	0.56	0.70	0.72	0.66	0.66	0.62	0.63	0.67
6. Building and Construction	4.58	5.13	4.79	4.45	4.34	4.29	4.73	5.73	5.35	6.62	4.95	5.39	5.76	6.67	7.46	6.68	4.62	5.88
7. Distribution	12.27	12.16	12.40	12.18	12.05	12.62	13.15	13.06	12.90	12.95	12.88	12.87	12.75	12.17	11.18	10.72	8.54	11.26
8. Transport and Communication	4.78	4.89	4.88	5.37	4.81	5.16	4.96	4.49	4.49	5.11	3.94	2.78	2.78	2.46	3.84	3.08	2.24	3.49
9. General Government	2.65	3.23	3.51	3.25	2.99	2.90	3.24	3.26	3.08	3.22	5.48	7.62	6.22	5.46	6.16	5.27	3.74	7.09
10. Education	2.28	2.78	2.81	2.98	2.99	3.01	3.31	3.22	3.27	3.36	3.55	2.37	2.49	2.42	2.34	2.20	1.51	2.29
11. Health	0.61	0.46	0.52	0.60	0.64	0.66	0.72	0.77	0.81	0.76	0.76	0.68	0.71	0.62	0.70	0.77	0.52	0.87
12. Other Services	1.71	1.81	1.99	2.09	2.17	2.26	2.45	2.59	2.72	2.77	3.27	2.78	2.43	2.19	2.64	2.18	1.55	1.68
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Calculated from Table 1.

Notes applying to Table 1 apply to this table also.

TABLE 2.3

AVERAGE SECTORAL GROWTH RATES 1959-1974

	1959-66	1968-74	Average for 1959-74
1. Agriculture	4.7	16.9	8.1
2. Mining Excluding Oil	39.1	127.4	72.6
3. Oil	125.3	159.6	126.4
4. Manufacturing and Crafts	13.9	29.4	18.8
5. Electricity and Water Supply	13.7	28.2	17.4
6. Building and Construction	33.4	14.0	20.2
7. Distribution	7.8	23.5	12.8
8. Transport and Communication	5.8	15.6	9.0
9. General Government	5.9	26.2	17.9
10. Education	10.4	16.0	10.9
11. Health	15.5	25.3	16.7
12. Other Services	12.7	16.5	13.0
13. Gross Domestic Product	7.0	33.0	16.8

Source: Calculated from Table 1.

TABLE 2.4

SAVINGS AND GROSS CAPITAL FORMATION IN NIGERIA, 1962/63 - 1975/76

(All figures in millions of Naira)

	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68*	1968-69*	1969-70*	1970-71	1971-72	1972-73	1973-74	1974-75*	1975-76*
1. Buildings	141.6	144.0	144.2	212.8	205.2	151.8	147.0	157.0	215.7	329.7	382.1	529.4	1,116.9	1,533.5
2. Other Construction Except Land Improvement	68.6	75.6	90.4	116.6	128.0	135.6	101.6	176.8	261.8	411.8	554.5	400.3	588.0	1,383.9
3. Land Improvement, Plantations and Orchard Development	51.2	46.8	46.8	73.4	71.6	52.2	46.2	38.4	28.5	34.6	42.6	47.2	43.2	22.8
4. Transport Equipment	34.0	36.4	61.4	54.6	52.4	43.2	49.8	69.7	131.0	166.2	150.9	193.4	273.9	705.6
5. Machinery and Equipment	66.6	70.2	121.8	157.8	144.4	100.8	98.2	116.1	245.7	340.8	283.2	326.3	514.1	1,160.6
6. Gross Fixed Capital Formation (GFCF)	352.0	393.0	503.8	615.2	601.6	483.6	437.8	558.0	882.7	1,282.5	1,401.4	1,505.6	2,554.8	4,806.8
7. Plus Exports	344.8	409.8	462.2	578.2	599.8	528.8	466.6	682.8	953.8	1,422.8	1,522.1	2,467.8	6,243.7	5,652.7
8. Less Imports	456.4	479.4	587.8	645.4	658.6	671.4	561.4	702.2	937.8	1,327.6	1,285.5	1,808.5	2,743.3	4,968.5
9. Gross National Savings	261.4	323.4	378.2	548.8	542.8	343.8	343.8	538.6	899.5	1,376.9	1,638.8	2,164.3	6,054.4	5,245.4
10. Gross Domestic Product	2,597.6	2,745.8	2,894.4	3,110.8	3,374.8	2,752.6	2,656.2	3,549.3	5,205.1	6,570.7	7,206.5	8,682.6	13,915.1	16,655.8
11. Investment Ratio (%)	13.55	14.30	17.38	19.78	17.83	17.57	16.48	15.58	16.96	19.52	19.44	17.75	18.21	12.79
12. Savings Ratio (%)	10.10	11.78	13.07	17.62	16.65	13.91	12.91	14.95	17.28	20.96	22.72	25.51	43.36	35.79
13. Savings as a Ratio of GFCF (%)	74.54	82.29	75.19	89.06	91.42	79.20	78.55	96.47	101.90	107.36	116.88	143.75	236.14	109.14

Source: Federal Office of Statistics, Lagos, National Accounts of Nigeria: 1958/59 to 1973/74, June, 1976, Table 5 and the supplement.

*Excludes figures for the former Eastern States.

*Preliminary estimates only.

TABLE 2.5

MAJOR COMMODITIES IN NIGERIA'S EXPORT TRADE: 1961-1975

	Values in ₦ Million															Percentages														
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Raw Cane Sugar	67.4	66.8	64.8	80.3	85.4	56.6	100.4	103.8	105.2	111.8	141.2	101.1	112.4	159.6	101.8	19.7	20.4	17.8	19.8	16.2	10.3	23.8	24.9	15.2	15.2	11.3	7.1	5.8	2.8	3.7
Palm Products	39.8	33.8	41.6	42.8	41.8	44.8	15.6	28.4	19.6	31.8	26.8	15.7	18.9	43.7	18.4	11.6	10.3	11.2	10.8	7.8	8.8	3.5	4.9	2.8	3.5	2.8	1.6	0.8	0.8	0.4
Groundnuts	64.8	64.8	51.2	56.6	75.6	81.6	78.8	36.8	71.6	41.4	24.2	19.1	45.5	6.8	-	18.7	19.8	19.8	16.3	14.2	14.6	14.8	6.7	10.3	4.8	3.9	1.3	2.8	0.3	-
Groundnut Oil	18.8	17.4	13.2	16.2	20.8	21.6	14.4	19.8	21.8	23.2	12.8	10.9	23.6	11.4	0.2	2.9	3.8	3.6	3.8	3.8	3.8	3.8	4.6	3.1	3.6	1.8	0.8	1.8	0.2	0.8
Rubber	22.8	23.8	23.6	22.8	21.8	23.8	12.6	12.6	19.2	17.6	12.4	7.4	19.4	33.2	15.2	6.4	7.8	6.4	5.2	4.3	4.1	2.6	3.8	3.8	3.8	1.8	0.5	0.8	0.6	0.3
Crude Petroleum	35.8	33.4	41.4	64.3	134.2	184.8	144.2	74.8	261.8	509.6	951.8	1,176.2	3,893.5	5,365.7	4,548.1	6.7	10.2	11.2	15.3	25.8	33.8	38.5	17.8	37.8	56.1	74.6	82.7	83.5	93.6	92.8
Raw Cotton	27.3	11.6	18.8	13.2	6.6	18.4	13.8	6.6	6.8	13.2	11.8	8.4	6.7	-	-	6.5	3.6	5.1	3.9	1.2	3.8	2.7	1.6	3.8	1.5	0.9	0.8	0.2	-	-
Others	82.6	82.4	82.8	118.4	148.1	135.4	96.2	141.4	186.2	115.8	98.2	98.6	156.4	164.1	136.5	27.6	24.8	25.2	27.6	26.6	24.5	28.2	34.4	27.8	23.2	7.6	6.5	6.7	1.9	2.8
TOTAL EXPORTS*	341.4	324.2	360.7	478.8	576.7	617.4	476.2	413.8	683.2	877.8	1,288.6	1,421.8	3,268.4	5,755.8	4,914.4	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8

Source: FOS, Review of External Trade, (Several Years).
Also available in the CBN Annual Reports and Statement of Accounts.

*Excludes re-exports.

TABLE 2.6

ANALYSIS OF NIGERIA'S IMPORTS BY END-USE: 1965-1975

(All Values in ₦ Million at Current Prices)

	1965		1966		1967		1968		1969		1970		1971		1972		1973		1974		1975	
	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%
1. CONSUMER GOODS																						
A. Non-Durable Consumer Goods																						
(i) Food	51.6	9.4	58.6	11.5	48.0	10.8	32.2	8.5	43.6	9.4	62.2	8.4	91.2	8.8	99.4	10.1	131.4	10.8	166.4	9.6	353.8	9.5
(ii) Textiles	44.0	11.7	42.0	8.2	51.6	11.5	32.0	8.5	30.4	6.5	39.0	5.3	56.2	5.5	53.4	5.4	36.8	3.0	31.5	1.8	81.5	2.2
(iii) Others	71.2	13.0	64.0	12.5	57.0	12.8	51.8	13.6	54.8	11.8	78.4	10.6	125.6	11.8	118.5	12.1	138.7	11.4	173.6	10.1	353.0	9.5
B. Durable Consumer Goods	17.8	3.2	14.4	2.9	15.4	3.4	9.2	2.4	13.4	2.9	24.4	3.3	43.0	4.0	51.5	5.2	67.9	5.2	68.5	4.0	191.7	5.2
TOTAL	204.6	37.3	179.4	35.1	171.4	38.5	125.2	33.2	142.2	30.6	204.0	27.6	320.0	30.1	322.6	32.8	369.6	30.4	440.0	25.5	979.8	26.4
2. CAPITAL GOODS																						
(i) Capital Equipment	156.2	28.5	177.2	34.7	120.8	27.2	103.0	27.3	126.4	27.2	232.4	31.5	348.2	32.7	279.4	28.3	326.2	26.8	498.1	28.4	1,135.9	30.6
(iii) Transport Equipment*	40.2	7.3	35.2	6.9	31.4	7.0	30.2	8.0	45.4	9.8	78.8	10.7	109.4	10.3	68.5	9.0	116.0	9.6	124.9	7.2	371.1	10.0
(iii) Raw Materials	92.8	16.9	94.4	18.4	88.0	19.8	83.4	22.1	114.8	24.5	186.8	25.3	247.6	23.3	221.9	22.8	314.2	25.8	519.3	30.1	902.7	24.0
(iv) Fuel	50.6	6.3	7.6	1.5	17.6	4.0	29.2	7.8	31.2	6.7	22.8	3.0	9.8	0.8	9.8	1.0	13.6	1.1	55.4	3.2	100.2	2.7
TOTAL	353.8	59.0	314.4	61.5	257.8	58.0	245.8	65.2	317.8	68.2	520.8	70.5	714.2	67.1	609.4	61.1	770.8	63.5	1,189.7	68.9	2,509.9	67.7
3. PASSENGER CARS	20.0	3.7	17.4	3.4	15.8	3.5	5.8	1.6	5.4	1.2	13.8	1.9	29.4	2.8	60.2	6.1	76.6	6.3	97.8	5.6	220.5	5.9
	578.4	100.0	511.2	100.0	445.0	100.0	376.8	100.0	464.4	100.0	737.8	100.0	1,063.6	100.0	961.2	100.0	1,216.2	100.0	1,726.7	100.0	3,710.0	100.0

Source: Federal Office of Statistics, Review of External Trade, (F.O.S., Lagos).

Notes: (i) Values are given c.i.f.

(ii) *Transport Equipment excludes Passenger Cars, Bicycles, Motorised Cycles, Scooters and parts thereof and all invalid carraiges (except passenger cars) are classified under consumer durable goods.

TABLE 2.7

PETROLEUM SECTOR ACCOUNTS: 1963-1970
(Millions of Naira)

	1963	1964	1965	1966	1967	1968	1969	1970
A. Contributions to the Gross Domestic Product								
1. Gross Proceeds	41.4	65.4	138.2	201.0	143.6	75.6	265.8	541.2
2. Exports	40.2	64.0	136.2	183.8	144.0	75.6	261.6	517.2
3. Local Proceeds	1.2	1.4	2.0	17.2	- 0.4	---	4.2	24.0
4. Intermediate Inputs	25.6	32.2	36.0	38.4	46.2	38.2	52.0	71.6
5. Indirect Taxes	0.4	1.8	4.4	5.4	2.8	3.2	8.0	15.0
6. Value-Added	14.2	29.4	93.8	151.8	89.8	33.0	199.2	438.8
7. Gross Domestic Product (GDP)*	2,745.8	2,894.4	3,110.0	3,374.8	2,752.6	2,656.2	3,549.3	5,205.1
8. Value added as a % of GDP	0.51	1.02	3.02	4.50	3.26	1.24	5.61	8.43
9. Value-Added as a % of Gross Proceeds	34.3	45.0	67.9	75.5	62.5	43.6	74.9	81.1
10. Wages and Salaries	4.0	4.6	5.4	5.4	5.0	3.6	5.6	8.8
11. Government Revenue	9.6	22.8	22.4	32.0	51.2	30.2	45.8	161.4
12. Investment Income	0.4	2.0	66.0	114.4	33.6	- 0.8	147.8	268.6

Sources: (i) Tims, W. (1974), Nigeria: Options for Long-Term Development, Table 46, p. 248.

(ii) Federal Office of Statistics, National Accounts of Nigeria: 1958/59 to 1973/74 and the Supplement: Table 2.

Notes: * The figures on GDP refer to financial years April 1 to March 31.

TABLE 2.8

PETROLEUM SECTOR ACCOUNTS, THE BALANCE OF PAYMENTS: 1963-1975
(millions of Naira)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1. Total Exports (f.o.b.): Oil and Non-Oil	370.4	402.4	530.6	558.0	479.8	416.8	624.6	891.4	1,344.4	1,437.1	2,369.5	6,105.7	5,246.1
2. Oil Exports (f.o.b.)	40.2	64.0	136.2	183.8	144.8	74.0	261.6	517.2	980.4	1,186.4	2,006.0	5,670.7	4,896.3
3. Oil Exports as a % of Total Exports	10.8	15.9	25.7	32.9	30.2	17.8	41.9	58.0	72.9	82.6	84.6	92.8	93.3
4. Oil Sector Imports (c.i.f.)	- 8.4	- 23.4	- 27.0	- 39.0	- 27.4	- 19.8	- 25.4	- 52.4	- 50.6	- 45.2	- 41.0	- 52.4	- 118.0
5. Trade Balance (Oil)	31.8	40.6	109.2	144.8	117.4	54.2	236.2	464.8	929.8	1,141.2	1,965.0	5,618.3	4,778.3
6. Trade Balance (Oil and Non-Oil)	- 29.2	- 68.6	- 5.6	62.0	53.0	34.8	166.4	173.0	285.0	477.5	1,166.9	4,439.3	1,617.1
7. Non-Factor Service Payments	- 12.8	- 24.6	- 44.4	- 79.0	- 63.0	- 56.4	- 96.2	- 97.0	- 125.0	- 147.9	- 216.8	- 257.8	- 235.2
8. Investment Income	- 0.4	- 2.0	- 66.0	-114.4	- 33.6	0.8	-147.8	-268.6	-215.6	- 389.8	- 415.1	- 308.1	- 320.8
9. Investment Income as a % of Total Imports	---	---	12.3	23.1	7.9	---	32.3	37.4	20.4	40.6	34.5	18.5	8.8
10. Current Balance	18.2	14.0	36.4	29.0	- 14.4	- 2.2	140.0	383.6	600.6	612.3	1,338.8	5,057.1	4,241.6
11. Current Balance as a % of Oil Trade Balance	57.2	34.5	33.3	20.0	- 12.3	- 4.06	59.3	82.5	64.6	53.6	68.1	90.0	88.8
12. Direct Investment and Short-Term Capital	+ 10.4	+ 36.2	+ 34.8	+ 57.8	+ 91.0	+ 59.8	- 33.4	-130.4	+ 4.0	+ 195.8	+ 64.5	+ 135.8	+ 121.4
13. Overall Balance*	28.6	50.2	71.2	86.8	75.6	57.6	106.6	253.2	604.6	808.1	1,403.3	5,182.9	4,363.0
14. Overall Balance as a % of Export Proceeds	71.1	78.4	52.3	47.2	52.2	77.8	40.7	49.0	61.7	68.1	70.0	91.4	89.1

Source: Central Bank of Nigeria, Annual Report and Statement of Accounts, 1965-1975.

* Table 11 explains how the overall balance is computed.

TABLE 2.9

PETROLEUM SECTOR ACCOUNTS: 1974/75 TO 1979/80
(₦ Million)

	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80
A. CONTRIBUTIONS TO GDP						
1. Gross Proceeds	6,633.1	7,340.3	8,133.0	9,000.1	9,968.8	11,033.2
2. Exports	6,458.1	7,120.3	7,913.0	8,665.1	9,603.8	10,633.2
3. Local Proceeds	175.0	220.0	220.0	335.0	365.0	400.0
4. Intermediate Inputs	171.1	191.9	215.8	232.7	271.6	286.9
5. Indirect Taxes	16.8	17.7	18.7	19.7	20.7	21.9
6. Value Added	6,445.2	7,130.7	7,898.5	8,747.7	9,676.5	10,724.4
7. GROSS DOMESTIC PRODUCT (GDP)	14,982.2	17,014.8	19,415.0	22,450.9	26,206.3	30,862.0
8. (6) as a % of GDP	43.0	41.9	40.7	38.9	36.9	34.9
9. Wages & Salaries-Local	19.3	19.8	22.7	26.0	29.8	33.8
10. Wages & Salaries-Abroad	11.4	14.0	14.4	14.8	15.2	15.7
11. Government Revenue	4,346.4	4,804.9	5,328.9	5,894.9	6,528.1	7,231.3
12. Government Inv. Income	1,134.9	1,258.8	1,392.9	1,547.7	1,711.5	1,927.2
13. Foreign Inv. Income	933.2	1,033.2	1,140.0	1,264.3	1,391.9	1,516.4
B. BALANCE OF PAYMENTS						
14. Exports (f.o.b.)	6,458.1	7,120.3	7,913.0	8,665.1	9,603.8	10,633.2
15. As % of Total Exports	94.4	94.2	94.6	94.8	95.0	95.3
16. Imports (c.i.f.)	45.7	46.6	47.5	45.6	41.0	38.2
17. Trade Balance (Oil)	6,412.4	7,073.7	7,865.5	8,619.5	9,562.8	10,595.0
18. Trade Balance (Total)	4,581.1	4,501.4	4,412.3	4,064.1	3,475.1	2,692.7
19. Non-Factor Services	- 294.2	- 361.6	- 372.5	- 303.0	- 334.5	- 385.1
20. Foreign Inv. Income	- 933.2	-1,033.2	-1,140.0	-1,264.3	-1,391.9	-1,516.4
21. As a % of Total Imports	41.4	33.8	28.8	24.9	21.0	17.9
22. Current Balance	5,185.0	5,678.9	6,353.0	7,052.2	7,836.4	8,693.5
23. As a % of Oil Balance	18.0	19.2	17.9	17.9	17.8	17.4
24. As a % of Total Balance	20.4	23.0	25.8	31.1	40.0	56.3
25. Direct Investment	389.3	494.0	497.9	355.0	389.8	465.1
26. Capital Transfers	---	- 441.3	- 260.7	- 80.0	- 80.0	- 78.0
27. Overall Balance	5,574.3	5,731.6	6,590.2	7,327.2	8,146.2	9,080.6
28. (27) as % of Gross Proceeds	84.0	78.1	81.0	81.4	81.7	82.3
29. (27) as % of GDP	37.2	33.7	33.9	32.6	31.1	29.4

NOTE: These figures are estimates for the current development plan period, 1975-1980.

Source: Federal Government of Nigeria, Third National Development Plan: 1975-1980, (Central Planning Office, Lagos, Nigeria, 1975), Table 5.4, page 50 and Table 5.16, page 58.

TABLE 2.10

BALANCE OF PAYMENTS OF NIGERIA: 1965 - 1970
(All Figures in Millions of Naira)

	1965			1966			1967			1968		
	Oil	Non-Oil	Total	Oil	Non-Oil	Total	Oil	Non-Oil	Total	Oil	Non-Oil	Total
1. Merchandise	109.2	-114.8	- 5.6	144.8	- 82.8	62.0	117.4	- 64.4	53.0	54.2	- 19.6	34.6
2. Export (fob)	136.2	394.4	530.6	183.8	374.2	558.0	144.8	333.8	478.8	76.8	343.8	418.8
3. Import (cif)	- 27.0	-509.2	-536.2	- 38.8	-457.8	-496.0	- 27.4	-397.4	-424.8	- 19.8	-362.8	-382.2
4. Balance on Services	- 72.8	- 54.4	-127.2	-115.8	- 68.8	-183.6	-103.8	-106.2	-208.2	- 56.4	-186.8	-237.2
5. Balance on Unrequited Transfers	---	5.4	5.4	---	3.4	3.4	---	- 4.8	- 4.8	---	34.4	34.4
6. Balance on Current Account	36.4	-163.8	-127.4	29.0	-147.4	-118.4	- 14.4	-174.6	-188.2	- 2.2	-188.8	-188.2
7. Balance on Capital Account	34.8	97.2	132.8	57.8	38.8	96.8	78.2	24.8	103.8	93.8	106.2	188.8
8. Balancing Item			18.2			4.8			- 17.2			14.2
9. OVERALL BALANCE			23.8			- 17.6			- 76.4			8.8

	1969			1970			1971			1972		
	Oil	Non-Oil	Total	Oil	Non-Oil	Total	Oil	Non-Oil	Total	Oil	Non-Oil	Total
1. Merchandise	236.2	- 69.4	166.8	464.8	-191.8	173.0	529.8	- 844.8	285.8	1,161.2	-663.7	477.8
2. Export (fob)	761.6	363.8	824.8	517.2	374.2	891.4	968.4	364.8	1,344.4	1,186.4	250.7	1,437.1
3. Import (cif)	- 25.4	-432.4	-457.8	- 52.4	-466.8	-718.4	- 38.8	-1,888.8	-1,858.4	- 45.2	-814.4	- 859.6
4. Balance on Services	- 96.2	-288.8	-298.2	- 81.2	-186.4	-268.8	-329.2	- 187.8	- 516.2	- 529.8	-257.8	- 785.8
5. Balance on Unrequited Transfers	---	28.8	28.8	---	45.8	45.8	---	1.2	1.2	---	- 14.3	- 14.3
6. Balance on Current Account	-148.8	-268.4	-129.4	383.8	-433.4	- 58.8	888.4	- 831.8	- 231.2	412.3	-935.8	- 322.7
7. Balance on Capital Account	- 33.4	114.8	88.4	-138.4	178.6	48.2	4.8	288.4	293.4	186.8	73.4	268.2
8. Balancing Item			43.2			47.4			88.4			8.7
9. OVERALL BALANCE			- 8.4			48.8			117.8			- 48.8

	1973			1974			1975			1976		
	Oil	Non-Oil	Total	Oil	Non-Oil	Total	Oil	Non-Oil	Total	Oil	Non-Oil	Total
1. Merchandise	1,965.8	- 796.1	1,144.8	5,618.3	-1,179.8	4,438.5	4,648.3	-3,161.2	1,487.1	5,826.8	-4,533.4	1,293.5
2. Export (fob)	2,884.8	363.5	2,369.5	5,678.7	435.8	6,185.7	4,766.3	348.8	5,116.1	5,917.8	425.6	6,343.4
3. Import (cif)	- 41.8	-1,161.6	-1,282.8	- 52.4	-1,614.8	-1,666.4	- 118.8	-3,511.8	-3,629.8	- 98.8	-4,958.8	-5,849 8
4. Balance on Services	- 626.2	- 452.6	-1,878.8	- 561.2	- 573.5	-1,314.7	- 579.3	- 788.4	-1,367.7	- 547.4	- 907 6	-1,455.8
5. Balance on Unrequited Transfers	---	- 35.4	- 35.4	---	- 62.1	- 62.1	---	- 76.8	- 76.8	---	- 97.8	- 97.8
6. Balance on Current Account	1,338.8	-1,286.1	52.7	5,057.1	-1,894.6	3,062.5	4,068.8	-4,026.3	42.6	5,278.5	-5,538 8	- 258.3
7. Balance on Capital Account	84.5	80.3	144.8	133.8	- 141.7	- 8.8	121.4	- 19.7	141.1	- 42.8	- 108.6	- 150.6
8. Balancing Item			- 23.1			48.6			- 26.2			- 38 8
9. OVERALL BALANCE			174.4			3,102.2			157.5			- 438.9

Source: Central Bank of Nigeria: Annual Reports and Statement of Accounts, 1967-1977.

TABLE 2.11

OIL COMPANIES' CONTRIBUTION TO THE BALANCE OF PAYMENTS: 1968-1975

	1968	1969	1970	1971	1972	1973	1974	1975*
1. Payments to Government or Government Authorities	33.4	53.8	176.4	524.4	729.1	1,333.1	5,200.6	4,347.6
2. Other Local Payments	25.0	57.8	96.8	113.2	129.6	121.7	154.7	185.6
3. Variation in Cash Holdings	- 0.8	- 0.8	+ 4.0	- 12.2	- 4.3	- 4.2	+ 15.1	+ 8.2
4. Local Receipts	---	- 4.2	- 24.0	- 38.6	46.3	- 47.3	- 177.5	- 178.2
Total Contribution to the Balance of Payments	57.6	106.6	253.2	604.8	808.1	1,403.3	5,192.9	4,363.0
% Change from Previous Period		85.07	137.52	138.86	33.61	73.65	270.04	- 15.98

Source: Central Bank of Nigeria, Annual Reports and Statement of Accounts, 1969-1976.

* Provisional.

+ This is the oil sector's overall balance reported in Table 2.8.

TABLE 2.12

REVENUES ACCRUING TO GOVERNMENT FROM OIL PRODUCTION: 1964/65 TO 1971/72
(Values in ₦ millions)

		1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72
1.	Rents	7.722	8.711	9.897	11.043	12.300	12.803	14.155	16.688
2.	Royalties	6.691	14.492	23.266	16.294	5.762	30.172	73.044	148.247
3.	Premia	1.269	.241	1.000	---	---	.059	.002	7.200
4.	Profits Tax	.399	5.722	5.724	12.034	5.949	23.118	111.716	441.540
5.	Other fees[1]	.002	-.009	5.089	2.513	5.571	9.292	20.025	9.296
6.	Total Government Revenue from Petroleum Exploration	16.084	29.195	44.976	44.884	29.582	75.444	218.943	623.038
7.	Government Revenue from Marketing Companies	---	---	---	39.079	37.952	45.742	57.020	90.706
8.	Government Revenue from the NPRC	---	---	---	---	---	---	9.625	16.932
9.	Total Direct Government Revenue from the Oil Sector	16.084	29.195	44.976	80.963	67.534	121.186	285.587	770.676
10.	Total Government Revenue	299.132	321.870	339.196	300.176	299.986	435.908	758.068	1,305.724
11.	Oil Revenue as a % of Government Revenue	5.376	9.070	13.259	26.972	22.986	27.800	37.673	59.023

Sources: (i) Ministry of Petroleum Resources, Annual Reports of the Petroleum Division, Lagos, Nigeria.
(ii) Federal Office of Statistics, Annual Abstract of Statistics: 1974 (Lagos, F.O.S., 1976), Table II.1, p.117.

Note: [1] Includes customs duty, local fees, harbour dues and pipeline license fees.

FOOTNOTES
(to Chapter 2)

[1]This figure is an estimate based on the 1962-63 Census. There is still a major debate over the actual population. The mid-year estimate by the Central Planning Office, Lagos, Nigeria, puts it at 78.6 million.

[2]For a detailed account of the growth and progress of the Nigerian economy before the second world war, see Helleiner, G.K., Peasant Agriculture, Government and Economic Growth in Nigeria, (Homewood, Illinois, R.D. Irwin, 1966).

[3]Aboyade, O., Foundations of an African Economy: A Study of Growth and Investment in Nigeria, (New York, Praeger, 1966), p. 3.

[4]Okigbo, P.N.C., Nigerian National Accounts: 1950-57, (Enugu, Federal Ministry of Economic Development, 1961), pp. 6-7.

[5]It can be seen from Table 2.1 that the Nigerian Civil War (1967-70), apart from slowing down the economy, only had devastating effects on the economy in the first two years, causing a decline of about 25% in the GDP between 1966/67 and 1968/69. By 1969/70, the economy had regained its momentum and GDP recorded a 33.6% of growth over the 1968/69 level and an absolute increase of ₦ 174.5 million over the 1966/67 level. A more detailed account of the economic impact of the war and the policies by which such rapid recovery was achieved is given in Aboyade, O. and A.A. Ayida, "The War Economy in Perspective", NJESS, Vol. 13, no. 1, 1971, pp. 13-37.

[6]This seeming anomaly is discussed by both Aboyade (1966) p. 118 and Peter B. Clark (1970) p. 44 but can be explained by the high rates of increase in the prices of capital imports and other components of Gross Fixed Capital Formation as shown by Peter B. Clark's Table 3.3, p. 43. See also Table 5A, p. 109 of Aboyade's study.

[7]It is reported that in 1968, these three sectors contributed an average of 8% of the manufacturing value-added. See Guidelines to the Third National Development Plan, p. 18 and also Bhambri, R.S., "Second National Development Plan: A Selective Appraisal", NJESS, Vol. 13, p. 183.

[8]It should be noted that the decline in the oil-sector's share of the GDP does not necessarily mean that the level of petroleum activity will slow down; it only means that as the linkage effects of this dynamic sector spread through the entire economy, the other sectors are expected to record large increases in their rates of growth.

[9]Dickie, R.K., "Development of Crude Oil Production in Nigeria and the Federal Government's Central Measures", paper presented to the Institute of Petroleum, London, June, 1966 (Mimeo). Cited in Pearson, S.R., Petroleum and the Nigerian Economy, (Stanford University Press, Stanford, California, 1970), Chapter 2.

[10]The success rate is simply the ratio of oil-bearing wells to total wells drilled irrespective of whether the well contains only gas deposits or not. A more detailed account of oil exploration and drilling activities in Nigeria is given in Schatzl, L.H., Petroleum in Nigeria (Ibadan, Oxford University Press, 1969), Chapter 1.

[11]These terms refer to the group of seven oil companies who control an average of 70% of the western world's oil production, refining capacity and international tankers tonnage. This group included, in their order of importance: Standard Oil of New Jersey (Exxon), The Royal Dutch/Shell Group, British Petroleum, Gulf Oil Corporation, Texaco, Standard Oil of California and the Standard Oil of New York.

[12]Usoro, E.J., "The Oil Sector", The Quarterly Journal of Administration, Vol. 5, No. 3, 1971, p. 168.

[13]This rapid growth of oil production activity was interrupted by the civil war especially in 1968 when only 51.9 million barrels were produced as compared to 116.5 million barrels in 1967. However, despite the slow-down in production, exports were kept as high as possible and for 1968 and 1969, more crude was exported than actually produced, the difference being supplied from stockpiles.

[14]It should be noted that natural gas is also produced along with crude oil in Nigeria at a rate of about 800 cubic feet per barrel of oil. Currently, more than 90% of the gas so produced is flared as can be seen from columns 5 and 6 of Appendix Table III.1. However, a liquefied natural gas plant is being constructed and should be in operation by 1980.

[15]Perhaps the best study of the development of petroleum legislation in Nigeria is given by Schatzl, L.H., Petroleum in Nigeria, op. cit., pp. 77-101.

[16]Falegan, S.B., "The Impact of the Crude Petroleum Industry on Nigeria's Balance of Payments: 1960-1973", Central Bank of Nigeria Economic and Financial Review, Vol. 11, no. 2, 1973, pp. 7-12.

[17]See Nigeria's Third National Development Plan: 1975-1980, (Lagos, Central Planning Office, 1974), p. 30.

CHAPTER 3: THE BASIS FOR MULTI-SECTORAL MULTI-LEVEL PLANNING IN NIGERIA

3.1 Introduction

The rapid progress of the Nigerian economy since independence has been impressive in spite of the numerous political, administrative, financial and other problems that the country has faced in the last two decades. This is especially so considering the fact that comprehensive national planning is a relatively recent phenomenon in Nigeria. Although the first attempt at planning was made in 1946, it was not until 1962 that a concerted effort was made at planning on a national scale. Thus, a legitimate question arises regarding the extent to which planning has contributed to the rapid progress of the economy especially in the post-independence period.

This chapter reviews the role of planning in the development of the Nigerian economy and critically assesses the scope, objectives and methodology of planning in Nigeria since 1962 with a view to establishing a basis for multi-sectoral and multi-level planning in the country. In the next section, a detailed critical evaluation of the Nigerian planning experience in the post-war period is presented. This is followed by a discussion of the rationale for the proposed shift to dynamic multi-sectoral planning on a consistent basis. The third section of the chapter sets up a framework for incorporating the inter-temporal planning model into the existing planning process and suggests some reforms that would have to be made in order to adapt the present planning machinery to suit the demands of dynamic multi-sectoral and multi-level planning.

3.2: A Critical Evaluation of the Nigerian Planning Experience

3.2.1: Planning in Nigeria Before 1962

Prior to the attainment of independence in 1960, Nigeria had already been involved with planning for fourteen years. The approach to planning at this stage was essentially rudimentary, with the resulting plans being constantly revised at both the national and regional levels. In effect, this first phase of the Nigerian planning experience which lasted from 1946 to 1962 could be described as the experimental stage of development planning in Nigeria. Despite the haphazard nature of planning in this period, the country has since accepted planning as a useful framework for economic decision making and for the systematic management and comprehensive development of the economy.

The initial effort at planning in Nigeria resulted from the Colonial Development and Welfare Act of 1940 and the British government's decision to make development grants to the colonies in an attempt to contribute directly to the development of the colonial peoples. In pursuit of this goal, the Colonial Office requested the colonial administrations for Ten-Year Plans which would serve as the basis for the disbursement of Colonial Development and Welfare grants. Thus, the Colonial Development Board, consisting mainly of senior colonial officials, was set up in Nigeria in 1944. In 1946, the Ten-Year Plan of Development and Welfare for Nigeria, 1946-56[1] was launched as a blueprint for action on both a national scale and on a long-term basis. However, the Ten-Year Plan was highly limited in scope, consisting only of programmes in the areas of health, education, water supply and transport and communication as well as other schemes for the expansion of regular services and provision of physical facilities. In

all, the plan had a cost estimate of ₦ 106.8 million which was to be disbursed on the basis of existing departmental budgets. The policies it embodied were aimed at the improvement of the general health and welfare of the people. About 43% of the total financial requirements of the plan was to be provided by the Colonial Office from the Development and Welfare Funds, 27% was to be from the Nigerian Treasury and the balance of 30% was expected to be procured through external loans.

Unfortunately, the Ten-Year Plan was handicapped from the start because the Colonial Development Board, faced with the post-war shortage of high-level manpower, had relied mainly on generalist administrators who lacked the technical expertise to undertake the difficult task of development planning. The Board also failed to take account of Nigerian opinion in the planning process. Thus, whilst the Board was busy executing the projects in the plan, the political mood of the country was geared towards the attainment of political independence and the mass participation that was so essential for the plan's success was not forthcoming. A series of constitutional changes following the Richards Constitution of 1947 and the formal replacement of the existing provinces by regional governments in 1951 disrupted the plan's framework and rendered it almost obsolete. In view of these constitutional changes and some unanticipated cost-overruns as well as substantial shortfalls in the execution of the stipulated projects, the plan was revised giving rise to the Revised Plan of Development and Welfare for Nigeria: 1951-56.[2] The revised 1951-56 plan involved the balance of ₦ 68 million from the original Ten-Year Plan and, given the rate of inflation, this figure necessarily involved considerable underspending and a substantial reduction in the scope of the plan. The 1951-56 plan

retained the same character as its predecessor; it consisted of a series of development projects aimed largely at the provision of those social and economic services that the colonial administration thought was the minimum necessary for the general improvement of the country.

A general overview of the 1946 and 1951 plans points to one fact - that the initial attempt at planning in Nigeria failed, although it was a genuine attempt at comprehensive development planning. This was due in part to the simplistic approach to planning adopted by the colonial administrators, the inadequacy of the planning machinery and the conspicuous absence of properly defined social and economic objectives in these plans.[3] Referring to the Colonial Development and Welfare Program, Aboyade declared:

> "In retrospect, this cannot be properly called a development plan. It was more a catalogue of little interrelated proposals with ill-defined goals and no coherent statement of policy. Its execution was half-spirited. Its general impact on the fundamental problem of underdevelopment was minimal and unsystematic. The plan was limited to the public sector, and even here did not cover the whole range of it."[4]

Despite these shortcomings, the organizational quality of the planning process during both the 1946 and 1951 plans possessed some impressive characteristics that are similar to the kind of multi-level planning that is advocated in this study.[5] Within an environment of continuous political change, the plans remained national in scope and were drawn up and executed under a single government through a process of institutional co-ordination that is characteristic of multi-level planning. More importantly, the planners demonstrated a conscious recognition of the shortage of high-level manpower and attempted to deal with it by manpower budgeting.[6] This attempt at such an early stage in the country's planning history should be appre-

ciated no matter how inadequate the result of such an effort was.

Subsequent to the approval of various constitutional changes that were to come into effect in 1954, the government, recognizing the implied administrative decentralization and increased responsibilities of the regions, commissioned a World Bank Mission in 1953 "to study the possibility for development in the major sectors of the economy and to make recommendations for practical steps to be taken, including the timing and the co-ordination of developmental activities".[7] By the time the World Bank Mission completed its study and submitted its report in 1954, Nigeria had become a federation and the basis of effective political leadership had shifted to the regions. Recognizing these changes, the mission clearly delineated the federal and regional components of the planning task and recommended that a National Economic Council be established to provide an institutional framework for the co-ordination of the multiple plans that were embodied in its report.[8]

In March 1955, the Revised 1951-56 Plan was abruptly terminated in order to allow the regions to start their own plans from April of that year. Thus, between 1955 and 1960, Nigeria had five simultaneous development programmes of varying degrees of sophistication and comprehensiveness and these were not necessarily in full alignment with each other. There was no attempt to relate the various plans to one another or to any quantitative or qualitative national objectives. As Adedeji put it:

> "...the five development programmes of the governments were far from constituting an integrated, mutually consistent and co-ordinated development program."[9]

Basically, none of the constitutional changes introduced at this stage could have so disrupted the planning machinery as to make co-ordinated plan-

ning impossible. However, the political climate engendered by the creation of regions inevitably led to intense rivalry among the regions and this made co-operative effort difficult. Each government struck off in its own independent direction with the World Bank Report serving as the only rallying point. Worse still, the Federal government, lacking virile political leadership and an articulated set of national objectives, failed to provide the effective co-ordination that was so necessary.[10]

One essentially new dimension introduced to Nigerian planning at this stage was the regional character of the plans. The World Bank Mission Report which embodied the plan had structurally delineated the areas of federal and regional jurisdiction. Thus, whilst the federal government planned to spend 56% of its budget on transport and communications, the regions focussed more on the provision of social services, especially education, health and water supply. The progress made in plan formulation and the success recorded in plan implementation also differed substantially among the regions. Only the Western region had what could be regard as a plan; the other regions encountered all sorts of difficulties in plan execution arising mainly from the shortage of executive capacity and financial resources. By 1959, it had become obvious that the regional plans were out of consonance with one other in both their content and timing.[11] The West had gone beyond the current plan to propose a more sophisticated program for 1960-1965 whilst the two other regions could only extend their rudimentary plans to 1962. As the folly of inter-regional rivalry became increasingly obvious, all the regions agreed to terminate their different regional plans by March 1962 and thereafter embark on a national planning effort.

Nigeria's planning experience up to 1962 can therefore be sum-

marily described as experimental with the emphasis being on the need to devise a basket of projects for which development funds could be made available at both the national and regional levels. Since projects were chosen from the basket on the basis of departmental budgets, there was no systematic relationship between the projects that were implemented and between those projects and precisely defined objectives. The absence of explicit national goals in the entire period provided a lot of scope for ad-hoccery in the name of flexibility but the consequence of this was that it became difficult to trace the effects of public expenditure programmes on private economic activity.[12]

3.2.2: The National Planning Effort Since 1962

(i) The Groundwork for National Economic Planning

In the closing years of the 1950's, the prospect of political independence in 1960 offered the Federal government greater scope for the use of economic policy instruments. At the same time, planning was becoming increasingly popular among several African countries not only as a framework for the processing of aid programs but also as a matter of national prestige.[13] It was very obvious that several of the administrative, fiscal, economic and institutional bottlenecks which inter-regional rivalry had engendered unduly hampered the progress of the economy and the regions were now more resolute and co-operative in the effort to embark on comprehensive national planning.

Beginning with 1958, certain changes were introduced into the planning process that were to influence the character and quality of subsequent national economic plans. Since both the regions and the federal

government shared powers over certain economic matters, the Joint Planning Committee (JPC) was established in 1958 as an institution through which the regional efforts could be channelled into the national planning effort. The Economic Planning Unit[14] was also established as a professional agency responsible for plan formulation and co-ordination on behalf of the N.E.C., which was essentially a political organ of government. Furthermore, several studies were undertaken as part of the detailed preparation for the national comprehensive plan that was to be launched in 1962. The JPC had completed its background study entitled Economic Survey of Nigeria, 1959[15] and was already reviewing several other studies that had implications for plan formulation. These included detailed studies of higher education, staff training and manpower needs; a new set of national income estimates for 1950-57; a report on transport co-ordination by the Stanford Research Institute as well as feasibility studies of several projects in the area of manufacturing and hydroelectric energy.[16]

Despite all these pre-plan arrangements, there was still a major handicap that had to be overcome if the task of planning was to be accomplished. The Federal Ministry of Economic Development which had the full responsibility for actual economic planning could only rely on the Economic Planning Unit for the supply of planning expertise. However, the EPU was inadequately staffed to meet the challenge of national economic planning. In particular, the federal civil service still relied to a large extent on generalist administrators and expatriate staff although it was felt that indigenous expertise would be needed in order to give the plan some Nigerian content. The official view was, however, different. Although the federal government had a handful of economists at its disposal and had on

occasion consulted some others in the universities, subsequent events showed the government's lack of confidence in and failure to capture the patriotic zeal of such indigenous manpower as was available, if only to provide them the opportunity to acquire the skill they supposedly lacked. Instead, the government took the view that indigenous economists were "incapable of carrying out the responsibility"[17] and, taking advantage of its Technical Assistance Program, requested a supply of expatriates to undertake the planning exercise. It is important to note here that this official lack of faith in local expertise constituted a major error on the part of the political leadership, an error which made the planning task more difficult.

Among the several expatriate economists that constituted the technical assistance team, Wolfgang Stolper and Lyle Hansen, both sponsored by the Ford Foundation, seem to have exerted the greatest influence on the planning process as well as the final plan document.[18] Both of them, however, came with fairly modest planning backgrounds and from a country (the U.S.A.) in which planning neither had legitimate roots nor was accorded the importance it demanded in the economic process. At the same time that Professor Stolper resumed as head of the EPU, Dr. P.S.N. Prasad was seconded from the World Bank and he soon became the Economic Adviser to the Prime Minister and the Chairman of the JPC, the official counterpart of the NEC. Within this setting, it was inevitable that the JPC and EPU would differ on several issues concerning the plan. The planning task proved even more difficult as the EPU had only persuasive power over the regions whilst the the JPC, the political rallying point for the representatives of all the governments, met only occasionally. However, in spite of the bargaining

and compromise called for by this uneasy atmosphere, the general theoretical views of the planners in the EPU constituted the basic framework for the plan and other decisions relating to it.

Any fair assessment of the Nigerian planning experience must therefore start from the foregoing outline of the environment in which the first national plan was drawn. It is also against this background that the subsequent national plans are to be judged if they are to be appreciated as vast improvements over the first national plan. It should, however, be noted that even with the return to national economic planning, the organizational coherence that characterized planning in Nigeria during the first ten years of planning was now lost as was the conscious attempt to make the plan an instrument of integrated economic development.[19]

(ii) Three Comprehensive National Plans

In the period since 1962, Nigeria has had three national development plans; these have been comprehensive to varying degrees. The first of these was the First National Development Plan, 1962-68[20] launched in 1962 but suspended at the outbreak of the Nigerian Civil War (1967-1970). The Second National Development Plan, 1970-74[21] which was basically a programme for post-war reconstruction, was later extended to 1975; and the current plan, The Third National Development Plan, 1975-80[22] is the most ambitious of these three plans and it perhaps represents the best attempt Nigerian planners have made at integrated national economic planning. All these plans, however, differ in their degree of sophistication as well as their scope, objectives, planning methodology as well as overall strategy. Each one of them is examined in turn according to these features and they

are all critically assessed in the next section.

(a) The First National Development Plan: 1962-68

The major stride towards national economic planning in Nigeria was taken in 1959 when the National Economic Council declared that:

> "...a National Development Plan be prepared for Nigeria that the objective of the achievement and maintenance of the highest possible rate of increase in the standard of living and the creation of the necessary conditions to this end, including public support and awareness of both the potentials that exist and the sacrifices that will be required".[23]

In essence, this was a confirmation of the need for comprehensive planning on a national scale and both the JPC and EPU had been set up to provide the framework for the formulation and co-ordination of the regional plans. It was with the background of these directives and the planning machinery that the First Plan was drawn with the EPU as the dominant agency in the planning machinery.

Given the vague and inadequate definition of the goals the plan was expected to achieve, the planners' task was necessarily difficult from the start as they had to translate the vaguely-defined objectives into quantifiable goals. Although it was difficult to decipher the extent to which the standard of living should be increased within such a short span of time or by what means this was supposed to be accomplished, the planners made a conscious effort to translate the directives into the following statement:

> "Within the six years of the plan, the economy will achieve and, if possible, surpass the average of 4% in the growth of the GDP."[24]

Specifically, they aimed at: a target saving of about 15% of the GDP by 1975;[25] an annual investment of 15% of the GDP during the first plan; the achievement of increases in the level of employment and improved education and health as

well as the acceptance of common priorities by all the governments. The highest priorities were accorded to agriculture, industry and the training of high-level and intermediate manpower. These in themselves were modest targets at which specific policy instruments could be aimed but the planning environment was not such as to make this step of the planning task an easy one. The ensuing confrontation between the political leaders and the planners regarding the quantification of the objectives is perhaps an example of the misconception on both sides regarding what the planning exercise was expected to accomplish.

At this particular stage in Nigeria's development (only two years after independence), the country lacked the kind of political leadership that could guide it towards a national philosophy and a programme of social reform. Political activity was conceived as a means of sharing the gains of economic growth and the strategies and compromises implied were rationalized in terms of economic pragmatism.[26] Thus, there was apparent lack of comprehension of the planning process and its implications on the part of the politicians and, given the non-specification of national goals in the original NEC directives, the plan was conceived by many of the politicians as a means of providing social services and the distribution of industrial projects. The planners at the EPU, however, did not accept this naive definition of pragmatism even though they accepted the need for social reform, if only to change the political climate. In their attempt to avoid ideological quabbles, they placed emphasis on such things as completeness, consistency, feasibility and economic efficiency. Lyle M. Hansen admits that this attempt to follow a planning process that was devoid of "dogma, prejudice, set doctrines and ideological commitment"

seems to have been carried too far for it forced the planners to reduce comprehensive national planning to an almost technical level of operation as the planners "deliberately ignored the wider social issues in planning and ostensibly followed no theory of development or model of planning".[27]

It seems then that although the political leadership was fully intent on initiating economic change, it was only willing to do this to a limited extent for, in the face of the choice between economic growth and the continuity of power, they opted for the latter and allowed political patronage and the need to satisfy purely political considerations to prevail over the need for economic growth. The planners, on the other hand, by attempting too hard to eliminate political intervention drew a plan that was resisted and widely criticized as having failed to cater to the welfare of Nigerians. Adding the fact that the planning team was largely expatriate, the plan failed to secure the mass support the NEC had envisioned in its directives.

Despite these fundamental handicaps to the planning process, as well as the acute shortage of planning manpower and the complications introduced by the requirement that the plan had to be approved by both the federal parliament and regional legislatures, the plan was launched in June 1962. Although it could hardly be described as the best in the circumstances, it was a vast improvement over the earlier plans in several ways. It was to a large extent national in character since all the governments recognized and accepted common objectives and targets and a uniform planning period. The coverage of the plan was also broader than those of earlier plans and, to the extent that all the regions approved them, the plan's goals were national. However, because the plan itself embodied

four[28] other separate plans seemingly bound together only by the recognition of common objectives and targets, it lacked internal consistency and there was extensive duplication across regions.[29]

In all, the total planned fixed investment for the six years of the plan was ₦ 2,366 million out of which only ₦ 780 million (33%) was to be invested in the private sector. The balance of ₦ 1,586 million was expected to be invested in public sector projects with Transport, Electricity, Manufacturing, Trade and Industry, and Education dominating the allocation of funds in that order. It is quite interesting that about 50% of the total resources required to finance the plan was expected to be derived from foreign sources. However, none of these targets was ever achieved. In the first two years of the plan, the public sector program fell short of the ₦ 264.4 million target, reaching only ₦ 129.2 million in 1962 and only ₦ 126.8 million in 1963. Even in 1966, the public sector investment was only ₦ 180 million.

An insight into the basic problems of the plan is best illustrated by the policy framework adopted for its execution and the criteria for project selection employed by the planners. Over and above the (seemingly unrealistic) expectation that the programme would require ₦ 961 million foreign financing through foreign assistance and capital inflows, the planners expected that inflation and balance of payments crises could be prevented by the appropriate use of fiscal and monetary controls. In addition, all direct controls were to be avoided; free repatriation of profits and capital was to be fostered and maintained and nationalization was thought to be "undesirable, unnecessary and absolutely out of consideration under any circumstance"[30] even though Nigerians were expected to control increas-

ing proportions of the economy. Import-substitution was implied but not emphasized as explicit policy -- the various governments expressed interest in industrialization but the plan did not provide any specific guidelines as regards the goals and methods. As it turned out, the foreign grants and loans failed to materialize in adequate proportions and, with the domestic money supply rising faster than was planned, domestic prices rose at an average of 4% per annum during the entire period.

The major controversy over the plan centered around its criterion for project selection. Although Stolper did not actually agree with everything in the final plan document, his profitability criterion was the dominant factor employed in determining the plan's basic characteristics. Recognizing that the potential benefits of any project should be assessed in the wider context of its relation to other projects and giving greater priority to overall resource allocation for growth rather than sectoral details, it was decided that economic profitability should be the overriding criterion for project selection. According to Stolper,

> "there is no logical inconsistency between insisting on economic profitability and using various factor-proportions criteria. But the criterion of economic profitability has the inestimable advantage of being more general and of being operational and quantifiable."[31]

The planners therefore gave more emphasis to investment projects with short payoffs on the basis of a high social rate of discount. For some part, the profitability criterion was loyally adhered to but in most cases, only the interaction effects of external economies were taken into account. In fact, any external economies which the planners could not clearly perceive were held to be unlikely to exist and thus ignored[32] and there were many of these given basic non-linearities and disequilibrium conditions that

make adequate pricing difficult in a typical developing country.

The profitability criterion has been criticized because it does not have any objective basis for the distribution of indirect benefits when several projects are interrelated. The logic for not taking account of these structural interdependence aspects of dynamic external economies rested on the thinking that it would constitute double-counting but it also implied that the approach to project evaluation had become sequential; to the extent that this procedure is based on marginal adjustments, the project composition of the plan cannot represent the optimum allocation of resources, especially since market prices for skilled labour and capital were employed instead of general equilibrium prices.[33]

Overall, the plan fell below all expectations in terms of what it was expected to accomplish. Because the philosophy and the guidelines of the plan were not made public and because of the unwarranted secrecy that surrounded its preparation, the public awareness and support which was needed for its successful implementation was never really generated. In addition, the political leadership failed to give it the full commitment it required. It was generally felt that the plan was, from the beginning, conceived as an inevitable compromise between what was desired and what was possible[34] and the planners strongly resented the extent to which the government had tried to execute the "bargaining plan" as if it was a realistic plan.

By 1965, it had become clear that the planning effort had been frustrated and the plan itself was off-target. With the outburst of political crises in the country, the inflow of foreign investment slowed down and the plan's excessive reliance on foreign sources of funds became a

problem. As a result of the inadequate inflow of foreign capital and the cumulative deterioration of the political situation in the country, the economy began to lose its momentum as the rate of growth declined from the 5.7% recorded in 1962/63 to only 3.8% in 1964/65. In the last two years of the plan, Nigeria was involved in a civil war. During this time, problems of national unity had priority over economic expediency and the plan was reduced to a series of annual Capital Budgets which served as the main instrument of control and resource allocation for the war-time economy. In essence, the plan was terminated in 1966.

(b) The Second National Development Plan: 1970-74

Towards the end of the Nigerian civil war, the Nigerian government decided to devise a policy framework for the reactivation and reconstruction of war-affected areas as well as the development of the rest of the economy as soon as the war ended. The Second National Development Plan, 1970-74 (SNDP) was the product of this endeavour and it was aptly subtitled "A Programme of Post-War Reconstruction and Development". The foundations for the planning effort were laid at the "Ibadan Conference" (March 24-29, 1969) which was jointly organized by the Federal Ministry of Economic Development and the Nigerian Institute for Social and Economic Research to enhance cooperative effort in planning among the twelve states, some of which were planning for the first time.[35] In addition to regular meetings of the Conference of Planners in preparation for the planning exercise, the already defunct Joint Planning Committee was replaced by the Joint Planning Board (JPB) which was made up of senior officials of various economic agencies and institutions as well as state representatives and

their advisers. Specifically, the JPB was established to "(i) harmonize and co-ordinate economic policies and development activities of the Federal and State governments and their agencies, and (ii) examine in detail all aspects of economic planning and make recommendations through appropriate authorities to the Supreme Military Council"[36] which is now at the head of the planning machinery. These changes indicate that, having learnt from its past planning experience, Nigeria now recognized the possibility of using planning as a deliberate weapon of social change and was embarking on a planning effort to realize this goal.

The basic philosophy behind the Second Plan went beyond rehabilitation to include the need to lay adequate foundations for a self-reliant economy as indicated by the following statement:

> "The basic objective of planning in Nigeria is not merely to accelerate the rate of economic growth and the rate at which the level of the population can be raised; it is also to give her an increasing measure of control over her own destiny...Nigeria should be in a position to generate from a diversified economy, sufficient income and savings of its own to finance a steady rate of growth with no more dependence on external sources of capital or manpower than is usual to obtain through the natural incentives of international commerce."[37]

Although it was questionable whether these objectives could be achieved within a single planning period, the civil war had shown that the economy was dynamically resilient and could thus be made to generate its own momentum by the use of appropriate policies.

In following with the objective of internal dependence, the Second Plan was drawn up entirely by Nigerian planners although there was no definite approach to the planning exercise. The indication is that the Second Plan was drawn up from submissions of the various ministries and extra-

ministerial departments in response to requests by the various economic planning agencies in the federation in the same fashion as the almost traditional project-basket approach to planning. However, the plan was different from the earlier plans in two ways: (a) it was expected to be a catalytic agent for structural and social change in the economy and (b) it was largely financed from internal sources. In particular, the plan tried to consciously integrate the private sector into the planning process and, in contrast to the 50% external funding envisaged during the First Plan, only 20% of the Second Plan was to be financed from foreign sources.

Convinced that "economic progress would be faster if a nation is motivated in its economic activity by a common social purpose", that "national planning should be aimed at the transformation of the whole society" and that "a set of national objectives must deal simultaneously with the community's standard as well as quality of life",[38] the planners decided that the five principal national objectives would be to establish Nigeria as:[39]

(a) a united, strong and self-reliant nation,

(b) a great and dynamic economy,

(c) a just and egalitarian society,

(d) a land of bright and full opportunities for all citizens, and

(e) a free and democratic society.

Admittedly, these were meant to infuse a sense of national purpose into economic and planning matters and were not expected to be achieved within a single planning period.[40] However, the stated objectives were not operational magnitudes from which the planning exercise could begin. In terms of quantifiable magnitudes, the Second Plan aimed at: a 6.6% average

annual growth rate of the GDP during the plan and higher rates thereafter; an increase in the Gross Fixed Capital Formation to about 20% during the plan period; a substantial reduction in the rate of inflation to 1.5% per annum or less; reduction in personal and regional disparities in income distribution; reduction in unemployment; reduced dependence of the Nigerian economy on foreign markets for traditional exports and on foreign capital and increased participation of Nigerians in the ownership and control of non-indigenous enterprises. Furthermore, priority was to be given to agriculture, industry, transportation and manpower development and the general strategy of the plan was to encourage agricultural diversification without reducing export crop production and to increase the pace of import-substitution by shifting to intermediate and capital goods production.

In all, the Second Plan aimed at an effective capital programme of ₦ 3.192 billion with the public sector investing ₦ 1.56 billion while the private sector was expected to invest ₦ 1.632 billion. This 49:51 ratio of public to private investment represented a remarkable change in the emphasis given to the private sector and the plan performance indicates that the private sector successfully capitalized on this breakthrough; actual plan results show a 41.6:58.4 ratio. The plan also anticipated a post-war decline in Gross Fixed Capital Formation from 18.4% of the GDP in 1970/71 to 16.8% in 1973/74. Most of these magnitudes were, however, exceeded during the planning period: instead of the anticipated decline in the ratio of the GFCF to the GDP, there was an increase from only 14.8% in 1970/71 to 19.6% in 1973/74 whilst the Building and Construction component of the GFCF increased from 53% to 67% between 1970/71 and 1973/74 as a result of post-war reconstruction.

For the first time, the plan enunciated a set of general policy measures as an important complement to the various investment programmes embodied in the plan. It was expected that public policy could be directed at ensuring the maximum flow of internal resources for financing the plan and guaranteeing certain minimum consumption requirements. In addition, economic and price stability was to be maintained within reasonable limits; inequalities in wealth, income and consumption standards were to be minimized if only to reflect a sense of social justice and ensure distributional equity and sectoral credit guidelines were established as a means for combating inflationary levels in various sectors as well as optimizing the growth rates in the different sectors of the economy. However, the plan still did not go far enough as to indicate the specific dimensions of policy or the instruments by which the stated objectives were to be accomplished. For example, the problem of balanced regional development was only mentioned as one of the goals, but there were no policy prescriptions in the plan or anticipated changes in the revenue allocation formula to reflect this goal. In some other cases either the plan failed to specify the set of policy tools available for the pursuit of a goal (e.g. import substitution) or several mutually inconsistent goals were embodied in the plan. This is exemplified by the wages and salaries revision that took place without a corresponding increase in the economy's output, thus defeating the attempt to combat inflationary pressures.[41]

The basic strategy adopted for the planning exercise derived from the need to ensure that "all investment decision units in the economy operate on the same wavelength and within the same framework of expectations"[42] with special reference to the stated national objectives. Thus, it was

decided that in order to achieve the overall growth path prescribed for the whole economy and keep in conformity with the five principal national objectives, project selection would be based on the net social cost-benefit approach which pays particular attention to relative investment yields. Accordingly, eight criteria were used in identifying and selecting the various investment programmes in the plan.[43] As a result, there was a drastic change in the sectoral allocation of investment programmes in the plan. Greater emphasis was given to economic activities and social overhead capital with substantial reductions in the shares of the total public investment programme taken up by general administration and financial obligations in the belief that expansion of directly productive activities and investment in human capital contributed more to rapid economic development. However, there was a substantial difference between the planned and actual capital programmes as will be shown in a later section.

Perhaps the major error on the part of the planners lay in the procedure by which the candidate investment projects were assembled. Since these were compiled from the submissions of the various ministries and other agencies in the country and such submissions were not guided by principles similar to the social cost-benefit approach, the project-selection scheme was necessarily sub-optimal and so was the resulting investment programme. Since the procedure for project-selection neither started from below nor above, the sectoral programmes that emerged from this exercise were often not addressed to any coherent set of well-defined goals. The Guidelines to the Third National Development Plan admits this error, stating that the sectoral programmes in the previous plans were at best "ex-post rationalizations of the project-mix as submitted by the executing

agencies".[44] This explains why it has been a constant feature of Nigerian plans that stated goals are often not reflected by the development projects.

Although a social cost-benefit criterion was established for the plan, priorities were to be accorded to projects that also maximized the domestic value-added and possessed the greatest output and employment potential within the shortest gestation period.[45] It is not impossible to imagine a successful coupling of these two levels of objectives since they are not inherently conflicting. However, this was not successfully done in the planning exercise and it seems the planners found a way of maintaining the same double standards in the planning process. For example, whilst the aggregate public investment programme was distributed according to the stated priorities, the output projections did not seem to bear any reasonable relationship to the sectoral priorities or overall goals. Thus, the growth centers of the economy (oil and manufacturing) were given less attention in planning than their role as prime-movers in the economy demanded. It is our view that these shortcomings are due mainly to the absence of a consistent planning framework or explicit planning model in the Nigerian planning process. This would be further discussed in the section on the rationale for multi-sector, multi-level planning.

Even if we were to accept the claim that the plan was drawn in a hurry and at a time when the future course of the economy was difficult to predict, it is difficult to think that the planners were not too ambitious in the major assumptions behind the plan. For one thing, four years is too short a period within which one could expect to reverse the main socio-economic frustrations the economy had undergone in the 1960's. Secondly, the plan was not really a comprehensive plan in that it left wide gaps

between national goals and priorities and detailed public sector projects on the one hand while it failed to establish firm guidelines for the management and control of the private sector on the other.[46] In terms of its execution, the plan document was released eight months late and funds were not made available until after the first year. The extent to which planning could even be used to effect the five national objectives in the short run remains questionable since they are not reducible to manageable magnitudes and planning is neither necessary nor sufficient for their accomplishment.

Perhaps the greatest problem during the plan period was the lack of planning discipline on the part of the government and its executing agencies. The original nominal investment programme was revised upwards in the wake of the oil boom and high cost-overruns resulting from inflation. There was considerable expansion in the scope of existing projects, new projects were introduced while some other were revised and redesigned. This led to an increase in the total capital programme from ₦ 3.192 billion to ₦ 5.31 billion although the fulfillment rate in the public sector remained at only 67%, implying that there were major distortions to the planned proportions taken by the various sectors in the investment programme. Actual public capital expenditure in the economic sectors reached only 49.2% (compared to 52.7% in the plan) as a result of relatively poor performance in agriculture, commerce and finance. Overall, the Second Plan exceeded most of its targets especially in the basic economic indicators but much of this was due to the unplanned inflow of oil funds which substantially contributed to plan distortion as a result of inadequate management.

(c) The Third National Development Plan: 1975-1980

In accordance with normal planning practice, the efforts to draw up

the Third National Development Plan started long before the Second National Plan period expired. The subsequent extension of the Second Plan period to cover 1974/75 also gave the planners adequate time to make a more serious effort at development planning and it should be admitted that the Third National Plan is of substantially better quality than the earlier plans. In August 1973, the government issued the Guidelines to the Third National Plan to all official agencies and, through the Central Planning Office, it encouraged the widest consultations with all the relevant economic institutions in the country. In addition to instituting regular conferences of the Commissioners responsible for economic development and revitalizing the Joint Planning Board, the government set up the National Economic Advisory Council in 1972 to ensure that the interests of the private sector were fully taken into account in the Third Plan.

Recognizing that the planning task had become too technical to be left to generalist administrators, the Economic Planning Unit was replaced in 1972 by the Central Planning Office, CPO. The CPO is a fully professional planning agency of the ministry of Economic Development and was responsible for drawing the Third National Development Plan, 1975-80. The CPO started the planning exercise by organizing an intensive course in plan formulation for all planners in the country. The usefulness of this course which was jointly given by the Planning Studies Programme of the University of Ibadan and the World Bank Development Institute was borne out by the improved quality of the Third Plan over earlier plans. The planners also indulged in extensive consultations with sector-specialists who had been recruited to study the strategic sectors of the economy (mainly agriculture, industry, education, health and transportation) and to assist the

federal and state officials in articulating projects for inclusion in the plan. These efforts bear testimony to the conviction of the Nigerian government that planning could be used to put Nigeria on the path to self-sustaining growth.

The result of all these efforts, The Third National Development Plan, 1975-1980, has been dubbed "A Monument to Progress" and is undoubtedly the most ambitious development effort ever attempted in Nigeria. Its capital programme of ₦ 30 billion, which is several times the size of all the previous plans put together, represents a conscious attempt to use the massive inflow of oil funds to secure a radical transformation of the Nigerian economy. It was the first Nigerian plan drawn up within the framework of a system of national accounts and such effort was put into its formulation that every project has both detailed physical targets and approved financial allocations, combined within the attempt to relate the sectoral programmes and projects to carefully articulated economic goals. The plan was drawn by a professional planning agency - the CPO - and, considering the emphasis given by the planners to these factors that directly affect the welfare of the average Nigerian, its full implementation should lead to an appreciable increase in the general standard of living.

The five principal national objectives identified in the Second Plan were retained as the broad objectives of the Third Plan but an attempt was made to transcribe these into short-term objectives which are operationally meaningful. These include an attempt to raise the GDP growth to an annual average rate of 9.0% which, given the 2.5% population growth rate, should enable the per capita income to double by 1990 and put

Nigeria among the class of developed countries by the end of the century. The planned increase in constant cost GDP from ₦ 15.448 billion in 1975/76 to ₦ 22.692 billion in 1979/80 was also expected to become more evenly distributed in both the interpersonal and spatial sense. The plan also aimed at an increase in the supply of high-level manpower while reducing unemployment among the semi-skilled and unskilled labour categories. In addition, the plan aimed at increased diversification of the economy in order to ensure balanced development as well as conscious indigenisation of both the ownership and control of economic activity in Nigeria. Furthermore, the plan outlined the means by which fiscal and monetary policies can be combined with an incomes policy in pursuing the goals of price stability, social equity and economic growth and development. Most of the objectives and policies were supposed to make the economy sufficiently broad-based to absorb the shocks of potential fluctuations in economic activity as Nigeria's oil reserves begin to dwindle in the future. It was therefore necessary to utilize the surplus of investible oil funds to increase the economy's human and physical productive capacity and create the necessary infrastructure for a self-reliant economy.

Although the capital programme was divided among four major headings -- economic, social, administration and regional development -- the planners adopted a macroeconomic model depicting the proximate functioning of the national economy for the basic projections of sectoral levels of economic activity. The plan states in part:

> "...Given the qualitative and quantitative inadequacy or even the complete absence of relevant data, an eclectic approach has been adopted in projecting macroeconomic variables for the Third Plan period. Econometric techniques have been judiciously employed to determine

> qualitative relationships where available data are sufficiently reliable."[47]

It appears then that the planning process was finally designed for the deliberate pursuit of intelligent planning. However, one-period econometric forecasts are at best only an imperfect substitute for the type of long-period multi-sectoral, multi-level approach to planning envisaged in this study.

At the sectoral level, projected growth rates were based on historical growth trends, estimates of the sector's potential and actual productive capacity and an assessment of the structural impacts of the sectoral programmes and on the overall economy. The projected public investment programme of ₦ 30 billion was divided up between the public and private sectors in a 2:1 ratio with the largest expenditure going to the transportation and manufacturing sectors which fully account for 20% of the total public capital expenditure. Two other sectors (Education and Power), in addition to the aforementioned two, were identified as the major sectors from which the economy's growth momentum would be generated during the plan period. With the implied concentration of the public sector investment programme in these sectors, they were expected to grow at an average rate of 20% per annum with building and construction continuing its dominance of the gross fixed capital formation.

Overall, the Third Plan is of substantially better quality than the earlier plans. Apart from the consultative approach adopted in its formulation and the considerable expansion of the planning machinery, the implementation procedure was streamlined to get rid of undue delays in the implementation of projects. To effect the efficient disbursement of funds, the

system of revenue allocation was redesigned thus making sure that all the states have adequate funds to implement their programmes. In addition, the plan expressed a definite commitment to plan discipline and prescribed sanctions for dealing with agencies found guilty of plan distortion.

The Third Plan is, however, not without its shortcomings especially as regards the assumptions underlying the major macroeconomic projections and plan targets, the validity of its theoretical and methodological framework and its apparent over-ambition and excessive optimism. Following the OPEC price-hikes of 1973 and the subsequent massive inflow of petro-dollars into the country, the planners proceeded on the assumption that the 1974 oil production level of 2.4 million barrels per day could be maintained and possibly increased to 3.0 million barrels per day in 1980. This was the basis of all projections regarding the sources of finance for the plan as well as the expected growth rates of the GDP. However, the planners seem to have discounted the need for a detailed model of the oil sector within the world oil market dominated by OPEC.[48] In particular, there was no specification of the world oil supply and demand balances behind the plan or the time-profile of OPEC allocations to Nigeria throughout the period. The realism of the assumption that Nigeria's oil-production will increase continuously despite the drive towards lower oil-imports in the consuming nations is questionable.[49] As it turned out, only a few months after the Plan was launched there was a global excess supply of oil in 1975 as a result of the world-wide recession and vigorous energy economizing strategies in OPEC's major markets in the Western world. As a result of OPEC-ordered cutbacks, Nigeria's oil production dropped drastically to an average of 1.5 million barrels per day in 1975 leading to a ₦ 1.82 billion short-

fall in the expected contribution of the oil sector to the GDP. This in turn led to substantial revisions of major plan estimates and it is not impossible that the plan was thrown off its balance by the distortions that these revisions imply.

As pointed out earlier, one major credit of the Third Plan is that it expressed a definite commitment to plan discipline. However, the record of plan execution in the first year seems to convey a contrary impression. The planners had assumed that, with a combination of the fiscal, monetary and other anti-inflationary policy measures embodied in the plan, inflation could be kept within reasonable proportions (an average of 6.0%) throughout the plan. However, they overlooked the policy conflict implicit in promoting import liberalization at the same time that wages and salaries are revised upwards. With the payment of Udoji Awards,[50] domestic money supply was substantially expanded and, with no corresponding increase in domestic production plus explicit import liberalization (and the ports congestion that followed), it was inevitable that inflationary pressures in the economy could not be contained. In the first year of the plan, the rate of inflation (based on the GDP deflator) was 6.6% compared to 5.4% expected in the plan. Actually, the urban consumer price index had increased 34.1% in 1975 and detailed breakdown of this composite index reveals that fuel and light, food, drinks and other purchases rose respectively by 50.8%, 42.1%, 40.1% and 37.7%.[51]

Admittedly, the Third Plan's quality was greatly enhanced by the econometric basis of its major projections as well as its overall picture of how the economy functions. However, this view can at best only reveal

the aggregate characteristics of the economy but not enough detail for adequate planning. Since the structure of the said econometric model is not published, it is impossible to know how much flexibility and insight it actually permits in the planning process, especially in the face of shortfalls in major plan targets and distortions of plan proportions. The single-period input-output or even a static linear programming approach involving all the sectors of the economy is definitely preferable to the econometric approach on account of the flexibility it permits in plan revision and the insight it provides in evaluating the impact of plan distortions.[52] To the extent that an econometric (forecasting) model cannot be made to explicitly incorporate the basic objectives espoused by the planners, the planning framework can be said to be completely devoid of an optimality criterion beyond those employed in project selection. To this extent, the Third Plan's framework can be said to have only provided an educated guide to the project-basket approach to planning and, creditably, at both the sectoral and aggregate levels for the first time. In some sense, therefore, the Third Plan's shift to the use of quantitative planning techniques represents an obvious improvement in Nigerian planning but its framework still failed to provide a means for incorporating the basic objectives and priorities into the planning process.

(iii) A Critical Assessment of the Planning Strategy Since 1962[53]

Overall, Nigeria's planning experience has been characterized by the steady evolution of the planning framework and a noticeable improvement in planning expertise throughout the entire period. However, there still exist certain procedures in the Nigerian planning process that have

unduly limited the return to the effort devoted to conscious planning in terms of plan fulfilment. Perhaps the most striking observation is that, in the atmosphere of constitutional changes and political evolution of Nigeria as a unified entity, the nice attribute of integrated planning which was the major virtue of the Ten-Year Plan (1946-56) have become conspicuously absent in Nigerian planning since independence. This has in turn given rise to other characteristics which are now almost entrenched in the planning process.

It is now almost characteristic of Nigerian plans that their philosophical basis derives only from high-sounding proclamations of the long-term aspirations of the society which may or may not be related to the plan itself. Both the First Plan and the Second Plan and, to a lesser extent, the Third Plan, were characterized by only broadly defined national objectives and priorities which were not easily reducible to operational magnitudes. Although the Third Plan has somewhat overcome this problem by outlining a list of short-term objectives, the existence of a super-set of objectives which cannot necessarily be accomplished by economic planning exposes the planning process to political intervention. Generally, since the broad objectives are not reducible to quantifiable criteria which can be used in evaluating proposals emanating from the different states and economic agencies, the result has been taken up by unnecessary compromise of plan priorities and targets, and wide gaps between stated goals and priorities and the composition of the investment programme that is actually implemented.

The major factor which has accounted for the unsteady course charted

between plan launching and plan implementation is the one-level approach to planning adopted in all the Plans to date. Starting from the original Ten-Year Plan in which projects were only drawn up to back requests for colonial welfare and development plans, Nigerian planning has consistently and faithfully adhered to the project-basket approach to planning, without any appreciable guidance from or relationship to macroeconomic aggregates. As this procedure only required a criterion for selecting projects for inclusion in the plan, Nigerian planning has been carried out largely without an explicit model or framework for evaluating the overall impact of projects so selected or those executed. Only the Third Plan considered this necessary and even then, the procedure of planning by econometric projections, as it was done in its formulation, remains questionable. This lack of an explicit planning framework has further made it difficult to trace the economic effects of various plan revisions.

Considering the implications of these shortcomings, it appears that the solution lies not only in the incorporation of a multi-sectoral model into the planning process but also in establishing a multi-level planning framework for Nigeria with adequate dual-directional flows of information and proposals from the national, through the sectoral to the project level and vice-versa. With this type of framework, it would become obvious that debates over project selection criteria, which constitutes the major distinction between the First Plan and the later plans, should remain at the rudimentary stages of the planning exercise and should not be the major preoccupation of Nigerian planning.[54] Instead, greater attention should be

given to the harmonious co-ordination of federal and state plans in an attempt to devise a system whereby the sectoral and project characteristics of the plan can be made to transcend political boundaries. To this extent, the Third Plan's idea of offering intensive courses for planners should be continued and so should the policy of consultation with project specialists in the process of plan formulation.

Another major problem in the three post-independence plans has been the apparent lack of plan discipline and the various lags in the implementation process. The record on these two counts as can be seen in Table 2.1 has not been very impressive. The First Plan period saw substantial shortfalls in the implementation of economic and social overhead projects in terms of both their percentage shares and percentage deviations from the planned targets. Both of these sectors were each underfulfilled by more than 30%, leaving them with only 70-75% of the actual implemented programme instead of the over 90% they were expected to take in the entire investment programme. At the same time, the capital expenditures for administrative and finance capital outlays exceeded their plan limits by more than 100%, leading to substantial increases in their shares of the total investment programme. The Second Plan seems to have been generally underfulfilled in all the sectors but the consolation here lies in the systematic nature of the underfulfilment. Although the shortfall in plan implementation was about 25-30% in all the four sectors, the proportional composition of the actual investment programme bears close similarity to the planned proportions. However, the distortion implied by the 30.7% shortfall in the total

investment programme cannot be overlooked, especially since both of these plans had no framework for assessing the economic effects of these distortions. It is yet too early to report figures for the Third Plan but if the reported actual capital expenditures for the first year are any guide, we cannot expect any improvement in plan performance. The published figures for 1975-76 indicate that instead of the plan proportions of 70.03% to Economic Activities, 11.31% to Social Services, 8.18% to Regional Development and 10.48% to General Administration, the actual proportions were 62.71%, 20.93%, 10.23% and 6.13% respectively, which still shows substantial underfulfillment in the directly productive sectors even if we ignore the shortfalls implied by dollar-values of these capital expenditures.[55]

Although this relatively poor performance in plan implementation can be directly blamed on the inadequate financial procedures that still pervade the administration, some of it is also due to the indecision in plan execution engendered by the limited commitment to planning by the military leadership. For example, among the industries listed in the Second National Development Plan as possessing the greatest potential for forward and backward linkages with the rest of the economy (especially the Iron and Steel Complex, the Petro-Chemical Complex, the Nitrogeneous Fertilizer Project and the Liquefied Petroleum Gas Plant), many were still only in the feasibility study stage of implementation at the end of the Second Plan and still have not shown any notable progress in the Third Plan. Many of these projects have been bogged down by political haggling over their precise locations. What these problems point to is the fact that the present planning framework is easily susceptible to factors that are often extraneous to planning.

3.3 The Rationale for Multi-Sectoral Inter-Temporal Planning in Nigeria

One major lesson that could be learned from the Nigerian experience is that it is illusory to equate grandiose proposals of national goals and aspirations (without an adequate analytical framework for pursuing such goals) to economic planning, no matter how sophisticated the planning machinery is. In the previous section, we discussed the serious consequences implied by the absence of an analytical framework in the Nigerian planning system. It should be emphasized again that the orientation of planning in Nigeria should be changed from the project-basket approach and its excessive concern over project-selection criteria to the need to devise a model that is capable of providing us insights into the structural relations in the economy, thus enabling us to appreciate and better understand the dimensions and implications of current plan decisions for the economy in both the short-run and in the long-run.

Admittedly, there is evidence that the planning machinery has always appreciated the general equilibrium nature of planning as well as the need for an iterative macroeconomic framework to serve as the analytical guide to the planning process.[56] However, no effort has so far been made to develop such a framework. This study is an attempt not only to fill this gap but also to develop a framework for multi-sectoral inter-temporal planning on a consistent basis. The rest of this section is therefore devoted to establishing the rationale for the proposed shift to multi-sectoral planning and how this could be incorporated into the present planning machinery.

The essence of economic planning lies in the belief that an economy could be made to grow faster and utilise its factor endowments and other resources more efficiently by the use of a predetermined set of policy-instruments. But the growth process itself is inherently dynamic and, over the planning horizon, those structural changes the economy undergoes must be understood if the economy is to be kept on its predetermined path. Planners have often relied on the analytical model underlying their planning exercise for this fundamental aspect of the planning task. However, the extent to which a model can be expected to highlight these changes depends on the amount of detail embodied in the series of structural relations which constitute the model.

At the most rudimentary level, aggregative models of the Mahalanobis type have been employed in planning but the restrictive nature of the assumptions underlying such models have rendered them of limited value for planning. Recently, the emergence of high-speed computation equipment has fostered the construction of large-scale planning models that are so detailed that numerous sectors of the economy can be modelled simultaneously. Typically, such models seek to optimize the state of the economy, subject to the limitations imposed by the scarcity of resources, the techniques of production as well as the patterns of structural relations within the entire system. The nature of this problem (involving optimisation of an objective subject to constraints) as well as the inherently logical process involved in reconciling the structural limitations in the various sectors of the economy has made mathematical programming an indispensable tool in economic planning.

Nigerian planning has, however, remained on a completely different level, regarding the problem posed by planning and the technique adopted for its solution. Since the approach to planning has emphasized the need to secure a basket of projects for execution, the overriding problem has involved the choice of an appropriate project-selection criterion, which at best is only a partial equilibrium approach to planning. Whether it uses Stolper's profitability criterion as in the First Plan or the Social-Cost-Benefit criterion of the Second and Third Plans, the microeconomic approach to planning by project selection necessarily ignores the various dynamic external economies engendered by the simultaneous execution of various projects in the actual context of planning. Although it is true that project evaluation criteria are sufficiently detailed to take account of all the costs and benefits associated with specific projects, the approach is necessarily sub-optimal since it lacks a framework for ensuring that the optimal plan for each sector is compatible with those of the other sectors in the economy. This can only be done within the framework of a multi-sectoral programming model of the economy.

Basically, the computational algorithm involved in a mathematical programming model proceeds by evaluating each activity in the economy for its efficiency or profitability, seeking the optimal solution by a search procedure that ensures that all the costs and benefits of every project are dynamically and simultaneously considered. Since this process prices all activities entering the solution basis, the output of the programming model is a set of optimal activity levels as well as shadow-prices reflecting the opportunity costs of resources allocated to each sector. However, despite these advantages of comprehensiveness and flexibility, it is useful

to incorporate the project-selection approach with multi-sectoral programming especially if the former is retained at a lower level of a two-level planning process; this does not violate the general equilibrium nature of programming nor the dynamic pricing of resources and their allocation. Rather, the programming model yields a set of consistent product and factor prices which can be used in the evaluation of individual investment projects. Thus, in a two-level planning sequence, it is possible to link the general equilibrium nature of planning with the partial equilibrium analysis involved in project evaluation.

An additional complication is, however, introduced once we realize that the future is a series of short-runs which are not disjoint. Since planning is a continuous exercise requiring that we evaluate the consequences of current consumption and investment decisions for the future, there must be a mechanism by which the series of short-runs typically embodied in a perspective plan are bound together and a way for assessing how structural shifts in a given period affect or overflow into other periods. The orientation of dynamic multi-sectoral planning is therefore not only to optimize the economy's objective function in the current period but to find that path along which such an objective function (typically, a social welfare function or its proxy) is optimized throughout the entire planning horizon. Thus, with the introduction of temporal factors into the planning model, the planning solution yields not only an instantaneous allocation of resources that is optimal but a sequence of such allocations that is dynamically consistent internally. With the implied dynamic coupling of the series of plans embodied in a single perspective plan, we are able to evaluate the current performance of the economy as well as the direction and intensity of

current structural shifts for the future path of the economy. This is the scope of the dynamic multi-sectoral programming model that is embodied in this study, the details of which are outlined in the next chapter.

As regards the incorporation of the proposed model with the existing planning machinery, it would be seen in the next chapter that the proposed model requires a dual-directional flow of information between the two levels of planning envisaged by this study. It is proposed that the current planning machinery which centers around the Central Planning Office be retained at the lower level because of its abundant supply of sector-specialists who have regular contact with the planning ministries in all the states. The multi-sector programming model can thus be superimposed on the existing planning machinery, with a new planning institution charged with the responsibility of inter-temporal planning for all the sectors of the economy. The Draft Constitution of the Federal Republic of Nigeria which is due to come into effect in 1979 proposes that a National Planning Commission be established for this specific purpose as well as for macroeconomic planning of monetary and fiscal policy for the entire economy. This fits perfectly with the framework proposed for this model.

TABLE 3.1

PLANNED AND ACTUAL CAPITAL EXPENDITURES IN NIGERIA'S DEVELOPMENT PLANS 1962-1980
(Millions of Naira)

Major Planning Sectors	First National Development Plan, 1962-68[1]						Second National Development Plan, 1970-74						Third National Plan 1975-80	
	PLANNED		ACTUAL		PERCENTAGE DEVIATIONS		PLANNED[2]		ACTUAL[3]		PERCENTAGE DEVIATIONS		PLANNED	
	Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal
ECONOMIC	915.732	593.186	625.778	409.238	-31.66	-31.00	1,701.311	1,080.883	1,098.973	606.013	-35.4	-43.93	20,474.082	17,469.005
\	67.5	71.90	58.32	59.00	---	---	52.71	55.96	49.13	49.19	---	---	62.30	66.80
SOCIAL	330.334	139.042	211.786	91.812	-35.89	-33.97	840.151	293.381	615.423	211.856	-26.75	-27.99	3,786.765	2,272.831
\	24.4	16.85	19.74	13.24	---	---	26.03	15.19	27.51	17.20	---	---	11.50	8.70
ADMINISTRATION	93.106	88.374	209.548	182.584	+113.59	+106.60	612.764	483.813	476.396	368.184	-22.25	-23.90	4,449.845	4,034.727
\	7.24	10.71	19.53	26.32	---	---	18.98	25.05	21.30	29.88	---	---	13.60	15.40
FINANCIAL OBLIGATIONS/ REGIONAL DEVELOPMENT*	7.8	4.4	25.666	9.598	+229.05	+118.13	73.601	73.601	49.976	45.996	-37.53	-37.53	4,144.124	2,388.552
\	0.06	0.05	2.39	1.38	---	---	2.28	3.81	2.06	3.73	---	---	12.60	9.10
TOTAL	1,353.6	825.002	1,072.998	693.616	-20.73	-15.92	3,337.827	1,931.678	2,236.768	1,232.029	-30.70	-36.22	32,854.616	26,165.115

Sources: 1. Figures for 1962-68 from the Second National Development Plan: 1970-74, Table 3, p. 13
2. Revised Planned Public Capital Expenditure from the Second Progress Report on the Second National Development Plan, 1970-74, Appendix, Table 5, p. 107.
3. Actual Capital Expenditure as reported by the Federal Office of Statistics, Annual Abstract of Statistics, 1974, Table 17.2, p. 231.

* The Regional Development allocation applies only to the Third National Development Plan, 1975-80 which did not anticipate any financial obligations.

FOOTNOTES
(to Chapter 3)

[1]Government of Nigeria, Sessional Paper No. 24 of 1945 (Lagos, Government Printer, 1946).

[2]Government of Nigeria, Sessional Paper No. 6 of 1951 (Lagos, Government Printer, 1951).

[3]No attempt was made at the concise definition of the plan's goals and objectives apart from the general concern for the provision of social and infrastructural services as stipulated in the Preliminary Statement on Development Planning in Nigeria. See G.K. Helleiner, Peasant Agriculture, Government and Economic Growth in Nigeria, (Homewood, Illinois, R.D. Irwin, 1966).

[4]Aboyade, O., Foundations of An African Economy (New York, Praeger, 1966) p. 150. More detailed comments on the Nigerian planning experience in the immediate post-war years is contained in Chapter 5 of this book.

[5]The first known suggestion of a shift to multi-level planning is embodied in Aboyade's study, Aboyade, op. cit. chapter 7. The exact definition of multi-level planning, however, differs between Aboyade's study and the present one in terms of both the scope and dimensions of such a plan as well as the planning techniques involved at the different levels. This point will be further discussed later in this chapter.

[6]Aboyade, O., Foundations of an African Economy, op. cit., p. 151.

[7]International Bank for Reconstruction and Development (I.B.R.D.), The Economic Development of Nigeria, (Baltimore, Johns Hopkins Press, 1955), Preface.

[8]The National Economic Council was not established until 1955, a little too late for it to be effective as a co-ordinating agency in the planning process. Thus, the termination of the 1951-56 Plan brought to an end the effort to have an integrated national development plan and it is unfortunate that those fine organizational qualities of the first ten years of planning did not carry over to the immediately succeeding period.

[9]Adedeji, A., "Federalism and Development Planning in Nigeria" in A. Ayida and H.M.A. Onitiri, eds., Reconstruction and Development in Nigeria (Ibadan, NISER/O.U.P., 1970), p. 101.

[10]Adedeji, A., ibid., p. 101.

[11]In contrast to the seemingly sophisticated economic programme of the Western region, the Eastern region only had a plan "outline" whilst the Northern region's document was aptly entitled "A Statement of Policy on the Development Finance Programme". See E. Dean, Plan Implementation in Nigeria: 1962-1966 (Ibadan, NISER/O.U.P., 1972), Chapter 1 for more details.

[12]Ohiorhenuan, J.F.E., Structural Factors in the Macroeconomic Planning Process: A Study of Planning in Nigeria, Unpublished Ph.D. Dissertation, McMaster University, 1975, p. 28.

[13]See J.H. Green, "Four African Dev. Plans", Journal of Modern African Studies, Vol. 3, no. 2, 1965, pp. 249-279.

[14]The Economic Planning Unit has since grown to become the present Central Planning Office, a fairly sophisticated and well-staffed professional planning institution which is largely responsible for planning at the national level as well as the supervision and co-ordination of the planning programs of the states.

[15]Federal Government of Nigeria, Economic Development of Nigeria, 1959, (Lagos, National Economic Council, 1959).

[16]See E. Dean, Plan Implementation in Nigeria: 1962-66, op. cit., p. 16 and Ohiorhenuan, op. cit., p. 22 for more detailed references to these studies.

[17]Aboyade, O., op. cit., p. 154.

[18]Although it would be unfair to blame the shortcomings of a joint planning effort on a single individual, Aboyade has convincingly argued that the content of the 1962-68 plan could be successfully traced to Professor Stolper's general view of economic development. See Aboyade, op. cit., Chapter 5, especially pp. 163-175. Stolper's own assessment of his experience in Nigeria is reported in his book, Planning Without Facts, (Cambridge, Mass., Harvard University Press, 1966).

[19]Throughout the 1956-62 period and also during the period of the First National Development Plan, 1962-68, Nigeria in essence had multiple plans for the different governments in the federation. It was not until the Second National Development Plan, 1970-74, that an attempt was made again at comprehensive national planning.

[20]Nigeria, National Development Plan, 1962-1968, (Lagos, Federal Ministry of Economic Development, 1962).

[21]Nigeria, Second National Development Plan, 1970-1974, (Lagos, Federal Ministry of Information, 1970).

[22]Nigeria, Third National Development Plan, 1975-1980, (Lagos, Central Planning Office, 1975).

[23]First National Development Plan, 1962-68, op. cit., pp. 46-47.

[24]Ibid, p. 46.

[25]This portrays the implicit recognition of the need to use the plan as the foundation for the accomplishment of self-sustaining growth within two decades. The planners thought that such a target could only be achieved if the domestic savings ratio was increased from about 9.5% in 1960/61 to at least 15% in 1975 so that the bulk of domestic investment could be sustained by domestic resources. See the First Plan, op. cit., pp. 23-24.

[26]Much of this was due to the fact that power still derived mainly from the regions to which most of the politicians owed their allegiance and some of it could be blamed on external vested interests. For more comments on the politics of Nigeria's first republic and their implications for planning, see Aboyade, op. cit., pp. 159-160.

[27]Hansen, L.M., "Methods of Economic Programming and Analysis in the Plan", NJESS, Vol. 4, No. 2, 1962, p. 93. Also cited by Aboyade, Foundations of an African Economy, op. cit., pp. 160-161.

[28]At the start, there were three regions (East, North and West) but in March 1963, the Mid-West region (now Bendel State) was created out of the Western region and the 1962-68 proposals for the West had to be modified accordingly.

[29]Adedeji, "Federalism and Dev. Planning", op. cit., p. 102.

[30]See Aboyade, Foundations of an African Economy, op. cit., pp. 162-163.

[31]W.F. Stolper, Planning Without Facts, op. cit., p. 146. Chapter 5 of Stolper's book gives a more detailed rationalization of the planning decision model and the decision to use economic profitability as the criterion for project selection.

[32]Aboyade, O., Foundations of an African Economy, op. cit., p. 177.

[33]A more detailed criticism of the profitability criterion vis-à-vis the general equilibrium approach based on linear programming is given by Clark, P.B., Planning Import Substitution, (Amsterdam, North-Holland, 1970), Chapter 8.

[34]See Aboyade, Foundations of an African Economy, op. cit., p. 168.

[35]In May, 1967, the existing four regions of Nigeria and the federal territory of Lagos were restructured into twelve new states. Since then, the number of states has been increased to nineteen plus new Federal capital territory located near Abuja in the geographical centre of the country. From the planning standpoint, this new structure seems to represent a natural division of the country into economic regions.

[36]Nigeria, Second National Development Plan, 1970-74, op. cit., p. 10.

[37]Nigeria, Second National Development Plan, 1970-74, op. cit., p. 37.

[38]Ibid., p. 31.

[39]Ibid., p. 32.

[40]Because these five objectives represent the broad view of the ultimate aspirations of the Nigerian society, they were accepted for the Third National Plan, 1975-80.

[41]A more detailed criticism of the plan's policy framework and the shortcomings in the implementation of these policies can be found in O'Brien, S. and R. Meyers, "The Progress of the Economy" in "Progress on Nigeria's Second National Development Plan: A Symposium", Quarterly Journal of Administration, Vol. 7, no. 2, 1973, pp. 114-115.

[42]Nigeria, Second National Development Plan, op. cit., p. 35.

[43]Ibid., p. 41. See also Aluko, S.A., "Resource Allocation and Overall Strategy", Quarterly Journal of Administration, Vol. 7, no. 2, 1973, pp. 273-275.

[44]Nigeria, Guidelines for the Third National Development Plan: 1975-80, (Lagos, Central Planning Office, 1974), p. 7.

[45]Nigeria, Second National Development Plan, op. cit., p. 38.

[46]See O'Brien and Meyers, op. cit., p. 118.

[47]Nigeria, Third National Development Plan: 1975-1980, op. cit., p. 43.

[48]A specific characteristic of the model embodied in this study is that there is detailed planning of the inflow of oil-funds and other financial capital over the entire planning period. This is the subject of Chapter 5 of this study.

[49]Apparently, the basic premise for their projections was that since world demand for OPEC oil was growing at 5% per annum and assuming that the 1973 shares would be maintained by OPEC at least until 1980, Nigeria's production could be expected to grow at 5% too. It is our belief that the world oil market is not as simplistic as these assumptions seem to portray and five years is too long a period for these assumptions to constitute the basis of inflexible expectations.

[50]In pursuit of its avowed objective of ensuring a more equitable distribution of income, the government had instituted the Udoji Public Service Review Commission which, among other fundamental reforms of the public service, recommended substantial increases in public-sector wages and salaries. The private sector soon followed suit. Even if one does not quarrel with the propriety of such unplanned increases in government outlays, one has to question the rationality behind the lump-sum payment of the arrears of salaries while trying to keep the rate of inflation low.

[51]Nigeria, First Progress Report on the Third National Development Plan: 1975-80, (Lagos, Central Planning Office, 1977).

[52]It is not known exactly why the planners opted to use an econometric model as the basis of their forecasts. The studies done on the Nigerian economy by Nicholas G. Carter (1963) and Peter B. Clark (1970) embody sufficient data for static linear programming which should have been a better starting point for the shift to quantitative economic planning.

[53]This section focusses on the period since 1962 when the first "comprehensive" national plan was launched. The period before 1962 has been left out because of the haphazard and rudimentary nature of the planning process that characterized this period.

[54]It is the view of this study that the disagreement between the proponents of the profitability criterion and the Social cost-benefit criterion is legitimate in theory but irrelevant in Nigerian planning practice. The applicability of these criteria is limited by the degree of accuracy possible in the calculation of these measures in a system that is pervaded by non-linearities and second-best situations.

[55]See First Progress Report on the Third National Development Plan: 1975-1980, (Lagos, Central Planning Office, 1977), Table 2.20, p. 23.

[56]As early as 1958, the Nigerian government commissioned a study of the structural characteristics of the economy. Although the result of this study conducted by Nicholas Carter was published in 1962, no attempt has been made to incorporate input-output analysis into the Nigerian Planning process. See Carter, N.G., "An Input-Output Analysis of the Nigerian Economy, 1959-60", Working Paper #29-63, School of Industrial Management, M.I.T., 1963.

CHAPTER 4: A DYNAMIC MULTI-SECTORAL PLANNING MODEL FOR NIGERIA

4.1 Introduction

Despite the great strides which had been made in economics since the turn of the century, economic literature up to the second world war was characterized by a conspicuous lack of concern for those problems that were peculiar to developing or less-developed economies. Those development problems that attracted any attention were only treated in relation to the theory of business cycles or within the context of the challenge to the neo-classical theory of resource allocation by the economics of imperfect competition. The depression. however, provided great insights into the complex interrelationships among the several economic problems hitherto treated individually. This realization stimulated Rosenstein-Rodan's theory of general economic interdependence and, with parallel developments in mathematical economics, development planning soon became the framework within which a concerted effort could be made in dealing with the myriad of problems at the core of the development question.[1]

In the context of this study, economic planning is defined as the systematic charting of a desired course of national action aimed at achieving specified targets, at both the national and sectoral levels which are considered to be ingredients of economic development over time. That is, planning is a public guide to action specifying the detailed projects and processes for securing overall economic growth as well as a coordinating mechanism for those policies that may affect the desired growth path and the consequences of these changes in the short-run on the long-term patterns of

growth and development of the economy.[2] However, because of these different dimensions of the planning task, a quantitative planning model is often necessary as the framework within which all the processes outlined above can be evaluated.

In the process of its evolution and acceptance by many countries, planning has come to take many shapes and forms in different countries at different times. What we have today is a wide range of possible models, the choice from which is often made on the basis of such factors as data availability, the institutional framework for planning and the nature of the policy problems that the plan is designed to solve. Although improvements in the techniques of economic planning in the past twenty years have increased the appeal of planning to many developing countries, these more sophisticated models often require highly accurate data and skilled personnel for their application. Consequently, comprehensive development planning has only been slowly accepted in many developing countries although the typical developing country today has evolved some short-term blueprint for action in the name of a plan at one time or another. These have varied in their degree of sophistication from the aggregate Harrod-Domar-type models, through static input-output and linear programming models to dynamic input-output and multi-period linear programming models. The choice from among these alternative models has to be guided by the specific circumstances of the country for which the model is being constructed and what planning is expected to accomplish. The premise of this study is that development planning is essentially dynamic rather than static and, if we are to permit all the processes of development to work themselves out consistently, long-term planning is the appropriate framework for a planning model.

This chapter presents the structure of a dynamic multi-sectoral planning model for Nigeria. Our choice of the multi-sector framework has been guided by the fact that an aggregative model with one or a few sectors will not adequately represent Nigeria's circumstances and the diversity of its economy. The main objective of this chapter is to outline and develop the structure of the multi-sectoral planning model proposed for Nigeria. In the next section, we present an overview of the literature on economic planning models with a view to highlighting the general structure of planning models and the properties of the models outlined in the third section The last section offers some comments regarding the adaptability of the proposed planning model to the Nigerian planning process.

4.2 The General Structure of Multi-Sectoral Planning Models

An overview of the numerous models existing in the literature on economic planning conveys the impression that a typology of planning models, some of which are based on varying experiences and circumstances of different countries, is impossible. However, since the planning exercise itself involves the problem of how to transform an economy from a current state to another desirable state by the utilization of scarce resources, a typology could be attempted on the basis of how the different models tackle this economic problem. Using this as a primary criterion, it is possible to discern four basic groups into which the planning models can be categorized, viz: (i) aggregative growth models which deal with one or a few sectors of the economy, (ii) input-output or Leontief-type multi-sector models which emphasize the consistency and feasibility of the stated targets with the given resources, (iii) optimising multi-sector models that explore the

various alternatives open to the economy on the basis of a criterion function, and (iv) non-optimising macroeconomic models that use the known structure of the economy to make consistent forecasts of the economy's growth. These models are further distinguished as being static or dynamic depending on the extent to which the time it takes to transform the economy is explicitly taken into account.

This simple classification of planning models, despite its convenience, is not exhaustive nor are the groups exclusive; most of the models reviewed in this section bear certain close similarities. Because the models have been designed to suit particular situations in specific countries, each category embodies a whole spectrum of models sharing a basic methodological approach but it is also possible to put a given model in more than one category depending on the structural properties of its specification. We shall proceed by describing the broad categories in turn.

4.2.1 Aggregative Planning Models

Since development is an inherently inter-temporal process, development planning models have been generally growth oriented. The simplest and perhaps the generic form of aggregative planning models is the Harrod-Domar growth model which determines the rate of growth of national income and other macroeconomic magnitudes as a function of the economy's marginal propensity to save and the marginal capital-output ratio. In planning practice, such models have been used to trace the interrelationships among crucial macro-variables like consumption, investment and foreign trade as well as the implications of changes in these for the demands for domestic resources. A logical extension of the Harrod-Domar model, the Kalecki model, has been

used as the basis of exploratory long-term planning in Poland[3] whilst other variants have been employed mainly in long-term economic projections.

More sophisticated versions of these aggregative planning models proceed by classifying the various sectors of the economy into a few major sub-systems, which may or may not be structurally interrelated, before the growth theory is applied. The most popular among these, the Feldman-Mahalanobis model,[4] was used as the starting point in Indian planning. Based on the assumption of a full-employment economy with only two inter-dependent (capital and consumption goods) sectors, the model uses investment as a policy-variable to influence the rate of growth of national income. A variation of this model, the two-sector model proposed by Ichimura[5] incorporates both supply and demand components into the analysis but did not allow any interactions between the sub-systems. However, the general result in these models remains the same - that the rate of growth of the economy depends on the ratio of the marginal propensity to save to the capital-output ratio (or weighted proportions of these parameters in two-sector models).

This excessive dependence of the growth path on a few parameters which are often outside the control of the planner is the major short-coming of aggregate models. Despite the questionable realism of their assumptions, their simplicity has bestowed upon them certain advantages in the form of data requirements and computation, which makes them attractive to many small less-developed countries. However, they are often too aggregative to offer us any useful insights into the operational characteristics of the economy and have therefore been of limited use in actual planning practice except for ensuring the consistency of ancillary projections of macro-variables in

more detailed and refined models.

4.2.2 Input-Output or Leontief-Type Planning Models

Unlike the two-sector models described above, Leontief-type input-output models are genuine multi-sectoral models which use inter-industry flows describing the structural relationships among the various sectors of the economy to generate alternative resource allocation programmes within a general equilibrium framework. The main focus of the model is on the consistency of the critical aspects of the plan with stated targets and the feasibility of the ensuing production allocation with the availability of resources.

The most popular version of the Leontief model is the static, open input-output model which is built around an inter-industry flow matrix with exogenous specification of the basic components of final demand by sector of destination, all embodied in a single vector F.[6] At the core of this model is a statement of supply and demand balances in the system which would typically take the form:

$$(4.1) \quad X_i + M_i = \sum_j X_{ij} + F_i$$

This relationship states that, for each sector i, domestic production X_i, plus imports M_i, must be sufficient to satisfy intermediate deliveries to other sectors, $\sum_j X_{ij}$, and final demand for this sector's output, F_i. The final demand would typically include such things as private and government consumption, investment, exports and changes in inventories. Using the reltionship $\sum_j X_{ij} = \sum a_{ij} X_j$ and stating equation (4.1) in matrix form, we have:

$$(4.2) \quad X + M = AX + F$$

where $A = [a_{ij}]$ and $a_{ij} = X_{ij}/X_j$ is the input-output coefficient expressing the units of commodity i required to produce one unit of commodity j. It follows from equation (4.2) that:

$$(4.3) \quad X = [I - A]^{-1} (F - M)$$

so that, using a single matrix inversion, we are able to trace the direct and indirect demands implied by the final demand elements (F - M) in calculating the sectoral production levels, X, and we are assured that the resulting output levels are consistent with the targets specified in the final demands. By further specifying the basic resource constraints in the economy in addition to the material balance equation (4.2), it is possible to derive direct estimates of resource requirements implied by the calculated output levels along with the multi-sectoral forecast of production levels.[7]

The above procedure is, however, possible only through a series of simplifying assumptions which are sufficiently useful to permit parameter estimation without distorting the true picture. The main thrust of these assumptions is that each sector produces a homogeneous good which can be used to satisfy the various intermediate and final demands by use of a linear technology based on fixed input-output proportions. The question of fixity of the input-output coefficients has attracted attention in the literature and there exist several alternative techniques for making them variable in planning applications. For example, Anne Carter (1970) suggested that the input-output coefficients be made explicit functions of time so that forecasts can be made on the basis of how the input-structure and the product-mix of particular sectors have changed or are likely to

change in the future. Another suggestion by Klein (1953) is that the a_{ij}'s be interpreted as resulting from a Cobb-Douglas production function with the implication that while they stay constant in value terms, they need not stay constant in volume terms. Tims (1968) and von Rijckengheim (1969) suggest that, instead of directly forecasting the input-output ratios, we should state the model in incremental form so that changes in these coefficients are related to marginal changes in output levels. Perhaps the best method for dealing with the fixity of the input-output coefficients is Stone's technique for updating and forecasting changes in the inter-industry flows table.[8] Dubbed the RAS method, it involves "an iterated series of multiplications which bring flows from an old matrix into line with the more recent totals for the rows and columns" as may be obtained from national accounts data. This method is used in updating the Nigerian input-output table and is further discussed in Chapter 6.

The logical extension of the Leontief model into a multi-period framework is the dynamic input-output model which incorporates an explicit investment theory rather than treating investment demand as an exogenously specified component of final demand. Using an accelerator-type theory of investment in which current demand for investment goods depends on future expected growth of output, we can define the vector of investment demand in period t, J(t), as the sum of new investment, D(t), and replacement, R(t). That is:

$$(4.4) \quad J(t) = BD(t) + BR(t)$$

where $B = [b_{ij}]$ is the capital coefficients matrix which serves to

distribute investment by the sector of destination.[9] Suppose that B exists and its elements remain fixed over time. The simple forward-looking accelerator-based demand for new investment is:

$$(4.5) \quad D(t) = \hat{k}[X(t+1) - X(t)]$$

where $\hat{k}$ is the diagonal matrix of incremental capital-output ratios.[10] If we add to the above the assumption that replacement requirements are related to existing capital stocks by proportionality factors in the form:

$$(4.6) \quad R(t) = \hat{\delta}\, K(t)$$

where elements of the diagonal matrix $\hat{\delta}$ can be interpreted as constant depreciation coefficients, the basic material balance equation now takes the form:[11]

$$(4.7) \quad X(t) = A\,X(t) + B\hat{k}[X(t+1) - X(t)] + B\hat{\delta}\hat{k}\,X(t) + F(t) \qquad t = 0, 1, 2, \ldots.$$

This equation resolves into:

$$(4.7') \quad B\hat{k}\,X(t+1) = X(t) - A\,X(t) + B\hat{k}\,X(t) - B\hat{\delta}\hat{k}\,X(t) - F(t)$$

If we create a new matrix $H = B\hat{k}$ and assume that H^{-1} exists, the difference equation of the dynamic input-output model takes the form:

$$(4.8) \quad X(t+1) = [I + H^{-1}\ (I-A) - \hat{\delta}\ ]X(t) - H^{-1}F(t)$$

the solution to which could take the general form:

$$(4.9) \quad X(t) = [I + H^{-1}\ (I-A) - \hat{\delta}\ ]^t\ X(0) + X^*(t).$$

The first term in equation (4.9) is the solution of the homogeneous equation when the final demands F(t) are set identically to zero (implying that all surpluses in the system are immediately reinvested) and $X^*(t)$ is

the particular solution of equation (4.8).

The most common problem that arises in dynamic input-output analysis is that of ensuring the stability of the system and this depends on the characteristic values of the matrix $[I + H^{-1} (I-A) - \hat{\delta}]$. It is claimed that one of these characteristic values will correspond to a balanced growth path for the system along which the elements of the vector $X(t)$ stays in fixed proportion to each other and grow at equal constant rates. According to Lance Taylor, "whether or not output levels will converge to balanced growth from arbitrary initial conditions depends on the other characteristic values" and he warns that "if any of these characteristic values correspond to growth rates exceeding that of the balanced growth path, the system will diverge and finally generate negative output levels in some sectors."[12] Since it is theoretically impossible to predict when the above will occur and in view of the great practical value of the dynamic Leontief model for making consistent investment and output forecasts, attempts have been made to get around the instability problem entirely.

It is suggested that, since the dynamic nature of the model itself derives from the accelerator-based investment theory such as that assumed in (4.5), the divergence of the model from the balanced growth path could occur when the model is run forward in time. Thus, backward simulation of the difference equation in (4.7) towards the initial conditions is suggested. A recursive procedure for this backward simulation from terminal conditions is known as the Leontief "Dynamic Inverse" which, whilst not offering us any scope for modifying the terminal conditions to ensure that the given output levels are obtained, provides us with insights into the production structure which would have to precede and accompany expenditure

on all investment projects coming on stream in the terminal year.[13]

In practical applications, this problem has been dealt with by the introduction of a balancing vector W(t) in (4.7) and imposing certain restrictions on capital stock or capacity as follows:

$$(4.10) \quad X(t) + W(t) = A\,X(t) + J(t) + F(t)$$

$$\hat{k}X(t) \leq K(t)$$

$$W'(t)[K(t) - \hat{k}X(t)] = 0$$

It can be seen that there is now some scope for excess capacity in the dynamic model since the balancing vector has positive entries only when there are capacity shortfalls. The third set of constraints are in effect the same as Hawkins-Simon conditions. Generally, the positive entries in W(t) are interpreted as endogenously determined import levels that are required to balance supply and demand. Models set in this fashion are dubbed "almost consistent" and have been used by Bergsman and Manne (1966), Clopper Almon (1970), and Clark and Taylor (1971). Recent experience with dynamic input-output analysis comes mainly from Japan and are well documented in the works of Jinchiki Tsukui (1966), (1968) and (1970).[14]

Despite their exploratory capacity, input-output models still suffer from certain basic shortcomings that have limited their use in planning. The dynamic input-output model is essentially oversimplistic in its investment theory and fails to provide any explicit criterion by which the best growth path might be selected from among the possibilities. The model is often too compact to allow any scope for policy changes nor does it incorporate the constraints imposed on the system by savings requirements, foreign exchange and balance of payments. Most of these problems are easily

taken care of in linear programming models which are sufficiently flexible in their formulation and do not require the constraints to possess any specific structural properties. It has, however, been important to review the dynamic input-output model more closely as certain elements have been extracted from it in the formulation of some aspects of the dynamic multi-sectoral planning model outlined in the next section.

4.2.3 Optimising Planning Models

Optimising planning models differ from input-output models mainly because they involve the maximization of a social welfare function (or its plausible proxy) subject to a set of constraints which represent the structural and technological characteristics of the economy, its resource availabilities as well as other objectives modified into constraints. This maximand could in turn be used as the criterion for choosing the best among the various alternative choices open to the economy. Although all such models can be styled "programming" models, they vary in their basic structure depending on whether the maximand and/or the constraints are in linear or non-linear form. Thus, we have linear programming models on the one end of the spectrum and optimal control models (which are generally non-linear in both the maximand and constraints) on the other.

The most popular optimising planning model is the static linear programming model which is superior to the static input-output model because it incorporates a maximand. Like input-output models, the linear programming model is based on the assumption of sectoral product homogeneity, linearity of production functions and fixity of input-output coefficients. However, static linear programming provides us greater scope in applied planning for

incorporating restrictions on material balances, trends in total factor uses, balance of payments and savings constraints and absorptive capacity limitations. By its very structure, the solution to the linear programme simulates a competitive resource-allocation system complete with shadow prices for all activity levels and binding constraints. The usefulness of these shadow prices in the evaluation of projects for inclusion in the sectoral investment programme has made them very popular in planning practice.

Although static linear programming models have been employed for planning in developing countries, more serious applications of this technique have relied on the dynamic version because of the inherently dynamic nature of development planning itself. Basically, the dynamic linear programme is made up of a series of static linear progammes linked together by investment and capital accumulation equations which, by being intertemporal, give rise to the dynamic nature of the problem. This "piling up" of static linear programmes to yield a tableau for the dynamic linear programme imposes some restrictions on the number of sectors in each period or the number of periods admissible in the model in order to keep the problem manageable.[15] Furthermore, the piling up process gives rise to two major problems that are of interest to this study.

The first of these concerns the investment theory embodied in the dynamic model which usually takes the accelerator form. Generally, the dynamic model generates the sectoral levels of investment endogenously up to a finite horizon at which the model is truncated. The immediate problem then is to ensure that sufficient capital is passed on to the post-terminal years to make the economy grow in the required turnpike proportions. One way in which this is done is to specify, a priori, the rates of growth of

capital stocks in the final period of the plan during which period full capital utilization is assumed. By imposing the additional assumptions that capital stocks are not shiftable between sectors and that all the sectors of the economy grow at the same rate during the plan, then capital stock and output would grow at the same rate and investment in each period would be proportional to the total investment over the planning horizon. These proportionality factors so derived, called "stock-flow conversion factors" can then be used to forecast investment in each period on the basis of the growth rate assumed for all the sectors during the planning horizon. These stock-flow conversion factors were first used by Chenery and Bruno (1962) and Manne (1963). It is also possible to allow each sector to have its own growth rate although this would lead to additional complications in computation.[16]

The second problem, closely related to the above, concerns the need to reduce the size of the problem by limiting the number of capital-producing sectors in the model. One easy way of doing this is to assume that each type of capital is shiftable and may thus be moved among sectors at will. Under this assumption, the dynamic model requires capital accumulation equations only for the few types of capital goods produced in the economy and adding-up conditions can be imposed to ensure that the demand for capital will not exceed the total supplies. Although this may save a lot of constraints in the typical developing country where very little capital is produced outside the construction sector, the assumption of shiftable capital stocks has been known to give rise to over-specialization in some sectors, a result which may not be acceptable to policy-makers.

A variation of the first solution has been employed in specifying terminal conditions for the dynamic linear programming model outlined in the

next section. We have allowed identical sectoral growth rates up to the first post-terminal period, the point at which the model is truncated. The implicit assumption here is that if the model satisfies the constraints imposed on it by the balanced sectoral growth rates, then sufficient capital exists in the immediate post-terminal period to ensure that output will continue to grow in the required proportions. This is similar to the treatment found in Eckaus and Parikh (1968) and Manne (1973).

A more general programming model is the optimal control planning model which is similar to dynamic linear programming models in the way time is explicitly taken account of but are more general because they allow for both linear and non-linear maximands and constraints. The structure of a typical optimal control planning model would be:

$$(4.12) \qquad \text{Maximize } W = V' K(T) + \int_0^T \{u[C_T(t)]e^{-\omega t}\}dt$$

subject to

$$(4.13.1) \quad \dot{X}(t) = A X(t) + B D(t) + C(t)$$

$$(4.13.2) \quad X(t) = f[L(t), K(t), t] \quad \text{and}$$

$$(4.13.3) \quad \dot{K}(t) = g[D(t)]$$

where $A = [a_{ij}]$ and $B = [b_{ij}]$ assume their standard roles.

In this formulation, the planning model tries to maximize the sum of the stream of utilities from total consumption over the planning horizon (discounted at the rate ω) and the value of terminal capital stocks, with V' as the valuation vector. Although the material balance constraints in (4.13.1) are similar to those found in dynamic linear programming models, the structural relationships need not be linear. Furthermore, output levels now

depend on explicit production functions which involve labour, capital and technological change (4.15.2). Also, the capital accumulation equations (4.15.3) make changes in capital stock a function of investment rather than being exactly equal to investment.

With this framework, and assuming full employment in the economy, optimal control planning models proceed to compute the optimal solution to the system in equations (4.12) and (4.13) by use of the Pontryagin Maximum Principle.[17] However, there is no known application of optimal control models in applied planning although several algorithms have been used to demonstrate the numerical convergence of such models. The most notable among these include multi-sectoral models solved by Radner and Friedman (1968), Friedman (1968) and Kendrick and Taylor (1970). Recent models by Bergendorff, Blitzer and Kim (1973) and Martens and Pindyck (1973) suggest ways of solving control models along the lines of the dynamic linear programming formulation.

On the whole, then, it can be seen that as far as long-term or perspective planning goes, dynamic optimising models offer us greater scope for exploring the development possibilities open to the economy and an opportunity for tracing the trade-offs among alternative growth paths in a consistent manner. They also possess the additional advantage that they can be modified to incorporate other major concerns of planning including import-substitution, dynamic comparative advantage and project analysis. However, it should be noted that dynamic optimising models are very expensive in terms of manpower and computation. Nevertheless they have proven to be very reliable in generating consistent long-term multi-sectoral planning programmes in India, Mexico and Latin America[18] and

could be an effective educational guide to planners regarding the policy choices open to them if properly used.

4.2.4 Non-Optimising Planning Models

The models we have considered so far are all operated in value terms and often call for the construction of price-indices because there may be valuation problems when there is a difference between producers' prices and users' prices, especially when competitive imports are involved in the model. Thus, several quantity-based macro-planning models have been specified to generate the same Walrasian general equilibrium found in optimising models. Starting with basic microeconomic approach, these models estimate sectoral production functions from which sectoral factor demand functions can in turn be derived by use of the usual competitive market assumptions. Assuming that these production functions have the neo-classical properties with factor-shares summing up to total income, a process of utility maximization is then used to generate sectoral consumption demands. Thereafter, the focus of the analysis shifts to the search for that unique equilibrium at which excess demands are zero.

Several algorithms, including those by Scarf (1969), Chenery and Raduchel (1971) and Raduchel (1972), have been devised for finding the general equilibrium solution in such multi-sectoral, multi-factor models. Their basic attraction remains in the flexibility of their formulation which permits more realistic representations of the economy as well as illuminating comparative statics experiments once the solution is obtained. However, they require tremendous amounts of data for all the production function parameters and demand functions to be estimated and this could

be expensive. Furthermore, there is only limited scope for basic constraints like savings and investment linkages which affect the economy's choice set and these are obviously vital if the model is to be of relevance to long-term planning.[19] A logical extension of such models is their application to multi-sectoral forecasts of economic growth and their use in long-term macroeconomic simulations. The most notable of such studies are those by Leif Johansen (1968) and (1973) for the Norwegian economy.

It is necessary at this stage to make some important observation concerning the nature of the models we have just reviewed. Most of the models described in this section are often expressed in real terms implying that the monetary magnitudes, the role of relative price changes and the interactions of inflation, finance and flow of funds are all ignored. Furthermore, these models are completely devoid of all aspects of uncertainty, concerning themselves with this problem only by the use of sensitivity analysis. These comments apply equally to the model outlined in the next section but we are proceeding along these lines only in the hope that, realizing these theoretical shortcomings of multi-sectoral models, their implications in planning practice can be appreciated and the limitations of the models can be fully recognized.

From among all the various models reviewed above, this study has chosen the dynamic linear programming model as the most appropriate framework within which to design a multi-sectoral planning model for Nigeria. The dynamic linear programming model has the appeal that it permits consistent multi-sectoral forecasts of the economy's alternative growth paths and provides a criterion for choosing among these. Thus, it meets the

requirements in this study for a long-term framework which allows experiments to be performed with the Nigerian economy. The structure of the proposed dynamic multi-sectoral planning model is outlined next.

4.3 A Dynamic Multi-sectoral Planning Model for Nigeria

In the introductory paragraph to his famous study, Nicholas Carter wrote:

> "...Nigeria is now executing her first National Development Plan. This will be followed by her second one and within a few years a third one. At some point in this continuing planning process, she will be likely to embrace some of the more sophisticated planning techniques that are now being refined. When this time comes, Nigeria will need, among other things, an input-output table."[20]

It is quite interesting that more than fifteen years after this hope was expressed, Nigeria has, to some extent, acquired an input-output table[21] although the application of this table to more sophisticated planning techniques is still a goal to be realized. This project is therefore an outgrowth of the need to fill this gap, in the hope that Nigeria can graduate from the existing planning framework to multi-sectoral planning on a more consistent basis.

The dynamic multi-sectoral planning model proposed here for the Nigerian economy extends over a period of 27 years separated into nine periods, each of three years length. For the purposes of the planning exercise, an initial period covering the years 1974-1977 is set up so that the first period of the plan covers the years 1977-1980. Also, period 9 (1998-2001) is chosen as the first post-terminal period and is used in setting the terminal conditions for the long-term plan. In all, the model

has thirteen different production sectors and ten major sets of constraints in each period. These are all combined into a large-scale linear programming problem with dynamic coupling of the periods achieved by the capital accumulation and growth equations. The structure of the multi-sectoral planning model is presented below.

4.3.1 The Objective Function

The economy's objective function is maximized subject to the constraints imposed by resource-supplies, production capacity as well as foreign exchange. This choice of an objective function is not a particularly easy task.

Ideally, one would like to maximize the country's social welfare function; but Arrow's Impossibility Theorem has shown that, even under the best conditions, it is impossible to derive a social welfare function that would represent an ordering of social states according to their order of desirability for all individuals in society. Most optimising models have therefore tried to substitute acceptable proxies for the social welfare function, the most common and easily interpretable being the level of aggregate consumption.

Perhaps the most popular form in which this social welfare indicator has been represented in dynamic multi-sectoral models is the "gradualist" model which was established by Manne in his proof of the optimal conditions for the stability of an infinite horizon planning model.[22] The gradualist model's main property is that it assumes that consumption rises monotonically from an initial level and is thus more politically acceptable because it avoids "flip-flop" behaviour in consumption over the entire

plan. However, it fails to recognize that certain increases in consumption are transitory and non-sustainable. Thus the gradualist model was only used in part in the formulation of the objective function. Instead, the model uses the alternative to the gradualist model, which involves the explicit specification of the maximand as the sum of the stream of consumption over the planning horizon and the value of terminal capital stocks, both appropriately discounted at the social rate, ω. That is:

$$(M.1)^* \quad \text{Maximize } W = \sum_{t=1}^{9} \frac{C_T(t)}{(1+\omega)^{nt-1}} + \sum_{j=1}^{13} \frac{K_j(9)}{(1+\omega)^{26}} \quad t=1, 2, 3, \ldots 9 \quad n=3$$

This maximand is a composite of two objectives: (a) to maximize the value of the discounted stream of consumption over time, and (b) to maximize the value of terminal period capital stocks. The first of these is a proxy that substitutes for the maximization of discounted utility from consumption over time and is in the tradition of multi-sectoral models. Terminal capital stocks have been added to the maximand to take care of the fact that, in the inter-temporal maximization of consumption, future generations need to be compensated by ensuring that sufficient capital exists in the terminal period to ensure that the level of production does not fall off after the terminal period of the plan. This is similar to the maximand found in Bruno, Frankel and Dougherty (1970).

In addition, we have introduced some elements of the gradualist consumption path into the model to ensure that there are no drops in the

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*Equations are numbered differently here for purposes of clarity of presentation. All equations starting with M enter the model while the others remain in sequence with other equations in the chapter.

level of aggregate consumption below the initial value $\bar{C}_T(1)$. This is along the lines of Chahravarty and Lefeber (1965) and Eckaus and Parikh (1968) and is introduced as a constraint in the model as:

$$(M.2)\quad C_T(t) \geq (1+c^*)\, C_T(t-1),\quad C_T(1) \geq \bar{C}_T(1) \qquad t=2,\ 3,\ldots,8$$

4.3.2 The Model's Constraints

The maximand in equation (M.1) is maximized subject to the following constraints which represent the economy's resource supplies, production capacity, foreign exchange availability and other objectives introduced as constraints. These are discussed according to their major categories.

(i) Material Balance Constraints

The structure of the material balance constraints employed is fairly standard for all multi-sectoral planning models. It requires that in each period, the value of the sum of each sector's gross domestic production, X_i, and its imports, M_i, must be at least sufficient to satisfy domestic inter-industry demands, $\sum_j X_{ij}$, as well as domestic consumption, gross investment and exports; the $\xi_i^C C_T$, I_i^G and E_i, respectively. Thus, for the typical sector i, the material balance constraint is expressed as:

$$(M.3)\quad \sum_{j=1}^{13} a_{ij}\, X_j(t) + \xi_i^C\, C_T(t) + E_i(t) + \sum_{j=1}^{13} \beta_{ij}\, I_j^G(t) \leq X_i(t) + M_i(t)$$

This set of constraints applies in this form in all periods and is put in matrix form as:

$$(M.3.1) \quad -(I-A)\,X(t) + \xi^{C}\,C_{T}(t) + E_{9}(t) + B\,I^{G}(t) - M(t) \leq 0$$

$$t=1, 2, 3,\ldots 9$$

where $A = [a_{ij}]$, $B = [\beta_{ij}]$, and $E_9(t)$ is a nine-element diagonal matrix because only the first nine sectors of the Nigerian economy are assumed to be producing for exports. The other sectors - Utilities, Construction, Trade and Services and Transportation are assumed not to export.

(ii) Capital Capacity Constraints and the Process of Capital Accumulation

Ordinarily, the capacity limitation imposed on the level of production possible in any period t can be simply stated as $\hat{k}\,X(t) \leq \overline{K}(t)$ where $\overline{K}(t)$ is the amount of capital available during that period and $\overline{K}(1)$ is given, with future levels of capital stock being estimated as the sum of this opening capital stock and net additions to the capital stock over the planning period. However, since there is an assumed one-period lag between investment and the corresponding increase in capacity, the capacity constraints imposed by capital is stated as follows. For the first period of the plan, the level of capital stock available in each sector is prescribed so that the capital capacity constraint is:

$$(M.4.1) \quad k_j X_j(1) \leq \overline{K}_j(1) \qquad \text{for all sectors } j=1, 2, 3,\ldots 13.$$

However, because of the assumed lag in the maturation of investment, capital availability in any period $t+1$ depends on the level of gross investment in period t, $I_j^G(t)$ and the depreciation on opening capital stock in that period, $\delta_j K_j(t)$. Thus, the opening capital stock in period 2 is equal to:

(M.4.2) $K_j(2) = K_j(1) - \delta_j K_j(1) + I_j^G(1) = (1-\delta_j)\ K_j(1) + I_j^G(1)$

In general, this capital accumulation equation takes the matrix form:

(M.4.2') $K(t+1) = K(t) - \hat{\underline{\delta}}\ K(t) + I^G(t) = (I-\hat{\underline{\delta}})\ K(t) + I^G(t)$

$t=2,\ldots,8$

With a capital-transfer identity

(M.5) $K^*(t+1) = K(t+1)$

which permits the capital stocks computed as a basic variable in period t using equation (M.4.2') to be translated into the opening capital stock in the next period's sub-problem, the capital capacity constraints for any period t is the same as in equation (M.4.1) and can be stated in matrix form as:

(M.4.1') $\hat{\underline{k}}\ X(t) - K^*(t) \leq 0$

with $K^*(t)$ as the matrix of opening capital stocks.

(iii) The Labour Capacity Constraints

Like capital, the labour capacity constraints state that total utilization of labour must not exceed the availability. That is:

(M.6) $\lambda_j\ X_j(t) \leq \bar{L}_j(t)$ $\qquad t=1,\ 2,\ldots.9$

where the λ_j's are sectoral labour-output ratios and $\bar{L}_j(t)$ is the projected level of labour supply to sector j in target year t.

In a more detailed model, labour would be augmented by population growth and, in multi-skill models, by educational upgrading of different labour skills. In this model, it is assumed that labour in each sector is

homogeneous and that, given the initial sectoral levels of labour supply, labour availabilities in the future will grow at a given fixed rate of 10% per period. Thus, all the future levels of labour supply are prescribed and the process of projection can be represented as:

$$(4.14) \quad \bar{L}(t) = (1+\underset{\sim}{\lambda}^*)^{t-1} L(0)$$

where $\underset{\sim}{\lambda}^*$ is the diagonal matrix of labour-supply growth rates for all the sectors. For this model, equation (M.6) was applied in all periods, with projections of $\bar{L}_j(t)$ based on equation (4.14). The 10% rate of growth in sectoral levels of labour supply is the approximate rate assumed for the period 1975-80, the duration of the Third National Development Plan.

The alternative model - the multi-skill model - is being considered as one of the early extensions of this study. In the multi-skill model, the labour constraint would require that total requirement of any labour skill should not exceed the total availability of that labour skill, i.e.

$$\sum_{j=1}^{13} \lambda_{sj} X_j(t) \leq \bar{L}_s(t)$$

where λ_{sj} is the ratio of labour skill s required per unit of sector j's output and $\bar{L}_s(t)$ is the total supply of labour skill s in period t. A version of this model was applied in the model for Mexico by Keesing and Manne (1973).

(iv) Foreign Trade Activities - Imports and Exports

Most planning models explicitly specify the pattern of foreign trade activities and how they relate to the economy as a whole although the specification would vary from one model to the other. This model incorporates only two major foreign trade activities -- imports and exports. Basically, all imports are assumed to be non-competitive while exports are allowed to be freely determined by the model except in the oil sector where upper boundaries are imposed.

Imports are classified into three main categories according to their different end-uses: imports of final consumption goods, $C_m(t)$; imports of raw materials for inter-industry allocation, $X_m(t)$, and imports of investment goods, $J_m(t)$. Thus aggregate non-competitive imports will be:

$$(4.15) \quad C_m(t) + X_m(t) + J_m(t) = M(t) \qquad t=1, 2, 3,....,9$$

where each import class takes a specific proportion $\alpha_k(t)$ of total imports. Starting from an initial value $\alpha_k(0)$, each of these proportions change, depending on the value of ρ_t^k, the pre-determined rate of growth of the particular class of imports. Whether $\rho_t^k \lesseqgtr 0$ depends on the government policy with regard to the particular class of imports and the process of import-substitution; $\alpha_k(0)$ is the proportion of total non-competitive imports taken by the respective import class in 1974, the initial year of the long-term plan. Thus, the relationship of the import categories to the total is represented as:

(M.7) $C_m(t) = \alpha_C(t)\ M_T(t)$

$X_m(t) = \alpha_X(t)\ M_T(t)$ and

$J_m(t) = \alpha_J(t)\ M_T(t)$ where $\alpha_C(t) + \alpha_X(t) + \alpha_J(t) = 1$

Assuming that the rate of growth of each class of imports remains the same over time (i.e., $\rho_1^k = \rho_2^k = \ldots = \rho_t^k$ for any given class of imports), then, it follows that, starting from the initial proportions, the future proportions of each import class to total imports will be determined by the equation:

(4.16) $\alpha_k(t) = \alpha_k(0)\ [1 + \rho_t^k]^{t-1}$ where k = C, X, J

In effect, equation (4.16) ensures that the import-categories specified in equation (M.7) correspond to

(4.17) $C_m(t) = \alpha_C(0)\ [1 + \rho_t^C]^{t-1}\ M_T(t)$

$X_m(t) = \alpha_X(0)\ [1 + \rho_t^X]^{t-1}\ M_T(t)$ and

$J_m(t) = \alpha_J(0)\ [1 + \rho_t^J]^{t-1}\ M_T(t)$ t=1, 2, 3,....,9

Furthermore, an upper boundary was imposed on the growth of total imports in the economy to induce the domestic production of some of the commodities although the model still allocates imports by end-use. This was imposed in the form:

(M.8) $M(t) \leq (1 + \mu^*)\ M(t-1)$

The growth rate of aggregate imports, μ^*, is specified by government policy and, is one of the parameters employed in the experiments conducted with the model in Chapter 6.

Also, in order to aggregate the sectoral levels of imports in the material balance equation, the following equation was introduced into the model:

$$(M.9) \quad M_T(t) = \sum_{j=1}^{13} M_i(t) \qquad t=1, 2, 3, \ldots, 9$$

As regards exports, specific allowance had to be made for those sectors of the Nigerian economy whose products are not exported at all or constitute such minuscule proportion of total exports that they could be regarded as fully domestic. These sectors include: Utilities, Construction, Trade and Services and Transportation. For the other sectors, except the Oil sector, the level of exports was allowed to be determined from the material balance equation. This specification makes it possible for any sector to contribute to the country's earnings from exports by producing for export whenever such capacity exists, unlike other models where upper and lower boundaries are imposed on export activities.[23] However, because of the essential role the oil sector plays in the model, a constraint was imposed on this sector as follows:

$$(M.10) \quad \sum_{j=1}^{13} \theta_j X_j(t) + E_3(t) \leq \bar{F}(t) \qquad t=1, 2, 3, \ldots, 9$$

where the θ_j's are domestic oil utilization ratios.

This states that total domestic uses of oil plus exports of oil must not

exceed the maximum levels $\bar{F}(t)$, the Naira value of maximum oil production from the oil model. In this way, whilst the model determines oil exports endogenously, it does not violate the maximum levels of production prescribed by OPEC. In a different way, it is possible to find out how much oil the economy will produce in order to finance its development and satisfy its balance of payments requirements. By examining this constraint, it is possible to find out the extent to which the economy's oil production and revenue absorption capacity exceeds or falls short of the levels of production allocated to Nigeria in the oil sub-model to be described in Chapter 5.

(v) Aggregate Constraints

Over and above the basic elements of the model, it was necessary to include the following constraints relating to the balance of payments, foreign exchange availability, domestic savings and national income in the linear programming tableau.

As regards the balance of payments, the model requires that the total uses of foreign exchange must not exceed the total inflow. That is, we require that the total value of imports must not exceed the value of exports.

$$(M.11) \quad M(t) - E(t) \leq 0 \qquad t=1, 2, 3,\ldots,9$$

As regards the savings constraint, the model defines savings as the difference between national income and aggregate consumption. However, it is still possible to specify the savings constraint in a constant proportions form as in equation (M.12.1) or in an incremental form as in

(M.12.2).

(M.12.1) $C_T(t) \leq (1-s)\ Y(t)$ $\qquad t=1, 2, 3,\ldots,9$

(M.12.2) $[C_T(t) - C_T(t-1) \leq (1-s)\ [Y(t) - Y(t-1)]$ $\qquad t=2, 3,\ldots,9$

In either case, the specification is such that by imposing an upper bound on the propensity to save s, we also impose a lower bound on consumption. The basic model used equation (M.12.1).

Along with these constraints, national income was defined in the model as:

(M.13) $Y(t) = C_T(t) + I^G(t) + E(t) - M(t)$ $\qquad t=1, 2, 3,\ldots,9$

although an additional national income growth requirement:

(M.14) $Y(t) \geq (1+g^*)\ Y(t-1)$ $\qquad t=2, 3, 4,\ldots,9$

with $Y(1) \geq \bar{Y}(1)$ was added to ensure the consistency of consumption growth with the overall growth of the economy. This prevents the model from allocating large proportions of domestic production and imports to consumption. Thus, rather than allow the model to eat up its capital stock up to the penultimate period of the plan, when excessive amounts are then allocated to investment, the economy's capital stock is built up gradually over the entire planning horizon.

(vi) Terminal Conditions

Since the long-term model proposed here is only a finite horizon equivalent of an infinite horizon plan, it had to be truncated at an assumed terminal date. The main concern here is to ensure that sufficient capital exists in the immediate post-terminal period to ensure that

consumption, investment and capital stock will continue to grow at the desired rates oven after the plan is terminated. The method adopted in setting the terminal conditions for this model are based on the growth rates of labour supply over the entire planning period.

In equation (4.14), the levels of labour availability during each period was specified to grow from an initial level $\bar{L}(0)$ at a rate $\lambda^* = 10\%$ per period. Thus, by the first post-terminal period of the plan, the level of labour supply will be:

$$(4.18) \quad L_j(T+1) = (1+\lambda_j^*)^T L_j(0)$$

Given the sectoral labour-output ratios, $\hat{\lambda}$, these labour supplies imply output levels in the first post-terminal period equal to $X_j(T+1) = \frac{1}{\lambda_j} L_j(T+1)$. By applying the sectoral capital-output ratios to these then, we can define:

$$(M.15) \quad K_j(T+1) = \frac{k_j}{\lambda_j} L_j(T+1) = \frac{k_j}{\lambda_j} [1+\lambda_j^*]^T L_j(0)$$

This specification was applied in the terminal period to define the minimum levels of $K_j(T+1)$ in every sector.

4.3.3 The Planning Tableau

The foregoing system of equations relating to the objective function and the constraints is summarized in matrix form in Table 4.1. These were then used to construct the tableau for the dynamic planning model as shown in Tables 4.2 and 4.3. Table 4.2 shows the tableau for the first period of the plan and its linkages to the second period through the investment and capital accumulation equations, the growth limits imposed on imports and the minimum growth requirements for consumption and national

income. Table 4.3 shows the same pattern of inter-temporal relationships for any period $t > 1$ and its linkages to the suceeding period. The exact sequence of the sub-problems embodied in the model is shown in Table 4.4. Here, each A_t represents the basic structure of the sub-problem for period t and this is linked to the next period's sub-problem A_{t+1} through the matrix B_t. Thus, the large-scale linear programming problem covering the entire plan assumes a block-diagonal staircase structure.[24] Further details concerning the actual dimensions of the problem in empirical implementation are described in Chapter 6.

4.4 The Adaptability of the Planning Model to Long-Term Planning in Nigeria

As described earlier in Chapter 3, the approach to planning in Nigeria involves the coordination of several sectoral and state plans at the national level within the framework of short-term (five years in the Third Plan) forecasts of the economy's trend. Thus, the introduction of a long-term multi-sectoral planning model that involves the sequential coordination of sub-problems will require certain fundamental changes in the planning machinery as well as in the planning process.

Currently, the Central Planning Office, at the top of the planning machinery, is responsible for the coordination of federal and state plans as well as ensuring the overall consistency of the sectoral plans. However, the model embodied here will require a two level planning framework. We suggest that the proposed National Planning Commission, when it is established, should be charged with the task of multi-sectoral planning on the basis of the model embodied in this study. At the second level, the Central Planning Office would then be charged with drawing up the component's

of each sectoral programme during each period as may be required by the targets prescribed by the corresponding sub-problem of the multi-period planning model at the first level. In carrying out this micro aspect of the planning task, the Central Planning Office would then use the shadow-prices deriving from the inter-temporal planning model for project planning and appraisal. Because these prices are computed on the basis of the entire plan, their use will ensure that each period's sectoral programme is compatible with sectoral programmes in other periods.

This two-level planning framework is feasible for Nigeria since the Central Planning Office is already adequately staffed with sector-specialists; only the establishment of the National Planning Commission will require necessary modification to planning procedures. Also, the incorporation of the model as the basis of a two-level planning sequence ensures that sectoral programmes remain consistent with the national plan and the consequences of shortfalls in plan targets can be monitored. Furthermore, when fully implemented, the model is such that even when any period's sub-problem is revised, its implications for the long-term plan can be traced and necessary modifications can be made to the targets. We believe that this system of planning based on dual-directional flows of information between the Central Planning Office and the proposed National Planning Commission is an appropriate framework for long-term planning in Nigeria.

TABLE 4.1

SUMMARY OF EQUATIONS IN THE PLANNING TABLEAU

A. The following equations are presented in the same way that they appear in the planning tableau - Tables 4.2 and 4.3 Unless otherwise indicated, all the equations apply in all periods.

1. Material Balance Constraints:

$$-(I-A)\,X(t) + \xi^{C}\,C_{T}(t) + E_{g}(t) + B\,I^{G}(t) - M(t) \leq 0$$

2. Capital Capacity Constraints:

$$\hat{k}\,X(t) - K(t) \leq 0$$

3. Labour Capacity Constraints:

$$\hat{l}\,X(t) \leq \bar{L}(t)$$

4. Capital Accumulation:

$$-I^{G}(t) - (1-\hat{d})\,K(t) + K(t+1) = 0 \qquad t=1, 2, \ldots, 8$$

5. Imports of Consumer Goods:

$$C_{m}(t) = a_{c}^{C}\,M_{T}(t)$$

6. Imports of Raw Materials:

$$X_{m}(t) = a_{x}^{C}\,M_{T}(t)$$

7. Imports of Investment Goods:

$$J_{m}(t) = a_{J}^{C}\,M_{T}(t)$$

8. Total Imports:

$$M_{T}(t) - \hat{i}'\,M(t) = 0$$

9. Balance of Payments Constraint:

$$M_{T}(t) - \hat{i}_{g}'\,E_{g}(t) \leq 0$$

10. Savings Constraint:

$$C_{T}(t) - (1-s)\,Y(t) \leq 0$$

11. National Income:

$$-M_{T}(t) + C_{T}(t) + E_{g}(t) + I^{G}(t) - Y(t) = 0$$

12. Upper Bounds on Oil Production:

$$\hat{g}'\,X(t) + E_{g}(t) \leq \bar{F}(t)$$

B. The following equations are the basic linkage equations in the model and generally apply for periods 2 to 9 inclusive.

Capital Accumulation Equation (same as 4 above):

$$-I^{G}(t-1) - (1-\hat{d})\,K(t-1) + K^{*}(t) = 0$$

with $K^{*}(t) = K(t)$

Imports Growth Limit:

$$-(1+\mu^{*})\,M_{T}(t-1) + M_{T}(t) \leq 0$$

Minimum Growth Rate of Consumption:

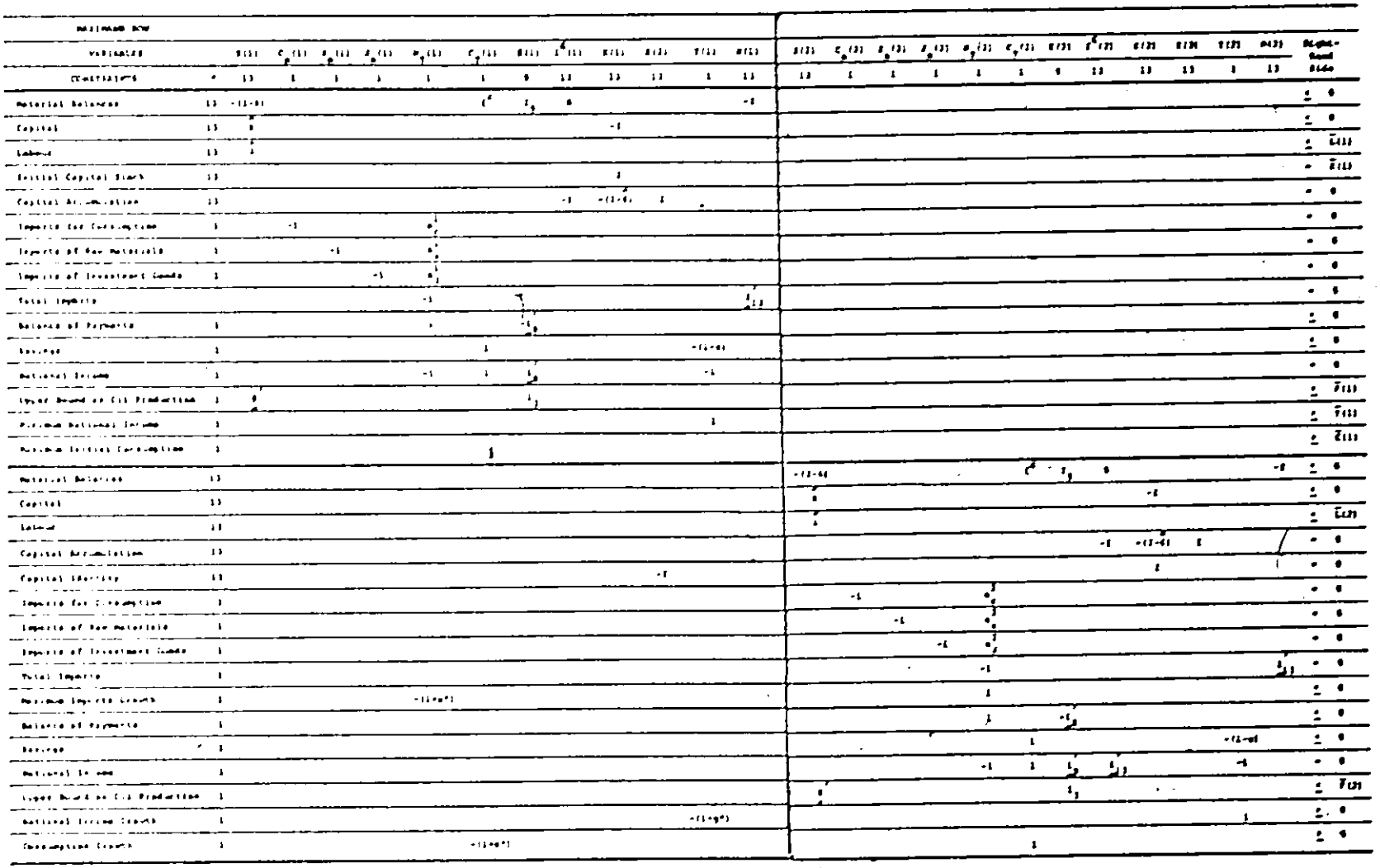
$$-(1+c^{*})\,C_{T}(t-1) + C_{T}(t) \geq 0$$

Minimum Growth Rate of National Income:

$$-(1+g^{*})\,Y(t-1) + Y(t) \geq 0$$

Table 4.3

The Planning Tableau for the First Period Showing its Linkages with the Second Period



Note: * The numbers in this row indicate the number of unique vectors (new constraints) relating to each of the unknown variables (specified constraints).

Table 4.3

The Planning Tableau for Any Period T Showing Its Linkages with Period T+1

MAXIMAND ROW																											
VARIABLES		X(t)	$C_p(t)$	$R_p(t)$	$J_p(t)$	$M_T(t)$	$C_T(t)$	B(t)	I(t)	K(t)	K(t+1)	Y(t)	H(t)	X(t+1)	$C_p(t+1)$	$R_p(t+1)$	$J_p(t+1)$	$M_T(t+1)$	$C_T(t+1)$	B(t+1)	I(t+1)	K(t+1)	K(t+2)	Y(t+1)	H(t+1)	Right-Hand Side	
CONSTRAINTS	*	13	1	1	1	1	1	9	13	13	13	13	13	13	1	1	1	1	1	9	13	13	13	13	13		
Material Balances	13	-(I-A)					c^c	i_g	a				-g													≤	0
Capital	13	k								-I																≤	0
Labour	13	l																								≤	$\bar{L}(t)$
Capital Accumulation	13								-I	-(I-δ)	I															=	0
Capital Identity	13									I																=	0
Imports for Consumption	1		-1			a_c^t																				=	0
Imports of Raw Materials	1			-1		a_r^t																				=	0
Imports of Investment Goods	1				-1	a_j^t																				=	0
Total Imports	1					-1							i_{13}													=	0
Maximum Imports Growth	1					1																				≤	0
Balance of Payments	1					1		$-i_g$																		≤	0
Savings	1						1					-(1-s)														≤	0
National Income	1					-1	1	i_g	i_{13}			-1														=	0
Upper Bound on Oil Production	1	f						i_j																		≤	$\bar{F}(t)$
National Income Growth	1											1														≤	0
Consumption Growth	1						1																			≤	0
Material Balances	13													-(I-A)					c^c	i_g	a				-g	≤	0
Capital	13													k								-I				≤	0
Labour	13													l												≤	$\bar{L}(t+1)$
Capital Accumulation	13																				-I	-(I-δ)	I			=	0
Capital Identity	13										-I											I				=	0
Imports for Consumption	1														-1			a_c^{t+1}								=	0
Imports of Raw Materials	1															-1		a_r^{t+1}								=	0
Imports of Investment Goods	1																-1	a_j^{t+1}								=	0
Total Imports	1																	-1							i_{13}	=	0
Maximum Imports Growth	1					$-(1+\mu^*)$												1								≤	0
Balance of Payments	1																	1		$-i_g$						≤	0
Savings	1																		1					-(1-s)		≤	0
National Income	1																	-1	1	i_g	i_{13}			-1		=	0
Upper Bound on Oil Production	1													f						i_j						≤	$\bar{F}(t+1)$
National Income Growth	1											$-(1+g^*)$												1		≤	0
Consumption Growth	1						$-(1+c^*)$												1							≤	0

Notes: This tableau applies to any period t+1 up to the terminal period.

*The numbers in this row (column) indicate the number of column-variables (row constraints) relating to each of the unknown variables (specified constraints).

Table 4.4

The Structure of the Large-Scale Linear Program for the Dynamic Multi-Sectoral Planning Model

MAXIMAND ROW	ω_1	ω_2	ω_3	ω_4	ω_5	ω_6	ω_7	ω_8	$\omega_9+V'K(9)$	right-hand side
T = 1	A_1									d_1
T = 2	B_1	A_2								d_2
T = 3		B_2	A_3							d_3
T = 4			B_3	A_4						d_4
T = 5				B_4	A_5					d_5
T = 6					B_5	A_6				d_6
T = 7						B_6	A_7			d_7
T = 8							B_7	A_8		d_8
T = 9								B_8	A_9	d_9

FOOTNOTES

(to Chapter 4)

[1]Although the origins of development planning are often traced to the evolution of the theory of economic growth, the major breakthroughs leading to the unification of the quantitative and qualitative analysis now embodied in the theory of development planning are directly attributable to the works of P.N. Rosenstein-Rodan, W.W. Leontief, Ragnar Frisch, Hollis Chenery and Jan Tinbergen among the several other pioneers of the immediate post-war years.

[2]Spulber, N. and I. Horowitz, Quantitative Economic Policy and Planning, (New York, W.W. Norton & Co., 1976), pp. 153-154.

[3]Kalecki, M., Introduction to the Theory of Growth in a Socialist Economy, (Oxford, Blackwell, 1969).

[4]Mahalanobis, P.C., "The Approach of Operational Research to Planning in India", Sankhya, vol. 16, 1955. This model has been subsequently elaborated and has constituted the foundation for several more advanced planning models now used in India. See Bhagwati, J.N. and S. Chakravarty, "Contributions to Indian Economic Analysis: A Survey", American Economic Review, Vol. 59, 1969 for a more detailed description.

[5]See United Nations, Programming Techniques for Economic Development, (Bangkok, United Nations, 1961).

[6]The alternative to the open Leontief model is the 'closed' model in which some of the elements of final demand are solved for endogenously. This closure is obtained by including these components in the matrix inversion process involved in the calculation of sectoral production levels.

[7]See Clark, P.B., "Intersectoral Consistency and Macroeconomic Planning" in Blitzer, C.R., L. Taylor and P.B. Clark, Economy-Wide Models and Development Planning, (London, Oxford University Press, 1975), Chap. 5, for examples of the applications of the static input-output model.

[8]See Stone, R., "The Use of Social Accounting Matrices in Building Planning Models" in his Mathematical Models of the Economy and Other Essays, (London, Chapman and Hall, 1967) and also Bacharach, M., Bi-proportional Matrices and Input-Output Change, (Cambridge, Cambridge University Press, 1970).

[9]Since many of the elements of B will be zero in a typical developing country where many sectors produce only for current final demand, the presence of B in the model could lead to problems in matrix inversion. However, there are many techniques for dealing with this problem.

[10]When the change in output responds to investment with a gestation lag different from the length of each planning period, equation (4.5) takes the form:

$$(4.5') \quad D(t) = \hat{k}\,[X(\tau) - X(t)]$$

where the gap τ-t represents the gestation lag. Generally, the length of the gestation period in relation to the length of each planning period has an effect on the model's adjustment to a set of balanced sectoral growth patterns and may lead to problems of stability for the whole system.

[11]Note that the vector F(t) now represents all final demands excluding investment and that the proportionality assumption that $K(t) = \hat{k}X(t)$ has been used so that the k_j's can be interpreted as simple capital-output ratios.

[12]See Lance Taylor, (1975), "Theoretical Foundations and Technical Implications" in Blitzer, C.R., L. Taylor and P.B. Clark, (1975), Economy-Wide Models and Development Planning, op. cit., Chapter 3, page 54. Among the considerable literature on the instability of dynamic input-output models, the most notable are by Chakravarty and Eckaus (1964), Burmeister and Dobell (1970), Chakravarty (1969) and Jorgenson (1961).

[13]The recursive procedure also offers the possibility that the multi-period matrix may be broken down into a series of more manageable single-period matrices and this decomposition procedure can be particularly useful when the multi-period matrix exceeds the capacity of the available computing equipment. See Leontief, W.W., "The Dynamic Inverse" in A. Carter and A. Brody, eds., Contributions to Input-Output Analysis, (Amsterdam, North-Holland, 1970) and comments on this paper by David Kendrick, "On the Leontief Dynamic Inverse", Quarterly Journal of Economics, Vol. 86, 1972, pp. 693-696.

[14]See Murakami, Y., K. Tokoyama and J. Tsukui, "Efficient Paths of Accumulation and the Turnpike of the Japanese Economy", Chapter 2 of Carter and Brody eds., op. cit., for a classic example of the application of the dynamic Leontief model.

[15]Several studies including those of Manne and Weisskopf (1970) and Bruno, Fraenkel and Dougherty (1970) have tried to overcome this problem by devising size-reduction procedures. This is considered unnecessary in the light of recent advances in computer technology and the design of solution algorithms.

[16]See Lance Taylor, Theoretical Foundations and Technical Implications", op. cit., Section 4.1 and 4.2 for a more detailed discussion of this topic. A similar technique is demonstrated in Clark, P.B., Planning Import Substitution, (Amsterdam, North-Holland, 1970).

[17]See Intrilligator, M.D., Mathematical Optimization and Economic Theory, (Englewood Cliffs, N.J., Prentice Hall, 1971), Chapter 14.

[18]See Eckaus, R.S. and K.S. Parikh, Planning for Growth: Multi-Sectoral Intertemporal Models Applied to India, (Cambridge, Mass., M.I.T. Press, 1968); Manne, A.S., "DINAMICO: A Dynamic Multi-Skill Model for Mexico" in Goreux, L.M. and A.S. Manne, eds., Multi-Level Planning: Case-Studies in Mexico, (New York, North-Holland/American Elsevier, 1973) and Clark, P.B. and A. Foxley, "Target Shooting With a Multi-Sectoral Model", in Eckaus, R.S. and P.N. Rosenstein-Rodan, eds., Analysis of Development Problems: Studies of the Chilean Economy, (Amsterdam, North-Holland, 1973).

[19]One major problem that has attracted attention with regard to these Walrasian equilibrium models is that of aggregation of capital and labour which is an offshoot of the Cambridge criticism. See Lance Taylor, "Theoretical Foundations and Technical Implications", in Blitzer, C.R., L. Taylor and P.B. Clark, Economy-Wide Models and Development Planning, op. cit., p. 98.

[20]Carter, N.G. (1963), "An Input-Output Analysis of the Nigerian Economy 1959/1960", Working Paper #29-63, M.I.T. School of Industrial Management, Cambridge, Massachusetts. Also in the Appendix to W.F. Stolper, Planning Without Facts (Cambridge, Mass., Harvard University Press, 1966), p. 323.

[21]The National Accounts Commission was set up in 1974 to construct a complete set of accounting tables, including input-output and capital matrices, for Nigeria. So far, the results of the Commission's work have neither been approved by the Supreme Military Council nor been officially published.

[22]Manne, Alan S. "Sufficient Conditions for Optimality in an Infinite Horizon Development Plan", Econometrica, Vol. 38, 1970, pp. 18-38.

[23]See Bruno, M., C. Dougherty and M. Fraenkel, "Dynamic Input-Output, Trade and Development", in Carter A.P. and A. Brody, eds., Applications of Input-Output Analysis, Chapter 3.

[24]The problem has been so structured to make it easily adaptable to a proposed application of the Nested Decomposition algorithm in future applications. See Ho, J.K., "Nested Decomposition of Large-Scale Linear Programs With the Staircase Structure", Technical Report #74-4, Systems Optimization Laboratory, Department of Operations Research, Stanford University, Stanford, California, May, 1974.

CHAPTER 5: A MODEL OF THE OIL SECTOR AS A SOURCE OF FUNDS FOR NIGERIA'S PLANS

5.1. Introduction

For most developing countries, the availability of domestic savings and foreign exchange in adequate amounts constitutes a major resource constraint to their development ambitions since such funds must be available if the development projects outlined in their plans are to be implemented. The realization that the availability of such funds for financing investment projects can improve the prospects of development, if not actually enhance the progress toward development, has led to the 'two-gap' theory concerning the relative importance of the domestic savings gap and the foreign exchange gap in financing economic development.

Generally, developing countries have had to rely on the inflow of foreign capital to finance their development programmes since the governments in these countries have very narrow capabilities for generating domestic savings through conventional fiscal measures or for using commercial policies to generate revenues from foreign trade, given their low incomes and limited involvement in foreign trade. However, the reliance on external finance has short-term benefits as well as serious long-term implications. In the short run, the inflows of foreign capital may be viewed as injections which may permit the country to achieve a higher growth target than would be possible without such capital inflows. But there is also the long-term implication that resources must eventually be withdrawn from the economy as profits are remitted abroad and outstanding loans and debts are amortized. Recent evidence indicates that some less-developed countries have been

caught in the debt-trap implied by the need to secure additional foreign assistance to meet their payments on outstanding loans.

Since the oil crisis of 1973, there has emerged a new class of developing nations, namely the Petroleum Exporting Countries, whose distinctive features have posed a great challenge to the dictum that the major cause of underdevelopment is the shortage of financial capital. Although these countries have as many heterogenous characteristics as similar ones, they generally have surplus supplies of financial capital and labour but limited supplies of physical capital and labour skills. Thus, many of them face the problem of developing a production structure that would enable them to invest domestically and transform their excess supplies of financial capital into productive human and physical capital over time. In the aftermath of the increases in oil-price in 1973, many of these countries resorted to ad-hoc decision rules in the investment of their surplus oil revenues since the inflow of such funds was sudden and there was no systematic evaluation of the alternative patterns of capital inflow or the utilization of such funds. Nigeria, being a member of the Organization of Petroleum Exporting Countries (OPEC), was one of these countries and, like the other members of OPEC, was involved in the haphazard allocation of petrodollars in the wake of the unanticipated oil boom.

The purpose of this chapter is to develop a model with which the inflow of oil funds can be reasonably anticipated thus enabling Nigeria to tailor her development programme to the expected inflow of oil funds. We start with a brief review of the conventional sources of funds for financing Nigeria's development plans as well as a discussion of the remarkable shift from the conventional sources to reliance on the oil sector as a source of

finance in the Third National Development Plan, 1975-1980. We then present a dynamic programming model of the world oil market in which OPEC is assumed to be a monolithic residual supplier of oil seeking to maximize the present value of the stream of joint profits accruing to its members. Next, the resulting optimum production levels are allocated to individual OPEC countries on the basis of certain rationing criteria reflecting their historical production levels, existing and future production capacities as well as their capacities to absorb oil revenues. The last section of the chapter discusses the allocation to Nigeria from the OPEC maximization model and derives alternative patterns of the inflow that could be expected, given some particular changes in the parameters of the basic model.

5.2: Sources of Finance in Nigeria's Post-Independence Plans

Starting from the Ten-Year Plan of Development and Welfare 1946-56, Nigeria, like most other developing countries, has come to rely on the government to provide a dominant proportion of financial resources for development planning. This is especially so because, given the shortage of domestic savings, private investment necessarily depends on the inflow of foreign capital which may sometimes be erratic. The initial attempt at development finance in Nigeria was an outgrowth of the colonial government's policy of ensuring that the colonies paid for themselves although the Ten-Year Welfare Plan had been proposed as a basis for the disbursement of development grants to Nigeria, along with other colonies. The important impact of this Ten-Year Plan on subsequent methods of development finance in Nigeria can be seen from the fact that, of its total estimated cost of ₦ 106.8 million, 43% was to be provided from the Colonial Development and Welfare Funds, 27% from

the Nigerian Treasury and the balance of 30% from external loans. Furthermore, these funds were to be disbursed on the basis of existing departmental budgets and proposals. Thus, from the start, the method of development finance has relied heavily on budgetary resources of the government as well as on the inflow of external grants and loans.

In discussing the sources of finance in Nigeria's Development Plan, therefore, we have to distinguish among the plans according to the extent to which they have relied on foreign resources vis-á-vis domestic resources as sources of development funds. With regard to the three post-independence plans discussed earlier, there has been a gradual shift in the pattern of finance from the 50% reliance on external funds in the First Plan (1962-68), through the reduced dependence on foreign capital (only 19.4%) in the Second Plan (1970-74) to the almost total dependence on domestic resources in the Third Plan (1975-80). The schemes for development finance embodied in these three plans warrant individual discussions and evaluation.

Nigeria's First National Development Plan 1962-68, launched only two years after independence, inevitably continued with the patterns of development finance that had characterized the pre-independence plans. Although the economy's prospects were bright and the country's export crops were doing well in the international commodity markets, the total volume of the plan and its implied financial requirements of ₦ 1,307.6 million required more funds than could be provided from these sources. Traditionally, domestic funds for development finance came from the recurrent budget surpluses of the various governments, from domestic borrowing through the issue of Development Stocks, from revenue surpluses of the marketing boards and from

the internal resources of the statutory corporations. These were normally augmented by grants-in-aid from the Colonial Office as well as inflows of private capital investment and technical assistance from abroad. However, the attainment of independence changed the existing pattern of relationships and, for the first time, the planners had to make a detailed, systematic and logically consistent plan of the inflow of financial resources for the First National Development Plan. The approach to financial planning adopted by the planners for the First Plan has become a major characteristic that set it apart from subsequent plans.

The planners proceeded by estimating the possible contributions from the traditional sources of funds after detailed consultation with the appropriate government agencies and a careful consideration of the determinants of government revenue. To this extent, the Central Bank of Nigeria gave its advice on the amount of domestic borrowing that could take place while keeping inflation within expected limits whilst the estimates of budget surpluses were made on the basis of expected growth in recurrent government spending and revenue. However, the estimation of financial requirements from external sources was carried out on an entirely different basis. Each government was supposed to limit its capital expenditure programme to twice the amount that it could provide by itself and was permitted to assume that the balance of such funds would be provided by foreign aid, thus guaranteeing that at least 50% of the total public investment programme would be financed from foreign sources.[1] Irrespective of the planners' intentions, this seemingly generous 'offer' of foreign 'aid' has been considered dubious especially since it included contractor finance and suppliers credits which were often made on terms that were scarcely conces-

sionnary.

The planned sources of funds for the First Plan as well as the actual sources of funds are shown in Table 5.1. Of the ₦ 1,307.6 million public sector investment programme for the First Plan, ₦ 654.2 million or more than 50% was expected to be procurred from external sources while domestic borrowing was expected to provide ₦ 151.4 million or 11.6% of the estimated financial requirements. As it turned out, the First Plan was suspended at the outbreak of the Nigerian civil war in 1967 thus limiting our comparison of the planned and actual sources to the first four years of the plan. The performance of the various sources of finance during the period 1962-1966 indicates that those sources that depended on the Nigerian economy performed better than expected and could not be blamed for the Plan's failure, whereas foreign aid inflow during the period proved grossly inadequate in both its volume and proportions. Compared with their four-year equivalent of the six-year programme, the government recurrent budget surplus and domestic borrowing more than fulfilled their planned targets with the surpluses over the plan targets amounting respectively to ₦ 104 million and ₦ 91.63 million within the first four years of the plan. These two sources alone contributed approximately 50% of total public investment as compared to the 15.9% they were expected to contribute. The other domestic sources - the internal resources of federal statutory corporations and the marketing boards - suffered some shortfalls, resulting mainly from the poor performance of Nigeria's export crops and the endemic inefficiency of the statutory corporations. The surprising shortfall in the inflow of foreign aid which led this source to contribute only 23.4% rather than the estimated 50% during the first four years of the plan has been blamed on the government's

reliance on contractor-finance and suppliers credits during the four years. However, it is equally true that such dependence on these unusual sources would not have been necessary if foreign aid inflow had been at the pace anticipated when the plan was launched. Of course, this inadequate inflow of foreign financial resources implied serious distortions to the plan's effective programme and much of the plan's overall poor performance could be blamed on irregularities in the planning and actual inflow of financial resources.

The frustrations experienced as a result of dependence on external resources which failed to materialize led the drawers of the Second Plan to examine the pattern of public expenditure more closely with a view to distinguishing those items that are income-generating from those that are revenue-absorbing and also to link public spending with the planning effort in a consistent way. Furthermore, the fact that the economy had shown great resilience in the face of the extreme scarcity of foreign exchange implied by the Nigerian civil war induced a special emphasis on self-reliance in the Second Plan. The specific circumstances of the immediate post-war economy were so precarious that a carefully planned scheme for development finance was necessary. The war years had created a large amount of public debt and a backlog of foreign debts and the real challenge was to find a means of reducing this backlog and rebuilding the country's balance of payments reserves to ensure the stability of the Naira while also financing the foreign exchange requirements implied by the massive capital required to fulfill the post-war reconstruction plan. Thus, it was clear from the start that the availability of financial resources would be a bottleneck and that foreign resources would have to be relied on during

the Second Plan.

However, the planners chose to draw upon the dynamism of the Nigerian economy by adopting a disciplined foreign exchange budget backed by stringent import restrictions in the belief that the economy's resources could be mobilised by the appropriate use of monetary and fiscal policies. Thus the financing assumption of the plan was that the bulk of the expenditure on current and capital accounts will come from internally generated private and public savings and other domestic resources with external capital acting only as a supplementary source of finance. To this extent, the state governments were expected to finance their public infrastructural programmes by the responsible use of marketing boards surpluses whilst the statutory corporations were expected "to become more efficient, viable and profitable, such that they would add to rather than detract from the pool of resources available for financing the nations development".[2] The Central Bank was expected to provide the necessary framework for accelerating the pace of development activity while maintaining monetary stability.

Under these assumptions, the Plan anticipated that more than 80% of its total public investment programme of ₦ 1,560 million would be mobilized from internal sources. A large proportion of this - over ₦ 900 million or 57.7% of the total programme - was to be provided through recurrent budget surpluses while the Central Bank was expected to raise ₦ 144.6 million through domestic borrowing over the four years. The statutory corporations and the marketing boards were expected to contribute only 5.1% and 8.6% of the total public programme, respectively. Although the proportions contributed by the domestic items remained fairly similar to those in the First Plan, the main distinguishing feature of the Second Plan was its limited

reliance on foreign sources; the projected foreign exchange gap was only ₦ 302 million or 19.4% of the total public investment programme which was a dramatic change from the 50% projected in the First Plan. Furthermore, such foreign capital inflows were expected to take the form of programme support and sectoral loans of the "soft" and conventional types instead of the project-tied loans and ad-hoc credit arrangements of the First Plan.[3]

The performance of the various sources of finance for the first three years are shown in Table 5.2. This table shows that for the three years, the total available financial resources amount to ₦ 1,492.8 million which was greater than the planned receipts of ₦ 1,240.4 by more than ₦ 252 million. This was mainly due to the steady increase in the contribution made by recurrent budget surpluses of governments which consistently exceeded the planned receipts from this source throughout the period covered. The performance of domestic sources would have been better but for the shortfalls in domestic borrowing which, while exceeding the initial planned receipt of ₦ 144 million, fell short of the revised targets by wide margins in the first two years and by more than ₦ 178 million over the three years. The two other domestic sources performed fairly well, with the marketing boards surpluses contributing ₦ 324.6 million, ₦ 190 million more than the planned receipt of ₦ 134.0 during the entire plan. In contrast, the contribution from external finance was very poor, reaching only 9.5% of aggregate capital receipts over the three years as against the 18.3% estimated for the first three years. Of the ₦ 227.6 million anticipated, the inflow of external finance was only ₦ 142.4 million, registering a shortfall of more than ₦ 85.2 million. This low level of external resource inflow was blamed mainly on "the slow rate of disbursement of negotiated and committed aid,

particularly project aid".[4] However, it is noteworthy that towards the end of the plan period, the economy had begun to receive massive inflows of foreign exchange following the increase in oil-prices by OPEC in 1973. The volume of the inflow was so much that the scheme for development finance underwent a complete overhaul by the time the Third Plan was drawn.

With the background provided by the massive inflow of oil funds in 1973 and 1974, the planners laid out the logical basis for financial arrangements during the Third National Development Plan, 1975-80 in the Guidelines for the Third National Plan as follows:

> "As far as the next Development Plan is concerned foreign exchange is unlikely to feature as a major problem. In fact, official projections indicate that after financing all external transactions relating to both current and capital needs, it may be possible to add to our external reserves about ₦ 1,500 million during the Third Plan period alone."[5]

This expressed optimism was not only a drastic change from the conventional methods of development finance but it also indicated that the economy had now fully recovered from the ravages of war and was substantially capable of meeting its own foreign exchange requirements. The immediate problem then was to find ways by which the revenues earned from oil could be used to permanently increase the economy's productive capacity. This was particularly necessary since oil is an exhaustible resource and schemes need to be found for internalising the benefits accruing to this rapidly growing sector and for purposefully investing the surplus revenues to create the necessary economic and social infrastructure for self-sustaining growth and on which the economy could thrive even after the oil reserves are exhausted.

The result of these optimistic projections are shown in Table 5.3 which is completely different from the traditional analysis of the sources

of finance for the previous plans. The striking observation here is that the planners had shifted from relying on budgetary surpluses, domestic borrowing and Marketing Board surpluses to an almost complete reliance on the oil sector as the source of finance over the entire five-year plan period. Based on a new scheme for resource allocation among all the states in the Federation, the Third Plan estimated a recurrent budget surplus amounting to over ₦ 26.739 billion over the five-year period of which ₦ 17.726 billion was to be raised from the additions to reserves from the foreign exchange budget shown in Table 5.3. Within the context of national economic planning, each state was supposed to be responsible for those programmes within its area of jurisdiction whilst the Federal Government undertook those programmes that were thought to be strategic to the Plan's success. Furthermore, the Federal Government also offered grants to the states to give priority to particular sectors that had suffered from the scarcity of resources in the earlier plans.

Judging from the volume of financial resources actually available during the first year of the plan, the initial estimates were too optimistic; the buoyant financial picture painted by the planners had suddenly vanished. As a result of cut-backs in oil production consequent upon the world-wide depression that was underway in 1975, Nigeria suffered a ₦ 2.557 billion shortfall in revenues from oil exports and this implied serious financial consequences for the whole plan. The government budgetary surplus amounted to only ₦ 2,224.2 million which was more than ₦ 2.6 billion short of the ₦ 4.8 billion anticipated by the planners. This also meant that only 46% of the anticipated funds was available in the first year of the plan. In all, the overall short-fall in the availability of financial resources

amounted to about ₦ 2.177 billion.[6]

The poor performance recorded by the Third Plan's financial budget in the first year can be blamed less on the unanticipated decline in oil exports but more on the haphazard methods by which oil revenues were projected for the plan. Although the planners' optimism was justified in the light of the rapid increases in oil revenues following the OPEC price hikes in 1973, there was no attempt made to systematically model the inflow of oil funds and specifically incorporate such a model into the planning framework adopted for the Third Plan. It is our belief that the world petroleum industry is too complex to be modelled by the simple projections used in the Third Plan. A model for specifically programming the inflow of oil funds into Nigeria as a member of OPEC is suggested in the next section. This model is such that the time pattern of the inflow of oil revenue can be generated within an OPEC-wide model and the consequences of such flows and deviations from them can be consistently evaluated within the context of the planning model outlined in Chapter 4.

5.3 The Oil Sub-Model: Optimal OPEC Production in a Stable World Market

The future prospects of the world oil industry have been a subject of great practical interest to both economists and policy makers, especially with regard to the optimal rate of depletion of a non-renewable resource. Thus, since the oil embargo of 1973 and the subsequent revisions in the price of oil by OPEC, the world oil industry and its future prospects have become the subject of several research efforts. Based on analytical frameworks similar to the original paper by Hotelling (1931) and subsequent refinements of the theory of exhaustible resources by Gordon (1967), Smith

(1968) and Solow (1974), most of these studies have attempted to predict the future prospects of the world oil market with particular reference to OPEC.

Some of these studies, including those by Adelman (1972), Hughes, Mesarovic and Pestel (1974), Nordhaus (1973) and Kennedy (1974), have approached the problem from the consuming nations' point of view by concerning themselves more with possible responses to OPEC price-setting behaviour and the possibilities of substituting other energy sources for OPEC oil. Other studies, notably those by Blitzer, Meeraus and Stoutjesdijk (1975), Kalymon (1975), Kyle and Moskowitz (1975) and Gately and Kyle (1977), have emphasized the economic motivations behind OPEC's pricing strategies, production decisions and capacity expansion policies as well as the implications of the current production decisions and market sharing schemes for the short-term and long-term interests of OPEC. However, most of these studies have been essentially non-dynamic in either their structure or methods of analysis and have therefore yielded results that have proven both incorrect and inappropriate judging by developments in the world oil market since 1973.[8] More recent models have come to recognize the predominance of economic factors in OPEC's behaviour as well as the relevance of the depletion of oil reserves to the long-term prospects of the world oil market. The latter factor has given rise to other studies on the augmentation of oil reserves through exploration, notably those by Bradley (1967), Uhler (1977), Cox and Wright (1974) and Culler and Cummings (1974).

Within the context of this study, the most interesting of these studies have been those that have tried to extend Hotelling's original study of the monopolistic pricing of exhaustible resources to include both the

export and domestic consumption aspects of the decision problem facing an oil producer. Among these, two studies - Kalymon (1975) and Kyle and Moskowitz (1975) - are noteworthy especially with regard to their depth of perception of the problem facing OPEC and their inclusion of the depletion of oil reserves among the major factors influencing OPEC behaviour. However, the model proposed in this study, while possessing certain similar characteristics to these studies, is different in its analytical framework and has a distinct two-tier approach to the analysis of OPEC production strategies.

5.3.1: The Model

The general framework of most OPEC-allocation models often starts from the determination of the world demand for oil and the proportion of it satisfied by non-OPEC supply. The difference between these, the residual demand for oil, is then assumed to be supplied by OPEC acting as a unified entity. However, such an approach precludes the possibility that OPEC's long-term interest may not necessarily be best served by a production policy that seeks to fully satisfy this residual demand for oil. This study formulates a model of OPEC as a monolithic oil-producing monopolist seeking to maximize the discounted stream of profits accruing to its members over time by the appropriate choice of a production profile, such that total oil extraction during the planning horizon does not exceed the total known reserves.[9] Furthermore, many of the existing studies have differed not only by their method of solution but also by their assumptions regarding future conditions in the world oil market especially with regard to short-run and long-run patterns of market responses, the treatment of

the domestic demand for oil and the role of OPEC's production capacity and potential predatory policies on production decisions.

In studies based on the Kalymon-type model of OPEC behaviour, the demand for OPEC oil is treated as a function of price at each point in time and is allowed to change with growth in market size. Although these studies set the problem within the framework of dynamic programming, their solution techniques generally employ Lagrangean optimisation methods. This method of solution does not fully incorporate the dynamic nature of the problem or the monopolistic properties implied by OPEC's dominance of the world oil market and its complete control of the residual demand for oil. Instead, OPEC's desire to maximize the discounted stream of profits from oil production accruing to its members, J(t), is formulated within the framework of the calculus of variations as follows:

$$\text{(5.1)} \qquad \text{Maximize } J(t) = \int_0^T [R(q) - C(q,x)]e^{-rt}\, dt$$

where r is the rate of discount, R(q) is the revenue function which depends on the quantity of oil extracted per period, q(t), and C(q,x) is the cost function which depends not only on the quantity of oil extracted but also on the cumulative extraction, x(t). The latter reflects the assumption that the cheapest oil is extracted first and thus takes account of the increasing cost of oil extraction over time.[10]

Since the rate of change of cumulative extraction at time t is equal to the rate of production, $\dot{x}(t) = q(t)$, the objective functional in (5.1) can be restated as:[11]

$$\text{(5.2)} \qquad \text{Maximize } J(t) = \int_0^T [R(\dot{x}(t)) - C(\dot{x}(t), x(t))]e^{-rt}\, dt$$

The only constraints explicitly incorporated into the problem are the initial and terminal conditions which specify that cumulative extraction in the initial period is zero but must not exceed the total known reserves, $\overline{X}$, in the terminal year although the terminal year, T, is not known and is therefore assumed to be variable. Thus, (5.2) is to be maximized subject to the constraints:

$$(5.3) \qquad x(0) = 0 \qquad \text{and} \qquad x(T) \leq \overline{X}$$

The first-order necessary condition for an optimal solution to this problem is described by the Euler equation which requires that:

$$(5.4) \qquad \frac{\partial J(t)}{\partial x(t)} - \frac{d}{dt}\left(\frac{\partial J(t)}{\partial \dot{x}(t)}\right) = 0$$

for all t during the planning horizon.

From our model, we have the following:

$$\frac{\partial J(t)}{\partial x(t)} = -\left\{\frac{\partial C(\dot{x}, x)}{\partial x}\right\}e^{-rt}$$

$$\frac{\partial J(t)}{\partial \dot{x}(t)} = \left\{\frac{\partial R(\dot{x})}{\partial \dot{x}} - \frac{\partial C(\dot{x}, x)}{\partial \dot{x}}\right\}e^{-rt}$$

and

$$\frac{d}{dt}\left(\frac{\partial J(t)}{\partial \dot{x}(t)}\right) = -re^{-rt}\left\{\frac{\partial R(\dot{x})}{\partial \dot{x}} - \frac{\partial C(\dot{x}, x)}{\partial \dot{x}}\right\} + \left\{\frac{\partial^2 R(\dot{x})}{\partial \dot{x}^2}\ddot{x} - \frac{\partial^2 C(\dot{x}, x)}{\partial \dot{x}^2}\ddot{x} - \frac{\partial^2 C(\dot{x}, x)}{\partial \dot{x}\,\partial x}\dot{x}\right\}e^{-rt}$$

Substituting these into (5.4), we get:

$$(5.5) \qquad -\frac{\partial C}{\partial x}e^{-rt} + re^{-rt}\left\{R'(\dot{x}) - \frac{\partial C}{\partial \dot{x}}\right\} - e^{-rt}\left\{R''(\dot{x})\ddot{x} - \frac{\partial^2 C}{\partial \dot{x}^2}\ddot{x} - \frac{\partial^2 C}{\partial \dot{x}\,\partial x}\dot{x}\right\} = 0$$

which yields the following equation of motion:

$$\ddot{x} = \frac{\frac{\partial^2 C}{\partial \dot{x}\,\partial x}\dot{x} - \frac{\partial C}{\partial x} + \{r R'(\dot{x}) - \frac{\partial C}{\partial \dot{x}}\}}{\{R''(\dot{x}) - \frac{\partial^2 C}{\partial \dot{x}\,\partial x}\}} \tag{5.6}$$

By use of the definitional relationship $\dot{x}(t) = q(t)$, we can convert equation (5.6) into a pair of equations of motion which describe the optimal profile of resource extraction and the rate of change in oil production along this optimal path:

$$\dot{q}(t) = \frac{\frac{\partial^2 C(q,x)}{\partial q\,\partial x} q - \frac{\partial C(q,x)}{\partial x} + r\{R'(q) - \frac{\partial C(q,x)}{\partial q}\}}{\{R''(q) - \frac{\partial^2 C(q,x)}{\partial q^2}\}} \tag{5.7}$$

$$\dot{x}(t) = q(t)$$

The second-order condition for optimality is defined by the Legendre condition which requires that

$$\frac{\partial^2 J(t)}{\partial \dot{x}^2} \leq 0,$$

that is:

$$e^{-rt}\{R''(q) - \frac{\partial^2 C(q,x)}{\partial \dot{x}^2}\} \leq 0.$$

This condition, it turns out, requires characteristics that are typically satisfied in the monopoly case such as increasing marginal cost

$$\frac{\partial^2 C}{\partial \dot{x}^2} > 0 \quad , \quad \text{and}$$

decreasing marginal revenues, $R'' < 0$. Furthermore, the Weierstrass-Erdman conditions are satisfied as long as the $\dot{x}(t)$ equation for the extremals are continuous.[12]

Further investigation of this model revealed that additional restrictions are imposed on the nature of cost-function admissible in this analysis. The steady state occurs when $\dot{q}(t) = \dot{x}(t) = 0$. However, the locus of points for which $\dot{q}(t) = 0$ passes through the steady-state point $(0,x^*)$, where $x^* \leq \bar{X}$ is the level of the cumulative extraction after which $R'(0) \leq \frac{\partial C}{\partial q}(0,x)$ and it is not profitable to extract oil. We can obtain the slope of this locus by differentiating equation (5.6) with respect to x along $\dot{q}(t) = 0$. We then have:

$$\frac{\partial^2 C}{\partial q\, \partial x}\frac{dq}{dx} + q\left\{\frac{\partial^3 C}{\partial q^2\, \partial x}\frac{dq}{dx} + \frac{\partial^3 C}{\partial q\, \partial x^2}\right\} - \left\{\frac{\partial^2 C}{\partial x^2} + \frac{\partial^2 C}{\partial q\, \partial x}\frac{dq}{dx}\right\}$$

$$+ r\left\{R''(q)\frac{dq}{dx} - \frac{\partial^2 C}{\partial q\, \partial x} - \frac{\partial^2 C}{\partial q^2}\frac{dq}{dx}\right\} = 0$$

which implies:

$$(5.8)\qquad \left.\frac{dq}{dx}\right|_{\dot{q}=0} = \frac{\frac{\partial^2 C}{\partial x^2} - q\frac{\partial^3 C}{\partial q\, \partial x^2} + r\frac{\partial^2 C}{\partial q\, \partial x}}{r\ R''(q) - \frac{\partial^2 C}{\partial q^2} + q\frac{\partial^3 C}{\partial q^2\, \partial x}}$$

This result implies certain restrictions on the signs of the partial derivatives and these have fundamental implications for the general structure of OPEC allocation models. It turns out that for a steady-state solution along the locus $\dot{q}(t) = 0$ with $\frac{dq}{dx} < 0$, we need a quadratic cost function such that:

$$\frac{\partial^2 C}{\partial q^2}, \quad \frac{\partial^2 C}{\partial x^2} > 0$$

and $$\frac{\partial^3 C}{\partial q \partial x^2}, \quad \frac{\partial^3 C}{\partial q^2 \partial x} \leq 0$$

and these can only be satisfied by a cost function that is fully quadratic in both q and x. Hitherto, most models including those by Cremer and Weitzman (1976), Pindyck (1976), Gately and Kyle (1977) and Marshalla (1977) have followed along the lines suggested by Nordhaus (1973) to specify the cost function such that the capital costs are inversely proportional to the volume of remaining reserves. However, our result indicates that the optimisation model imposes certain restrictions on the class of admissible cost functions thus helping to provide guidelines for the choice of an appropriate cost function for the empirical implementation of the model.

In order to apply the anlysis to the case of OPEC, it was necessary to specify the various demand and cost functions explicitly and to calibrate the requisite parameters to reflect the conditions in the world oil market. It was also necessary to ensure that all the conditions following from the optimisation model were met by these functions.

Following from our assumption that OPEC faces residual demand for oil after non-OPEC suppliers[13] have been allowed to satisfy their proportion of the world demand for oil, it is possible to specify the demand faced by OPEC, Q^D, as:

(5.9) $$Q^D = Q_W^D - Q_N^S$$

where Q_W^D is the world demand for oil and Q_N^S is the non-OPEC supply of oil. Evidently, future demand for OPEC oil depends on such factors as the economic activity in the major consuming areas, the time pattern of adjustment to the price of OPEC oil in the consuming nations as well as the availability of viable alternative backstop technology that could replace oil at a feasible substitution price. However, the record since the OPEC price increases of 1973 indicates that for the foreseeable future, the demand for OPEC oil can be expected to grow at fairly steady rates; irrespective of the schemes for reducing consumption in the major consuming countries, oil remains a versatile industrial raw material for which no immediate substitute is available in the energy and chemical processing industries. Thus, the world demand for OPEC oil was assumed to grow at a given annual rate, g, over the entire period covered by the model. Using a linear demand equation, we have:

$$(5.10) \qquad Q^D(t) = [a - bP(t)]\ (1 + g)^t$$

If we convert (5.10) to obtain a price function, we have:

$$(5.10') \qquad P(t) = \alpha - \beta \frac{Q^D(t)}{(1+g)^t}$$

where $\alpha = \frac{a}{b}$ and $\beta = \frac{1}{b}$; this equation was used in determining the price paths. It follows that the revenue function is:

$$(5.11) \qquad R(q(t)) = P(q(t))\ q(t) = [\alpha - \beta q(t)]\ q(t)$$

This function was specifically parametized by choosing the values of α and β such as to reflect the long-term elasticity of demand for OPEC oil equal to -0.33 while, at the same time generating the price per barrel that ruled

in 1974, the initial year of the optimization model.[14]

Similarly, the cost function which was required to be fully quadratic in both the rate of extraction, q(t), and the cumulative extraction, x(t), was specified as follows:

$$(5.12) \qquad C = eq + \frac{h}{2} q^2 + hxq + \frac{h}{2} x^2$$

thus ensuring that both x and q are equally weighted in determining the cost of production. The values of the basic parameters were then chosen to reflect the estimates of production costs in the Persian Gulf, where more than 80% of OPEC's supply of oil is produced.[15] In particular, the cost parameters e and h are such that the marginal cost per barrel of oil increases from 22 cents after 10 billion barrels of oil have been produced to $1.12 after 100 billion barrels and further to $3.62 after 500 billion barrels have been produced.

Substituting the values of the derivatives derived from equations (5.11) and (5.12) into equation (5.6), we get:[16]

$$(5.13) \qquad \dot{q}(t) = rq(t) + \frac{h(1+r)}{2\beta + h} x(t) - \frac{r(\alpha-e)}{2\beta + h}$$

Using the relationship $q(t) = \dot{x}(t)$ (which implies that $\dot{q}(t) = \ddot{x}(t)$), (5.13) translates into:

$$(5.14) \qquad \ddot{x}(t) - r\dot{x}(t) - \frac{h(1+r)}{2\beta + h} x(t) = - \frac{r(\alpha-e)}{2\beta + h}$$

which is a second-order differential equation describing the optimum profile of cumulative extraction over time. The general solution to (5.14) can be stated as:

$$(5.15) \qquad x(t) = A_1 e^{\lambda_1 t} + A_2 e^{\lambda_2 t} + \frac{r(a-c)}{h(1+r)}$$

where $$\lambda_1, \lambda_2 = \frac{1}{2}\left[r \pm \left(r^2 + \frac{4h(1+r)}{2\beta + h}\right)^{1/2}\right]$$

In order to definitize the equation the initial conditions obtaining in both 1974 and 1975 with regard to cumulative extraction were used to determine the values of A_1 and A_2.[17] Once equation (5.15) is particularized, we can define the annual extraction rate by using the relationship $q(t) = \dot{x}(t)$.

The optimum production profile so derived was then allocated to the individual OPEC members as maximum output levels they would produce without unduly threatening the stability of the cartel. Such a market allocation criterion should normally reflect the production capacity of individual OPEC members, their levels of known ultimately recoverable and potentially discoverable reserves as well as their capacities to absorb oil revenues. However, the secrecy surrounding the world oil industry in general and the OPEC in particular makes it difficult to define a market-sharing formula that sufficiently incorporates these factors. Thus, we have instead assumed that OPEC allocates the optimum output to its different members on the basis of past production levels since these figures themselves indicate the actual market shares controlled by each member. The share of the optimum output allocated to any member, it was assumed, was based on a five-year moving average of the historical market shares.[18]

The initial allocation was based on available actual data on market-shares from 1969 to 1977. That is, the allocation for 1974 was based on the average market shares over the period 1969 to 1973 whilst the allocation

for the next year was based on the actual average market-shares for the five-year period 1970-1974. After 1977, the calculation of the market-shares is based on the market-shares predicted by the model itself. Table 5.4 shows the actual values of the market shares from 1969 to 1977 and the predicted market shares for the period 1974-1977. Whilst the predicted values approximate the actual figures for those countries that have kept fairly steady market shares over time, the gap between the predicted and actual market shares are much wider for those countries whose share of the market have fluctuated widely over time, especially Kuwait, Venezuela and Libya. The predicted market-shares for Iran, Nigeria and Algeria are quite comparable to the actual market-shares for the period 1974 to 1977.

Since the optimization model computes a single OPEC oil price, the preceding market shares are then translated into oil revenues for each individual country over time. The details of the alternative revenue patterns accruing to Nigeria from oil production are further discussed in the next section.

5.4: Results of the Oil Sub-Model: Alternative Oil Revenues Accruing to Nigeria from Oil Production

5.4.1: Results of the Oil Sub-Model

The optimum rate of oil extraction was determined by using equation (5.15). However, the solution depends on the particular values assigned to the various parameters of the model. The parameters of the demand and cost functions were set at the following levels:

$$\alpha = 19.942 \qquad \beta = 0.667 \qquad h = 0.005 \qquad e = 0.120$$

These values were thought to be the most plausible set of values taken by

those parameters as reflected in previous studies of the oil industry by Kalymon (1975), Blitzer et. al. (1975), Fischer et. al. (1975) and Gately and Kyle (1977). However, in order to explore the influence of the rate of discount r and the rate of growth of world demand g on the optimum production profile, nine experiments were conducted using different sets of values for r and g in computing the optimum levels of production and the implied price paths over 50 years. These sets of parameters are specified in Table 5.5.

In all, the nine experiments fall into three major categories: cases 1, 2 and 3 are based on a constant value of the rate of discount, r, while g, the rate of growth of world demand, is increasing; cases 4, 5, 6 and 10 involve simultaneous changes in the values of both the rate of discount and the rate of growth of world demand, while cases 7, 8 and 9 explore the effect of a higher rate of discount (r = 0.05) on the production profile and the price paths. It should be noted that the parameters for cases 5 and 7 are the same.

The overall indication from the computation experience with the OPEC-wide optimization model is that whilst the price paths would be significantly affected by changes in the values of α and β to reflect changes in the elasticity of demand as one would expect, the optimum production profile is sensitive only to the rate at which the producers discount the future whilst the price path is influenced by both the rate of discount and the rate of growth of world demand. Generally, as r increases, the rate of resource exhaustion is higher, implying a tendency for the price paths to decline over time. On the other hand, an increase in g does not alter the production profile but leads to a steady increase in the price of oil over

time. The results of the different sets of experiments are discussed in turn.

In the first set of experiments (Cases 1, 2 and 3), we set the value of r at 4.0% and varied the value of g from 5.0% to 6.0%. These three cases generated the same production profile (represented in Table 5.9 by Case 3) but three different price paths shown in Table 5.6 and Figure 5.1. Starting with a base-case with the world demand for oil growing at 5% per annum, the price of oil gradually increases from $12.881 in 1974 to $16.598 in 1974 U.S. dollars at the terminal date in 2014[19] and then on to $16.923 in 2024. The increase in g from 5% to 5.5% leads to an upward shift in the price path reflecting a 3.3-cent increase in the price of oil in the initial year, a gap which widens to more than 59 cents at the terminal date and to about 65 cents in 2024. Similarly, a further increase in g to 6.0% is reflected in an upward shift in the price path. Calculated in current dollars, these seemingly marginal changes in the price paths could amount to substantial increases in OPEC revenues over time, especially since the date of exhaustion is the same for the three models and the failure to reduce the rate of growth of consumption can only lead to massive transfers of real resources from the consuming nations to OPEC.

In the second set of experiments, we varied the values of both r and g simultaneously. In this case, the model generated a different extraction profile and a different price path for each of the four cases. In Case 4 (r = 4.5%, g = 4.5%), the production profile is such that the initial rate of extraction is 30.413 million barrels per day (mb/d) in 1974; gradually increasing to 111.139 mb/d in 2012 when total OPEC resources are

exhausted. These are shown in Figure 5.2 and as case 4 in Table 5.9. With an increase in r and g to 5.0% in case 5, the initial rate of extraction declines to 30.373 mb/d although the production profile rises at a faster rate, especially after 1995. The result of the higher rate of extraction is an earlier exhaustion date (2010) with a daily production of more than 119 million barrels per day at the terminal date. This case is shown as case 5 in Table 5.9. In cases 6 and 10 which reflect further increases in r and g to 5.5% and then to 6.0%, the same results are obtained: a simultaneous increase in the rate of discount and in the rate of growth of demand for OPEC's oil leads to a higher rate of resource extraction and thus an earlier time of resource exhaustion - 2009 and 2007 in case 6 and 10 respectively. With regard to the effects of these simultaneous changes in r and g, the model shows how the impact of supply and demand conditions are borne out through the changes in the price paths. Whilst the increases in r lead to higher rates of extraction and thus a tendency to lower prices, the accompanying increases in the rate of growth and demand lead to higher oil prices over time, yielding net upward shifts in the price paths as r and g increase although the price increases are much smaller than those observed in the first set of experiments. These results are shown in Table 5.7 and it can be seen from Figure 5.3 that although the resultant price changes are significant in the first few years, the price paths converge to about just slightly above $15.00 over 50 years.

The final set of experiments involving cases 7, 8 and 9 were similar to the first set (cases 1, 2 and 3) although the value of r was increased to 5.0%. As earlier observed, the effect of the increase in g is mainly reflected in higher oil prices although the price paths are significantly dif-

ferent now that r has been increased from 4.0% to 5.0%. In particular, the rate of change of prices is much slower increasing from about $12.9 in case 7 to only $15.137 in 2024; at the terminal date, the year 2010, the price is only $15.155. A similar pattern of moderate but steady increases in the price of OPEC oil is noted in cases 8 and 9. These results are shown in Table 5.8 and Figure 5.4. The corresponding uniform extraction profile for all the three cases is represented by case 10 in Table 5.9. To further highlight the effect of the increases in the rate of discount on the price profile, Table 5.10 showing cases 1 and 7, cases 2 and 8 and cases 3 and 9 has been added. Each of these three pairs of cases belong to one of two production profiles -- either case 3 or case 5 of Table 5.9; there are six different price paths which show how the increase in r tends to reduce the rate of increases in the price of oil over time but the increase in g leads to an upward shift in the price path.

5.4.2: The Implied Production Allocations to Nigeria and Oil Revenues Accruing to Nigeria from Oil Production

In all the cases described in the foregoing section, the optimum production profile was allocated to individual OPEC members on the basis of their historical market shares. The resulting production profile for Nigeria is shown in Table 5.11. In essence, there are five distinct production profiles since cases 1, 2 and 3 are the same and so also are cases 5, 7, 8 and 9. All these maximum output levels call for steady increases in production capacity from about 1.7 million barrels per day to between 3.6 and 5.2 million barrels per day in year 1998 which is the terminal year of the long-term plan. Subsequently, the required production capacity increases at faster rates as some OPEC members begin to exhaust their re-

serves and Nigeria is allocated increasing proportions of the market. Furthermore, these results show that Nigeria's estimated oil reserves of 51.525 billion barrels of oil[20] are exhausted one to three years before total OPEC reserves. Compared with the other OPEC members, Nigeria exhausts its reserves ahead of Saudi Arabia, Kuwait, the United Arab Emirates, Iraq and Indonesia but after Iran, Venezuela, Algeria and Libya have exhausted their reserves. In terms of their implications for Nigeria's capacity to produce the specified output levels, the levels of daily production shown in Table 5.11 are not likely to be difficult to meet at least until 1990; the current daily capacity is more than 2.5 million barrels per day and is expected to increase to 2.8 million barrels per day in 1980.

The implied revenue flows are shown for cases 1 to 10 in Table 5.12. Given the steady increase in the price of oil over time and the steady increases in the rate of extraction in some of the cases, we are not surprised that the expected revenue increases steadily from less than 10 billion U.S. dollars in the first few years to more than $20 billion in each case in the year 1998 and further to more than $50 billion by the year 2010, if the resources are not already exhausted.

However, since the oil revenues were meant to be applied as uncompensated fund-transfers from the oil sector for financing Nigeria's development, it was necessary to convert the revenue inflows into the expected revenues in each target-year of the long-term plan. Thus, each stream of revenues computed and shown in Table 5.12 was converted to Nigerian Naira at the official 1974 exchange rate or ₦ 1 = $1.6228. The results for each case and for the nine target-years of the planning horizon are shown in Table 5.13. These levels of revenue inflow from oil production were employed in the

planning model as the maximum levels of foreign exchange inflow that could be expected over the planning period and was used in defining the balance of payments equation as well as the lower and upper limits on the oil sector's level of activity.

Mathematical Appendix:

Given the revenue function as:

(5.11) $R(q) = \alpha q - \beta q^2$

It follows that $R'(q) = \alpha - 2\beta q$ and $R''(q) = -2\beta < 0$

Also, assuming the quadratic cost function:

(5.12) $C(q,x) = eq + \frac{h}{2} q^2 + hxq + \frac{h}{2} x^2$

then:

$$\frac{\partial C(q,x)}{\partial q} = e + hq + hx$$

$$\frac{\partial C(q,x)}{\partial x} = hq + hx$$

$$\frac{\partial^2 C(q,x)}{\partial q \partial x} = h > 0$$

$$\frac{\partial^2 C(q,x)}{\partial q^2} = h > 0$$

Substituting these values into equation (5.7), we get

$$\dot{q}(t) = \left[\frac{hq - (hq + hx) + r\{\alpha - 2\beta q - (e + hq + hx)\}}{-(2\beta + h)}\right]$$

$$= \left[\frac{hq - hq - hx + r\{\alpha - 2\beta q - e - hq - hx\}}{-(2\beta + h)}\right]$$

$$= \frac{\{hx - r[\alpha - 2\beta q - e - hq - hx]\}}{2\beta + h}$$

$$= \frac{rq(2\beta + h) + hx(1 + r) - r(\alpha - e)}{(2\beta + h)}$$

Thus we have:

$$\dot{q}(t) = rq(t) + \frac{h(1+r)}{(2\beta+h)}\,x(t) - \frac{r(\alpha-e)}{(2\beta-h)} \tag{5.13}$$

TABLE 5.1

SOURCES OF FUNDS IN NIGERIA'S FIRST NATIONAL DEVELOPMENT PLAN+

Sources	Planned Sources 1962-68		Actual Sources							
	₦ m	%	1962/63	1963/64	1964/65	1965/66	4-Year Total	A	B	C
1. Recurrent Budget Surplus	56.8	4.344	34.46	16.98	44.48	46.1	142.02	37.87	+104.15	21.21
2. Domestic Borrowing	151.4	11.578	46.82	58.9	46.6	40.24	192.56	100.93	+ 91.63	28.76
3. Internal Resources of Federal Statutory Corporation	160.0	12.236	9.78	19.18	9.38	9.54	47.88	106.67	- 58.79	7.15
4. Marketing Boards Surplus	78.2	5.981	8.38	9.64	10.52	6.1	34.64	52.13	- 17.49	5.17
5. External Finance	654.2	50.030	21.38	19.42	39.88	75.76	156.44	436.13	-279.69	23.36
6. Other	207.0	15.831	17.8	38.92	28.32	11.06	96.10	138.0	- 41.9	14.35
Total	1307.6	100.0	138.62	163.04	179.18	188.8	669.64	871.73	-202.09	100.0

Notes:
+ All figures are millions of Nigerian Naira except where percentages are indicated.
A The values in this column represent 4-year equivalents of the 6-year plan.
B This column compares the actual sources of funds for the years 1962-66 with the four-year equivalent of the targets in the 6-year plan. Shortfalls carry a minus (-) sign while surpluses are indicated by a plus (+) sign.
C This column indicates the percentage contributed by each source to the actual availability of funds.

Source: Dean, E., (1973), Plan Implementation in Nigeria (Ibadan, Oxford University Press/ NISER), Ch. 3, Table 3 VIII.

TABLE 5.2

SOURCES OF FUNDS IN NIGERIA'S SECOND NATIONAL DEVELOPMENT PLAN+

Sources	Planned Sources 1970-74		1970/71			1971/72			1972/73.			1970-73		
	₦ m	%	Planned	Actual	*	Planned	Actual	*	Planned	Actual	*	Planned	Actual	*
Recurrent Budget Surplus	900.4	57.717	65.4	76.9	+ 11.5	151.4	331.1	+179.7	261.6	346.0	+ 84.4	478.4	754.2	+275.8
Domestic Borrowing	144.6	9.269	216.0	45.6	-170.4	175.0	120.1	- 54.9	- 2.8	44.0	+ 46.8	388.2	209.7	-178.5
Internal Resources	79.0	5.065	13.6	19.9	+ 6.3	16.5	15.2	- 1.4	21.4	30.0	+ 8.6	51.6	65.1	+ 13.5
Marketing Boards Surplus	134.0	8.59	29.6	47.3	+ 17.7	28.2	117.7	89.5	36.8	156.6	+119.8	94.6	324.6	+230.0
External Finance	302.0	19.359	115.4	21.2	- 94.2	55.0	91.0	+ 36.0	57.2	30.2	- 27.0	227.6	142.4	- 85.2
Total	1560.0	100.0	440.0	210.9	-229.1	426.2	675.1	+248.1	374.2	606.8	+232.6	1240.4	1492.8	+252.4

Notes: +All figures are in millions of Nigerian Naira except where percentages are indicated.

*These columns compare the planned inflow of funds from various sources with the actual inflows. A surplus is indicated by a plus (+) sign while a shortfall is indicated by a minus (-) sign.

Source: Government of Nigeria (1974), Second Progress Report on the Second National Development Plan: 1970-74, (Lagos, Central Planning Office), Table 10, page 24.

TABLE 5.3

FOREIGN EXCHANGE SOURCES IN THE THIRD NATIONAL DEVELOPMENT PLAN: 1975-80

	Millions of Naira				
	1975/76	1976/77	1977/78	1978/79	1979/80
1. Oil Exports	7120.3	7913.0	8665.1	9603.8	10633.2
2. Non-Oil Exports	346.8	355.6	368.6	387.0	396.0
3. Total Exports	7467.1	8268.6	9033.7	9990.8	11029.2
4. Total Imports	-2213.7	-2972.7	-3970.6	-5334.6	- 6280.2
5. Payments for Non-Factor Services	- 752.0	- 892.6	- 999.0	-1181.1	- 1516.3
6. Payments for Factor-Services	- 758.0	- 698.1	- 676.4	- 705.0	- 752.1
7. Net Transfers	- 61.2	- 70.7	- 82.5	- 94.1	- 109.0
8. Net Private Capital Inflow	105.2	349.7	403.4	458.6	510.0
9. Net Public Capital Inflow	11.0	15.0	9.0	2.0	1.0
10. Net Additions to Reserves (Including Short-Term Capital)	3979.6	3999.2	3717.6	3136.6	3342.6
11. Total Foreign Exchange Availability	8087.2	9318.7	10292.7	11415.9	12599.3
% Contributed by Oil	88.044	84.915	84.187	84.126	84.395

Source: Computed from Tables 5.20 and 5.21 of The Third National Development Plan: 1975-80, (Lagos, Central Planning Office, 1975), pp. 60-61.

TABLE 5.4

ACTUAL AND PREDICTED MARKET SHARES OF OPEC MEMBERS

		1969	1970	1971	1972	1973	1974	1975	1976	1977
1. SAUDI ARABIA	Actual	0.163	0.145	0.202	0.232	0.245	0.278	0.293	0.281	0.293
	Predicted						0.197	0.204	0.216	0.219
2. IRAN	Actual	0.160	0.154	0.176	0.186	0.189	0.197	0.189	0.193	0.177
	Predicted						0.173	0.176	0.180	0.181
3. KUWAIT	Actual	0.132	0.119	0.130	0.121	0.097	0.084	0.074	0.070	0.059
	Predicted						0.120	0.117	0.117	0.115
4. VENEZUELA	Actual	0.170	0.151	0.138	0.119	0.109	0.097	0.083	0.075	0.071
	Predicted						0.137	0.131	0.127	0.127
5. NIGERIA	Actual	0.026	0.060	0.059	0.067	0.066	0.073	0.063	0.068	0.074
	Predicted						0.056	0.062	0.062	0.062
6. ALGERIA	Actual	0.045	0.041	0.031	0.040	0.035	0.032	0.033	0.034	0.035
	Predicted						0.038	0.037	0.036	0.037
7. UNITED ARAB EMIRATES*	Actual	0.029	0.026	0.041	0.034	0.050	0.055	0.060	0.063	0.064
	Predicted						0.036	0.037	0.040	0.039
8. LIBYA	Actual	0.147	0.190	0.107	0.083	0.070	0.049	0.052	0.063	0.064
	Predicted						0.119	0.114	0.099	0.097
9. IRAQ	Actual	0.072	0.062	0.059	0.054	0.065	0.060	0.078	0.075	0.072
	Predicted						0.062	0.061	0.060	0.060
10. INDONESIA	Actual	0.035	0.034	0.035	0.040	0.043	0.045	0.046	0.049	0.053
	Predicted						0.037	0.038	0.039	0.039
11. OTHERS+	Actual	0.021	0.019	0.021	0.025	0.030	0.030	0.029	0.030	0.027
	Predicted						0.023	0.024	0.025	0.025

NOTES: *The United Arab Emirates includes Abu-Dhabi, Dubai and Sharjah.

+The other OPEC members are Ecuador, Gabon and Qatar.

SOURCE: The market-shares for 1969-1973 were calculated from data on OPEC exports published in World Oil; the special issue of this journal published every year on February 15 offers a detailed review of the world oil industry.

TABLE 5.5

VALUES OF r AND g USED IN THE SIMULATION EXPERIMENTS WITH THE O.P.E.C. OPTIMIZATION MODEL

	r	g
Case 1	0.040	0.050
Case 2	0.040	0.055
Case 3	0.040	0.060
Case 4	0.045	0.045
Case 5	0.050	0.050
Case 6	0.055	0.055
Case 7	0.050	0.050
Case 8	0.050	0.055
Case 9	0.050	0.060
Case 10	0.060	0.060

TABLE 5.6

The Effect of Changes in the Rate of Growth of World Demand for OPEC-Oil on Oil Price

	PRICE PER BARREL		
YEAR	CASE 1	CASE 2	CASE 3
1974	12.88133	12.91479	12.94794
1975	13.07602	13.14094	13.20495
1976	13.26168	13.35621	13.44847
1977	13.43876	13.56117	13.68072
1978	13.60771	13.75639	13.90091
1979	13.76892	13.94239	14.11020
1980	13.92278	14.11966	14.30920
1981	14.06968	14.28866	14.49851
1982	14.20994	14.44985	14.67866
1983	14.34392	14.60364	14.85017
1984	14.47192	14.75043	15.01354
1985	14.59424	14.89058	15.16920
1986	14.71118	15.02445	15.31761
1987	14.82299	15.15237	15.45915
1988	14.92993	15.27466	15.59421
1989	15.03225	15.39161	15.72315
1990	15.13018	15.50351	15.84630
1991	15.22394	15.61061	15.96399
1992	15.31373	15.71318	16.07651
1993	15.39975	15.81145	16.18415
1994	15.48220	15.90565	16.28717
1995	15.56124	15.99598	16.38581
1996	15.63705	16.08264	16.48032
1997	15.70979	16.16583	16.57092
1998	15.77961	16.24573	16.65761
1999	15.84665	16.32250	16.74119
2000	15.91105	16.39630	16.82124
2001	15.97295	16.46729	16.89815
2002	16.03246	16.53561	16.97207
2003	16.08970	16.60139	17.04316
2004	16.14478	16.66476	17.11157
2005	16.19781	16.72585	17.17743
2006	16.24890	16.78476	17.24087
2007	16.29812	16.84161	17.30202
2008	16.34559	16.89650	17.36099
2009	16.39137	16.94952	17.41789
2010	16.43556	17.00077	17.47281
2011	16.47822	17.05032	17.52587
2012	16.51944	17.09828	17.57715
2013	16.55929	17.14470	17.62673
2014	16.59782	17.18967	17.67469
2015	16.63510	17.23326	17.72112
2016	16.67120	17.27552	17.76609
2017	16.70617	17.31653	17.80966
2018	16.74005	17.35634	17.85189
2019	16.77292	17.39500	17.89286
2020	16.80480	17.43258	17.93261
2021	16.83575	17.46911	17.97121
2022	16.86581	17.50465	18.00869
2023	16.89503	17.53924	18.04512
2024	16.92344	17.57293	18.08053

TABLE 5.7

THE EFFECT OF CHANGES IN BOTH r AND g
ON THE PRICE OF OPEC-OIL

	PRICE PER BARREL			
YEAR	CASE 4	CASE 5	CASE 6	CASE 10
1974	12.85674	12.89961	12.94205	12.98408
1975	13.00109	13.05804	13.11421	13.16962
1976	13.13793	13.20746	13.27575	13.34281
1977	13.26760	13.34832	13.42724	13.50440
1978	13.39042	13.48106	13.56925	13.65507
1979	13.50672	13.60607	13.70229	13.79547
1980	13.61678	13.72376	13.82885	13.92621
1981	13.72090	13.83448	13.94341	14.04787
1982	13.81935	13.93860	14.05239	14.16098
1983	13.91239	14.03644	14.15421	14.26604
1984	14.00026	14.12831	14.24927	14.36354
1985	14.08320	14.21452	14.33793	14.45391
1986	14.16144	14.29535	14.42055	14.53758
1987	14.23518	14.37106	14.49744	14.61495
1988	14.30464	14.44193	14.56893	14.68638
1989	14.37001	14.50818	14.63531	14.75222
1990	14.43147	14.57004	14.69685	14.81280
1991	14.48920	14.62775	14.75382	14.86844
1992	14.54337	14.68149	14.80647	14.91941
1993	14.59414	14.73148	14.85502	14.96599
1994	14.64167	14.77789	14.89971	15.00844
1995	14.68610	14.82091	14.94073	15.04700
1996	14.72758	14.86070	14.97830	15.08190
1997	14.76622	14.89742	15.01258	15.11334
1998	14.80217	14.93123	15.04376	15.14152
1999	14.83554	14.96226	15.07201	15.16664
2000	14.86645	14.99065	15.09748	15.18887
2001	14.89501	15.01654	15.12031	15.20836
2002	14.92132	15.04004	15.14066	15.22532
2003	14.94549	15.06128	15.15865	15.23984
2004	14.96760	15.08035	15.17440	15.25207
2005	14.98775	15.09737	15.18804	15.26215
2006	15.00603	15.11244	15.19967	15.27020
2007	15.02252	15.12565	15.20940	15.27633
2008	15.03730	15.13709	15.21733	15.28065
2009	15.05044	15.14685	15.22355	15.28326
2010	15.06201	15.15500	15.22815	15.28425
2011	15.07209	15.16162	15.23122	15.28372
2012	15.08074	15.16679	15.23283	15.28175
2013	15.08801	15.17057	15.23308	15.27841
2014	15.09398	15.17304	15.23197	15.27378
2015	15.09869	15.17424	15.22964	15.26793
2016	15.10220	15.17424	15.22613	15.26093
2017	15.10456	15.17310	15.22149	15.25283
2018	15.10583	15.17087	15.21578	15.24370
2019	15.10604	15.16759	15.20906	15.23358
2020	15.10524	15.16332	15.20137	15.22254
2021	15.10347	15.15811	15.19276	15.21060
2022	15.10078	15.15199	15.18327	15.19783
2023	15.09720	15.14500	15.17295	15.18427
2024	15.09276	15.13718	15.16184	15.16994

TABLE 5.8

THE EFFECT OF CHANGES IN THE RATE OF GROWTH OF WORLD DEMAND FOR OPEC-OIL ON OIL PRICE GIVEN A HIGHER RATE OF DISCOUNT

	PRICE PER BARREL		
YEAR	CASE 7	CASE 8	CASE 9
1974	12.89951	12.93298	12.96604
1975	13.05804	13.12314	13.18731
1976	13.20746	13.30276	13.39627
1977	13.34832	13.47244	13.59364
1978	13.48106	13.63272	13.78012
1979	13.60607	13.78412	13.95636
1980	13.72376	13.92714	14.12296
1981	13.83448	14.06224	14.28049
1982	13.93860	14.18987	14.42950
1983	14.03644	14.31043	14.57050
1984	14.12831	14.42431	14.70395
1985	14.21452	14.53189	14.83030
1986	14.29535	14.63352	14.94999
1987	14.37106	14.72953	15.06339
1988	14.44193	14.82022	15.17088
1989	14.50818	14.90589	15.27282
1990	14.57004	14.98663	15.36953
1991	14.62775	15.06329	15.46132
1992	14.68149	15.13562	15.54848
1993	14.73148	15.20375	15.63128
1994	14.77769	15.26821	15.70998
1995	14.82091	15.32911	15.78483
1996	14.86070	15.38665	15.85604
1997	14.89742	15.44100	15.92384
1998	14.93123	15.49235	15.98842
1999	14.96226	15.54087	16.04997
2000	14.99065	15.58670	16.10867
2001	15.01654	15.63000	16.16469
2002	15.04004	15.67092	16.21818
2003	15.06128	15.70957	16.26928
2004	15.08035	15.74610	16.31815
2005	15.09737	15.78060	16.36491
2006	15.11244	15.81321	16.40967
2007	15.12565	15.84401	16.45257
2008	15.13709	15.87312	16.49370
2009	15.14685	15.90063	16.53316
2010	15.15500	15.92662	16.57106
2011	15.16162	15.95118	16.60748
2012	15.16679	15.97439	16.64251
2013	15.17057	15.99632	16.67623
2014	15.17304	16.01705	16.70871
2015	15.17424	16.03663	16.74002
2016	15.17424	16.05514	16.77023
2017	15.17310	16.07264	16.79940
2018	15.17087	16.08917	16.82759
2019	15.16759	16.10480	16.85485
2020	15.16332	16.11957	16.88124
2021	15.15811	16.13354	16.90681
2022	15.15199	16.14674	16.93159
2023	15.14500	16.15921	16.95564
2024	15.13718	16.17101	16.97900

TABLE 5.9

ALTERNATIVE PRODUCTION PROFILES RESULTING FROM THE SIMULATION EXPERIMENTS WITH CHANGES IN r AND g

OPEC OIL PRODUCTION IN MILLIONS OF BARRELS PER DAY

YEAR	CASE 3	CASE 4	CASE 5	CASE 6	CASE 10
1974	30.45205	30.41260	30.37323	30.33392	30.29467
1975	31.09299	31.13367	31.17441	31.21521	31.25609
1976	31.76484	31.89327	32.02263	32.15293	32.28417
1977	32.46894	32.69332	32.92048	33.15046	33.38326
1978	33.20672	33.53581	33.87066	34.21138	34.55806
1979	33.97968	34.42285	34.87605	35.33951	35.81347
1980	34.78935	35.35663	35.93966	36.53884	37.15478
1981	35.63736	36.33946	37.06468	37.81388	38.58761
1982	36.52544	37.37378	38.25448	39.16874	40.11795
1983	37.45531	38.46213	39.51261	40.60864	41.75216
1984	38.42884	39.60719	40.84281	42.14848	43.49711
1985	39.44796	40.81176	42.24402	43.76371	45.35999
1986	40.51467	42.07878	43.73543	45.44008	47.34853
1987	41.63110	43.41136	45.30642	47.32366	49.47097
1988	42.79943	44.81274	46.96663	49.27091	51.73608
1989	44.02197	46.28031	48.72095	51.33866	54.15320
1990	45.30110	47.83567	50.57454	53.53416	56.73230
1991	46.63935	49.46457	52.53285	55.86509	59.48397
1992	48.03931	51.17694	54.60163	58.33961	62.41954
1993	49.50373	52.97693	56.78693	60.96637	65.56104
1994	51.03546	54.86887	59.09514	63.75451	68.89132
1995	52.63747	56.85732	61.53301	66.71376	72.45406
1996	54.31289	58.94707	64.10766	69.85440	76.25384
1997	56.06496	61.14314	66.82658	73.18738	80.30619
1998	57.89708	63.45079	69.69770	76.72425	84.62767
1999	59.81279	65.87557	72.72937	80.47730	89.23591
2000	61.81579	68.42328	75.93040	84.45954	94.14972
2001	63.90996	71.10002	79.31009	88.68477	99.39012
2002	66.09934	73.91218	82.87825	93.16762	104.97545
2003	68.38814	76.86648	86.64521	97.92361	110.93147
2004	70.78077	79.96997	90.62190	102.96918	117.28140
2005	73.28183	83.23006	94.81983	108.32176	124.05107
2006	75.89613	86.65450	99.25114	113.99986	131.26900
2007	78.62868	90.25146	103.92866	120.02307	138.96151
2008	81.48474	94.02949	108.86589	126.41217	147.16245
2009	84.46977	97.99758	114.07711	133.18921	155.90531
2010	87.58950	102.16515	119.57735	140.37755	165.22437
2011	90.84989	106.54211	125.38249	148.00146	175.15785
2012	94.25719	111.13884	131.50927	156.08670	185.74602
2013	97.81790	115.96625	137.97535	164.66564	197.03162
2014	101.53884	121.03579	144.79937	173.76228	209.06098
2015	105.42711	126.35948	152.00099	183.40994	221.88228
2016	109.49012	131.94991	159.60095	193.64181	235.54763
2017	113.73564	137.82035	167.62112	204.49307	250.11235
2018	118.17175	143.98407	176.08459	216.00106	265.63552
2019	122.80691	150.45747	185.01570	228.20531	282.17940
2020	127.64996	157.25407	194.44014	241.14778	299.81248
2021	132.71010	164.39052	204.38501	254.87295	318.60463
2022	137.99697	171.88370	214.87840	269.42795	338.63239
2023	143.52064	179.75132	225.95195	284.86279	359.97660
2024	149.29161	188.01197	237.63600	301.23046	382.72419

TABLE 5.10

COMPARISON OF ALTERNATIVE PRICE-PATHS AT TWO DIFFERENT RATES OF DISCOUNT

	PRICE PER BARREL					
YEAR	CASE 1	CASE 7	CASE 2	CASE 8	CASE 3	CASE 9
1974	12.88133	12.89961	12.91479	12.93298	12.94794	12.96604
1975	13.07602	13.05804	13.14094	13.12314	13.20495	13.18733
1976	13.26168	13.20746	13.36621	13.30276	13.44897	13.39627
1977	13.43876	13.34832	13.58117	13.47244	13.68072	13.59364
1978	13.60771	13.48106	13.79639	13.63272	13.90391	13.78012
1979	13.76892	13.60807	13.99239	13.78412	14.11020	13.95639
1980	13.92278	13.72376	14.11966	13.92714	14.30920	14.12296
1981	14.06968	13.83468	14.28866	14.06224	14.49851	14.28344
1982	14.20994	13.93860	14.44985	14.18987	14.67866	14.42453
1983	14.34392	14.03544	14.60364	14.31043	14.85017	14.57055
1984	14.47192	14.12831	14.75043	14.42431	15.01354	14.71345
1985	14.59424	14.21752	14.89058	14.53189	15.16920	14.85351
1986	14.71118	14.29535	15.02445	14.63352	15.31761	14.98106
1987	14.82299	14.37106	15.15237	14.72953	15.45915	15.10639
1988	14.92993	14.44193	15.27466	14.82022	15.59421	15.22980
1989	15.03225	14.50818	15.39161	14.90589	15.72315	15.35152
1990	15.13018	14.57004	15.50351	14.98683	15.84633	15.46983
1991	15.22394	14.62775	15.61061	15.06329	15.96394	15.58193
1992	15.31373	14.68149	15.71318	15.13552	16.07651	15.68848
1993	15.39975	14.73148	15.81145	15.20375	16.18415	15.78973
1994	15.48220	14.77789	15.90565	15.26821	16.28717	15.88594
1995	15.56124	14.82091	15.99598	15.32911	16.38581	15.97733
1996	15.63705	14.86070	16.08264	15.38665	16.48032	16.06414
1997	15.70979	14.89742	16.16583	15.44100	16.57092	16.14658
1998	15.77961	14.93123	16.24573	15.49235	16.65781	16.22484
1999	15.84665	14.96225	16.32250	15.54087	16.74119	16.29911
2000	15.91105	14.99065	16.39630	15.58670	16.82124	16.36955
2001	15.97295	15.01654	16.46729	15.63000	16.89815	16.43634
2002	16.03246	15.04004	16.53561	15.67092	16.97207	16.49964
2003	16.08970	15.06128	16.60139	15.70957	17.04316	16.55962
2004	16.14478	15.08035	16.66476	15.74610	17.11157	16.61645
2005	16.19781	15.09737	16.72585	15.78060	17.17743	16.67026
2006	16.24890	15.11244	16.78476	15.81321	17.24087	16.72119
2007	16.29812	15.12565	16.84161	15.84401	17.30202	16.76937
2008	16.34559	15.13709	16.89650	15.87312	17.36099	16.81493
2009	16.39137	15.14685	16.94952	15.90063	17.41789	16.85801
2010	16.43556	15.15500	17.00077	15.92662	17.47281	16.89871
2011	16.47822	15.16162	17.05032	15.95118	17.52587	16.93716
2012	16.51944	15.16679	17.09828	15.97439	17.57715	16.97345
2013	16.55929	15.17057	17.14470	15.99632	17.62673	17.00771
2014	16.59782	15.17304	17.18967	16.01705	17.67469	17.04003
2015	16.63510	15.17424	17.23328	16.03663	17.72112	17.07052
2016	16.67120	15.17424	17.27552	16.05514	17.76609	17.09928
2017	16.70617	15.17310	17.31653	16.07264	17.80966	17.12641
2018	16.74005	15.17087	17.35634	16.08917	17.85189	17.15201
2019	16.77292	15.16759	17.39500	16.10480	17.89286	17.17617
2020	16.80480	15.16332	17.43258	16.11957	17.93261	17.19896
2021	16.83575	15.15811	17.46911	16.13354	17.97121	17.22047
2022	16.86581	15.15199	17.50465	16.14674	18.00869	17.24077
2023	16.89503	15.14500	17.53924	16.15921	18.04512	17.25994
2024	16.92344	15.13716	17.57293	16.17101	18.08053	17.27806

Note: Cases 1, 2 and 3 have a common rate of discount (r = 0.04) but changing rates of growth of world demand for OPEC-oil while Cases 7, 8 and 9 have a higher rate of discount (r = 0.05) but with values of g corresponding to Cases 1, 2 and 3 respectively.

TABLE 5.11

PRODUCTION ALLOCATIONS TO NIGERIA FROM THE OPEC-WIDE OPTIMIZATION MODEL

- MILLIONS OF BARRELS PER DAY -

YEAR	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6	CASE 7	CASE 8	CASE 9	CASE 10
1974	1.695	1.695	1.695	1.693	1.690	1.688	1.690	1.690	1.690	1.686
1975	1.917	1.917	1.917	1.919	1.922	1.924	1.922	1.922	1.922	1.927
1976	1.966	1.966	1.966	1.974	1.982	1.990	1.982	1.982	1.982	1.998
1977	2.028	2.028	2.028	2.042	2.056	2.070	2.056	2.056	2.056	2.085
1978	2.044	2.044	2.044	2.064	2.085	2.106	2.085	2.085	2.085	2.127
1979	2.061	2.061	2.061	2.087	2.115	2.143	2.115	2.115	2.115	2.172
1980	2.144	2.144	2.144	2.179	2.215	2.252	2.215	2.215	2.215	2.290
1981	2.197	2.197	2.197	2.240	2.285	2.331	2.285	2.285	2.285	2.378
1982	2.249	2.249	2.249	2.302	2.356	2.412	2.356	2.356	2.356	2.471
1983	2.300	2.300	2.300	2.362	2.426	2.494	2.426	2.426	2.426	2.564
1984	2.359	2.359	2.359	2.431	2.507	2.587	2.507	2.507	2.507	2.670
1985	2.427	2.427	2.427	2.511	2.600	2.693	2.600	2.600	2.600	2.791
1986	2.492	2.492	2.492	2.588	2.690	2.798	2.690	2.690	2.690	2.912
1987	2.560	2.560	2.560	2.669	2.786	2.919	2.786	2.786	2.786	3.042
1988	2.631	2.631	2.631	2.754	2.887	3.028	2.887	2.887	2.887	3.169
1989	2.706	2.706	2.706	2.845	2.995	3.156	2.995	2.995	2.995	3.329
1990	2.786	2.786	2.786	2.941	3.110	3.292	3.110	3.110	3.110	3.489
1991	2.868	2.868	2.868	3.041	3.230	3.435	3.230	3.230	3.230	3.657
1992	2.953	2.953	2.953	3.146	3.357	3.587	3.357	3.357	3.357	3.837
1993	3.043	3.043	3.043	3.257	3.491	3.748	3.491	3.491	3.491	4.030
1994	3.138	3.138	3.138	3.373	3.633	3.920	3.633	3.633	3.633	4.235
1995	3.236	3.236	3.236	3.496	3.783	4.102	3.783	3.783	3.783	4.455
1996	3.339	3.339	3.339	3.624	3.941	4.295	3.941	3.941	3.941	4.688
1997	3.447	3.447	3.447	3.759	4.109	4.500	4.109	4.109	4.109	4.937
1998	3.560	3.560	3.560	3.901	4.285	4.717	4.285	4.285	4.285	5.213
1999	3.677	3.677	3.677	4.050	4.471	4.946	4.471	4.471	4.471	5.486
2000	3.800	3.800	3.800	4.207	4.668	5.193	4.668	4.668	4.668	5.788
2001	3.929	3.929	3.929	4.371	4.876	5.452	4.876	4.876	4.876	7.309
2002	4.064	4.064	4.064	4.544	5.095	6.851	5.095	5.095	5.095	7.719
2003	4.205	4.205	4.205	4.726	6.371	7.201	6.371	6.371	6.371	10.286
2004	4.352	4.352	4.352	5.881	6.664	9.635	6.664	6.664	6.664	12.992
2005	5.389	5.389	5.389	6.120	8.873	11.999	8.873	8.873	8.873	13.742
2006	5.581	5.581	5.581	8.109	10.995	12.628	10.995	10.995	10.995	0.000
2007	7.358	7.358	7.358	8.445	11.513	13.296	11.513	11.513	11.513	0.000
2008	7.625	7.625	7.625	10.416	12.060	0.000	12.060	12.060	12.060	0.000
2009	9.357	9.357	9.357	10.856	0.000	0.000	0.000	0.000	0.000	0.000
2010	9.703	9.703	9.703	11.317	0.000	0.000	0.000	0.000	0.000	0.000
2011	10.064	10.064	10.064	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

TABLE 5.12

REVENUES ACCRUING TO NIGERIA FROM OIL PRODUCTION

- MILLIONS OF 1974 U.S. DOLLARS -

YEAR	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6	CASE 7	CASE 8	CASE 9	CASE 10
1974	7968.190	7988.890	8009.394	7942.676	7958.842	7974.697	7958.842	7979.434	7999.833	7990.246
1975	9145.674	9194.099	9238.884	9108.149	9160.017	9211.462	9160.017	9205.681	9250.701	9262.491
1976	9516.145	9585.992	9652.565	9467.454	9556.165	9644.656	9556.165	9625.118	9692.776	9732.942
1977	9945.452	10036.043	10124.512	9866.832	10015.901	10145.500	10015.901	10109.029	10199.976	10275.461
1978	10152.098	10262.935	10370.752	10088.905	10258.614	10429.595	10258.614	10374.021	10486.192	10601.914
1979	10355.653	10486.122	10612.332	10290.939	10503.126	10717.961	10503.126	10640.568	10773.526	10935.570
1980	10697.252	11051.343	11199.701	10831.532	11096.643	11366.410	11096.643	11261.092	11419.423	11641.055
1981	11280.265	11455.638	11624.079	11217.361	11535.933	11861.749	11535.933	11725.851	11907.839	12195.169
1982	11666.505	11863.474	12051.326	11609.345	11985.452	12372.092	11985.452	12201.511	12407.569	12769.823
1983	12042.469	12259.512	12467.487	11994.139	12431.585	12883.625	12431.585	12674.248	12904.585	13351.086
1984	12459.932	12699.720	12926.250	12423.436	12928.198	13452.523	12928.198	13199.057	13454.941	13997.615
1985	12929.611	13192.144	13446.991	12908.211	13487.397	14092.240	13487.397	13788.538	14071.685	14724.400
1986	13450.917	13969.800	14492.511	13378.188	14036.350	14727.348	14036.350	14368.399	14679.130	15453.427
1987	13948.375	14456.101	14982.709	13867.931	14611.469	15396.251	14611.469	14975.927	15315.375	16225.307
1988	14335.053	14866.045	14972.865	14360.704	15216.614	16103.558	15216.614	15615.198	15984.674	17045.579
1989	14848.100	15203.056	15530.534	14924.061	15460.102	16058.691	15460.102	16294.879	16695.999	17924.992
1990	15383.845	15763.225	16111.766	15494.185	16538.616	17058.818	16538.616	17011.712	17446.122	18861.403
1991	15934.234	16334.953	16708.819	16083.853	17244.880	18496.809	17244.880	17758.344	18227.591	19848.013
1992	16508.096	16930.614	17330.279	16701.532	17988.408	19383.486	17988.408	18544.696	19050.675	20897.246
1993	17106.570	17563.900	17977.904	17349.087	18771.802	20322.393	18771.802	19373.601	19916.387	22013.867
1994	17731.171	18219.130	18653.069	18028.000	19597.337	21316.771	19597.337	20247.563	20833.406	23202.491
1995	18381.592	18895.118	19355.608	18738.556	20465.714	22368.204	20465.714	21167.474	21796.757	24465.638
1996	19056.518	19591.604	20086.297	19481.659	21378.661	23479.426	21378.661	22135.299	22810.565	25807.679
1997	19764.650	20334.401	20648.041	20260.240	22340.227	24655.777	22340.227	23155.379	23879.447	27235.575
1998	20501.334	21106.931	21642.315	21076.175	23353.029	25901.109	23353.029	24230.650	25006.520	28754.654
1999	21269.648	21908.544	22470.522	21931.117	24419.674	27219.328	24419.674	25364.010	26194.913	30371.201
2000	22071.470	22744.597	23334.067	22826.755	25542.838	28614.487	25542.838	26558.454	27447.849	32090.573
2001	22907.850	23615.821	24234.746	23755.188	26725.696	30091.273	26725.696	27817.510	28769.112	40570.003
2002	23780.870	24527.196	25174.601	24748.786	27971.785	37661.089	27971.785	29145.101	30162.903	42098.041
2003	24692.206	25477.482	26155.455	25775.728	35025.968	39841.134	35025.968	36533.626	37835.270	57741.675
2004	25643.864	26469.521	27179.210	32126.488	36679.949	53367.072	36679.949	38299.239	39690.052	72326.074
2005	31659.326	32697.916	33789.128	33481.171	48893.931	66520.286	48893.931	51106.618	52998.931	76551.386
2006	33099.937	34191.528	35321.652	44413.110	60646.655	70060.806	60646.655	63458.845	65852.485	0.000
2007	43769.627	45229.196	46735.656	46307.497	63560.336	73809.720	63560.336	66579.607	69136.247	0.000
2008	45491.591	47024.436	48317.569	57170.326	66630.192	0.000	66630.192	69870.045	72601.679	0.000
2009	55962.637	57800.418	59488.569	59535.091	0.000	0.000	0.000	0.000	0.000	0.000
2010	58206.731	60206.419	61880.188	62218.927	0.000	0.000	0.000	0.000	0.000	0.000
2011	60538.122	62631.638	64376.482	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

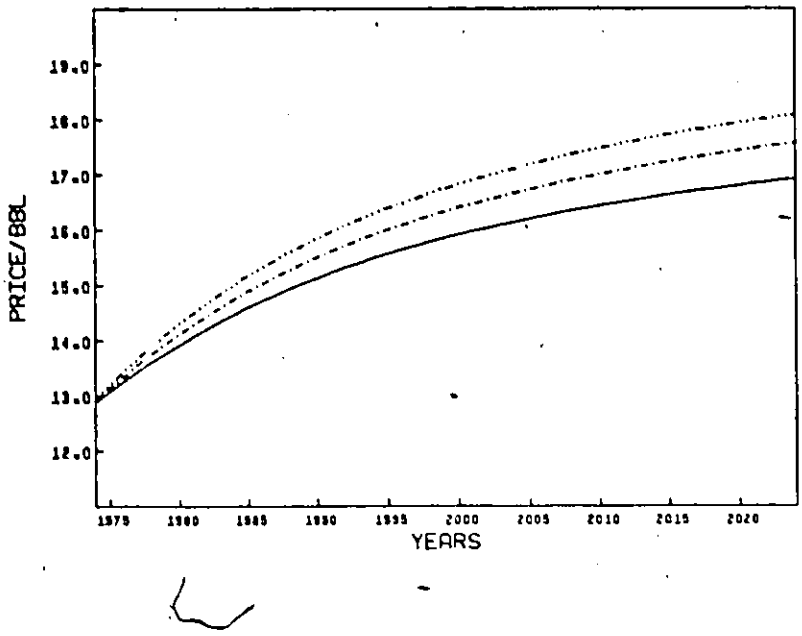
TABLE 5.13

ANTICIPATED REVENUE-INFLOWS FROM OIL PRODUCTION
IN MILLIONS OF NIGERIAN NAIRA

CASES	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
1	4910.149	6123.575	6715.093	7420.791	8245.573	9149.680	10172.545	11327.084	12633.389
2	4922.905	6184.399	6810.046	7555.159	8421.161	9368.410	10473.894	11643.528	13006.489
3	4935.540	6234.915	6901.467	7628.701	8585.476	9570.209	10679.245	11927.291	13336.403
4	4894.427	6092.329	6674.594	7391.015	8243.880	9196.488	10291.799	11547.071	12987.537
5	4904.389	6171.987	6837.961	7660.577	8694.464	9733.294	11084.796	12611.359	14390.578
6	4914.159	6251.848	7004.197	7939.133	9075.270	10388.643	11944.470	13783.718	15968.753
7	4904.389	6171.987	6837.961	7660.577	8694.464	9733.294	11084.796	12611.359	14390.578
8	4917.078	6229.375	6939.298	7801.111	8854.078	10041.212	11427.592	13043.797	14931.384
9	4929.648	6285.418	7036.438	7952.049	9045.557	10288.390	11739.386	13431.573	15409.498
10	4927.648	6331.933	7173.438	8227.191	9522.694	11045.718	12877.277	15076.188	17719.284

FIGURE 5.1

THE EFFECT OF CHANGES IN THE RATE OF GROWTH OF WORLD DEMAND FOR OPEC'S OIL ON OIL PRICE



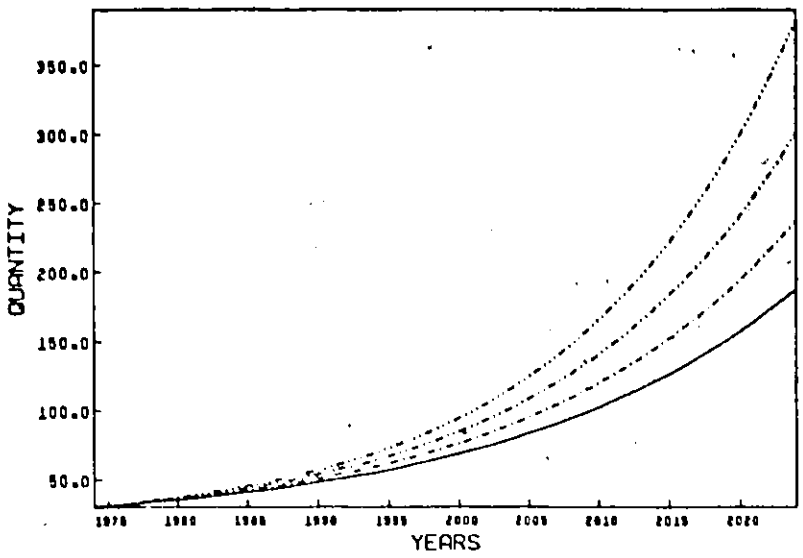
——————— Case 1: r = 0.04 g = 0.050

— · — · — Case 2: r = 0.04 g = 0.055

— ··· — ··· — Case 3: r = 0.04 g = 0.060

FIGURE 5.2

THE EFFECT OF CHANGES IN r AND g ON THE OPTIMAL RATE OF OIL EXTRACTION BY OPEC



——————— Case 4: r = g = 0.045

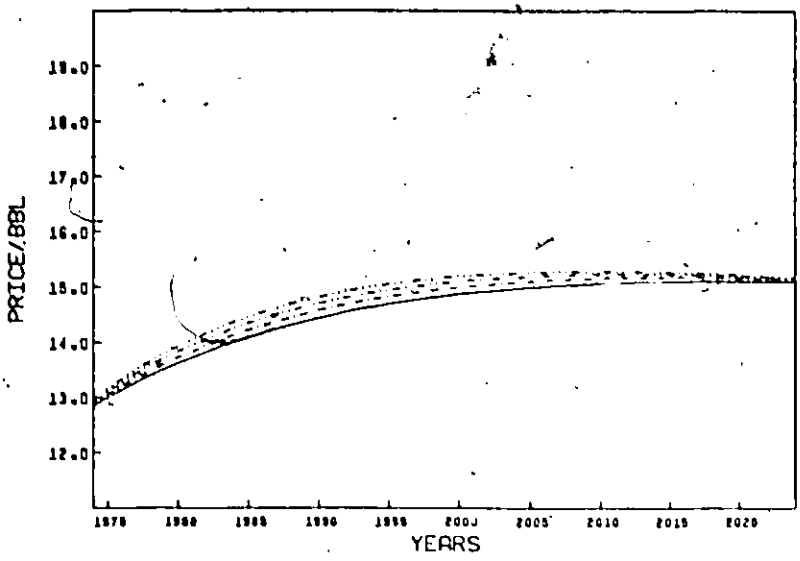
—— · —— · —— Case 5: r = g = 0.050

—— ·· —— ·· —— Case 6: r = g = 0.055

—— ··· —— ··· —— Case 10: r = g = 0.060

FIGURE 5.3

THE EFFECT OF CHANGES IN r AND g
ON THE PRICE OF OPEC OIL



Case 4: r = g = 0.045

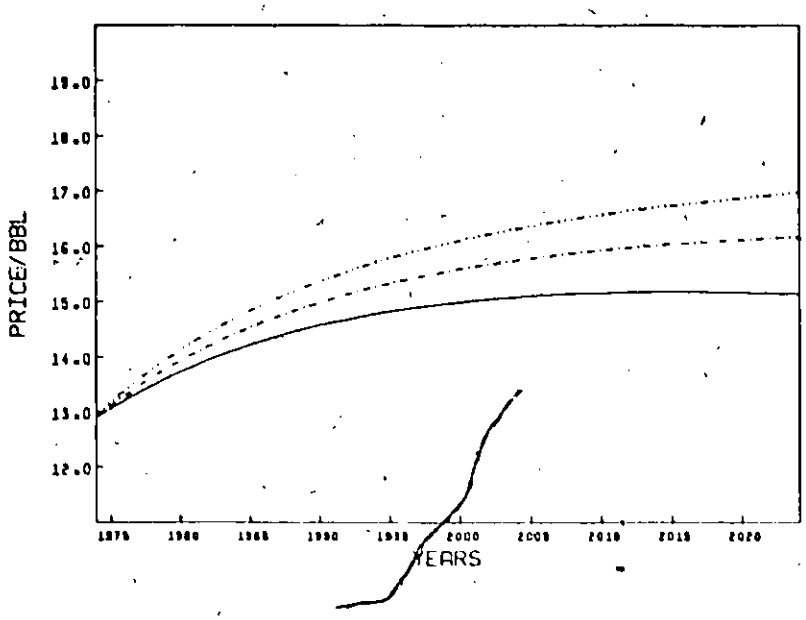
Case 5: r = g = 0.050

Case 6: r = g = 0.055

Case 10: 4 = g = 0.060

FIGURE 5.4

THE EFFECT OF CHANGES IN THE RATE OF GROWTH OF WORLD DEMAND ON OIL PRICES GIVEN A HIGHER RATE OF DISCOUNT



——————— Case 7: r = 0.05 g = 0.050

——— · ——— · ——— Case 8 r = 0.05 g = 0.055

——— .. ——— .. ——— Case 9: r = 0.05 g = 0.060

FOOTNOTES
(to Chapter 5)

[1]Dean, E., Plan Implementation in Nigeria, (Ibadan, NISER/OUP, 1972), pp. 96-99

[2]Nigeria, Second National Development Plan: 1970-74, (Lagos, Central Planning Office, 1970), p. 65.

[3]Nigeria, Second National Development Plan, ibid., 1970, p. 299.

[4]Nigeria, Second National Development Plan: 1970-74 - Second Progress Report, (Lagos, Central Planning Office, 1975), p. 25.

[5]Nigeria, Guidelines for the Third National Development Plan: 1975-80, (Lagos, Central Planning Office, 1973), p. 8.

[6]See the First Progress Report on the Third National Development Plan: 1975-80, (Lagos, Central Planning Office, 1977), pp. 12-13 and Table 2.18.

[7]A survey of such research efforts is given by Fischer, D., D. Gately and J.F. Kyle, "The Prospects of OPEC: A Critical Survey of the World Oil Market", Journal of Development Economics, vol. 2, 1975, pp. 363-386. A more recent compendium of papers on the world oil market is contained in the August, 1976 issue of the European Economic Review.

[8]There is an on-going argument concerning whether the structure of such models have been incorrect or the models were analytically sound but the parameter estimates employed in their forecasts of future trends in the world oil market were inaccurate. This study contends that most of these studies have short-comings on one or both of these counts.

[9]Since reserves consist of both proven reserves as well as secondary recoveries and potential discoveries due to exploration, the best approach would be to incorporate the exploration stage of the oil production process into the model as done by Uhler (1977) or to formulate the problem as that involving the optimal extraction of an exhaustible resource under conditions of uncertainty as in Dasgupta and Stiglitz (1976) and Gilbert (1976). However, these alternative approaches depend on knowledge of success-rates in oil exploration as well as geophysical equations describing the pressure characteristics of oil wells which are both beyond the scope of this study. We have chosen to proceed under the assumption that estimates of reserves are made with due consideration given to these factors.

[10]Although this formulation seems only intuitive, it is shown below that the optimization model itself imposes specific requirements on the class of admissible cost-functions, quite contrary to the usual practice of using arbitrarily specified cost-functions.

[11]As far as this sub-model is concerned, the time-index t refers to years instead of the time-periods of the multi-sectoral planning model.

[12]The three conditions used here are standard optimality requirements in calculus of variations. For further details, see Intrilligator, M.D., Mathematical Optimization and Economic Theory, (Englewood Cliffs, New-Jersey, Prentice-Hall, 1971), Chapter 11.

[13]This group includes all oil-producing countries in the developed industrial world as well as supplies from the U.S.S.R. and China.

[14]Estimates of the elasticity parameter vary but 0.33 represents the medium-to-low estimate of the elasticity of demand for OPEC oil used in several studies including those by Gately and Kyle (1977), Kalymon (1975) and Marshalla (1977).

[15]See Rustow, D.A. and J.F. Mungo, OPEC: Success and Prospects, (New York, New York University Press, 1976) Table 3, p. 133 and also Kalymon (1975) and Marshalla (1977).

[16]The mathematical derivation of equation (5.13) is given in the mathematical appendix to this chapter.

[17]Since we know the model's boundary condition requires that $x(0) = 0$, we can define the total cumulative extraction after one year as $x(1)$ and this was equal to 11.23105 billion barrels at the beginning of the 1975 production year. See Rustow and Mungo, OPEC: Successes and Prospects, op. cit., pp. 128-129.

[18]There is no reason to suspect that the 5-year moving average will lead to the allocation of production levels which exceed the individual country's production capacity. However, as the total OPEC output increases over time, such massive capacity build-ups may be necessary. Thus, the implied assumption in the analysis is that whenever any country suffers a shortfall in output due to capacity limitation, such a shortfall can be absorbed by one of the leading producers like Saudi Arabia.

[19]It is necessary to note that since the model does not price the remaining reserves, these are not reflected in the price paths. However, since the terminal date is variable, the simulation of price-paths beyond the exhaustion of known reserves would indicate the optimum price profile in case additional oil reserves are discovered.

[20]Estimates of the world's reserve of crude oil vary depending on the estimate of potential recoverable reserves. The estimate quoted here has been derived from a combination of estimates from the International Energy Biweekly Statistical Review published by the U.S. Central Intelligence Agency and estimates by Moody, J.D. and R.W. Esser, "World Crude Resource May Exceed 1500 Billion Barrels", World Oil, September, 1975, p. 49.

CHAPTER 6: APPLICATION OF THE MODEL TO DYNAMIC MULTI-SECTORAL PLANNING FOR NIGERIA

6.1 Introduction

Within any planning context, the design of a planning model constitutes only a stage at the beginning of the planning process. The essence of such an effort lies in the application of the model to a specific economy for which the model is only an abstract construct. Quite often, such a practical application is a difficult task to accomplish especially with regard to bridging the gap between economic theory and economic policy. In the earlier chapters, the basis for dynamic multi-sectoral planning in Nigeria was established. In Chapter 4, the structure of the planning model was outlined in detail and in Chapter 5, a model establishing the oil sector as the major source of finance for Nigeria's future development plans was outlined, along with alternative patterns of anticipated revenue-flows from an OPEC-wide allocation model. These two aspects of the planning exercise are integrated into a single framework and applied to multi-sectoral planning for Nigeria over the period 1974 to 2001 in this chapter.

The next section of this chapter consists of a discussion of the procedures by which the existing Nigerian data base was adapted to suit the requirements of our model specification. This includes a discussion of the sources of the data used in the analysis, the scheme of sectoral aggregation and the methodology involved in constructing both the input-output matrix and the capital coefficients matrix employed in this study.

In the third section of the chapter, the results of the base-case or reference solutions are presented. The discussion begins with a brief outline of the initial operational and computational procedures involved in the implementation of the model. This is followed by a discussion of the basic characteristics of the base-case model and the results of the reference solutions. However, dynamic linear programming models possess the capacity for use as tools in simulating the consequences of a wide range of alternative policy goals and for tracing the trade-offs among these goals. Thus, simulation experiments were conducted with the model, and the results of these experiments are presented and discussed in the fourth section of the chapter. The last section of the chapter presents a summary of the main results of the planning exercise as well as an overview of the computational experience.

6.2 Adapting the Existing Data Base for Multi-Sectoral Planning

6.2.1 Sources of Data Employed in the Analysis

The most common problem encountered in planning for a typical developing country is the dearth of statistical data in the appropriate magnitudes and with the required degree of accuracy and reliability. However, the extent to which this problem inhibits the successful completion of the planning task varies from country to country and within the same country over time. In Nigeria's case, the problem posed by the shortage of statistical data has been minimal since there now exists abundant data on the major macroeconomic aggregates and other variables required in this study.[1]

Much of the data employed in the implementation of the model was collected from official publications of the three major data sources on

the Nigerian economy - the Federal Office of Statistics (FOS), the Central Planning Office (CPO) and the Central Bank of Nigeria (CBN). Of the several publications of the FOS, this study has relied mainly on the Annual Abstract of Statistics up to 1974, the annual Industrial Survey of Nigeria from 1963 to 1974 and the National Accounts of Nigeria: 1958/59 to 1973/74 and the supplement to it published in June, 1977.[2] Unlike the Annual Abstract of Statistics which contains all kinds of economic statistics on Nigeria, the latter publications are more specific. The Industrial Survey of Nigeria, published annually since 1963, includes data on all manufacturing activities and was the source of data on gross output, value-added, employment and capital stocks for the manufacturing sectors.[3] The National Accounts of Nigeria, published every two years since 1972, is the major source of data on macroeconomic aggregates especially the gross domestic product and the gross national product by sectors, the structure of gross fixed capital formation and the pattern of external trade and transactions.

The data available from the CPO is embodied in the various development plan documents and the progress reports on them as well as from internal reports and special studies of the macroeconomics division of the CPO. The Central Bank of Nigeria publishes both the Annual Report and Statement of Accounts and the Economic and Financial Review as well as a periodic update on the economy entitled Nigeria's Principal Economic and Financial Indicators. All these documents, supplemented by data from the Research Department of the Central Bank, proved very useful especially since the CBN is partly responsible for monitoring economic activity in the country and is charged with managing the inflows of oil and non-oil foreign exchange resources into Nigeria. Thus, data on foreign trade, balance of

payments and oil revenues were largely obtained from the Central Bank's sources.

In addition to the government agencies, some of the data used in the update of the Nigerian input-output table and the construction of the capital matrix was obtained from P.B. Clark's Planning Import Substitution (1970) and from Dr. Arik Kuyvenhoven of the Netherlands School of Economics.

In many instances, the data so obtained was not in readily useable form and thus had to be substantially modified to suit the requirements of our analysis. A detailed discussion of the derivation of each variable is deferred till a later part of this section. Because the data has been aggregated in many instances to suit the 13-sector framework of the planning model, a detailed discussion of the sectoral aggregation scheme is presented next.

6.2.2 Sectoral Aggregation for Planning Purposes

For a long time, there existed a gap between the aggregative models designed by planning theorists and the highly disaggregated microeconomic approach employed by professional planners. The lack of application of the former was due to limited interest among researchers who focussed on designing and proving the numerical properties of planning models. Applications of aggregative models in sufficient sectoral detail was also limited by computational capacity up to the late 1960's. On the other hand, the microeconomic approach to planning had the operational appeal that it permits planning by project evaluation and is devoid of aggregation bias. Recent advancements to computation techniques and

computer technology have helped to narrow this gap by making possible the specification of large-scale models involving as many sectors and time-periods as the planner may choose. However, in choosing the number of sectors to include in a planning model, one has to take into account the computational inconvenience implied by excessive disaggregation, the limitation imposed by time, manpower and other resource constraints, the loss of realism that over-aggregation may imply and the operational goals of the planning exercise. The choice of a 13-sector framework in the design of an inter-temporal planning model for Nigeria has been guided by these factors as well as the extent to which the required data is readily available in useable form.

A cursory look at Nigerian economic statistics conveys the impression that such data that is pertinent to planning has traditionally been supplied according to sector detail. However, the sector classification scheme varies depending on the data source and the variable being measured. For example, the 48 different activities currently listed in the Nigerian Industrial Survey are treated as only two sub-sectors (Manufacturing and Crafts respectively) of the Manufacturing sector in the National Accounts. Furthermore, several studies of the Nigerian economy based on input-output techniques have varied in their sector-detail. The original study by Nicholas Carter (1963) devised a 20-sector input-output table for Nigeria in 1959/60. The Carter table was subsequently condensed to an 11-sector table to which 14 import-substitution activities were added, yielding a 25-sector table. Clark further augmented these by 61 'new' sectors to form a 86-sector input-output table for the Nigerian economy.

Following Clark's study, Arik Kuyvenhoven (1976) outlined 106 sectors of the Nigerian economy.[4] Thus, data available from different sources have to be aggregated consistently and adapted to the requirements of the planning exercise.

The dynamic multi-sectoral planning model outlined in Chapter 4 was implemented in this study on the basis of a 13-sector framework. This 13-sector classification bears a close relationship to the classification scheme adapted in the earlier studies mentioned above, differing from them only in the disaggregation of the manufacturing sectors. Table 6.1 outlines the relationship between the 13-sector classification scheme adapted in this study on the one hand, and Carter's 20-sector classification and Clark's 25-sector classification on the other.

It can be seen from Table 6.1 that the 13-sector aggregation scheme adapted here differs from Carter's 20-sector and Clark's 25-sector schemes because it further aggregates the manufacturing sectors into only six sectors as compared to ten sectors in the Carter table and eighteen sectors in Clark's table. Also, Carter's first three sectors were aggregated into a single sector, namely Agriculture, Forestry and Fishing (Sector 1). The last four sectors - Utilities (10), Construction (11), Trade and Services (12) and Transport (13) - are nearly identical in all three tables. As compared to Clark's 11-sector aggregation, the metal and non-metal mining sector (number 3 in Clark's table) has been broken down into mining excluding oil and oil mining and refinery, sectors 2 and 3 respectively in this study, because of the special role accorded the oil sector in the planning model. Furthermore, the sequential arrangement of the sectors in this study is according to the natural order of sectors as laid down in the

International Standard Industrial Classification (ISIC) code. The exact relationship between our 13-sector classification scheme and Clark's 86-sector and Kuyvenhoven's 106-sector disaggregated tables is presented in Appendix Table VI.1.

6.2.3 The Basic Data Employed in the Analysis

(i) Existing Input-Output Tables for Nigeria

The earliest input-output table for the Nigerian economy was constructed by Nicholas G. Carter in 1963.[5] This study, commissioned by the government as a direct complement to an earlier study on Nigeria's National Accounts, 1950-57 by Okigbo (1962), was intended to lay the foundation for multi-sectoral planning in Nigeria. Carter's table depended mainly on projections of Okigbo's Nigerian national accounts series over the period 1950-1957 to 1959. Following the basic nature of input-output analysis, Carter's table outlined intermediate transactions among twenty sectors of the Nigerian economy and the final deliveries by these sectors to consumption, investment and export for the fiscal year April 1, 1959 to March 31, 1960. Carter's study has, however, been of limited use in Nigerian planning especially because of the close relationship it bears to Okigbo's study.[6]

In a different study on import-substitution in Nigeria, Carter's table was updated and expanded by P.B. Clark (1970). The starting point in Clark's study was an 11-sector aggregate version of the Carter table from which 14 import-substitution sectors were disaggregated to create a 25-sector table for 1959/60. These were further augmented by 61 'new' sectors which, although importing in 1959, were thought to be future import-

substitution sectors. To complete the row and column entries for these 61 new sectors, Clark used estimates from "feasibility studies of potential Nigerian industries or from industrial census and inter-industry tables of other underdeveloped countries".[7] Although this adaptation of 'potential' technology for some sectors from other developing countries has limited the use of Clark's table, the procedure is logically sound and, as long as it is not conducted in an arbitrary way would be accepted in the circumstances. In Clark's analysis, the elements of the 86-sector matrix for the deliveries by the new sectors to the existing sectors were estimated from the value of imports delivered to each of the twenty-five industries in which case the sectoral value of imports is an estimate of the gross production by the potential industry and the import deliveries to each existing sector an approximation of actual deliveries that would have been made if the sector was already in existence.

Although Clark's study was interested in import-substitution possibilities in Nigeria, the input-output table it was based on was adapted for use in this study mainly because it is the most reliable existing table. It has also been used as the basis of special studies on the Nigerian economy by the World Bank and the International Monetary Fund. A more recent study by Arik Kuyvenhoven (1976) has expanded the Clark table to a 106-sector format by the inclusion of 'new' sectors on the basis of feasibility studies for the Third National Development Plan as well as some long-term projections of the economy.[8] Data supplied by Dr. Arik Kuyvenhoven has been used as a guide in the update of the input-output table and as the sole basis for the construction of the capital matrix.[9]

(ii) Bi-proportional Estimate of the Nigerian Input-Output Transactions Matrix

Alternative techniques exist for the update of input-output matrices. The earliest method was suggested by Leontief (1941) who suggested the use of the form:

$$(6.1) \quad L_{ij}(1) = r_i \, s_j \, L_{ij}(0)$$

for estimating the i,j-th input-output ratio for the current period from known values of the corresponding i,j-th input-output ratio in the initial period. Once the additional restriction that $L_{ij} \geq 0$ is added to equation (6.1), the matrix $L(1) = [L_{ij}]$ is said to be non-negatively bi-proportional to the initial matrix L(0). An alternative method based on linear programming was suggested by Matuszewski, Pitts and Sawyer (1964). Other suggested techniques are closely related to Leontief's original suggestion but involve more detailed econometric investigation and data that they are of limited practical use. These include the stochastic model by Friedlender (1961), the GNP or final demand "blow-up" methods suggested by Arrow and Hoffenberg (1959) and another technique based on classical analysis of variance suggested by Granger (1977).[10] These techniques are however generally more complicated and have been shown to be inferior to the RAS technique developed by Stone (1962).[11]

Stone's model proposed an equation similar to 6.1 but he suggested that, instead of estimating the individual elements of the matrix L(1), equation (6.1) would be fitted to single observations on total intermediate outputs U_i's and total intermediate inputs V_j's. That is, given the initial matrix L(0) and the current values of $U_i(1)$, $V_j(1)$, and $q_j(1)$, the gross output of commodity j, Stone determined r_i's and s_j's such that:

$$(6.2)\quad \sum_{j=1}^{n} r_i\, s_j\, L_{ij}(0)\, q_j(1) = U_i(1) \quad \text{and}$$

$$(6.3)\quad \sum_{i=1}^{m} r_i\, s_j\, L_{ij}(0)\, q_j(1) = V_j(1)$$

By conventional notation, $U_i = \sum_{j=1}^{n} X_{ij}$ and $V_j = \sum_{i=1}^{m} X_{ij}$, the observed total intermediate output of commodity i and total intermediate input into commodity j. The row multipliers, r_i's are then interpreted as measures of substitution tendencies between commodity inputs whilst the column multipliers s_j's, are interpreted as measures of upward or downward tendencies in the "degree of fabrication" in individual industries.[12] Thus, using observable data on the marginal totals and on gross outputs, the update of an initial input-output matrix L(0) to a current matrix L(1) consists of solving equation (6.1) subject to the constraints (6.2) and (6.3) as well as the non-negativity requirement that $L_{ij}(1) \geq 0$. The solution to the model is an estimate of the current input-output table where rows and columns sum to observed total intermediate inputs and outputs or marginal totals. This model was first employed in updating the British input-output table[13] and has since been tested in other studies mainly by Paelnick and Waelbroeck and has been applied in studies by Benard.[14]

The major shortcoming of the RAS technique is that it is zero-preserving and as such its predictive accuracy may be difficult to sustain over long periods of time especially if the economy is developing and undergoing changing technologies. However, it is suggested that in specific instances when the technology is known to have changed, the entry of a small non-zero number in the i,j-th coefficient corresponding to the observed

change in the initial matrix enables the RAS technique to produce a non-negative coefficient in the updated matrix.

This technique has been employed in updating an aggregated 13-sector table for 1965/66 derived from Clark's study to a current matrix for 1974/75. This application required both the modification of the basic data as well as the techniques. Whereas the RAS technique updates input-output coefficients a_{ij}'s, we have chosen to update the intersectoral transaction flows, X_{ij}'s. This is logically valid since $a_{ij} = X_{ij}/X_j$ and, because the updates are based on current values of the X_j, $\sum_{i=1}^{m} X_{ij}$ and $\sum_{j=1}^{n} X_{ij}$ per sector, the updates of the X_{ij}'s imply an indirect update of the a_{ij}'s.

(iii) Procedures Involved in the Input-Output Update

The application of the RAS technique requires observations on the row and column marginal totals and data on gross production as primary data. However, neither of these was available according to the 13-sector format adapted for this study and had to be derived from available data. In his study, Clark (1970) published the detailed disaggregated 86-sector input-output table for the Nigerian economy in 1959/60 as well as the sectoral levels of commodity balances in the optimal solution dated 1965/66. Thus, on the assumption that the input-output coefficients stayed constant between 1959/60 and 1965/66, it is possible to convert each a_{ij}^{59} into a transaction flow X_{ij} in 1965/66 by use of the equation

$$(6.4) \quad X_{ij}^{65} = a_{ij}^{59} \; X_j^{65}$$

where X_j^{65} in the gross production in sector j in 1965/66. The new 86-

sector matrix $X^{65} = [X_{ij}^{65}]$ was then aggregated to a 13-sector matrix according to the sectoral aggregation scheme outlined above.

The other half of the data preparation involved the computation of the column totals $TC_j = \sum_{i=1}^{13} X_{ij}$ and row totals $TR_j = \sum_{j=1}^{13} X_{ij}$ from the available national accounts data. Since the value of gross domestic production, X_j is equal to the sum of total inputs into the production of a commodity, TC_j, and the value-added in the production process, V_j we can state that:

$$(6.5) \quad TC_j = X_j - V_j$$

The National Accounts of Nigeria publishes data on value-added, but only in the sectors corresponding to the national accounts format; here manufacturing is broken down into only two sub-sectors. Thus, data problem here involved two stages - first to transform national accounts data to suit our 13-sector format with six manufacturing sectors and then to obtain the sectoral levels of total intermediate inputs.

The data for value-added and gross production in the six manufacturing sectors was obtained from the Nigerian Industrial Surveys. However, the Industrial Surveys cover only those firms employing more than ten persons and as such would not give the same figures as the national accounts. Furthermore, because the ratio of value-added to gross production in these sectors was found to be unstable over time, it was decided that a weighted average of the ratio of sectoral value-added and gross production to total value-added and gross production be employed in defining the ratios for transforming the national accounts manufacturing sector's value-added to their sectoral shares. The simple form of this ratio is:

$$(6.6) \quad M_{mt} = \frac{V_{mt} + X_{mt}}{\sum_{m=1}^{6} (V_{mt} + X_{mt})}$$

where the subscript m refers to the six manufacturing sectors (sectors 6 - 9) in the 13-sector table and the time subscript t refers to the nine years from 1965 to 1974, excluding 1967.[16] These ratios were applied to the national accounts data to obtain the sectoral levels of value-added in the six manufacturing sectors. The ratios so derived are reported along with the ratios of value-added to gross production in the manufacturing sectors in Table 6.2.

In the second step, the value-added ratios for the manufacturing sectors were combined with estimates of value-added ratios in the other sectors obtained from Kuyvenhoven's study to convert the sectoral levels of value-added into sectoral levels of gross production X_{jt} for 1965 to 1974. Using equation (6.5) the sectoral levels of total inputs can then be defined as:

$$(6.7) \quad TC_{jt} = (1-\sigma_{jt})X_{jt}$$

where $\sigma_{jt} = V_{jt}/X_{jt}$

The estimated total inputs for 1974-1975 are reported in Table 6.4.

In order to derive the sectoral values of sectoral total intermediate outputs, $TR_j = \sum_{j=1}^{13} X_{ij}$ a distinction had to be made between sectoral total domestic supply X_i^* and the sectoral gross production X_i derived above. Generally, $X_j^* = \sum_{j=1}^{13} X_{ij} + F_i^*$ where F_i^* is the sectoral level of final demand which includes final deliveries to consumption, investment and exports

less imports. The data on final demands was obtained from the National Accounts publication and, using the initial 1965/66 input-output, was used to derive the $TR_i = \sum_{j=1}^{13} X_{ij}$ as follows. Since $X_i^* = X_i + M_i$ where M_i is sectoral level of imports and,

$$(6.8) \quad X_j^* = \sum_{j=1}^{13} X_{ij} + F_i = \sum_j a_{ij} X_j + F_i^*$$

We obtain the result:

$$(6.9) \quad X_{jt} = \sum_j a_{ij} X_{jt} + (F_{it}^* - M_{it}) \text{ or, in matrix notation}$$

$$(6.9') \quad X_t = A X_t + F_t \qquad \text{where } F = F^* - M$$

$$\text{Thus, } X_t = [I-A]^{-1} F_t \qquad \text{and the result:}$$

$$(6.10) \quad TR_t = [X_t - F_t]$$

gives us estimates of the sectoral levels of total intermediate demands for the period 1965-1974.

Both the time-series data on TC_{jt} and TR_{jt} so obtained were then employed as the required marginal constraints in the bi-proportional update of the initial input-output table from 1965/66 to 1974/75. The scheme for the update was sequential, with updates performed for one year at a time. Thus, the updated 1966/67 table was based on the initial 1965/66 table whilst the updated 1968/69 table was based on the updated 1966/67 table and so on. Table 6.3 shows the resulting 13-sector input-output coefficients matrix whilst Table 6.4 shows the input-output transactions flow matrix for 1974/75 in greater detail. The matrix in Table 6.3 was used as the matrix $A = [a_{ij}]$ required in the multi-sectoral planning model.

(iv) The Capital Coefficients Matrix

Like the input-output transactions matrix, the existing capital coefficients matrix for Nigeria dates back to Clark's study which also published an 86-sector table for Nigeria for 1965/66.[17] This table was subsequently updated by Kuyvenhoven (1976). Kuyvenhoven's matrix is a highly disaggregated 106-sector matrix for 1974/75 and was largely based on Clark's original table with necessary modifications made to incorporate the new sectors and more recent data obtained from the Industrial Surveys up to 1972 and the changes in the structure of the economy's capital stock as a result of the Second National Development Plan, 1970-74. The capital coefficients matrix employed in this study was derived mainly from Kuyvenhoven's table but with modifications made to reflect more up-to-date data obtained from the 1973 and 1974 Industrial Surveys as well as capital programmes embodied in the Third National Development Plan.

In order to aggregate the 106-sector table into a 13-sector table, the sectoral levels of capital stock, K_j's, were updated from their 1972 levels reported by Kuyvenhoven to the 1974 levels reported in the Industrial Surveys and the opening levels of capital stocks in the non-industrial sectors as published in the Third National Development Plan, 1975-80. With these, all the coefficients in Kuyvenhoven's table were converted into K_{ij}'s, actual values of capital stocks in sector j purported to be delivered as investment goods by sector i. Each K_{ij} includes deliveries of investment goods in the form of machinery and equipment, furniture and fixtures, buildings, civil engineering works, transport equipment and land. Once the K_{ij}'s were obtained, they were aggregated according to the aggregation scheme outlined earlier. The aggregated values of the K_{ij}'s were in turn converted

into capital coefficients as follows.

The existing capital stock in each sector was assumed to have been accumulated from deliveries of investment goods to that sector by domestic industries or by imports of capital goods delivered to that sector over time. Thus, β_{ij}, the capital coefficient representing the delivery of investment good j by any sector i was defined as the ratio of the existing capital stock in sector j originating from sector i. That is

$$(6.11) \quad \beta_{ij} = K_{ij}/K_j$$

where the K_{ij}'s and K_j's are valued at their original book values[18] and each K_j includes the valuation of capital stocks delivered from imports K_{mj}. Thus, if we define β_{mj} as K_{mj}/K_j, it follows that $\sum_i \beta_{ij} + \beta_{mj} = 1$. The resulting input-output capital coefficients matrix is presented in Table 6.5

(v) Other Data

Apart from the input-output matrices, other basic data employed in the analysis include data on initial capital stocks, estimates of labour availability, capital-output and labour-output ratios, consumption ratios, oil use ratios and other parameters, especially the import-shares by type of imports, the depreciation rate and the savings rate. The most important of these are shown in Table 6.6 and the others are described in the glossary of variables in Appendix Table VI.2.

The value-added ratios for the non-industrial sectors were taken from data supplied by Kuyvenhoven while those for the industrial sectors were calculated from the Industrial Surveys as earlier described. These

have been used along with National accounts estimates of the 1974/75 sectoral value-added to compute the sectoral gross production in 1974/75. The sectoral capital output ratios were obtained in the same way - from Kuyvenhoven's data for the non-industrial sectors and from the industrial surveys for the other sectors. The labour-output ratios were simply computed from the ratios of labour supply to gross production in 1974/75, the former being taken from the sectoral supplies of labour as reported in the Third National Development Plan;[19] the estimates for each of the industrial sectors were again obtained from their respective shares of total industrial labour supply reported in the Industrial Survey, 1974.

Although the initial levels of labour availability were obtained in this manner, the sectoral levels of labour supply employed in the empirical implementation of the model were revised upwards when these given labour supply limits were causing the model to be infeasible. The upward revision involved a 10% increase in the level of initial labour supply in all sectors, over the 1974/75 level. However, the increase in sectoral labour supply during the first period 1974-1977 was assumed to be half of that projected for the 1975-80 period covered by the Third National Development Plan.[20] The sectoral levels of labour availability in subsequent periods were then assumed to grow at a rate of 10% per period over the entire planning horizon. These projected sectoral levels of labour supply are shown in Table 6.7.

Kuyvenhoven's estimates of the capital-output ratios were applied to the data on gross production in each sector to obtain the sectoral level of capital stock in the 106-sector matrix and then aggregated

into 13-sectors. The consumption ratios are simply the ratios of sectoral consumption expenditures to the total consumption expenditures in 1974/75; government expenditure is allocated in total to sector 12 - Trade and Services. Also, the domestic oil-use ratios, θ_j's, were approximated by the third row of the input-output coefficients matrix corresponding to the deliveries by the oil sector to the domestic economy.

Among the standard parameters of the model are the import growth rates for the three categories of imports - imports of consumer goods, C_m, imports of raw materials, X_m, and imports of investment goods, J_m. These were projected from the past trends of the structure of imports as well as explicit government policies regarding the desired structure of imports in the future.[21] The targets set in the Third Plan imply that the rates of growth of these import categories will be $\rho_t^c = -0.08676$, $\rho_t^x = 0.031669$ and $\rho_t^J = 0.06464$ for C_m, X_m and J_m respectively. The values of the other parameters are as explained in Appendix Table VI.2.

The specification of the basic data as outlined above was only a starting point in our analysis. The model itself had to be empirically implemented. The discussion of the computational experience in implementing the model as well as the results of the computation is presented next.

6.3 Empirical Implementation of the Model

This section presents the results of the application of the basic data just described to dynamic multi-sectoral planning for Nigeria for the period 1974 to 2001, using the model outlined in Chapter 4. The entire planning horizon was divided into nine planning periods each of three years length. However, the model was implemented in terms of the targets to be

attained in the first year of each three-year planning period on the assumption that these target-years would constitute the representative year for each planning period. This 'target' specification of the model is acceptable once it is ensured that all relevant variables are made to grow at annual rates and are duly converted to their three-year equivalents.

6.3.1 Basic Characteristics of the Application

The linear programming tableau which embodies the 9-period dynamic planning model was earlier described in Chapter 4 and its structure was shown in Table 4.4. In empirical application, the tableau involved 746 rows including the maximand row, the constraints and bounds on both initial values of gross production and terminal values of capital stocks. Also, given the set of column variables, slacks and the right-hand side, the linear-programming tableau involved 1440 structural variables. This is evidently a large-scale problem and, with only 0.43% density of the constraint matrix, the model had to be solved by specialized computational techniques that explore the problem's basic sub-structure in computing the optimal solution. The problem was solved at different stages by use of solution algorithms embodied in Control Data Corporation's APEX III and I.B.M.'s MPSX, both of which are designed for large-scale linear programming problems with sparse matrices and are available with the parametrics option.[22]

It should be recalled here that the starting point in this study was to devise a dynamic multi-sectoral planning model within a framework that allows us to explore the future prospects of the Nigerian economy, with special regard to the extent to which the economy can be made to transform its inflows of oil-revenues into physical and human capital over time. Thus,

the empirical implementation of the model involved not only the determination of the basic macroeconomic indices of domestic production, investment, capital stocks, national income and imports but also the changes in these resulting from changes in the basic constraints of the model as well as the foreign exchange requirements implied by the different combinations of these constraints and the optimal activity levels. In all, 19 different cases were designed for this purpose. All the experiments require that a 5% minimum growth of consumption should be achieved per year, that the country's external payments should at least be in balance at any time and that terminal capital stocks should be sufficient to ensure that production activity continues beyond the terminal state of the model. The basic characteristics of these experiments are outlined in Table 6.8 and are described in sets below.

The first set of experiments - Experiments 1, 2 and 3, constitute the base-case experiments for the implementation of the model. These experiments were designed to explore the limits of resource-utilization in the Nigerian economy under different assumptions regarding the inflow of oil-revenues and the nature of the imports constraint. Experiment 1 permits the imports growth constraint to be non-binding but prescribes the maximum levels of foreign exchange utilization on the basis of minimum levels required for a feasible solution. In Experiment 2, the import growth constraint is activated at a maximum of 20% per period with the foreign exchange availability still prescribed. This was done to explore the extent to which the restriction of imports can force the model to use domestic resources. In Experiment 3, the model was allowed to choose its own

foreign exchange requirements,[23] given the maximum growth rate of imports at 20% per period. With this, it is possible to determine the country's basic revenue-absorption capacity given the goals set by the other constraints of the model.

The second set of experiments involve the variation of the rate of growth of imports, given the free choice of foreign exchange requirements. The objective of these experiments is to determine how significantly import control policies affect the economy's absorptive capacity as well as its levels of domestic production and investment activities. In Experiment 4, the rate of growth of imports is reduced to 15% per period whilst, in Experiment 5, it is increased to 25% per period.

In the third set of experiments, the savings rate is varied parametrically in order to explore its effects on the main variables especially total consumption, investment, capital stocks and imports. Since variations in the savings rate imply variations in maximum levels of total consumption and therefore the value of the objective function, an attempt is made here to discover how the model reallocates the given resources in seeking the optimal solution. Starting from Experiment 3 where the savings rate is 20%, it is reduced to 15% in Experiment 6, then increased to 18% in Experiment 9 and further to 22.5% in Experiment 10.

All the other experiments in the application involved the variation of the initial capital stock or changes in the rate of discount. Whilst the former was conducted in order to discover the extent to which the shortage of physical capital could be said to constrain Nigeria's development, the latter experiments were conducted in order to discover the effect of

changes in the rate of discount on levels of domestic production and foreign exchange requirements. Experiments 7, 8 and 17 increased the levels of sectoral capital stock by 5%, 10% and 20% respectively from their initial levels in Experiment 3 while Experiments 11 and 12 increased the rate of discount from 5% per annum in Experiment 3 to 7½% and 10% per annum respectively. The remaining set of experiments - Experiments 13, 14, 15, 16, 18 and 19 involve simultaneous variation in both the rate of discount and the initial levels of sectoral capital stock.

The result of all the foregoing experiments is a massive amount of data which, if taken singularly, will require a substantially larger report than this study envisages. The approach adopted in presenting the results of these experiments is to classify the experiments into their different sets and examine the effects of the changes introduced in each set of experiments on the major macroeconomic variables as well as the implications of these for foreign exchange requirements. The results are presented next.

6.3.2 The Results of the Base-Case Experiments

The base-case experiments involve Experiments 1, 2, and 3 in which an attempt is made to discover the effects of changes in the imports constraint and the pattern of the inflow of oil-funds on the Nigerian economy. In terms of their impact on major macroeconomic variables, these experiments show that changes in the import constraint, given a fixed pattern of foreign exchange inflow, do not have any effect on the pattern of production or investment, or the structure of capital stock but have significant effects on the sectoral as well as aggregate levels of imports. On the

other hand, changes in the availability of foreign exchange have significant effects on domestic production, investment, capital stock, imports, consumption and foreign exchange requirements.

The effect of the activation of the imports growth constraint from its non-binding status in Experiment 1 to a 20% limit in Experiment 2, both with fixed foreign exchange flows as compared to the free choice of foreign exchange requirements in Experiment 3, is shown in Table 6.9.[24] The overall indication is that without the imports growth constraint, all the sectors with the exception of Agriculture, Forestry and Fishing will import at the same level as when the import growth constraint is activated at 20%. However, when the import growth constraint is activated, Agriculture more than doubles its level of imports so that aggregate imports increase substantially in all periods. Agriculture's imports increase from ₦ 2758.997 million to ₦ 5656.406 million in 1974 and its imports total ₦ 18,822.815 million in 1998, which is 50% more than the corresponding level of ₦ 12733.981 in Experiment 1. However, when foreign exchange inflows are freely chosen in Experiment 3, imports to the Agriculture sector increase only marginally in 1974 but the other sectors show significant changes in their import activities. All the other sectors show increased import activities as a result of unlimited availability of foreign exchange resources, the most significant increases being made in Food, Beverages and Tobacco, Textiles and Apparel, Transport Equipment, and Utilities. Two sectors, Construction and Trade and Services, show a contrasting pattern of imports. Whereas the former shows a significant decrease in imports from ₦ 613.594 million to ₦ 376.156 million in 1974, followed by substantial increase in imports, the

latter shows an increase in 1974 from ₦ 272.289 million to ₦ 367.978 million, then followed by steady declines until 1995 when its imports start to increase again. It is notable that two sectors, Mining excluding Oil and Oil do not import at all in Experiments 1 and 2. In Experiment 3, Mining still remains fully domestic (non-importing) but the oil sector shows imports of ₦ 2736.677 million in 1977 and ₦ 3264.803 million in 1998. The overall impact of the relaxation of the imports constraint on total imports is shown in Figure 6.1. It can be seen that with the activation of specific imports growth constraint, there is a general increase in the level of total imports with total imports in Experiment 2 growing at a steady rate, presumably at the specified rate until the terminal period although the sectoral levels of imports are fluctuating throughout the entire period.

The foregoing observations have their implications for the levels of domestic production and investment and thus, the rate at which capital is built up over time. As can be seen in Tables 6.10 for Experiment 1 and and Table 6.11 for Experiment 3, the relaxation of the foreign exchange constraint induces most of the sectors to import rather than produce domestically. It should be noted that, because of the additional demand for foreign exchange, production in the oil sector increases substantially especially between 1977 and 1992. The most significant changes are observed in Transport Equipment where there is no domestic production between 1980 and 1989. Agriculture only shows declines in domestic production in 1977 and between 1980 and 1986. Domestic production is also reduced in Sector 2, Mining excluding Oil, until 1995 when the levels are the same as in Experiment 1. It should be noted that apart from a decrease in domestic production in 1995, Transportation does not show any significant response to the

pattern of the inflow of foreign exchange.

The overall implications of these changes in total domestic production are not as significant as the sectoral details seem to imply. Over the entire planning period, the levels of total domestic production in Experiment 3 is within one billion Naira less than the levels in Experiment 1 except in 1983 when the total domestic production in the former exceeds the latter. This confirms the fact that as the other sectors reduce their domestic production, the oil sector's production activity is increased in order to finance the increases in imports implied by the reduction in domestic production in the other sectors.

An examination of the patterns of gross investment in Experiments 1 and 3 further reveal that the additional demands for foreign exchange are being required to finance the displacement of domestic production by imports rather than to finance domestic investment in any particular way. Again, the aggregate levels of gross investment differ between both experiments by less than one billion Naira, averaging about 5% to 6% of aggregate investment in each period over the entire planning horizon, although the structure of gross investment is significantly different between both experiments. Whereas the Mining sector builds up capital less quickly in Experiment 3 than in Experiment 1, the oil sector's investment profile shows an upward trend, at least up to 1983. This is an indication that if the oil sector is expected to be the source of finance for Nigeria's future plans, then it should be given greater priority in the government's capital programmes in the near term rather than in the distant future. Our computation experience also shows that, apart from the Mining and Oil sectors, the other sectors build up their capital stock only when the capital capacity limit is being

approached.

The implications of these changes in the sectoral composition of gross investment are shown in Tables 6.13 and 6.14. Table 6.13 shows the actual levels of capital stock in the economy for both Experiments 1 and 3 whilst Table 6.14 shows the structure of sectoral shares of aggregate capital stock in both cases. It can be seen from Table 6.13 that there is a general decrease in the rate of capital accumulation in Experiment 3 compared to Experiment 1, especially in the period up to 1986, after which the rate of capital stock growth is higher in Experiment 3. It should be noted that although the levels of capital stock declines in some sectors as a result of depreciation, the build-up of capital in the Mining and Oil Sectors and, to a lesser extent, Textiles and Trade and Services, is enough to keep the aggregate capital stock growing at an average of 20% per period in the period up to 1986 and at about 32% for the rest of the planning horizon. Another implication of these changes is in terms of the sectoral shares of total capital stock over the planning horizon as shown in Table 6.14. This table reflects the dominance of the Mining and Oil sectors in the investment picture as well as the declines in the ratio of the capital stock in Agriculture to total capital stock up till 1986.

An additional implication of the change in foreign exchange availability is seen in terms of its impact on the pattern of total consumption over time. Once the model is allowed to freely choose its foreign exchange requirements in Experiment 3, there is a general increase in the level of total consumption. This increase amounts to about ₦ 280 million in 1974, increases to about ₦ 480 million in 1977 and stays at about ₦ 700 million between 1980 and 1986, after which the profile of total consumption in

Experiment 1 exceeds that in Experiment 3 but by less than ₦ 100 million in any target-year for the rest of the planning horizon. These results are shown in Figure 6.2. Despite the change after 1986, this relaxation of foreign exchange availability has a direct impact on the value of the objective function, increasing it from ₦ 128,409.52148 million in Experiment 1 to ₦ 129,697.76269 in Experiment 3 which is the highest value attained by the objective function in any of these three experiments. Once again, the indication is that foreign exchange inflows would have their greatest impact on the Nigerian economy only in the period up to 1986, after which year the economy can be said to have reached its saturation point in terms of absorptive capacity.

The overall impact of the relaxation of foreign exchange availability on foreign exchange requirements can be seen in Figure 6.3. Compared to the prescribed levels of foreign exchange inflows in Experiment 1, the foreign exchange requirements in Experiment 3 are substantially larger, being at least two billion Naira above the prescribed levels except between 1992 and 1995 when both are the same. Note that this general increase in foreign exchange requirements is not dependent on the nature of the import constraint because the pattern of foreign exchange requirements is the same in Experiment 1 where the imports constraint is non-binding and in Experiment 2 where imports are allowed to grow at 20% per period.

6.3.3 Results of the Simulation Experiments

One basic characteristic of planning models based on linear programming is that once they are operational, they can be employed as tools in exploring the alternative configurations of the major macroeconomic variables

on the basis of systematic changes in the parameters of the reference solution. This portion of the study is considered to be equally important since the series of experiments so conducted provide the only means by which the impact of deviations from the standard values used in the base-case solution can be evaluated. Four sets of experiments have been conducted in this section and have been described earlier. However, in considering the results of the experiments, it should be noted that the series of changes introduced are not mutually exclusive in reality. They have been considered separately here in order to distinguish the effects of each type of change on the major macroeconomic variables. The results of the sets of experiments are presented here in turn.

(i) Effects of Changes in Rate of Growth of Imports

When the initial computer runs of the base-case model were being implemented, it was discovered that one of the most significant variables affected by the results in the first three experiments was the value of imports to each sector as well as the value of total imports. Thus, it was decided that imports should become amenable to explicit policy while allowing the model unlimited amounts of foreign exchange. This was done in Experiment 3 where the rate of growth of imports per period, μ, was set at 20%. From this level, μ was reduced to 15% in Experiment 4 and then increased to 25% in Experiment 5. The overall indication of the results in this set of experiments is that, given foreign exchange resources, total imports into the economy will grow at steady rates up till 1992 when all the three growth rates permit about the same amount of imports. Basically, when the rate of growth of imports is reduced, the model chooses a higher

level of imports in the initial period from which it grows at a slower but steady pace throughout the entire planning horizon. The converse is true when the μ is increased - imports start from a lower level and then grow at a faster pace over the planning horizon. These results are shown in Figure 6.4. The logic of the model's behaviour lies in the fact that, since domestic supply is the sum of domestic production and imports and, given unlimited foreign exchange resources, the model chooses a profile of imports without requiring massive increases in imports that would violate the imports growth constraint in later periods. Actual levels of total imports in these three cases start from a low of ₦ 6727.753 million in Experiment 5 and ₦ 8501.293 million and ₦ 11044.484 million in Experiments 3 and 4 respectively, converging to about ₦ 25 billion in 1992 and end at ₦ 33.847 billion for Experiment 3 and only ₦ 30.582 billion for both Experiments 4 and 5.

The sector detail of these changes in imports are interesting in the sense that there is no unique pattern of changes in sectoral levels of imports corresponding to that observed in total imports. Table 6.15 shows that the changes in μ have their greatest impacts on the imports by Agriculture, Non-metal Manufacturing, Metal Manufacturing, Transport Equipment, Construction and Trade and Services. It should be noted that the Mining sector is still fully domestic and this is true of the Basic Chemicals sector, to a lesser extent. The Oil sector is non-importing throughout most of the planning horizon except for imports in two periods in Case 3 and only once in Case 4. When the rate of growth of imports is reduced in Experiment 4, the observed general increase in total imports seems to be accounted for by: Agriculture up to 1992; Food, Beverages and Tobacco

between 1974 and 1980 and after 1989; Non-metal Manufacturing up to 1989 and by Utilities from 1989 to the end of the planning horizon. On the other hand, Transport Equipment imports less in the first few years (up to 1983) after which its imports are substantially larger than in Experiment 3. It should be noted that the sectoral levels of imports are the same for all sectors in the terminal period, the difference earlier noted between the total imports in Experiment 3 and Experiments 4 and 5 being accounted for by imports totalling ₦ 3264.803 million by the oil sector in 1998. Our observations with regard to the sectoral levels of imports are shown in terms of their ratios of sectoral imports to total imports in Table 6.16. One striking observation here is that the Transportation sector, which showed only small absolute changes in the value of its imports, shows a great sensitivity to changes in μ when the ratios are considered. Its share of total imports remains uniformly lower for Experiment 4 and uniformly higher for Experiment 5, at least until 1992. This indicates that whereas total imports increase (decrease) when μ is decreased (increased), this sector's imports stay fairly constant between experiments thus causing its share of total imports to change inversely with the changes in total imports.

The effect of changes in the growth rate of imports on domestic production is illustrated in Figure 6.5. Apart from Experiment 5 in which the increase in μ leads to a decrease in total domestic production from about ₦ 16.436 billion to ₦ 15.109 billion in 1974, the change in total domestic production is less evident than one would expect the changes in total imports discussed above to imply. Even when we consider the time-profiles of domestic production, the difference between the levels of total domestic

production is less than ₦ 500 million at any time and in the terminal period, total domestic production in Experiments 3, 4 and 5 is ₦ 55.981 billion. The sectoral breakdown of total domestic production reported in Table 6.17 which shows that, apart from Experiment 1 where the imports constraint is non-binding, the sectoral levels of domestic production remains fairly similar in the three other experiments. The greatest impact of changes in μ are on domestic production activities in the Mining and Trade and Services sectors. Four sectors - Food, Beverages and Tobacco, Non-metal Manufacturing, Metal Manufacturing and Transport Equipment - show the greatest susceptibility to the model's preference to import rather than produce domestically especially in Experiments 3, 4 and 5 where foreign exchange availability is unlimited. The ratios of sectoral production to total domestic production in this set of experiments show no appreciable difference as μ is varied.

As regards the other major macroeconomic variables including Gross Investment, Capital Stock, Consumption, and Gross National Product, changes in μ do not have any significant impacts especially in Experiments 3, 4 and 5. The overall implications of the changes in μ for foreign exchange requirements are shown in Figure 6.3. The observed pattern of foreign exchange requirements shows that when μ is lowered to 15%, there is no significant change in foreign exchange requirements although the level of total imports increases substantially in the first period. This indicates that rather than draw additional amounts of foreign exchange, the model actually re-allocates resources in the domestic economy, choosing to keep the foreign exchange requirements steady over the entire planning horizon. It can be seen in Figure 6.3. that, apart from the swings that result when foreign exchange limitations are removed, the foreign exchange requirements

in Experiments 4 and 5 are fairly equal except in the period 1989 - 1998.

What follows from the foregoing results is that the main impact of changes in the rate of growth of imports is on the levels of domestic production and also the levels of imports. As long as Nigeria has surplus foreign exchange resources, it will pay to import in some sectors rather than produce at home, at least until 1992. Thus, in order to encourage domestic production, the government should impose stricter controls on imports delivered to the Agriculture, Food, Beverages and Tobacco and the Non-metal Manufacturing sectors at least until 1989 and it should start to restrict imports to the Transport Equipment sector from 1983 onwards.

(ii) Effects of Changes in the Savings Rate

The next set of experiments involved variations in the savings rate. It should be recalled here that the structure of the savings constraint is such that a lower limit imposed on the savings rate implies an upper limit imposed on the ratio of total consumption to income. This constraint was especially useful in ensuring that the model does not try to allocate all production and imports to consumption in the optimization process. Our computation experience confirms that when this constraint is removed, the maximand is unbounded.[25] However, the systematic variation in the savings rate also has effects on the time-profiles of imports, domestic production, gross investment and capital stock as well as foreign exchange requirements. The simulation experiments were carried out with the savings rate, s, equal to 20% in Experiment 3 as the base-case. Then, it was reduced to 15% in Experiment 6, increased to 18% in Experiment 9 and further to 22.5% in Experiment 10. In one of the computer runs of the model, the

problem was infeasible with s = 25% except if the level of total consumption was reduced considerably in the first period.

In those experiments that were feasible, the results indicate that the major difference between the profiles of consumption attained in Experiments 3, 6, 9 and 10 is only in the first period. Generally, once the model, in satisfying the savings constraint, satisfies the initial consumption requirement, it attained about the same level of total consumption in the other periods, the difference being less than $10 million in all cases for the rest of the planning horizon. Except in Experiment 10 where the level of initial consumption that ensured feasibility was less than ₦ 12 billion, the value of total consumption starts from about ₦ 12.6 billion in 1974 and increases steadily to about ₦ 40.9 billion in 1998. The consumption profile for Experiment 6 (s = 15%) is uniformly less than that of Experiment 9 (s = 18%) whilst that in Experiment 10 starts from below the initial level of consumption in Experiment 9 but exceeds it by 1980. Also, the ratio of total consumption to the GNP is less for Experiment 10 only up to 1980 after which year it exceeds the same ratio in Experiments 3, 6 and 9. The differences in consumption profiles are reflected in marginal increases in the value of the objective function. The highest value of the objective function is attained in Experiment 6 (s = 15%) where it is ₦ 129.948 billion. This decreases to ₦ 129.944 billion in Experiment 9 and further to ₦ 129.372 billion in Experiment 10. These results, showing marginal changes in the objective function, indicate that, the higher the savings rate, the lower the level initial level of total consumption and thus, the lower the value of the objective function.

As regards the effect of changes in the savings rate on the level of imports, the results indicate that changes in the savings rate do not have any significant impacts on import activity, at least until 1992 as can be seen in Figure 6.6. In all three experiments conducted, the change in total imports is less than ₦ 100 million, especially after 1980. However, an examination of the sectoral levels of imports indicates that imports into Agriculture, Food, Beverages and Tobacco, Non-metal Manufacturing, Metal Manufacturing, Transport Equipment and Trade and Services respond to changes in the savings rate. Agriculture's imports are lowest when the savings rate is between 18% and 20%, especially before 1989. On the other hand, imports by the Food, Beverages and Tobacco sector decrease as the savings rate is increased, at least in the period up to 1992. In most of the sectors, the initial levels of imports differ by only small magnitudes but the levels of imports in the terminal period is the same, irrespective of the savings rate. Once more, the Mining sector remains fully domestic while the Oil sector imports in some periods; this occurred most frequently when s = 18%. These results are shown in Table 6.18. Three sectors - Mining, Textiles and Apparel and Basic Chemicals - do not show any significant changes in their imports to the changes in the savings rate.

The effects of changes in the savings rate in sectoral levels of production are shown in Table 6.19. Basically, the results indicate that the sectoral levels of production do not respond to changes in the savings rate in the initial period and, irrespective of the profiles attained during the planning horizon, each sector's level of production always converges to the same value in the terminal year in all four cases. The only appreciable differences in sectoral production levels between the two boundary-values are

noticeable only in the Mining and Trade and Services sectors up to 1995 and in the Transportation sector between 1986 and 1998. The implications of these changes in sectoral levels of production for the levels of total production in the four cases are shown in Figure 6.7. It can be seen that the significant impacts of changes in s on domestic production show up between 1977 and 1986. Generally, as the savings rate increases, the initial level of total domestic production decreases but increases substantially more than the other cases in the period after 1986. In all the cases examined, the value of total domestic production is at ₦ 55.982 billion in 1998 and, given that Experiment 10 with the higher savings rate (s = 22.5%) starts from a lower initial level, the results show that the higher the savings rate, the greater the growth rate of domestic production.

Perhaps the most interesting effects of changes in the savings rate are in terms of the changes in the profiles of gross investment and capital stock in the economy during the entire planning horizon. As can be seen in Table 6.20, the level of gross investment in the economy responds only to the changes in the savings rate. The investment profile is fairly uniform over time in Experiment 3, the base-case, but it changes in a particular pattern once changes in s are introduced. The results show that when s is reduced from 20% in Experiment 3 to 18% in Experiment 9 and further to 15% in Experiment 6, the initial level of gross investment decreases - by about ₦ 208 million in Experiment 9 and by about ₦ 300 million in Experiment 6, in 1974. However, from 1977 and till the terminal year of the plan, the level of gross investment increases faster, the lower the savings rate, thus leading to greater possibilities of fluctuations in economic activity. In Experiment 6 (s = 15%), investment exceeds the base-case values by ₦ 12

million in 1977, increasing steadily to more than ₦ 43 million by 1998. In Experiment 9 (s = 15%), the value of gross investment exceeds the base-case values by only ₦ 9 million in 1977 and by about ₦ 43 million in 1998. However, it can be seen that the investment profiles in these two experiments (6 and 9) differ by less than ₦ 5 million at any point in time. If we combine this with the finding that, when the savings rate is increased to 22.5% in Experiment 10, the level of aggregate gross investment first increases by about ₦ 385 million above the base-case values and then decreases steadily by about ₦ 19 million in 1980 to about ₦ 60 million in 1998 compared to the base-case, we can conclude that the optimal rate of savings for the economy is between 18% and 20%. In terms of the sectoral changes in investment activity implied by these trends in gross investment, the most sensitive sectors are Agriculture, Mining and Trade and Services and, to a lesser extent, the oil sector after 1989. These results are shown in Table 6.21.

In terms of the effects of the observed changes in gross investment (resulting from changes in the savings rate) on the economy's level of capital stock, the changes are only observable between two boundary values of the capital stock: ₦ 14.319 billion in 1971 and about ₦ 93.7 billion in 1998. However, the profiles between these two points differ as can be seen in Table 6.22. When the savings rate is increased from 15% to 18%, economy's capital stock increases by less than ₦ 10 million over time. However, when the savings rate is increased from 18% in Experiment 9 to 20% in Experiment 3, there is a substantial increase in the economy's capital stock amounting to between ₦ 200 - ₦ 300 million between 1977 and 1989 and this increase narrows to only ₦ 78 million in 1998. However, when s is further increased

to 22.5% in Experiment 10, the increase in the economy's capital stock is larger only in the near term - about ₦ 400 million between 1977 and 1983. This increase slowly decreases after 1986 to only ₦ 62 million in 1998. The sector details are shown in Table 6.23. It can be seen that the same sectors - Agriculture, Mining, Trade and Services, and the Oil sector after 1989 - whose investment levels responds to changes in the savings rate, respond to changes in s in terms of the changes in their capital stock. However, as Table 6.24 shows, these changes in investment and capital stock do not lead to any significant changes in the composition of the economy's capital stock, which is largely dominated by Agriculture, Mining, Oil, Trade and Services and Transportation. The only observation here is that over time, the ratio of sectoral to aggregate capital stock declines in Agriculture (from 0.248 to 0.101 between 1974 and 1998); Trade and Services (from 0.253 to 0.115) and in Transportation (from 0.117 to 0.046) between the initial and terminal states.

As regards the impact of the changes in s on foreign exchange requirements, the overall indication is that as the savings rate increases, there is relatively less demand for foreign exchange especially in the immediate years, up to 1986. In general, the foreign exchange requirements are highest with s = 18% in Experiment 9, followed by s = 20% in Experiment 6 and by s = 22.5% in Experiment 10.

The overall impression from the experiments with the savings rate is that whereas changes in the savings rate have only marginal effects on domestic production, imports and consumption, they have their most significant effects on the pattern of gross investment in the economy over time and also, on the structure of the economy's capital stock.

(iii) Effects of Changes in the Initial Capital Stock

Experiments were also conducted in order to find out the effects of changes in the initial levels of sectoral capital stock. Starting from the base-case in Experiment 3, the levels of capital stock prescribed in the initial period, $\bar{K}(1)$, was increased by 5% in all sectors in Experiment 7, by 10% in Experiment 8 and further to 20% above the initial levels in Experiment 17. The overall indication of the results is that changes in the initial capital stock have their greatest impact on domestic production and then only in the first few years. The impact of these changes on total levels of imports are low compared with the effects of other changes on imports. These changes have no significant effect on the economy's pattern of investment over time, as can be seen in Table 6.20. The effects of changes in initial capital stock on imports and domestic production are considered briefly.

Looking at Figure 6.8, we can conclude that the changes in the initial capital stock do not have any significant impacts on the level of aggregate imports. However, it should be noted that there are some changes in the level of imports, although very small changes. When the initial capital stock is increased from its base-case values in Experiment 3 by 5% in Experiment 7, we observe a steady increase in imports by about ₦ 21 million in 1974 to about ₦ 64 million in 1992, after which imports are less than in the base-case. However, when the sectoral levels of initial capital stock are increased by 10% in Experiment 8, there is a decrease in the level of imports amounting to ₦ 8 million in 1974 and only ₦ 38 million at its maximum in 1992. These changes indicate that, unless the increase in capital stock is significantly large, the model does not alter its pattern of

imports. However, when the capital stock is increased by 20% in Experiment 17, there is a general increase in the level of imports again, demonstrating that changes in capital stock do not affect the decision to import in any particular way.

The implications of these changes for the sectoral levels of imports are shown in Table 6.25. These results show that the most sensitive sectors are Agriculture, Food, Beverages and Tobacco, Non-metal Manufacturing, Construction and Trade and Services, although the changes are only marginal and are short-lived. In general, the increase in $\overline{K}(1)$ induces the largest decreases in imports into Agriculture, Transportation, Non-metal Manufacturing and Metal Manufacturing when the increase is 10%, whilst at the same time, the 10% increase in $\overline{K}(1)$ induces the largest increases into the Transport Equipment and Construction sectors. These changes do not induce any significant changes in the sectoral share of total imports.

The impact of changes in the initial capital stock on sectoral and aggregate levels of domestic production are perhaps more significant although there is no definite pattern in the changes, as can be seen in Figure 6.9. The most significant changes are indicated only until 1983 when the level of total domestic production is about ₦ 26 billion in all cases. Thereafter, the path for Experiment 17, which had increased more substantially because of the 20% increase in $\overline{K}(1)$, stays fairly close to the other cases. Between 1995 and 1998, all these paths converge to ₦ 55.981 billion, the terminal value of total domestic production. What this result implies is that these cases (Experiments 7 and 8) where $\overline{K}(1)$ is increased by 5% and 10%, stimulate a faster growth of total domestic production than when the initial

capital stock is increased by 20% in Experiment 17. An examination of the sectoral composition of the observed effects reveals that the most sensitive sectors are Mining (till 1986), Textiles (till 1980), Trade and Services (till 1992), Construction (till 1983) and Transportation (after 1989). These results are shown in Table 6.26. The implications for the sectoral shares of total domestic production are shown in Table 6.27. These ratios show that although there are no major shifts in the sectoral shares of total production in response to changes in $\bar{K}(1)$, the ratios show declines in Agriculture and in Oil and Transportation to a lesser extent over time whilst the Mining sector increases its share of total production from an average of 0.001 in 1974 to 0.310 in 1998.

(v) Effects of Changes in the Rate of Discount

Although these experiments were conducted in order to explore the patterns of time-preference embedded in the model, the results indicate that the model does not show any significant response to changes in the rate of discount, especially with regard to domestic production, investment and the economy's capital stock. The only changes that are significant enough to be reported here are in terms of imports and then, only after 1992 as can be seen from Figure 6.9. Before 1992, the aggregate level of imports is the same in Experiments 3 with (ω = 5% per annum), 11 (ω = 7.5%) and 12 (ω = 10%) increasing from about ₦ 8.5 billion in 1974 to about ₦ 25.5 billion in 1992. After 1992, imports are highest in Experiment 12, exceeding the base-case by ₦ 2.4 billion in 1995 and by ₦ 3.0 billion in 1998. An examination of the sectoral detail of these results shown in Table 6.28 indicates that the only sectors that change their

import levels in response to changes in the rate of discount are Agriculture (when ω is increased to 7.5%) and Metal Manufacturing (when ω is increased to 10%). In contrast, Basic Chemicals, which has hitherto remained insensitive to other changes in terms of its imports, starts with a substantially large amount of imports in the first two periods (₦ 2912.444 million in 1974 and ₦ 2743.771 in 1977) and then reduces the imports to normal levels by 1980.

An examination of Table 6.29 shows that there are no significant changes in domestic production in response to changes in the rate of discount. The only exception is the Mining sector and then only until 1986. If there are any changes in the other sectors production activities, they are neither significant nor sustained over time.

Overall, it could be said that changes in the rate of discount do not have any significant or sustained impacts on the levels of production, investment and consumption or on the level of the economy's capital stocks. The only noticeable impacts are in terms of imports and these occur only after 1992. It should be noted too, that because changes in ω do not affect the consumption profile over time, the value of the objective function decreases as the rate of discount is increased. From about ₦ 128.409 billion attained in Experiments 1 and 2 with restricted foreign exchange and ₦ 129.698 billion in Experiments 3 to 10, all with ω = 5% per annum, the value of the objective function decreases to ₦ 89.804 billion when ω = 7.5% and further to ₦ 65.199 billion when ω = 10%. The general insensitivity of the optimal solution to changes in ω seems to indicate that the pattern and availability of foreign exchange is the major determinant of the optimal

path chosen by the model. Furthermore, the results confirm the fact that the levels of the major macroeconomic variables chosen by the model once we allow unlimited foreign exchange availability represent those profiles which accord with the economy's maximum absorption capacity.

(v) The Combined Effects of Changes in the Initial Capital Stock and the Rate of Discount

Given that the results of earlier experiments with changes in the initial capital stock (Experiments 7, 8 and 17) and those with changes in the rate of discount were not as significant as one would expect, an attempt was made to discover the extent to which the economy would respond to combined changes in both the initial capital stock and the rate of discount. Again the results indicate that only two variables, imports and domestic production, are sensitive to the combined effects of changes in the rate of discount and the initial capital stock.

In all, six different experiments were conducted here. Experiments 13, 14 and 18 involve a higher rate of discount (ω = 7.5% per annum) but the initial capital stock is increased by 5%, 10% and then 20% in Experiments 13, 14 and 18 respectively. The other experiments (15, 16 and 19) involve an increased rate of discount (ω = 10% per annum) and the initial capital stock is gradually increased by 5%, 10% and 20% in Experiments 15, 16 and 19 respectively. By comparing the results in different combinations of these experiments, it is possible to discover the effects of changes in both the rate of discount and the initial capital stock. Because the number of possible combinations is large, we have chosen to describe the overall indications of the results in terms of their implications for domestic production and imports.

When $\bar{K}(1)$ is increased by 5% along with a higher rate of discount (ω = 7.5%) in Experiment 13, the level of total domestic production is higher than the level attained in Experiment 11 by about ₦ 1 billion in 1974 and by about ₦ 500 million in 1983, after which year it stays below the level in Experiment 11, till 1995. When $\bar{K}(1)$ is increased by 10% at the same rate of discount in Experiment 14, there is an initial increase in production amounting to ₦ 1.8 billion in 1974 and this gap gradually reduces till 1986, after which the production levels in Experiment 14 remain less than those in Experiment 11 till 1995. Compared with the base-case solution the results indicate that increases in the rate of discount accompanied by increases in the initial capital stock will lead to substantial increases in domestic production in the first few years of the planning period, after which the initial increases are compensated for by decreases in domestic production. However, it should be noted that in Experiment 18 where $\bar{K}(1)$ is increased by 20%, the model starts with lower values of domestic production (₦ 15.4 billion compared with about ₦ 18.0 billion in Experiment 14 and ₦ 17.2 billion in Experiment 13) and stays below the values in these other experiments till 1989. After 1989, the level of production in Experiment 18 does not increase significantly above those in the other Experiments (11, 13 and 14). These results can be seen in Table 6.30.

The impacts of these changes in $\bar{K}(1)$ and ω on the levels of imports are shown in Table 6.31. If we compare the results of Experiment 13 ($\bar{K}(1)$ increased by 5% at ω = 7.5%) with Experiments 3 and 11 which have the same initial capital stock but a higher ω in the latter, we find that the increase in both ω and $\bar{K}(1)$ lead to increases in the level of total imports over time. Comparing Experiments 13 and 3, this increase amounts to ₦ 108

in 1974, gradually increases to ₦ 324 million in 1992 after which it is more than ₦ 2 billion. Compared with the case involving a 5% increase in $\bar{K}(1)$, the increase in imports is moderate, amounting to only ₦ 59 million in 1974 and less than ₦ 200 million in 1992. This moderation in imports as a result of the increase in $\bar{K}(1)$ is explained by the higher levels of domestic production recorded in Experiment 13 as compared to Experiment 11. When the capital stock is increased by 10% in Experiment 14, the levels of imports decrease, compared with their levels in Experiment 11 and the base-case, Experiment 3. The decrease in imports are about ₦ 79 million below the base-case levels and ₦ 138 million below the levels in Experiment 11 in 1974. These decreases are maintained at steadily higher rates until 1992. Again the case with a 20% increase in $\bar{K}(1)$ (Experiment 18) constitutes the exception to these observations since it records increases in imports following the increase in $\bar{K}(1)$ till 1992 although the increases in imports are small.

In the next set of experiments, a higher rate of discount (ω = 10%) was used while the levels of initial capital stock was varied again. Experiments 12, 15, 16 and 19 all involve ω = 10% but $\bar{K}(1)$ is increased by 5%, 10%, and 20% in Experiments 15, 16 and 19 respectively over their levels in Experiments 3 and 12. The effects of these changes in ω and $\bar{K}(1)$ on production show that as $\bar{K}(1)$ is increased, domestic production increases over the levels recorded in the base-case solutions and in Experiment 12 and this increase holds until 1986. Between 1986 and 1995, the levels of production in Experiment 15 are below those in Experiments 3 and 12. When $\bar{K}(1)$ is increased by 10%, there are only moderate gains in production in the period up till 1981 after which the levels of domestic production stays below those

recorded in the other experiments.

As regards the effects of changes in $\bar{K}(1)$ at a higher rate of discount (ω = 10%) on imports, the results indicate that increases in the initial capital stock and the rate of discount will lead to increases in imports but the amount of increase is moderated as the initial capital stock is increased by up to 10%. Over the 10% change in the initial capital stock, the increase in imports are more substantial and grow faster although the increase in capital stock by 20% in Experiment 19 again exerts a moderating effect on the increases in imports. These results can be seen by comparing Experiments 15, 16 and 19 to Experiments 12 and 3 in Table 6.31.

Our conclusion with regard to these experiments is that, whereas changes in $\bar{K}(1)$ or ω do not have any significant effects on either domestic production or imports when considered separately, different combinations of these two changes have significant effects on the patterns of domestic production over time. Basically, when increases in the rate of discount are accompanied by increases in the initial capital stock, there is a tendency for domestic production to increase. Also, given a higher level of initial capital stock than in the base-case solutions, initial increases in import levels are moderated by increases in the capital stock. The best result, judged by how small the import requirements are and by the inducement given to domestic production, is the case where ω = 7.5% and the initial capital stock increased by 10% (Experiment 14).

6.4 An Overview of the Main Results of the Study

In the foregoing section, we have concentrated on the effects of individual changes on major macroeconomic variables, classifying the

experiments by their sets. In this section, we present a summary of the main results of the analysis especially as regards the major factors that influence each of the major macroeconomic variables including production, investment, consumption, capital stock, imports and foreign exchange over time. Among these variables, the pattern of foreign exchange requirements is perhaps the most important since it indicates the economy's absorptive capacity under alternative assumptions regarding the savings rate, the rate of discount, the rate of growth of imports and the level of initial capital stock. It is also particularly important since the levels of foreign exchange so determined must be compared with the foreign exchange revenues derived from the OPEC-wide oil model in Chapter 5 in order to discover whether or not the allocations to Nigeria are above or below its absorptive capacity as well as the implications of these results for future expansion of oil production capacity in Nigeria.

6.4.1 Comparison of Foreign Exchange Requirements in the Planning Model with Anticipated Foreign Exchange Revenues from the OPEC-Wide Allocation Model

In comparing the patterns of foreign exchange arising from the empirical implementation of the dynamic multi-sectoral planning model with the anticipated foreign exchange inflows from the OPEC-wide allocation model, it is important to remember the basic assumptions under which these alternative foreign exchange inflows were derived. In Chapter 5, we developed a dynamic programming model in which OPEC was to maximize its net revenues under various assumptions regarding its rate of discount and the rate of growth of world demand for OPEC's oil. The simulation experiments at this stage of the study resulted in five distinct production profiles and ten

alternative revenue profiles which were then allocated to Nigeria along with the other OPEC members on the basis of a 5-year moving average of their past market shares. The resulting anticipated foreign exchange revenues accruing to Nigeria from this OPEC-wide allocation model are compared to the optimally determined foreign exchange requirements arising from the planning model in Table 6.32. It should be noted that the foreign exchange requirements arising from the planning were either prescribed on the basis of earlier computations (in Experiments 1 and 2) or were allowed to be freely chosen by the model itself and are thus an acceptable approximation of Nigeria's revenue absorption capacity under alternative assumptions regarding the rate of growth of imports, the savings rate, the rate of discount and the opening levels of capital stock in the Nigerian economy.

A general overview of the results presented in Table 6.32 indicates that the foreign exchange requirements for the Nigerian economy to realize its development ambitions grossly exceed the anticipated revenue inflows from the OPEC-allocation model. The gap between the country's foreign exchange absorption capacity in the 19 experiments and the foreign exchange revenues to be derived from the allocations of market shares to it by OPEC varies between up to ₦ 2.4 billion in 1974 and an average of ₦ 3.5 billion in 1998. Alternatively, the maximum foreign exchange revenues that could be derived from strict adherence to OPEC's allocations in 1998 only correspond to the levels of foreign exchange required for the country's development between 1989 and 1992 so that the OPEC allocations are behind Nigeria's ambitions by at least six years. The implication here is that Nigeria is actually a revenue hungry member of OPEC as compared to the other OPEC members, notably Saudi-Arabia, Kuwait and the United Arab

Emirates, which are generally regarded as revenue surplus. However, contrary to the arbitrary classification of Nigeria as a revenue-scarce country, we have allowed the planning model to determine the extent to which Nigeria suffers from revenue shortage.

With these results, conclusions can be made regarding Nigeria's future bargaining position in OPEC. These results indicate that if Nigeria is to accomplish the development ambitions implied by the planning model, it should seek increases in the production allocations to it by OPEC. Alternatively, we can expect Nigeria, while keeping production levels in accordance with OPEC norms, to seek increases in the price of OPEC's oil on the world market in order to cover the gap between its foreign exchange requirements and those implied by OPEC allocations. The prospects for such an attempt to increase prices by Nigeria are especially more likely if we consider the implications of the foreign exchange revenues in Table 6.32 for oil-production capacity in Nigeria. It can be seen that the current daily production of about 2.4 million barrels far exceeds the capacity levels prescribed by the OPEC-allocation model and are more closely approximated by capacity requirements implied by the foreign exchange requirements determined by the planning model. This is especially so in Experiment 3, the base-case, as well as in Experiments 9, 14 and 19. A further implication is that since Nigeria's estimated production capacity currently stands at about 2.5 million barrels per day,[26] it already has the capacity to produce enough oil to meet its foreign exchange requirements in 1992 in the planning model or in 1995 in the OPEC allocation model. Thus it can be expected that, if and when market conditions permit, Nigeria will attempt to seek an increase in the price of OPEC's oil. This has been Nigeria's stance in the

past and is more likely to continue in the future.

6.4.2 An Overview of the Main Results of the Analysis

Considering the amount of detail embodied in the presentation of the results of our analysis in Section 6.3, it is difficult to attempt to re-classify the impacts of the changes according to the major macroeconomic variables. Such an effort runs the risk of boring the reader. However, we present below a summary of the main highlights of the results, our observations on the model's behaviour and a general overview of the computation experience.

Of all the major macroeconomic variables involved in this analysis, the most sensitive have been the level of domestic production and the level of imports, both in aggregate and sectoral terms, as well as the foreign exchange requirements. Our experiments started from a relaxation of the imports constraint and the variation of import growth rates. The effects of these two changes were presented in Figure 6.1 and 6.4 as well as in Table 6.31. The overall indication is that, although the profile of total imports vary in all the 19 experiments, the most significant changes are seen in Experiment 2 where the imports constraint is relaxed and in Experiment 3 when foreign exchange availability ceases to be an effective constraint. These changes are particularly consistent up till 1992. When the rate of growth of imports is increased, the near-term level of imports decreases but grows steadily at the higher rate. Also, the relaxation of the imports constraint leads to a uniform upward shift in the level of imports except in 1992. Within the context of these changes, Agriculture is the most active importing sector while both the Mining and Oil sectors

remain largely non-importing.

As regards domestic production, the most significant changes result from changes in the import constraint or in foreign exchange availability. When the foreign exchange supply becomes unlimited, the model has a tendency to choose to import rather than produce at home. Thus, the relaxation of the foreign exchange supply constraint has an indirect effect of reducing domestic levels of production. The most susceptible sectors are Food, Beverages and Tobacco, Non-metal Manufacturing, Mining and Transport Equipment. Also, whenever additional demand is made for foreign exchange, the oil sector's production increases accordingly, especially between 1977 and 1992. This is in accordance with our expectation that the oil sector will be the main source of foreign exchange resources for financing Nigeria's future development plans. Among the other changes that are introduced, changes in the initial capital stocks have a definite pattern of influence on domestic production, especially in the period up to 1989 and changes in the savings rate have their greatest impact on domestic production between 1977 and 1986. These results can be seen in Table 6.30 and in Figure 6.7 and 6.9.

The other macroeconomic variables - investment, capital stock and consumption seem to be influenced only by changes in some particular parameters. Of these, investment and capital stock respond mainly to changes in the savings rate as can be seen in rows corresponding to Experiments 6, 9 and 10 in Tables 6.20 and 6.22. An important observation here is that even when foreign exchange is freed in Experiment 3, the large increase in foreign exchange earnings that follow are not in any way used to finance investment; it is used instead to finance imports and these are not even reflected in the investment picture. On the other hand, capital

stock varies between two boundary-values: ₦ 14.349 billion in 1974 and about ₦ 93.7 billion in 1998. Again, the profiles of capital stock are in correspondence with the pattern of investment. Overall, regardless of the declines in capital stock shown in some sectors, the economy's aggregate capital stock grows at about 20% per period through 1986 and at about 32% per period after 1986.

An examination of Table 6.34 shows that the only factor that affects the consumption profile over time is the savings rate and then the increases are marginal. The most significant change in the consumption profile occurs when the foreign exchange constraint is relaxed. There is an upward shift in the path of consumption, especially in the period before 1986, as can be seen in Figure 6.2. This confirms the fact that the massive imports which follow the relaxation of foreign exchange requirements are delivered to consumption rather than investment. Closely related to these changes in total consumption are the patterns of the Gross National Product over time as shown in Table 6.35. Like Consumption, the GNP responds to the changes in the savings rate in Experiments 6, 9 and 10. Over the levels attained in Experiments 1 and 2, the relaxation of foreign exchange supply leads to a general increase in the GNP over time but the changes in the savings rate have a less definite pattern of influence on GNP especially when the savings rate is at 22.5% in Experiment 10.

Like the other variables, foreign exchange requirements are sensitive to the basic parameter changes introduced in the experiments. All the 19 experiments have their individual patterns of foreign exchange requirement over time, indicating that the structure of the Nigerian economy depicted by each combination of parameters would imply its own foreign

exchange budget when the dynamic multi-sectoral planning model is implemented.

Perhaps we should end this chapter by a review of the values attained by the objective function in all these experiments. These are presented in Table 6.36. The results show that apart from massive reductions in the value of the objective function resulting from increases in the rate of discount, the value of the objective function stays between ₦ 128.409 billion in Experiments 1 and 2 and ₦ 129.948 billion in Experiment 6. Along these lines, it should be noted that changes in the initial capital stock or in the rate of discount do not have any significant impacts on the major macroeconomic variables, but appropriate combinations of these two changes could influence both the pattern of domestic production and the level of imports. Our experience indicates that a 10% increase in the initial capital stock followed by an increase in the rate of discount to 7.5% from the base-case value of 5% per annum has a moderating effect on imports and could actually reduce them and increase domestic production as shown by Experiment 14.

TABLE 6.1

COMPARISON OF THE 13-SECTOR SCHEME IN THE PLANNING MODEL WITH SECTOR-CLASSIFICATION SCHEMES ADOPTED BY CARTER AND CLARK

13-Sectors of the Planning Model		Corresponding Sectors in Carter's 20-Sector Table		Corresponding Sectors in Clark's 25-Sector Table	
No.	Sector Name	No.	Sector Name	No.	Sector Name
1.	Agriculture, Livestock, Forestry and Fishing	1. 2. 3.	Agriculture Livestock, Fishing and Forestry Agricultural Processing	1.	Agriculture, Forestry and Fishing
2.	Mining Excluding Oil	8. 9.	Metal Mining Non-Metal Mining*	2.	Metal and Non-Metal Mining Excluding Oil
3.	Oil	9.	Non-Metal Mining*	3.	Oil Mining and Refinery
4.	Food, Beverages and Tobacco	7. 6.	Food Drink and Tobacco	4. 5. 6. 7.	Meat and Dairy Products Food Preparations Bakery and Confectionery Drink and Tobacco
5.	Textiles and Apparel	4. 5.	Textiles Clothing	8. 9.	Textiles Clothing Goods
6.	Non-Metal Manufacturing	17. 19. 20.	Non-Metal Manufacturing Wood, Leather etc. Miscellaneous	10. 11. 12. 13.	Wood Products Paper and Printing Rubber Products Cement and Concrete
7.	Basic Chemicals	10.	Chemicals	14. 15. 16.	Basic Industrial Chemicals Paints, Drugs and Cosmetics Other Chemical Products
8.	Metal Manufacturing	18.	Metal Manufacturing	17. 18. 19.	Structural Metal Products Machinery Electrical Appliances
9.	Transport Equipment	16.	Transport Equipment	20. 21.	Shipbuilding and Repairing Motor Vehicle and Bicycle Assembly
10.	Utilities	12.	Utilities	22.	Utilities
11.	Construction	14.	Construction	23.	Construction and Housing
12.	Trade and Services	13. 15.	Trade Services	24.	Trade and Services
13.	Transport	11.	Transport	25.	Transport and Communications

Note: Carter's scheme did not make any distinction between non-oil and oil activities in its non-metal mining sector. This is clearly distinguished in this study considering the special role accorded the oil sector in the planning model.

Table 6.2

RATIOS EMPLOYED IN OBTAINING MANUFACTURING SECTORS' ACTIVITY LEVELS 1965-1974

	1965	1966	1968	1969	1970	1971	1972	1973	1974
	Sectoral Shares of Total Manufacturing Value-Added								
1. Food, Beverages & Tobacco	.336	.385	.311	.341	.356	.361	.354	.399	.316
2. Textiles & Apparel	.115	.145	.194	.245	.279	.241	.206	.192	.208
3. Non-Metal Manufacturing	.184	.121	.154	.160	.157	.157	.177	.169	.185
4. Basic Chemicals	.075	.072	.087	.095	.086	.104	.111	.116	.102
5. Metal Manufacturing	.127	.136	.121	.137	.119	.134	.151	.117	.156
6. Transport Equipment	.163	.140	.134	.021	.002	.002	.000	.007	.032
	Value-Added Ratios								
1. Food, Beverages & Tobacco	.500	.475	.405	.545	.537	.540	.508	.561	.524
2. Textiles & Apparel	.389	.443	.425	.432	.420	.417	.423	.376	.425
3. Non-Metal Manufacturing	.407	.487	.390	.481	.459	.443	.469	.517	.525
4. Basic Chemicals	.449	.477	.478	.527	.410	.503	.451	.426	.433
5. Metal Manufacturing	.208	.221	.264	.310	.290	.294	.399	.288	.351
6. Transport Equipment	.202	.190	.243	.166	.603	.620	.138	.495	.426

Source: Calculated from data obtained from Industrial Survey of Nigeria, Lagos, Federal Office of Statistics, 1965-1974.

TABLE 6.3

THE UPDATED INPUT-OUTPUT COEFFICIENTS MATRIX FOR NIGERIA: 1974/75

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	AGRIC.FORESTRY	.02498	.00103	0.00000	.07744	.05963	.06482	.02043	.00474	0.00000	.00184	.04225	0.00000	0.00000
2	MINING EXC OIL	.00001	.00039	0.00000	.00384	.00024	.00156	.00499	.00435	0.00000	.00221	.01313	0.00000	.00000
3	OIL	.03737	.06420	.00210	.14004	.07582	.27241	.13708	.27546	0.00000	.39596	0.00000	0.00000	.24256
4	FOOD,BEV & TOBCO	.00322	0.00000	.00002	.15369	.00494	.01594	.02545	.03161	0.02000	0.00000	0.00000	0.00000	.00047
5	TEXTILES & APPRL	.00716	.00172	0.00000	.00105	.24964	.10578	.00140	.00246	0.00000	0.00000	0.00000	.00634	0.00000
6	NON-METAL MNFG	.00007	.00169	.00001	.00553	.00702	.02169	.01556	.00536	.10456	.00025	.05972	.00047	.00165
7	BASIC CHEMICALS	.00324	0.00000	.00083	.00645	.04246	.02434	.23707	.04990	.10301	.00031	.00941	.00356	.00047
8	METAL MANUF	.00011	.00840	.00007	.09727	.01431	.01495	.00667	.11618	.00935	.00522	.07994	.00176	.00645
9	TRANSPORT EQUIP	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	.03596	0.00000	0.00000	0.00000	0.00000	0.00000
10	UTILITIES	.00095	.01131	.00002	.00499	.00456	.00541	.00544	.01642	.02093	0.00000	.00944	.00400	0.00000
11	CONSTRUCTION	.00013	.01195	.00245	.00616	.02104	.00450	.04597	.02093	.05819	.00262	.15285	.02596	0.00000
12	TRADE/SERVICES	.00441	.01391	.00050	.03411	.07302	.03222	.05667	.04676	.13378	.00396	.07679	.03310	.00653
13	TRANSPORTATION	.00737	.00343	.00010	.01441	.01934	.01051	.01009	.02096	.07123	.00339	.04632	.01153	0.00000

TABLE 6.4

THE UPDATED INPUT-OUTPUT TRANSACTIONS MATRIX FOR NIGERIA: 1974/75

	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL INTERMED DEMAND	FINAL DEMAND	GROSS PRODUCTION
1	109.392	.116	0.000	42.590	26.636	20.843	4.191	1.910	0.000	.188	51.531	0.000	0.000	257.516	3524.572	3782.088
2	.854	.044	0.000	2.112	.124	1.144	1.074	1.763	0.000	.226	16.016	0.000	.127	22.682	93.697	113.379
3	141.344	7.279	637.507	88.512	33.865	87.592	29.465	111.522	0.001	48.546	0.000	0.000	181.795	1279.427	5636.834	6916.261
4	12.191	0.000	.115	84.530	2.222	5.140	5.471	.408	0.000	0.000	4.950	0.000	.196	114.273	439.712	549.985
5	.618	.195	0.003	.579	111.524	1.857	.101	.996	0.000	0.000	0.000	15.324	0.000	131.398	315.268	446.666
6	.099	.192	.074	3.043	3.539	6.973	3.345	2.412	7.163	.025	61.459	20.500	.694	109.917	211.628	321.545
7	12.239	0.000	5.710	3.545	19.144	7.838	50.960	20.203	7.057	.032	11.478	4.623	.119	147.027	67.925	214.952
8	.423	.052	.515	4.000	6.390	4.514	1.435	47.004	6.121	.535	97.493	4.265	2.786	176.253	220.507	404.860
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	14.558	0.000	0.000	0.000	0.000	0.000	14.558	53.949	68.507
10	3.576	1.283	.121	2.743	2.037	1.748	1.178	6.647	1.434	0.000	1.871	9.670	0.000	31.498	70.910	102.408
11	.473	1.355	16.943	3.386	9.415	1.447	9.882	11.712	3.438	.268	185.438	72.476	0.000	316.238	903.322	1219.560
12	16.667	1.577	3.434	18.768	33.019	10.361	12.182	35.124	9.165	.405	93.649	49.259	2.742	317.345	2181.523	2418.868
13	27.841	.389	.694	8.148	8.658	3.387	2.168	8.486	4.880	.247	56.484	27.899	0.000	149.422	270.254	419.676
SUM	324.862	13.383	665.122	261.947	256.574	152.839	121.444	262.753	39.259	42.574	575.015	239.019	188.458	3063.646	13915.181	16978.747

Note: All values are in millions of Nigerian Naira.

TABLE 6.5

THE 13-SECTOR AGGREGATED INPUT-OUTPUT CAPITAL COEFFICIENTS MATRIX FOR NIGERIA: 1974/75

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	AGRIC,FORESHNG	.191	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	MINING EXC OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	FOOD,BEV & TOCO	0.000	0.000	0.000	0.000	0.000	.013	0.000	.001	0.000	0.000	0.000	0.000	0.000
5	TEXTLES & APPRL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	NON-METAL MNFG	0.000	.006	.016	.003	.003	.002	.013	.002	.001	.002	0.000	.043	.003
7	BASIC CHEMICALS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	METAL MANUF	.051	.007	.154	.101	.018	.034	.181	.398	.129	.005	.218	.051	.010
9	TRANSPORT EQUIP	0.000	0.000	0.000	.030	.023	.015	.004	.009	.002	0.000	.009	.012	.859
10	UTILITIES	0.000	0.000	0.000	0.000	0.000	.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	CONSTRUCTION	.297	.198	0.000	.526	.361	.285	.450	.409	.802	.672	.100	.860	.094
12	TRADE/SERVICES	0.000	.041	.075	.013	.001	.006	.002	0.000	0.000	0.000	0.000	0.000	0.000
13	TRANSPORTATION	.008	0.000	0.000	.004	.006	.057	0.000	.005	.002	0.000	.009	.002	.021
	IMPORTS	.454	.748	.755	.323	.589	.447	.349	.177	.063	.321	.665	.031	.013

TABLE 6.6

SOME BASIC DATA EMPLOYED IN THE ANALYSIS

		Value-Added Ratio	Capital-Output Ratios	Labour-Output Ratios	Initial Capital Stock*	Consumption Ratio
		v_j	b_j	λ_j	$K_j(0)$	c_j^c
1.	Agriculture, Forestry & Fishing	0.925	0.95173	0.004779	3556.477	0.50061
2.	Mining Excluding Oil	0.882	1.89990	0.000018	215.420	0.0
3.	Oil	0.904	0.50000	0.000018	3485.130	0.01484
4.	Food, Beverages & Tobacco	0.524	0.35067	0.001760	155.779	0.04164
5.	Textiles & Apparel	0.425	0.32368	0.005216	101.284	0.04674
6.	Non-Metal Manufacturing	0.525	0.77420	0.004909	201.359	0.02318
7.	Basic Chemicals	0.433	0.54920	0.002429	83.798	0.00297
8.	Metal Manufacturing	0.351	0.39291	0.002866	97.095	0.00890
9.	Transport Equipment	0.426	0.33605	0.004246	16.154	0.00631
10.	Utilities	0.585	4.61000	0.000293	472.032	0.00501
11.	Construction	0.470	0.50000	0.000322	684.574	0.00584
12.	Trade & Services	0.901	1.50000	0.001984	3628.302	0.19522
13.	Transportation & Communication	0.742	4.00000	0.003336	1678.706	0.08949

Note: Capital Stocks are valued in millions of Nigerian Naira.

TABLE 6.7

ESTIMATED LEVELS OF SECTORAL LABOUR SUPPLY

		TARGET - YEARS								
		1974	1977	1980	1983	1986	1989	1992	1995	1998
1	AGRIC,FOR&FSHNG	19.64600	20.43600	22.47960	24.72756	27.20032	29.92035	32.91238	36.20362	39.82398
2	MINING EXC OIL	.08236	.08916	.09808	.10789	.11867	.13054	.14360	.15796	.17375
3	OIL	.03864	.04503	.04954	.05449	.05994	.06593	.07252	.07978	.08775
4	FOOD,BEV & TBCO	.85995	.97163	1.06879	1.17567	1.29324	1.42256	1.56482	1.72130	1.89343
5	TEXTLES & APPRL	1.79549	2.02667	2.23153	2.45469	2.70016	2.97017	3.26719	3.59391	3.95330
6	NON-METAL MNFG	1.40443	1.58684	1.74553	1.92008	2.11209	2.32330	2.55563	2.81119	3.09231
7	BASIC CHEMICALS	.40772	.46067	.50673	.55741	.61315	.67446	.74191	.81610	.89771
8	METAL MANUF	.62156	.70231	.77254	.84979	.93477	1.02825	1.13107	1.24418	1.36860
9	TRANSPORT EQUIP	.22454	.24266	.26693	.29362	.32298	.35528	.39081	.42989	.47288
10	UTILITIES	.03300	.03800	.04180	.04598	.05058	.05564	.06120	.06732	.07405
11	CONSTRUCTION	.27500	.40500	.44550	.49005	.53906	.59296	.65226	.71748	.78923
12	TRADE/SERVICES	5.28000	6.09500	6.70450	7.37495	8.11245	8.92369	9.81606	10.79766	11.87743
13	TRANSPORTATION	1.54000	1.55000	1.70500	1.87550	2.06305	2.26936	2.49629	2.74592	3.02051

NOTE - FIGURES ARE IN MILLIONS OF PERSONS

TABLE 6.8

BASIC CHARACTERISTICS OF THE EXPERIMENTS INVOLVED IN THE EMPIRICAL IMPLEMENTATION OF THE MODEL

Experiment No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Levels of the Constraints:																			
1. Rate of Growth of Imports	NB	*20%	20%	*15%	*25%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2. Foreign Exchange Availability	Prescribed	Prescribed	*Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free
3. Savings Rate	[illegible]	20%	20%	20%	20%	*15%	20%	20%	*18%	*22.5%	20%	20%	20%	20%	20%	20%	20%	20%	20%
4. Increase in the Initial Capital Stock	None	None	None	None	None	None	*5%	*10%	None	None	None	None	*5%	*10%	*5%	*10%	*20%	*20%	*20%
5. Rate of Discount	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	*7.5%	*10%	*7.5%	*7.5%	*10%	*10%	5%	*7.5%	*10%

Notes: * - These denote specific changes introduced in each experiment, compared to their initial levels.

NB - Non-binding

Free - Foreign exchange requirements are determined by the model itself rather than being exogenously prescribed.

TABLE 6.9

THE EFFECTS OF CHANGES IN THE IMPORTS CONSTRAINT AND FOREIGN EXCHANGE AVAILABILITY ON THE LEVELS OF SECTORAL AND AGGREGATE LEVELS OF IMPORTS

(Values in Millions of Naira)

SECTORS	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
AGRIC,FORLFSHNG	2794.997	3202.810	3071.013	5192.672	6388.642	7596.163	9481.912	10964.611	12733.901
MINING EXC OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FOOD,BEV & TBCO	160.567	144.695	194.213	249.970	300.065	462.610	591.506	691.180	469.507
TEXTILES & APPRL	353.679	391.063	460.664	559.497	713.397	851.266	1090.253	1363.066	1426.436
NON-METAL MNFG	194.337	172.000	265.152	415.006	556.437	592.771	567.636	1148.469	1105.336
BASIC CHEMICALS	0.000	0.000	6.000	15.544	0.000	0.000	2.327	60.063	21.206
METAL MANUF	300.211	455.623	596.976	676.682	937.929	1309.531	1344.100	4494.252	5512.612
TRANSPORT EQUIP	57.900	49.090	66.093	83.649	85.621	142.683	2105.228	1316.536	169.912
UTILITIES	0.000	13.507	49.574	97.353	165.901	237.490	385.138	179.166	287.560
CONSTRUCTION	613.994	0.000	0.000	0.000	642.000	3170.196	4514.442	469.520	0.000
TRADE/SERVICES	272.209	170.964	426.327	1757.906	2036.003	3794.250	2570.015	3944.026	5422.036
TRANSPORTATION	630.940	1057.205	1306.247	1614.599	2613.653	2377.436	2806.191	2007.557	3132.539
TOTAL	5630.629	5667.043	7639.589	10622.085	14641.535	20614.363	25466.526	27629.910	38566.042
AGRIC,FORLFSHNG	5656.406	7760.594	8512.350	9266.202	9358.206	8202.257	9969.639	13537.630	14022.410
MINING EXC OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FOOD,BEV & TBCO	160.567	144.695	194.213	249.970	300.069	462.610	564.355	716.152	469.507
TEXTILES & APPRL	353.679	391.063	460.664	559.497	713.397	851.266	1094.253	1363.666	1426.436
NON-METAL MNFG	194.337	172.000	265.102	415.006	556.437	592.771	628.461	1691.903	1105.336
BASIC CHEMICALS	0.000	0.000	6.000	15.544	0.000	0.000	2.327	61.063	21.206
METAL MANUF	349.211	455.623	596.976	676.682	937.929	1309.531	2157.626	3745.489	5512.612
TRANSPORT EQUIP	57.900	49.090	66.093	83.649	85.621	142.683	2180.634	1316.956	169.912
UTILITIES	0.000	13.507	49.574	97.353	165.901	237.490	382.260	181.013	287.568
CONSTRUCTION	613.594	0.000	0.000	0.000	642.000	3170.196	3360.100	1942.600	0.000
TRADE/SERVICES	272.209	170.964	426.327	1757.906	2036.003	3794.250	2769.542	3763.360	5422.038
TRANSPORTATION	630.940	1057.205	1306.247	1614.599	2613.653	2377.436	2075.720	2015.358	3132.539
TOTAL	8520.618	10233.621	12200.345	14736.415	17603.697	21220.437	25644.526	30557.629	36666.915
AGRIC,FORLFSHNG	5594.600	4867.586	6911.237	7925.841	8462.666	8510.280	9621.000	10551.409	12679.236
MINING EXC OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OIL	0.000	2736.677	0.000	0.000	0.000	0.000	0.000	0.000	3264.403
FOOD,BEV & TBCO	166.112	166.373	734.833	284.511	982.016	436.247	591.782	1507.665	845.625
TEXTILES & APPRL	362.147	617.933	558.169	591.132	718.370	849.591	1093.700	1355.426	1419.904
NON-METAL MNFG	217.809	91.709	197.625	729.561	626.958	996.410	1177.319	1475.020	1103.496
BASIC CHEMICALS	0.000	123.505	0.000	156.583	0.000	175.061	0.000	32.000	19.617
METAL MANUF	513.653	331.620	586.735	724.972	1081.177	1368.506	2220.457	3497.261	5507.117
TRANSPORT EQUIP	59.075	46.645	127.925	198.617	166.302	204.627	1245.756	2264.751	169.311
UTILITIES	0.000	4.017	38.186	82.760	130.615	204.189	153.901	287.122	206.963
CONSTRUCTION	376.156	1035.492	944.536	459.159	1612.313	3938.052	4615.500	0.000	0.000
TRADE/SERVICES	367.978	143.720	863.642	1893.067	2806.714	2129.693	2398.700	3457.906	5435.898
TRANSPORTATION	841.963	1832.633	1293.124	1606.033	1988.296	2359.556	2676.167	3656.571	3116.217
TOTAL	8501.293	16201.551	12261.062	14693.236	17620.201	21153.937	25364.726	26286.632	33067.236

Note: The first part of the Table refers to Experiment1, the second table refers to Experiment 2 and the third refers to Experiment 3.

TABLE 6.10

SECTORAL AND AGGREGATE LEVELS OF DOMESTIC PRODUCTION AND THEIR RATIOS: EXPERIMENT 1

SECTORS	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
AGRIC,FORESHNG	3735.855	4284.277	4716.478	4892.170	5702.372	6272.609	6899.870	7589.858	8348.843
MINING EXC OIL	22.698	494.455	2011.678	4499.079	7979.184	11794.604	14359.569	15795.526	17375.078
OIL	6916.261	6445.047	7063.396	7812.945	8677.202	11510.981	14277.644	15705.408	17275.949
FOOD,BEV & TBCO	444.233	552.063	607.269	667.996	734.795	808.275	889.102	978.012	1075.814
TEXTLES & APPRL	312.911	389.379	428.317	471.149	518.264	570.091	524.483	482.525	758.798
NON-METAL MNFG	260.086	323.845	297.938	274.103	252.175	474.142	521.556	479.832	631.083
BASIC CHEMICALS	152.582	190.358	209.394	192.642	253.366	278.703	306.573	282.047	370.957
METAL MANUF	247.119	307.143	282.571	259.966	239.168	449.687	494.656	544.122	598.534
TRANSPORT EQUIP	48.070	57.232	52.653	48.441	76.176	83.793	92.172	101.390	111.529
UTILITIES	87.558	94.202	86.666	79.732	73.354	67.485	62.087	232.136	255.349
CONSTRUCTION	1369.149	1539.946	1762.869	2642.729	2431.311	2236.806	2057.861	3929.362	2442.701
TRADE/SERVICES	2418.868	3078.283	3001.107	2761.018	2614.795	2584.045	4626.646	5453.366	5998.702
TRANSPORTATION	419.677	386.102	355.214	326.797	300.653	276.601	254.473	824.600	907.061
TOTAL	16436.267	18142.332	20875.549	24928.767	29852.815	37407.823	45366.694	52398.183	56150.390
AGRIC,FORESHNG	.227	.236	.226	.196	.191	.168	.152	.145	.149
MINING EXC OIL	.001	.027	.096	.180	.267	.315	.317	.301	.309
OIL	.421	.355	.338	.313	.291	.308	.315	.300	.308
FOOD,BEV & TBCO	.027	.030	.029	.027	.025	.022	.020	.019	.019
TEXTLES & APPRL	.019	.021	.021	.019	.017	.015	.012	.009	.014
NON-METAL MNFG	.016	.018	.014	.011	.008	.013	.011	.009	.011
BASIC CHEMICALS	.009	.010	.010	.008	.008	.007	.007	.005	.007
METAL MANUF	.015	.017	.014	.010	.008	.012	.011	.010	.011
TRANSPORT EQUIP	.003	.003	.003	.002	.003	.002	.002	.002	.002
UTILITIES	.005	.005	.004	.003	.002	.002	.001	.004	.005
CONSTRUCTION	.083	.085	.084	.106	.081	.060	.045	.075	.044
TRADE/SERVICES	.147	.170	.144	.111	.088	.069	.102	.104	.107
TRANSPORTATION	.026	.021	.017	.013	.010	.007	.006	.016	.016

Note: Values are in millions of Naira. Ratios refer to sectoral shares out of total domestic production.

TABLE 6.11

SECTORAL AND AGGREGATE LEVELS OF DOMESTIC PRODUCTION AND THEIR RATIOS: EXPERIMENT 3

SECTORS	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
AGRIC,FORESHNG	3736.855	3719.453	4716.478	5183.975	5702.372	6272.609	6899.870	7589.858	8348.843
MINING EXC OIL	22.900	5.081	1253.578	3042.168	5580.806	9579.313	14174.423	15795.526	17375.078
OIL	6916.261	8865.295	9751.823	10727.006	11799.707	12979.676	14277.644	15705.408	17275.949
FOOD,BEV & TBCO	444.233	552.063	0.000	667.996	0.000	808.275	889.102	0.000	1075.814
TEXTLES & APPRL	312.911	389.379	358.229	471.149	518.264	570.091	524.483	482.525	758.790
NON-METAL MNFG	260.096	323.845	297.938	0.000	431.038	0.000	0.000	0.000	631.083
BASIC CHEMICALS	152.582	0.000	164.434	0.000	214.465	0.000	306.573	282.047	370.954
METAL MANUF	247.119	307.143	282.571	259.966	0.000	0.000	494.656	544.122	598.534
TRANSPORT EQUIP	48.070	57.232	0.000	0.000	0.000	0.000	92.172	0.000	111.529
UTILITIES	88.465	94.202	86.666	79.732	73.354	67.485	211.032	194.150	255.349
CONSTRUCTION	1369.149	0.000	459.706	2643.807	2469.102	2271.574	2089.848	3929.362	2274.142
TRADE/SERVICES	2418.868	3078.283	2899.265	2667.324	3239.934	4050.759	4957.605	5453.366	5998.702
TRANSPORTATION	419.677	386.102	355.214	326.797	300.653	276.601	254.473	547.486	907.061
TOTAL	16437.177	17778.077	20625.902	26109.919	30329.696	36876.382	45171.884	50523.849	55981.827
AGRIC,FORESHNG	.227	.209	.229	.199	.188	.170	.153	.150	.149
MINING EXC OIL	.001	.000	.061	.117	.184	.260	.314	.313	.310
OIL	.421	.499	.473	.411	.389	.352	.316	.311	.309
FOOD,BEV & TBCO	.027	.031	0.000	.026	0.000	.022	.020	0.000	.019
TEXTLES & APPRL	.019	.022	.017	.018	.017	.015	.012	.010	.014
NON-METAL MNFG	.016	.018	.014	0.000	.014	0.000	0.000	0.000	.011
BASIC CHEMICALS	.009	0.000	.008	0.000	.007	0.000	.007	.006	.007
METAL MANUF	.015	.017	.014	.010	0.000	0.000	.011	.011	.011
TRANSPORT EQUIP	.003	.003	0.000	0.000	0.000	0.000	.002	0.000	.002
UTILITIES	.005	.005	.004	.003	.002	.002	.005	.004	.005
CONSTRUCTION	.083	0.000	.022	.103	.081	.062	.046	.078	.041
TRADE/SERVICES	.147	.173	.141	.102	.107	.110	.110	.108	.107
TRANSPORTATION	.026	.022	.017	.013	.010	.008	.006	.011	.016

Note: All values are in millions of Naira. Ratios refer to sectoral shares out of total domestic production.

TABLE 6.12

THE EFFECT OF CHANGES IN FOREIGN EXCHANGE AVAILABILITY
ON SECTORAL AND AGGREGATE LEVELS OF GROSS INVESTMENT

SECTORS	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
AGRIC,FOR&FSHNG	805.516	737.537	526.316	1143.576	976.881	1074.570	2776.183	1388.226	0.000
MINING EXC OIL	741.230	2957.724	5031.573	7295.575	8461.689	6665.862	10782.219	0.000	5941.881
OIL	41.043	566.976	657.310	744.646	1763.978	4766.185	1243.811	21276.467	30925.625
FOOD,BEV & TBCO	50.270	34.846	38.330	42.163	46.379	51.017	56.119	135.539	0.000
TEXTLES & APPRL	32.853	22.686	24.955	27.450	30.195	0.000	0.000	101.916	44.209
NON-METAL MNFG	65.470	0.000	0.000	0.000	187.466	66.075	263.490	0.000	0.000
BASIC CHEMICALS	27.450	18.818	0.000	41.814	25.047	27.551	0.000	101.080	0.000
METAL MANUF	31.349	0.000	0.000	0.000	90.231	31.803	126.366	0.000	0.000
TRANSPORT EQUIP	4.371	0.000	0.000	10.522	4.608	5.069	20.212	0.000	0.000
UTILITIES	0.000	0.000	0.000	0.000	0.000	0.000	1016.200	0.000	211.867
CONSTRUCTION	140.164	173.059	510.445	0.000	0.000	0.000	1018.065	813.728	0.000
TRADE/SERVICES	1279.386	253.630	0.000	111.987	267.650	3373.987	1795.277	3232.897	0.000
TRANSPORTATION	0.000	0.000	0.000	0.000	0.000	0.000	2351.941	1303.584	0.000
TOTAL	3219.104	4765.276	6788.929	9417.734	11854.124	16062.119	21459.883	28353.438	37123.762
AGRIC,FOR&FSHNG	267.956	1232.092	804.036	1099.151	782.691	1074.570	4285.125	0.000	0.000
MINING EXC OIL	0.000	2199.343	3588.674	5285.543	8445.001	10186.230	5234.332	5401.784	5941.881
OIL	1251.167	797.876	877.664	965.431	1061.973	1168.171	6555.643	18228.678	31509.505
FOOD,BEV & TBCO	50.270	0.000	70.388	0.000	85.169	51.017	0.000	187.169	0.000
TEXTLES & APPRL	32.853	0.000	45.826	27.450	30.195	0.000	0.000	101.916	44.209
NON-METAL MNFG	65.470	0.000	0.000	138.476	0.000	0.000	375.120	0.000	0.000
BASIC CHEMICALS	0.000	19.380	0.000	41.348	0.000	68.577	0.000	101.080	0.000
METAL MANUF	31.349	0.000	0.000	0.000	0.000	114.815	34.983	84.073	0.000
TRANSPORT EQUIP	4.371	0.000	0.000	0.000	19.890	0.000	0.000	18.595	0.000
UTILITIES	0.000	0.000	0.000	0.000	0.000	686.640	0.000	584.022	0.000
CONSTRUCTION	0.000	0.000	808.834	0.000	0.000	0.000	1003.351	813.728	0.000
TRADE/SERVICES	1389.025	0.000	0.000	1178.995	1605.029	2923.818	2973.261	817.062	0.000
TRANSPORTATION	0.000	0.000	0.000	0.000	0.000	0.000	1253.484	2323.364	0.000
TOTAL	3092.462	4248.691	6195.422	8736.394	12029.948	16273.838	21715.237	28661.471	37495.515

Note: Values are in millions of Naira. The top part of the Table refers to Experiment 1 and the lower part refers to Experiment 3.

TABLE 6.13

THE EFFECT OF CHANGES IN FOREIGN EXCHANGE AVAILABILITY
ON SECTORAL AND AGGREGATE LEVELS OF CAPITAL STOCK

SECTORS	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
AGRIC,FORESHNG	3556.477	4077.475	4488.814	4656.025	5427.119	5969.831	6566.814	8817.652	9500.466
MINING EXC OIL	215.420	939.416	3821.987	8547.800	15159.651	22408.569	27281.745	35881.425	33010.911
OIL	3459.131	3222.523	3531.698	3906.473	4338.601	5755.491	10061.236	10500.148	30936.604
FOOD,BEV & TBCO	155.779	193.586	212.945	234.239	257.563	283.430	311.773	342.950	451.053
TEXTLES & APPRL	101.284	126.034	138.638	152.502	167.752	184.527	169.765	156.184	245.505
NON-METAL MNFG	201.359	250.721	230.663	212.210	195.234	367.081	403.789	634.976	584.178
BASIC CHEMICALS	83.798	104.545	114.999	105.799	139.149	153.064	168.370	154.900	243.588
METAL MANUF	97.095	120.676	111.022	102.140	93.969	176.682	194.350	305.169	280.755
TRANSPORT EQUIP	15.154	19.233	17.694	16.279	25.599	28.159	30.975	48.709	44.812
UTILITIES	472.032	434.270	399.528	367.566	338.161	311.108	286.219	1279.521	1177.160
CONSTFUCTION	684.574	769.973	861.434	1321.365	1215.655	1118.403	1028.931	1964.681	2621.235
TRADE/SERVICES	3628.302	4617.424	4501.660	4141.528	3922.192	3876.067	6939.969	8180.048	10758.542
TRANSPORTATION	1678.706	1544.410	1420.857	1307.188	1202.613	1106.404	1017.892	3298.402	4338.113
TOTAL	14349.111	16420.286	19871.939	25071.113	32483.258	41738.814	54461.827	71564.764	94192.921
AGRIC,FORESHNG	3556.477	3539.915	4488.814	4933.744	5638.196	5969.831	6566.814	10326.593	9500.466
MINING EXC OIL	215.420	198.186	2381.674	5779.814	10602.972	18199.736	26929.987	30609.920	33010.911
OIL	3459.131	4432.647	4875.911	5363.503	5899.853	6489.838	7138.822	13123.359	30302.168
FOOD,BEV & TBCO	155.779	193.586	178.099	234.239	215.500	283.430	311.773	286.831	451.053
TEXTLES & APPRL	101.284	126.034	115.952	152.502	167.752	184.527	169.765	156.184	245.505
NON-METAL MNFG	201.359	250.721	230.563	212.210	333.710	307.613	282.452	634.976	584.178
BASIC CHEMICALS	83.798	77.094	90.307	83.083	117.784	108.362	168.370	154.900	243.588
METAL MANUF	97.095	120.676	111.022	102.140	93.969	86.452	194.350	213.785	280.755
TRANSPORT EQUIP	15.154	19.233	17.694	16.279	14.976	33.668	30.975	28.497	44.812
UTILITIES	472.032	434.270	399.528	367.566	338.161	311.108	972.859	895.030	1407.450
CONSTFUCTION	684.574	629.809	579.424	1341.903	1234.551	1135.787	1044.924	1964.681	2621.235
TRADE/SERVICES	3628.302	4727.063	4348.898	4000.986	4859.901	6076.138	8513.865	10805.957	10758.542
TRANSPORTATION	1678.706	1544.410	1420.857	1307.188	1202.613	1106.404	1017.892	2189.944	4338.113
TOTAL	14349.111	16293.644	19238.743	23895.158	30719.940	40292.292	53342.847	70790.657	93788.776

Note: Values are in millions of Naira. The first part of the table refers to Experiment 1 and the lower part refers to Experiment 3.

TABLE 6.14

THE EFFECT OF CHANGES IN FOREIGN EXCHANGE AVAILABILITY
ON THE RATIOS OF SECTORAL TO AGGREGATE CAPITAL STOCK

SECTORS	YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
AGRIC,FOR&FSHNG	.248	.248	.226	.186	.167	.143	.121	.123	.101
MINING EXC OIL	.015	.057	.192	.341	.467	.537	.501	.501	.350
OIL	.241	.196	.178	.156	.134	.138	.185	.147	.328
FOOD,BEV & TBCO	.011	.012	.011	.009	.008	.007	.006	.005	.005
TEXTLES & APPRL	.007	.008	.007	.006	.005	.004	.003	.002	.003
NON-METAL MNFG	.014	.015	.012	.008	.006	.009	.007	.009	.006
BASIC CHEMICALS	.006	.006	.006	.004	.004	.004	.003	.002	.003
METAL MANUF	.007	.007	.006	.004	.003	.004	.004	.004	.003
TRANSPORT EQUIP	.001	.001	.001	.001	.001	.001	.001	.001	.000
UTILITIES	.033	.026	.020	.015	.010	.007	.005	.010	.012
CONSTRUCTION	.048	.047	.044	.053	.037	.027	.019	.027	.028
TRADE/SERVICES	.253	.281	.227	.165	.121	.093	.127	.114	.114
TRANSPORTATION	.117	.094	.072	.052	.037	.027	.019	.046	.046
AGRIC,FOR&FSHNG	.248	.217	.233	.206	.184	.148	.123	.146	.101
MINING EXC OIL	.015	.012	.124	.242	.345	.452	.505	.424	.352
OIL	.241	.272	.253	.224	.192	.161	.134	.185	.323
FOOD,BEV & TBCO	.011	.012	.009	.010	.007	.007	.006	.004	.005
TEXTLES & APPRL	.007	.008	.006	.006	.005	.005	.003	.002	.003
NON-METAL MNFG	.014	.015	.012	.009	.011	.008	.005	.009	.006
BASIC CHEMICALS	.006	.005	.005	.003	.004	.003	.003	.002	.003
METAL MANUF	.007	.007	.006	.004	.003	.002	.004	.003	.003
TRANSPORT EQUIP	.001	.001	.001	.001	.000	.001	.001	.000	.000
UTILITIES	.033	.027	.021	.015	.011	.008	.018	.013	.015
CONSTRUCTION	.048	.039	.030	.056	.040	.028	.020	.028	.028
TRADE/SERVICES	.253	.290	.226	.167	.158	.151	.160	.153	.115
TRANSPORTATION	.117	.095	.074	.055	.039	.027	.019	.031	.046

TABLE 6.15

THE EFFECT OF CHANGES IN THE IMPORTS GROWTH RATE ON SECTORAL LEVELS OF IMPORTS

SECTORS		1974	1977	1980	1983	1986	1989	1992	1995	1998
		TARGET-YEARS								
1 AGRIC,FOR&FSHNG	3	5594.400	4067.580	6911.237	7925.041	8462.646	8510.200	9621.838	10551.489	12679.234
	4	8215.335	8947.944	9611.002	10160.268	9975.051	8721.489	9350.689	10782.381	12679.234
	5	2671.159	4369.823	4275.643	6134.292	7606.025	9708.908	9603.688	15227.714	12679.234
2 MINING EXC OIL	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3 OIL	3	0.000	2736.677	0.000	0.000	0.000	0.000	0.000	0.000	3264.803
	4	0.000	0.000	0.000	0.000	0.000	2062.277	0.000	0.000	0.000
	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 FOOD,BEV & TBCO	3	168.112	164.373	734.833	288.511	982.814	438.247	591.702	1507.665	845.625
	4	168.105	636.896	734.630	279.150	995.016	1140.458	1343.663	687.762	845.525
	5	168.112	169.764	306.229	283.335	367.592	454.459	1313.826	1456.166	845.625
5 TEXTILES & APPRL	3	362.147	417.933	550.169	591.132	710.378	849.591	1093.760	1355.424	1419.988
	4	362.147	417.814	550.966	592.248	709.945	855.881	1094.882	1359.225	1419.988
	5	362.303	414.907	549.894	591.596	1100.518	855.975	1096.099	1358.318	1419.988
6 NON-METAL MNFG	3	217.809	91.709	197.425	729.551	414.953	936.416	1177.319	1475.826	1103.494
	4	213.292	101.947	241.843	746.092	821.092	468.077	543.772	1108.773	1103.494
	5	201.691	112.252	176.912	495.736	844.935	487.332	591.580	1094.485	1103.494
7 BASIC CHEMICALS	3	0.000	123.585	0.000	156.583	0.000	175.061	0.000	32.006	19.417
	4	0.000	0.000	0.000	10.227	0.000	0.000	0.000	50.020	19.417
	5	0.000	10.266	958.566	2.797	18.983	0.000	0.000	44.522	19.417
8 METAL MANUF	3	513.653	333.428	580.735	728.972	1081.177	1360.584	2220.457	3897.261	5587.117
	4	514.365	317.178	674.995	717.738	1114.159	932.839	1992.839	4490.783	5587.117
	5	377.881	296.109	536.023	952.509	722.591	1044.162	1551.476	4493.307	5587.117
9 TRANSPORT EQUIP	3	59.075	46.605	127.935	150.617	166.381	204.427	1245.756	2264.751	169.311
	4	56.353	62.327	90.259	151.880	169.979	1215.768	2459.351	143.606	169.311
	5	94.618	112.370	128.124	147.073	143.619	120.140	3484.397	295.981	169.311
10 UTILITIES	3	0.000	8.017	38.186	82.768	130.611	204.109	153.561	207.122	206.943
	4	0.000	7.284	41.610	81.325	133.686	214.311	293.576	352.766	206.943
	5	0.000	9.788	41.282	80.118	142.636	224.345	147.925	212.916	236.943
11 CONSTRUCTION	3	376.156	1035.492	944.534	459.159	1612.313	3930.052	4015.588	0.000	0.000
	4	314.698	1233.249	505.985	621.942	1690.179	2473.225	3724.725	2213.679	0.000
	5	895.783	1447.411	1346.205	735.696	1565.568	3265.914	3235.341	1258.834	0.000
12 TRADE/SERVICES	3	367.978	143.720	863.682	1893.867	2086.714	2129.693	2390.798	3857.996	5435.698
	4	367.364	147.605	824.317	1737.983	1746.570	1737.559	2373.874	3975.538	5435.898
	5	278.574	741.592	1014.937	2056.381	1895.467	1982.281	2367.385	3866.681	5435.898
13 TRANSPORTATION	3	841.963	1032.433	1293.124	1654.033	1980.296	2355.556	2874.187	3056.571	3116.217
	4	842.626	1022.912	1330.669	1678.465	1994.276	2392.576	2579.591	2739.978	3116.217
	5	777.631	1025.470	1278.289	1667.610	1947.265	2387.994	2461.232	2777.516	3116.217

Note: Values in millions of Naira.

TABLE 6.16

THE EFFECT OF CHANGES IN THE IMPORTS GROWTH
ON THE RATIOS OF SECTORAL TO TOTAL IMPORTS

SECTORS		TARGET-YEARS								
		1974	1977	1980	1983	1986	1989	1992	1995	1998
1 AGRIC,FOR&FSHNG	3	.658	.399	.565	.539	.441	.402	.379	.374	.375
	4	.744	.697	.656	.605	.514	.393	.366	.386	.415
	5	.546	.484	.397	.467	.463	.473	.351	.475	.415
2 MINING EXC OIL	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3 OIL	3	0.000	.268	0.000	0.000	0.000	0.000	0.000	0.000	.096
	4	0.000	0.000	0.000	0.000	0.000	.093	0.000	0.000	0.000
	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 FOOD,BEV & TOCO	3	.020	.016	.060	.020	.056	.021	.023	.053	.025
	4	.015	.030	.050	.017	.052	.051	.032	.025	.028
	5	.025	.020	.029	.022	.022	.022	.051	.045	.028
5 TEXTLES & APPRL	3	.043	.041	.045	.040	.040	.040	.043	.048	.042
	4	.033	.033	.038	.035	.037	.039	.043	.049	.046
	5	.054	.049	.052	.045	.067	.042	.043	.042	.046
6 NON-METAL MNFG	3	.026	.009	.016	.050	.024	.047	.046	.052	.033
	4	.019	.008	.017	.044	.021	.021	.022	.040	.036
	5	.015	.013	.017	.037	.051	.024	.023	.034	.036
7 BASIC CHEMICALS	3	0.000	.012	0.000	.011	0.000	.008	0.000	.001	.001
	4	0.000	0.000	0.000	.001	0.000	0.000	0.000	.001	.001
	5	0.001	.001	.001	.000	.001	0.000	0.000	.001	.001
8 METAL MANUF	3	.060	.033	.047	.050	.061	.064	.147	.138	.165
	4	.047	.025	.046	.044	.053	.042	.078	.161	.193
	5	.056	.035	.051	.072	.044	.051	.060	.140	.183
9 TRANSPORT EQUIP	3	.007	.005	.010	.010	.009	.016	.029	.040	.035
	4	.005	.005	.006	.009	.009	.055	.006	.007	.026
	5	.014	.013	.012	.011	.011	.006	.130	.019	.026
10 UTILITIES	3	0.000	.001	.003	.006	.007	.010	.006	.007	.006
	4	0.000	.001	.003	.005	.007	.010	.011	.013	.007
	5	0.000	.001	.004	.006	.009	.011	.006	.007	.007
11 CONSTRUCTION	3	.044	.102	.077	.031	.031	.196	.158	0.000	0.000
	4	.028	.090	.035	.037	.047	.111	.106	.079	0.000
	5	.133	.172	.129	.056	.095	.159	.126	.039	0.000
12 TRADE/SERVICES	3	.043	.014	.071	.129	.114	.101	.094	.137	.161
	4	.033	.012	.056	.103	.092	.078	.045	.142	.178
	5	.041	.048	.047	.156	.115	.097	.092	.121	.178
13 TRANSPORTATION	3	.099	.101	.106	.115	.112	.111	.113	.108	.092
	4	.076	.041	.091	.110	.103	.106	.101	.097	.102
	5	.116	.122	.122	.127	.121	.116	.111	.087	.102

TABLE 6.17

THE EFFECT OF CHANGES IN THE IMPORTS GROWTH RATE ON SECTORAL LEVELS OF PRODUCTION

SECTORS	TARGET-YEARS								
	1975	1977	1980	1983	1986	1989	1992	1996	1998
1 AGRIC,FORESTRY									
2 MINING EXC OIL									
3 OIL									
4 FOOD,BEV & TOCO									
5 TEXTILES & APPRL									
6 NON-METAL MNFC									
7 BASIC CHEMICALS									
8 METAL MANUF									
9 TRANSPORT EQUIP									
10 UTILITIES									
11 CONSTRUCTION									
12 TRADE/SERVICES									
13 TRANSPORTATION									

Note: Values in millions of Naira.

TABLE 6.18

THE EFFECT OF CHANGES IN THE SAVINGS RATE ON SECTORAL LEVELS OF IMPORTS

SECTORS	TARGET-YEARS								
	1976	1977	1978	1979	1980	1981	1982	1983	1984
1 AGRIC.FORESTRY									
2 MINING EXC OIL									
3 OIL									
4 FOOD,BEV & TOBC									
5 TEXTILES & APPEL									
6 NON-METAL MNFG									
7 BASIC CHEMICALS									
8 METAL MANUF									
9 TRANSPORT EQUIP									
10 UTILITIES									
11 CONSTRUCTION									
12 TRADE/SERVICES									
13 TRANSPORTATION									

Note: All values are in millions of Nigerian Naira.

TABLE 6.19

THE EFFECT OF CHANGES IN THE SAVINGS RATE ON SECTORAL LEVELS OF PRODUCTION

SECTORS	TARGET-YEARS								
	1976	1977	1978	1983	1986	1989	1992	1995	1998
1 AGRIC,FORESTRY									
2 MINING EXC OIL									
3 OIL									
4 FOOD,BEV & TOBCO									
5 TEXTILES & APPAREL									
6 NON-METAL MFG									
7 BASIC CHEMICALS									
8 METAL MANUF									
9 TRANSPORT EQUIP									
10 UTILITIES									
11 CONSTRUCTION									
12 TRADE/SERVICES									
13 TRANSPORTATION									

Note: Values in millions of Naira.

TABLE 6.20

LEVELS OF GROSS INVESTMENT IN THE 19 EXPERIMENTS

	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
EXPT. NO. 1	3219.104	4765.276	6788.929	9417.734	11854.124	16062.119	21459.883	28353.438	37123.702
EXPT. NO. 2	3219.104	4765.276	6770.929	9417.934	11854.124	16062.119	21459.883	28353.438	37123.702
EXPT. NO. 3	3092.462	4248.691	6195.422	8736.394	12029.948	16273.838	21715.237	28661.471	37495.515
EXPT. NO. 4	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 5	3092.462	4248.691	6195.422	8736.294	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 6	2779.440	4260.407	6209.499	8753.319	12050.312	16298.458	21744.779	28697.088	37538.484
EXPT. NO. 7	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 8	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.371	37495.515
EXPT. NO. 9	2784.319	4257.224	6209.279	8753.055	12049.995	16298.076	21744.319	28696.533	37537.814
EXPT. NO. 10	3477.170	4259.682	6176.828	8714.037	12003.048	16241.550	21676.215	28614.424	37438.757
EXPT. NO. 11	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 12	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 13	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 14	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 15	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 16	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 17	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 18	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515
EXPT. NO. 19	3092.462	4248.691	6195.422	8736.394	12029.948	16273.938	21715.237	28661.471	37495.515

Note: All figures are in millions of Naira

TABLE 6.21

THE EFFECT OF CHANGES IN THE SAVINGS RATE ON SECTORAL LEVELS OF GROSS INVESTMENT

SECTORS		TARGET-YEARS								
		1974	1977	1980	1983	1986	1989	1992	1995	1998
1 AGRIC,FORESTRY										
2 MINING EXC OIL										
3 OIL										
4 FOOD,BEV & TOBCO										
5 TEXTILES & APPRL										
6 NON-METAL MNFG										
7 BASIC CHEMICALS										
8 METAL MANUF										
9 TRANSPORT EQUIP										
10 UTILITIES										
11 CONSTRUCTION										
12 TRADE/SERVICES										
13 TRANSPORTATION										

Note: All figures are in millions of Naira.

TABLE 6.22

LEVELS OF CAPITAL STOCKS IN THE 19 EXPERIMENTS

	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
EXPT. NO. 1	14349.111	16420.286	19871.939	25071.113	32483.258	41738.814	54461.827	71564.764	94192.921
EXPT. NO. 2	14349.111	16420.286	19871.939	25071.113	32483.258	41738.814	54461.827	71564.764	94193.021
EXPT. NO. 3	14349.111	16293.644	19238.743	23895.158	30719.940	40292.292	53342.847	70790.657	93788.776
EXPT. NO. 4	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876
EXPT. NO. 5	14349.111	16293.644	19238.843	23895.158	30719.840	40292.292	53342.847	70790.557	93788.876
EXPT. NO. 6	14349.111	15980.622	18962.579	23655.071	30515.985	40125.018	53213.475	70701.176	93742.170
EXPT. NO. 7	14349.111	16293.644	19238.643	23895.158	30719.940	40292.292	53342.847	70790.557	93788.776
EXPT. NO. 8	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876
EXPT. NO. 9	14349.111	15985.501	18966.885	23658.813	30519.164	40127.625	53215.491	70702.571	93742.698
EXPT. NO. 10	14349.111	16678.352	19603.766	24212.293	30999.347	40513.247	53513.738	70908.853	93850.569
EXPT. NO. 11	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.476
EXPT. NO. 12	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876
EXPT. NO. 13	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876
EXPT. NO. 14	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876
EXPT. NO. 15	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876
EXPT. NO. 16	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876
EXPT. NO. 17	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876
EXPT. NO. 18	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876
EXPT. NO. 19	14349.111	16293.644	19238.843	23895.158	30719.940	40292.292	53342.847	70790.657	93788.876

Note: All figures are in millions of Naira.

TABLE 6.23

THE EFFECT OF CHANGES IN THE SAVINGS RATE
ON SECTORAL LEVELS OF CAPITAL STOCK

SECTORS	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
1 AGRIC,FORESTRY									
2 MINING EXC OIL									
3 OIL									
4 FOOD,BEV & TOBCO									
5 TEXTILES & APPRL									
6 NON-METAL MNFC									
7 BASIC CHEMICALS									
8 METAL MANUF									
9 TRANSPORT EQUIP									
10 UTILITIES									
11 CONSTRUCTION									
12 TRADE/SERVICES									
13 TRANSPORTATION									

Note: All figures are in millions of Naira.

TABLE 6.24

THE EFFECT OF CHANGES IN THE SAVINGS RATE ON RATIOS OF SECTORAL TO AGGREGATE CAPITAL STOCK

SECTORS	TARGET-YEARS 1974	1977	1980	1983	1986	1989	1992	1995	1998
1 AGRIC,FOREFSHNG									
3	.248	.217	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.248	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.248	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.248	.211	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2 MINING EXC OIL									
3	.015	.017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.015	.012	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.015	.012	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3 OIL									
3	.241	.272	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.241	.277	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.241	.277	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.241	.266	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4 FOOD,BEV & TOCO									
3	.011	.017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.011	.015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.011	.014	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.011	.012	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5 TEXTILES & APPRL									
3	.007	.008	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.007	.008	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.007	.008	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.007	.008	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6 NON-METAL MNFG									
3	.014	.015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.014	.016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.014	.016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.014	.015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7 BASIC CHEMICALS									
3	.006	.005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.006	.005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.006	.006	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.006	.005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8 METAL MANUF									
3	.007	.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.007	.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9 TRANSPORT EQUIP									
3	.001	.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.001	.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.001	.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.001	.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10 UTILITIES									
3	.033	.027	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.033	.027	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.033	.027	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.033	.026	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11 CONSTRUCTION									
3	.044	.039	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.044	.039	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.044	.039	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.044	.038	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12 TRADE/SERVICES									
3	.253	.298	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.253	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.253	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.252	.328	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13 TRANSPORTATION									
3	.117	.095	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.117	.097	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	.117	.097	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	.117	.093	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 6.25

THE EFFECT OF CHANGES IN THE INITIAL CAPITAL STOCK ON SECTORAL LEVELS OF IMPORTS

SECTORS		TARGET-YEARS								
		1976	1977	1978	1983	1986	1989	1992	1995	1998
1 AGRIC.FORESTRNG	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2 MINING EXC OIL	7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	17	0.022	0.023	0.023	0.028	0.033	0.038	0.043	0.048	0.053
3 OIL	7	0.000	27.36.677	0.000	0.000	0.000	0.000	0.000	0.000	3264.462
	8	0.000	267.[illegible]	327.[illegible]	0.000	0.000	1618.[illegible]	0.000	0.000	0.000
	17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 FOOD,BEV & TOBCO	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5 TEXTILES & APPRL	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6 NON-METAL MNFG	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7 BASIC CHEMICALS	7	0.000	[illegible]	0.000	[illegible]	0.000	[illegible]	0.000	[illegible]	[illegible]
	8	0.000	[illegible]	0.000	[illegible]	[illegible]	[illegible]	0.000	[illegible]	[illegible]
	17	0.000	2640.[illegible]	0.000	[illegible]	[illegible]	0.000	0.000	[illegible]	[illegible]
8 METAL MANUF	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9 TRANSPORT EQUIP	7	59.875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10 UTILITIES	7	0.000	0.017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11 CONSTRUCTION	7	376.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	0.000
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	0.000
	17	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.000	0.000
12 TRADE/SERVICES	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13 TRANSPORTATION	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: All figures are in millions of Naira.

TABLE 6.26

THE EFFECT OF CHANGES IN THE INITIAL CAPITAL STOCK ON SECTORAL LEVELS OF PRODUCTION

SECTORS		TARGET-YEARS 1974	1977	1980	1983	1986	1989	1992	1995	1998
1 AGRIC,FORLFSHNG	3	3716.455	3723.453	4726.478	5183.975	5782.372	6272.669	6899.878	7589.858	8348.843
	7	3923.649	3783.569	4716.479	5183.975	5782.372	6272.669	6899.878	7589.858	8348.843
	8	4110.540	3830.652	4716.479	5183.975	5661.326	6272.609	6899.878	7589.858	8348.843
	17	4110.902	4250.051	4693.497	5183.975	5782.372	6272.609	6899.878	7589.858	8348.843
2 MINING EXC OIL	3	22.955	5.601	1253.579	3642.168	5546.856	9579.313	14174.423	15795.526	17375.878
	7	24.336	4.975	549.453	2561.546	4965.372	8728.511	14097.944	15795.526	17375.878
	8	5.392	104.314	737.286	2574.454	5136.360	9227.423	14028.262	15795.526	17375.878
	17	25.176	2.966	1383.882	3199.449	5938.321	9959.926	14359.569	15795.526	17375.878
3 OIL	3	6916.261	8865.295	9751.823	10727.066	11799.787	12979.676	14277.644	15705.468	17275.949
	7	7262.674	8865.295	9751.823	10727.066	11799.787	12979.676	14277.644	15705.468	17275.949
	8	7607.836	8865.295	9751.823	10727.066	11799.787	12979.676	14277.644	15705.468	17275.949
	17	7607.826	8865.295	9751.823	10727.066	11799.787	12979.676	14277.644	15705.468	17275.949
4 FOOD,BEV & TBCO	3	446.237	553.063	0.000	667.996	0.030	808.275	889.102	0.000	1875.814
	7	466.447	553.063	637.269	667.996	0.000	0.000	889.102	0.000	1875.814
	8	484.637	552.063	434.240	667.996	0.030	0.000	889.102	0.000	1875.814
	17	488.637	0.008	376.009	0.008	0.000	808.275	889.102	978.812	1875.814
5 TEXTLES & APPRL	3	312.935	389.379	359.229	471.149	518.264	576.091	524.483	482.525	758.798
	7	328.537	0.000	424.317	471.149	518.264	576.091	524.483	482.525	758.798
	8	344.223	389.379	428.317	471.149	0.000	570.091	524.483	482.525	758.798
	17	344.227	389.379	428.317	471.149	0.000	570.091	524.483	482.525	758.798
6 NON-METAL MNFG	3	260.586	321.845	297.938	0.000	431.638	0.000	0.000	0.000	631.883
	7	273.656	321.845	297.938	274.103	431.638	0.000	0.000	0.000	631.883
	8	286.694	321.845	297.938	274.103	0.000	474.142	0.000	0.000	631.883
	17	286.694	321.845	297.938	274.103	0.000	474.142	524.556	479.832	631.883
7 BASIC CHEMICALS	3	152.582	0.000	264.438	0.038	214.465	0.303	306.573	282.847	378.954
	7	165.211	0.000	264.412	188.659	253.366	278.703	306.573	282.847	378.954
	8	167.784	143.376	269.394	192.642	0.000	239.985	306.573	282.847	378.954
	17	167.784	0.000	269.394	192.642	0.000	271.246	306.573	282.847	378.954
8 METAL MANUF	3	247.119	307.143	282.571	259.966	0.030	0.398	494.656	544.122	598.534
	7	259.475	307.143	282.571	259.966	404.837	0.300	0.000	544.122	598.534
	8	271.830	307.143	282.571	0.000	0.000	0.000	0.000	544.122	598.534
	17	271.830	307.143	282.571	259.966	0.000	449.687	0.388	0.888	598.534
9 TRANSPORT EQUIP	3	48.870	57.232	0.000	0.000	0.000	0.000	92.172	0.000	111.529
	7	0.000	57.232	52.653	69.256	0.000	0.000	0.000	0.000	111.529
	8	52.877	57.232	52.653	69.250	0.000	0.000	0.000	0.000	111.529
	17	52.983	57.232	0.000	0.000	0.000	0.000	92.172	131.398	111.529
10 UTILITIES	3	88.465	94.202	86.666	79.732	73.354	67.485	211.832	194.158	255.349
	7	88.697	94.202	86.666	79.732	73.354	67.485	62.847	232.136	255.349
	8	89.493	94.202	86.666	79.732	73.354	67.485	62.847	232.136	255.349
	17	91.044	94.202	86.666	79.732	73.354	67.485	62.847	232.136	255.349
11 CONSTRUCTION	3	1369.149	0.000	459.706	2683.487	2469.132	2271.574	2849.648	3929.362	2274.142
	7	1437.606	0.000	2439.425	2683.487	2469.102	2271.574	1614.536	3929.362	2274.142
	8	0.306	849.741	0.000	2683.487	2469.132	2271.574	2699.457	3124.494	2274.142
	17	1506.365	0.000	0.000	2683.487	2469.132	2271.574	2643.344	2972.251	2274.142
12 TRADE/SERVICES	3	2418.868	3078.283	2899.265	2667.324	3239.934	4658.759	4957.605	5453.366	5998.782
	7	2539.811	3695.699	2765.243	3255.366	4097.194	4506.914	4957.605	5453.366	5998.782
	8	2663.755	3078.283	3386.111	3239.886	4097.194	4526.914	4957.605	5453.366	5998.782
	17	2661.293	2843.155	2748.651	2528.207	3131.474	4454.665	4957.605	5453.366	5998.782
13 TRANSPORTATION	3	419.677	386.102	355.214	326.797	330.653	276.601	254.473	547.486	987.861
	7	440.666	356.102	355.214	326.797	330.653	276.601	749.537	824.606	927.461
	8	461.632	346.102	355.214	326.797	330.653	276.601	743.514	684.636	927.461
	17	461.632	386.102	355.214	326.797	330.653	276.601	254.473	327.374	967.161

Note: All Values are in Millions of Nigerian Naira.

TABLE 6.27

THE EFFECT OF CHANGES IN THE INITIAL CAPITAL STOCK ON RATIOS OF SECTORAL TO TOTAL DOMESTIC PRODUCTION

SECTORS	TARGET-YEARS								
	1976	1977	1980	1983	1986	1989	1992	1995	1998
1 AGRIC,FORESTRNG									
2 MINING EXC OIL									
3 OIL									
4 FOOD,BEV & TOCO									
5 TEXTILES & APPRL									
6 NON-METAL MNFG									
7 BASIC CHEMICALS									
8 METAL MANUF									
9 TRANSPORT EQUIP									
10 UTILITIES									
11 CONSTRUCTION									
12 TRADE/SERVICES									
13 TRANSPORTATION									

TABLE 6.28

THE EFFECT OF CHANGES IN THE RATE OF DISCOUNT ON SECTORAL LEVELS OF IMPORTS

SECTORS		TARGET-YEARS								
		1976	1977	1980	1983	1986	1989	1992	1995	1998
1 AGRIC.FORESTRY	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2 MINING EXC OIL	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3 OIL	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4 FOOD,BEV & TOBCO	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5 TEXTILES & APPRL	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6 NON-METAL MNFG	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7 BASIC CHEMICALS	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8 METAL MANUF	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9 TRANSPORT EQUIP	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10 UTILITIES	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11 CONSTRUCTION	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12 TRADE/SERVICES	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13 TRANSPORTATION	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: Figures are in millions of Naira.

TABLE 6.29

THE EFFECT OF CHANGES IN THE RATE OF DISCOUNT ON SECTORAL LEVELS OF PRODUCTION

SECTORS		TARGET-YEARS								
		1974	1977	1980	1983	1986	1989	1992	1995	1998
1 AGRIC,FORSFSHNG	3	3736.855	3719.653	4718.678	5103.978	5702.372	6272.609	6499.670	7589.058	8368.843
	11	3736.855	3876.852	4718.678	4565.949	5702.372	6272.609	6443.264	7589.058	8368.843
	12	3736.855	3872.164	4718.678	4339.160	5702.372	6272.609	6499.970	7549.058	8368.843
2 MINING EXC OIL	3	22.900	5.081	1283.578	3967.168	5586.886	9579.313	14174.423	15795.526	17378.078
	11	22.126	105.724	1593.571	3465.312	5851.071	9660.539	14322.359	15795.526	17378.078
	12	21.816	3.746	993.572	2949.048	5826.851	9666.667	14322.322	15795.526	17378.078
3 OIL	3	6916.261	8865.295	9751.823	10737.806	11799.787	12979.676	14277.644	15735.408	17279.969
	11	6916.261	8865.295	9751.823	[illegible]	11799.787	12979.676	14277.644	15735.408	17279.969
	12	6916.261	8865.295	9751.823	13727.306	11799.787	12979.676	14277.644	15735.426	17279.969
4 FOOD,BEV & TBCO	3	444.233	552.663	0.000	667.996	0.000	808.275	889.102	0.000	1075.014
	11	444.233	552.663	0.000	667.996	0.000	808.275	889.102	0.000	1075.014
	12	444.233	552.663	0.000	667.996	0.000	808.275	889.102	0.000	1075.014
5 TEXTLES & APPRL	3	312.911	349.379	358.229	471.169	518.264	578.091	624.443	682.525	758.798
	11	312.911	349.379	427.163	471.169	518.264	578.091	624.443	682.525	758.798
	12	312.911	349.379	0.000	471.169	518.264	578.091	624.443	127.817	758.798
6 NON-METAL MNFG	3	260.686	323.865	297.938	0.000	431.834	0.000	0.000	0.000	631.883
	11	260.686	323.865	297.938	0.000	431.834	0.000	0.000	0.000	631.883
	12	260.686	323.865	297.938	0.000	431.834	0.000	0.000	0.000	631.883
7 BASIC CHEMICALS	3	152.502	0.000	166.434	0.000	225.665	0.000	306.573	282.857	370.954
	11	0.000	143.376	129.166	119.815	223.925	245.111	306.573	282.857	370.954
	12	152.502	0.000	209.394	187.297	223.910	240.264	306.573	282.347	370.954
8 METAL MANUF	3	247.119	337.163	282.571	259.966	0.000	0.000	494.656	544.122	598.536
	11	247.119	337.163	242.571	259.966	0.000	0.000	494.656	544.122	598.536
	12	0.000	0.000	0.000	0.000	0.000	0.000	494.656	544.122	598.536
9 TRANSPORT EQUIP	3	48.070	57.232	0.000	0.000	0.000	0.000	92.172	0.000	111.529
	11	0.000	57.232	0.000	0.000	76.176	83.793	92.172	0.000	111.529
	12	48.070	44.224	0.000	0.000	76.176	83.793	92.172	0.000	111.529
10 UTILITIES	3	88.465	94.202	86.666	79.732	73.254	67.485	241.032	196.150	255.369
	11	86.920	94.232	86.666	79.732	73.254	67.485	82.387	57.126	255.369
	12	84.395	94.232	86.666	79.712	73.254	67.485	82.387	232.136	255.369
11 CONSTRUCTION	3	1369.159	0.000	459.726	2683.467	2469.152	2271.574	2649.848	2924.362	2274.142
	11	1369.159	0.000	0.000	2683.467	2469.102	2271.574	2649.848	2924.362	2274.142
	12	1369.159	0.000	2364.972	2683.627	2469.102	2271.574	2649.848	2924.362	2274.142
12 TRADE/SERVICES	3	2618.864	3078.283	2899.265	2667.326	3279.934	3858.799	4957.605	5453.366	5998.702
	11	2618.864	3078.283	3166.167	3052.133	3019.332	3914.975	4957.605	5453.366	5998.702
	12	2618.864	3078.143	2812.826	3192.174	3659.561	3962.755	4957.605	5453.366	5998.702
13 TRANSPORTATION	3	419.677	386.162	355.214	326.797	360.651	376.601	254.473	567.486	907.061
	11	419.677	346.162	355.214	326.797	330.651	376.601	611.557	562.656	907.061
	12	419.677	384.162	355.214	326.797	330.651	376.601	254.473	669.363	937.061

Note: Figures are in millions of Naira.

TABLE 6.30

LEVELS OF TOTAL DOMESTIC PRODUCTION IN THE 19 EXPERIMENTS

	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
EXPT. NO. 1	16436.267	18142.332	20875.549	24928.767	29852.815	37407.823	45366.694	52398.183	56150.398
EXPT. NO. 2	16436.267	18142.332	20875.549	24928.767	29852.815	37407.823	45366.694	52398.183	56150.387
EXPT. NO. 3	16437.177	17778.077	20625.902	26109.919	30329.696	36876.382	45171.884	50523.849	55981.827
EXPT. NO. 4	16436.908	17646.367	21232.991	26329.028	30149.719	36798.938	44641.941	51104.714	55981.827
EXPT. NO. 5	15109.255	18171.347	20672.122	26275.729	30274.563	37211.725	44897.321	51387.360	55981.827
EXPT. NO. 6	16418.348	18048.496	21548.811	26228.817	30469.517	36787.490	45419.386	50406.347	55981.748
EXPT. NO. 7	17204.362	17580.124	22537.862	26750.793	31019.230	35952.164	43779.379	50838.949	55981.827
EXPT. NO. 8	16547.009	19022.626	23941.692	26490.827	29531.691	36886.420	44779.293	49897.507	55981.827
EXPT. NO. 9	15159.905	18039.431	22267.736	26199.895	30409.621	36906.625	43655.761	51580.672	55981.758
EXPT. NO. 10	16435.204	17757.269	19928.978	25427.509	30184.230	36909.734	45218.243	50838.949	55981.931
EXPT. NO. 11	16233.914	18132.885	20240.569	25918.681	30475.838	37161.333	45548.361	50401.965	55981.827
EXPT. NO. 12	16184.913	17609.323	21608.057	25624.571	30490.327	37180.012	45153.817	50328.184	55981.827
EXPT. NO. 13	17255.894	18132.885	22716.981	26297.799	30058.564	36064.696	44238.531	51059.581	55981.827
EXPT. NO. 14	18074.408	18283.443	21515.638	26470.157	30160.343	37793.098	42897.439	51221.204	55981.827
EXPT. NO. 15	17255.894	17983.828	22944.637	26592.878	31164.839	35638.656	42476.513	51887.424	55981.827
EXPT. NO. 16	16115.361	18925.320	20604.674	25763.287	29571.378	36637.735	44148.499	50988.269	55981.827
EXPT. NO. 17	18075.339	17527.370	20613.361	25926.873	29406.983	37855.972	45237.984	50399.724	55981.827
EXPT. NO. 18	15488.401	18057.626	20422.488	25313.737	29355.193	37020.633	45363.930	50876.048	55981.827
EXPT. NO. 19	18021.346	17446.415	20572.426	26912.500	29432.602	37161.658	44345.682	51238.221	55981.827

Note: Figures are in millions of Naira.

TABLE 6.31

LEVELS OF TOTAL IMPORTS IN THE 19 EXPERIMENTS

	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
EXPT. NO. 1	5630.609	5667.043	7639.509	10622.885	14641.535	20614.343	25464.524	27829.910	30580.082
EXPT. NO. 2	8529.018	10233.621	12280.345	14736.415	17683.697	21220.437	25464.524	30557.429	36668.915
EXPT. NO. 3	8501.293	10201.551	12241.862	14690.234	17628.281	21153.937	25384.724	28266.032	33847.238
EXPT. NO. 4	11044.484	12701.157	14606.330	16797.280	19316.871	22214.402	25546.563	27914.403	30582.336
EXPT. NO. 5	6727.753	8409.691	10512.114	13140.143	16425.178	20531.473	25664.341	32080.427	30582.436
EXPT. NO. 6	8549.974	10259.849	12311.819	14774.183	17729.020	21274.824	25529.688	28255.865	33907.038
EXPT. NO. 7	8522.776	10227.332	12272.798	14727.357	17672.829	21207.295	25448.874	28123.607	33748.329
EXPT. NO. 8	8493.423	10192.007	12230.529	14676.635	17611.961	21134.354	25361.225	28168.260	30582.436
EXPT. NO. 9	8425.483	10110.580	12132.696	14559.235	17471.082	20965.298	25158.358	28011.936	30582.453
EXPT. NO. 10	8560.324	10272.388	12326.866	14792.239	17750.687	21300.825	25560.990	30673.187	30582.412
EXPT. NO. 11	8550.299	10260.359	12312.431	14774.917	17729.901	21275.881	25531.057	28256.915	30582.436
EXPT. NO. 12	8562.170	10274.603	12329.524	14795.429	17754.515	21305.418	25566.501	30679.802	36815.762
EXPT. NO. 13	8609.715	10331.658	12397.990	14877.588	17853.106	21423.727	25708.472	30850.167	37020.200
EXPT. NO. 14	8422.750	10107.300	12128.759	14554.511	17465.414	20958.496	25150.196	28098.466	30582.436
EXPT. NO. 15	8513.710	10216.452	12259.743	14711.673	17654.029	21184.835	25421.802	27969.961	33563.953
EXPT. NO. 16	8654.026	10384.831	12461.797	14954.157	17944.988	21533.985	25840.783	31008.939	37210.727
EXPT. NO. 17	8581.328	10297.593	12357.112	14828.434	17794.241	21353.089	25623.707	28115.605	30582.436
EXPT. NO. 18	8561.451	10273.741	12328.489	14794.187	17753.024	21303.629	25564.355	28143.439	33772.127
EXPT. NO. 19	8632.313	10359.775	12430.530	14916.637	17899.964	21479.957	25775.948	27990.368	30582.436

Note: Figures are in millions of Naira.

TABLE 6.32

COMPARISON OF REQUIRED OIL REVENUES WITH ANTICIPATED OIL REVENUES FROM THE OPEC-WIDE ALLOCATION MODEL

	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
EXPT. NO. 1	6736.079	6255.261	6951.775	7686.769	8537.578	11355.446	14104.300	15512.118	17060.307
EXPT. NO. 2	6736.079	6255.261	6951.775	7686.769	8537.578	11355.446	14104.300	15512.118	17060.307
EXPT. NO. 3	6760.290	11411.323	9726.649	10601.673	11765.971	12824.231	14104.405	15653.073	20385.251
EXPT. NO. 4	6708.841	8754.143	9726.649	10601.673	11765.971	15002.900	14075.090	15512.240	17060.448
EXPT. NO. 5	6833.984	8674.646	9653.512	10601.673	11660.161	12824.050	14232.435	15637.728	17060.448
EXPT. NO. 6	6833.512	8674.652	9726.656	10601.681	11765.981	12824.242	14104.417	15653.088	20385.049
EXPT. NO. 7	6366.641	8674.646	9639.202	10601.573	11765.971	14639.286	14104.405	15653.073	17060.448
EXPT. NO. 8	6872.001	11344.987	12943.854	10601.673	11765.971	12940.623	14104.405	15653.073	17060.448
EXPT. NO. 9	6833.519	11042.734	12493.320	10601.681	14021.540	13850.076	14104.417	15526.849	17060.465
EXPT. NO.10	6778.357	8674.677	9726.640	10601.562	11765.959	13475.127	14104.388	18202.654	17060.426
EXPT. NO.11	6833.984	8674.646	9726.649	10601.673	11765.971	12824.231	14104.405	15653.073	17060.448
EXPT. NO.12	6793.650	8669.394	9726.649	10601.673	11765.971	12824.231	14104.405	18144.508	17060.448
EXPT. NO.13	6385.873	8674.646	13284.808	10601.673	10964.798	12892.103	14232.435	15653.073	23499.212
EXPT. NO.14	6057.675	11340.870	12563.656	10601.673	11765.971	12845.813	14232.435	15572.626	17060.448
EXPT. NO.15	6389.087	8619.015	9639.202	10601.673	11660.161	15011.923	14145.469	15512.240	17060.448
EXPT. NO.16	9778.072	8674.646	9726.649	10697.864	11765.971	14363.069	14232.435	15576.497	17060.448
EXPT. NO.17	5901.869	8754.143	9672.504	10697.864	13682.454	12824.231	14104.405	15512.240	17060.448
EXPT. NO.18	9645.301	8674.646	12621.082	10697.864	11765.971	13395.419	14104.405	15653.073	20250.139
EXPT. NO.19	6064.928	11449.437	9672.504	10697.864	13836.011	12824.231	14232.435	15512.240	17060.448
CASE 1	4910.149	6123.575	6715.093	7420.791	8245.573	9149.680	10172.545	11327.384	12633.309
CASE 2	4922.905	6184.399	6810.046	7555.159	8421.161	9368.410	10473.894	11643.528	13005.469
CASE 3	4935.540	6238.915	6901.467	7628.701	8565.476	9570.209	10679.245	11927.291	13336.403
CASE 4	4894.427	6092.329	6674.594	7391.015	8243.880	9196.488	10291.799	11547.071	12987.537
CASE 5	4904.389	6171.987	6837.961	7660.577	8694.464	9733.294	11064.796	12611.359	14391.578
CASE 6	4914.159	6251.848	7004.197	7939.133	9175.270	10388.643	11944.470	13783.710	15963.753
CASE 7	4904.389	6171.987	6837.961	7660.577	8694.464	9733.294	11064.796	12611.359	14391.578
CASE 8	4917.078	6229.375	6939.298	7801.111	8854.078	10041.212	11427.592	13043.797	14931.384
CASE 9	4929.648	6285.418	7036.438	7952.049	9045.557	10288.390	11739.386	13431.573	15409.490
CASE 10	4923.648	6331.933	7173.438	8227.191	9522.694	11045.718	12877.277	15076.188	17719.284

Note: All figures in millions of Naira.

TABLE 6.33

COMPARISON OF REQUIRED OIL PRODUCTION CAPACITY WITH PRODUCTION CAPACITY IMPLIED BY THE OPEC-WIDE ALLOCATION MODEL

	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
EXPT. NO. 1	1.433	1.275	1.368	1.469	1.590	2.070	2.523	2.731	2.962
EXPT. NO. 2	1.433	1.275	1.368	1.469	1.590	2.070	2.523	2.731	2.962
EXPT. NO. 3	1.438	2.326	1.914	2.025	2.191	2.337	2.523	2.756	3.529
EXPT. NO. 4	1.427	1.785	1.914	2.025	2.191	2.734	2.518	2.731	2.962
EXPT. NO. 5	1.454	1.768	1.900	2.025	2.172	2.337	2.546	2.753	2.962
EXPT. NO. 6	1.453	1.768	1.914	2.025	2.191	2.337	2.523	2.756	3.539
EXPT. NO. 7	1.354	1.768	1.897	2.025	2.191	2.668	2.523	2.756	2.962
EXPT. NO. 8	1.462	2.313	2.547	2.025	2.191	2.359	2.523	2.756	2.962
EXPT. NO. 9	1.453	2.251	2.458	2.025	2.611	2.524	2.523	2.734	2.962
EXPT. NO.10	1.442	1.768	1.914	2.025	2.191	2.456	2.523	3.205	2.962
EXPT. NO.11	1.454	1.768	1.914	2.025	2.191	2.337	2.523	2.756	2.962
EXPT. NO.12	1.445	1.767	1.914	2.025	2.191	2.337	2.523	3.195	2.962
EXPT. NO.13	1.358	1.768	2.614	2.025	2.042	2.350	2.546	2.756	4.080
EXPT. NO.14	1.288	2.312	2.472	2.025	2.191	2.341	2.546	2.742	2.962
EXPT. NO.15	1.359	1.757	1.897	2.025	2.172	2.736	2.531	2.731	2.962
EXPT. NO.16	2.080	1.768	1.914	2.043	2.191	2.619	2.546	2.742	2.962
EXPT. NO.17	1.255	1.785	1.903	2.043	2.548	2.337	2.523	2.731	2.962
EXPT. NO.18	2.051	1.768	2.484	2.043	2.191	2.441	2.523	2.756	3.516
EXPT. NO.19	1.290	2.334	1.933	2.043	2.577	2.337	2.546	2.731	2.962
CASE 1	1.044	1.248	1.321	1.417	1.536	1.668	1.820	1.994	2.193
CASE 2	1.044	1.249	1.321	1.417	1.536	1.668	1.826	1.994	2.193
CASE 3	1.044	1.249	1.321	1.407	1.536	1.668	1.820	1.994	2.193
CASE 4	1.043	1.258	1.343	1.455	1.595	1.753	1.939	2.154	2.404
CASE 5	1.042	1.267	1.365	1.495	1.666	1.838	2.069	2.331	2.641
CASE 6	1.040	1.276	1.388	1.537	1.724	1.945	2.210	2.528	2.907
CASE 7	1.042	1.267	1.365	1.495	1.666	1.838	2.069	2.331	2.641
CASE 8	1.042	1.267	1.365	1.494	1.658	1.846	2.069	2.331	2.641
CASE 9	1.042	1.267	1.365	1.495	1.658	1.846	2.069	2.331	2.641

Note: Figures are in millions of barrels per day.

TABLE 6.34

LEVELS OF TOTAL CONSUMPTION IN THE 19 EXPERIMENTS

EXP. NO.	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
1	12188.659	14109.897	16333.969	18908.611	22847.111	26448.387	30617.314	35443.368	41030.129
2	12188.659	14109.897	16333.969	18908.611	22847.111	26448.387	30617.314	35443.368	41030.129
3	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
4	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
5	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
6	12689.094	14689.212	17004.600	19684.950	22787.790	26379.715	30537.818	35351.341	40923.596
7	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
8	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
9	12684.118	14689.276	17004.673	19685.035	22787.889	26379.830	30537.950	35351.495	40923.774
10	11976.918	14672.239	17015.590	19697.672	22802.518	26396.765	30557.555	35374.189	40950.046
11	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
12	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
13	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
14	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
15	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
16	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
17	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
18	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993
19	12369.848	14693.303	17009.335	19690.431	22794.136	26387.061	30546.322	35361.186	40934.993

Note: Figures are in millions of Naira.

TABLE 6.35

LEVELS OF GROSS NATIONAL PRODUCT IN THE 19 EXPERIMENTS

EXP. NO	TARGET-YEARS								
	1974	1977	1980	1983	1986	1989	1992	1995	1998
1	15407.764	18875.173	23122.898	28326.545	34701.235	42510.506	52077.197	63796.806	78153.831
2	15407.764	18875.173	23122.898	28326.545	34701.235	42510.506	52077.197	63796.806	78153.831
3	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
4	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
5	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
6	15469.534	18949.619	23214.098	28438.269	34838.102	42678.173	52282.597	64048.430	78462.080
7	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
8	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
9	15468.437	18949.500	23213.953	28438.090	34837.884	42677.905	52282.269	64048.028	78461.588
10	15454.088	18931.922	23192.418	28411.710	34805.566	42638.315	52233.769	63988.613	78388.803
11	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
12	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
13	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
14	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
15	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
16	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
17	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
18	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508
19	15462.310	18941.994	23204.757	28426.825	34824.083	42661.000	52261.559	64022.657	78430.508

Note: Figures are in millions of Naira.

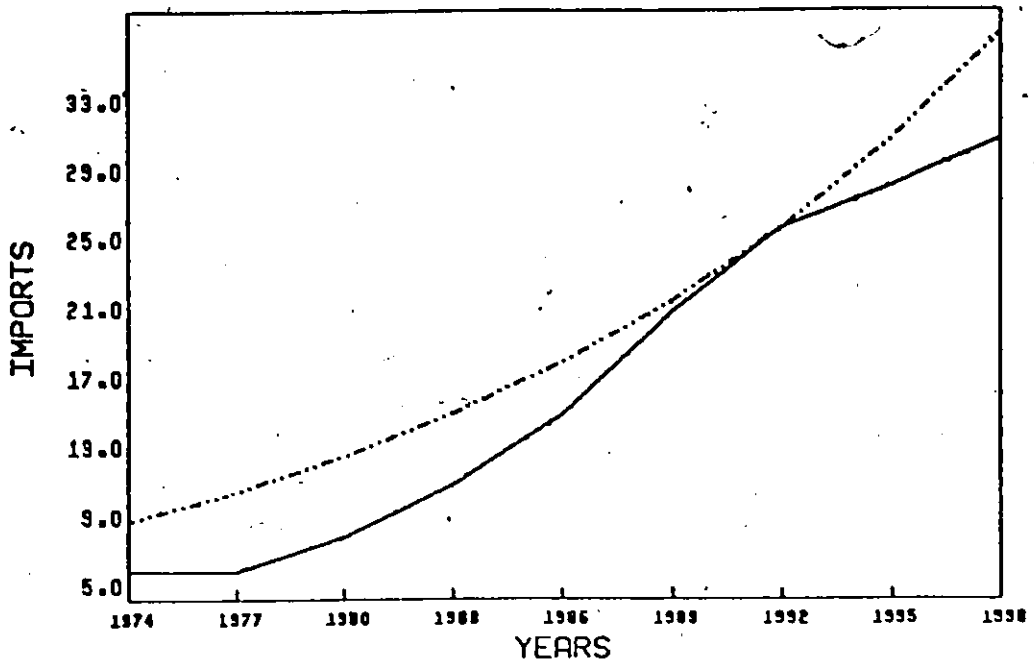
TABLE 6.36

VALUES OF THE OBJECTIVE FUNCTION IN THE 19 EXPERIMENTS

Experiment No.	Value of the Objective Function in ₦ Million	Major Characteristic of the Experiment
1	128,409.52148	F(t) prescribed, imports constraint non-binding
2	128,409.52148	F(t) is prescribed $\mu = 20\%$
3	129,697.76269	$\mu = 20\%$, F(t) is free
4	129,697.76269	$\mu = 15\%$
5	129,697.76269	$\mu = 25\%$
6	129,948.55247	$s = 15\%$
7	129,697.76269	$\bar{K}(1)$ increased by 5%
8	129,697.76269	$\bar{K}(1)$ increased by 10%
9	129,944.64369	$s = 18\%$
10	129,371.84633	$s = 22.5\%$
11	89,803.99649	$\omega = 7\frac{1}{2}\%$
12	65,199.26762	$\omega = 10\%$
13	89,803.99649	$\omega = 7\frac{1}{2}\%$, $\bar{K}(1)$ increased by 5%
14	89,803.99649	$\omega = 7\frac{1}{2}\%$, $\bar{K}(1)$ increased by 10%
15	65,199.26762	$\omega = 10\%$, $\bar{K}(1)$ increased by 5%
16	65,199.26762	$\omega = 10\%$, $\bar{K}(1)$ increased by 10%
17	129,697.76269	$\omega = 5\%$, $\bar{K}(1)$ increased by 20%
18	89,803.99649	$\omega = 7.5\%$, $\bar{K}(1)$ increased by 20%
19	65,199.26762	$\omega = 10\%$, $\bar{K}(1)$ increased by 20%

FIGURE 6.1

THE EFFECT OF IMPORTS CONSTRAINT ON THE LEVEL OF TOTAL IMPORTS



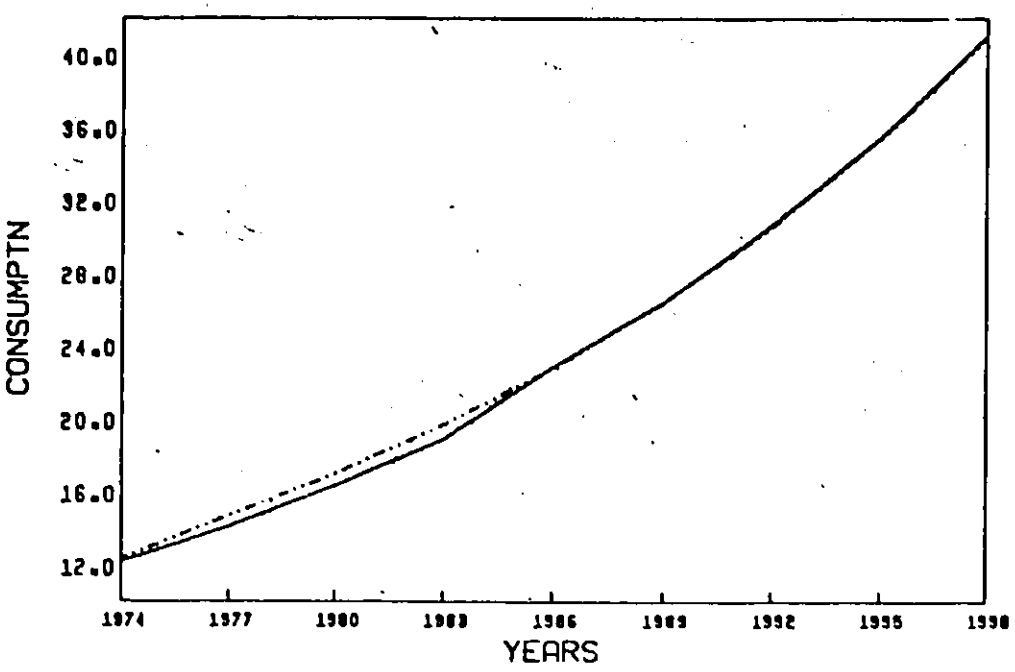
Note: Values of Total Imports are in billions of Nigerian Naira.

——————— Total Imports in Experiment 1: Imports Growth Constraint is Non-binding

—·—·—·— Total Imports in Experiment 2: Imports Growth Rate at 20% per period

FIGURE 6.2

THE EFFECT OF THE CHANGES IN FOREIGN EXCHANGE AVAILABILITY ON THE LEVEL OF TOTAL CONSUMPTION



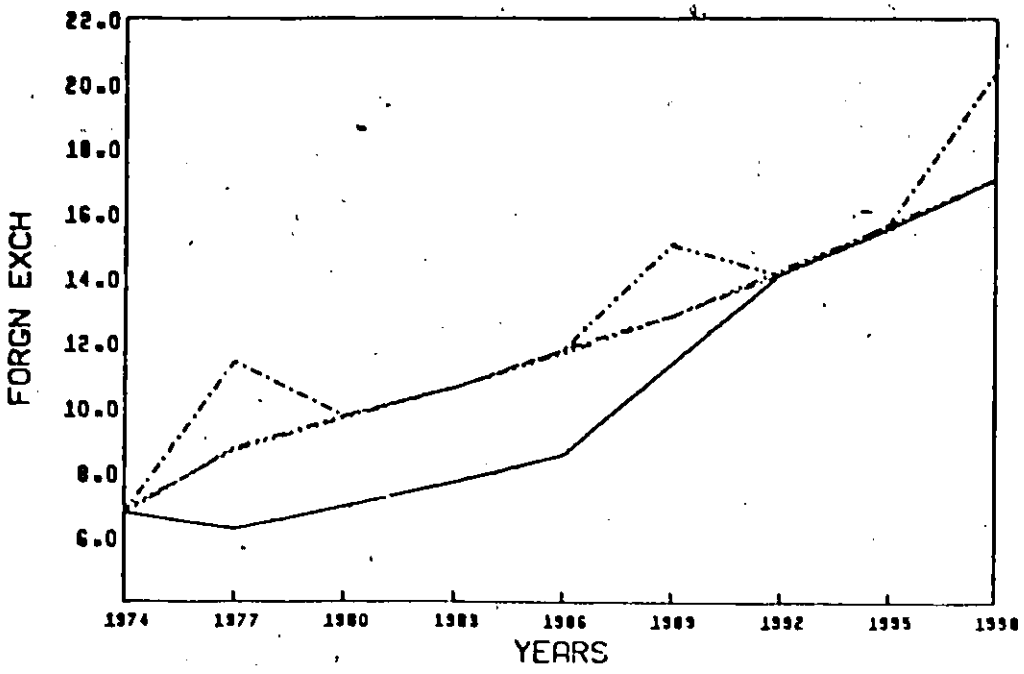
Note: Values of Total Consumption are in billions of Nigerian Naira.

——————— Total Consumption in Experiment 1: Foreign Exchange Availability is Prescribed.

——..——..— Total Consumption in Experiment 3: Foreign Exchange is Unrestricted.

FIGURE 6.3

THE EFFECTS OF CHANGES IN IMPORTS GROWTH RATE (μ)
ON FOREIGN EXCHANGE REQUIREMENTS



Note: Foreign Exchange Requirements are expressed in billions of Nigerian Naira.

——————— Experiment 1: μ is free

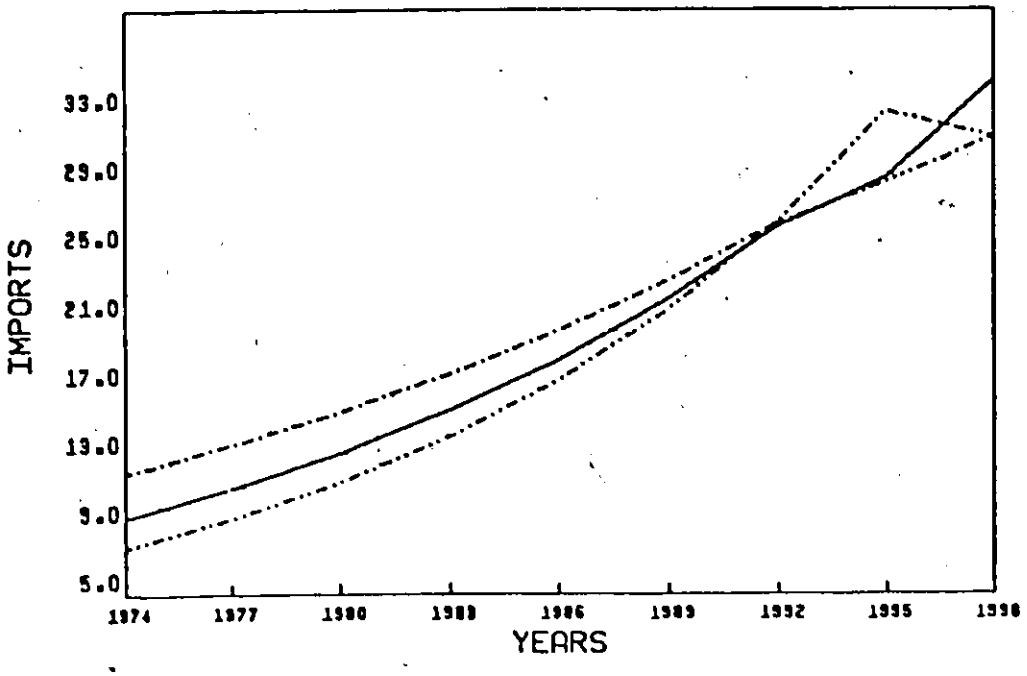
—.—.—.— Experiment 3: μ = 20% per period

—..—..— Experiment 4: μ = 15% per period

—...—...— Experiment 5: μ = 25% per period

FIGURE 6.4

THE EFFECTS OF CHANGES IN THE IMPORTS GROWTH RATE (μ)
ON THE LEVEL OF TOTAL IMPORTS



Note: Values of Total Imports are in billions of Nigeria Naira.

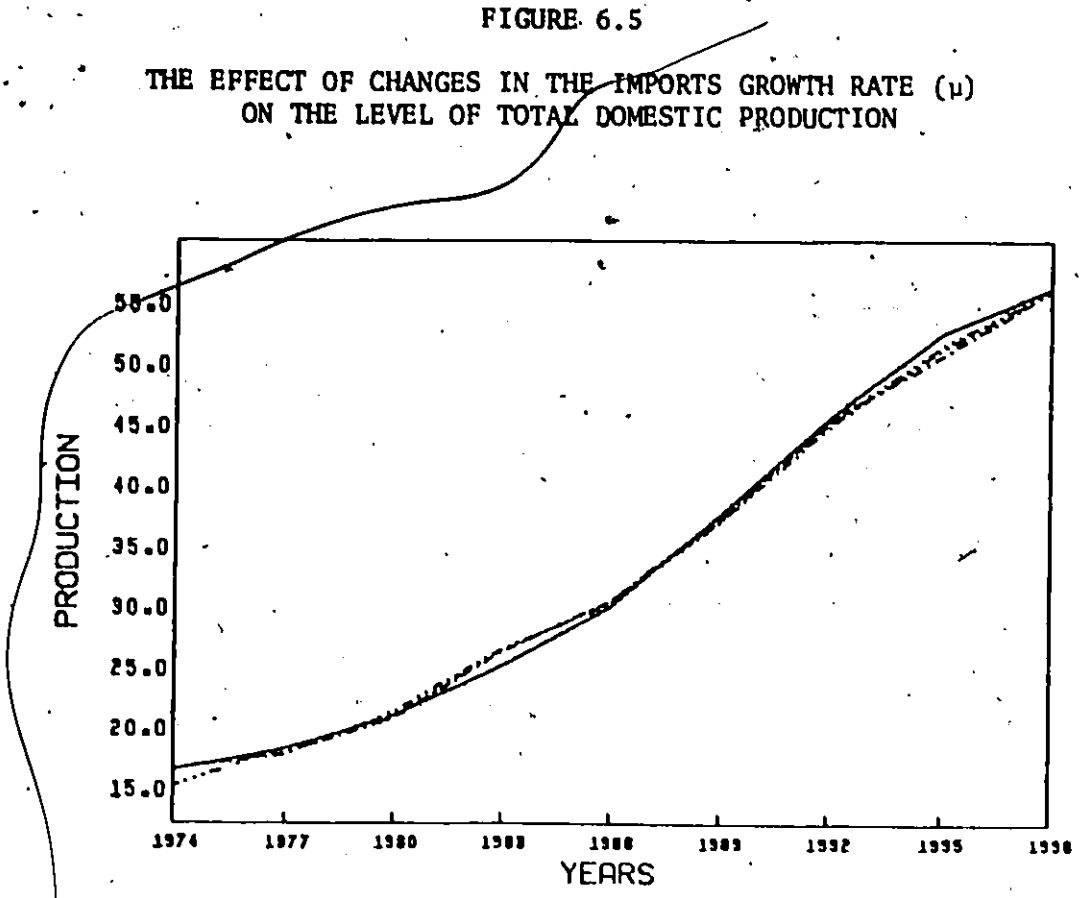
——————— Experiment 3: μ = 20% per period

—·——·—— Experiment 4: μ 15% per period

—··——··— Experiment 5: μ 25% per period

FIGURE 6.5

THE EFFECT OF CHANGES IN THE IMPORTS GROWTH RATE (μ)
ON THE LEVEL OF TOTAL DOMESTIC PRODUCTION



Note: Values of Total Domestic Production are in billions of Nigerian Naira.

——————— Experiment 1: μ is free

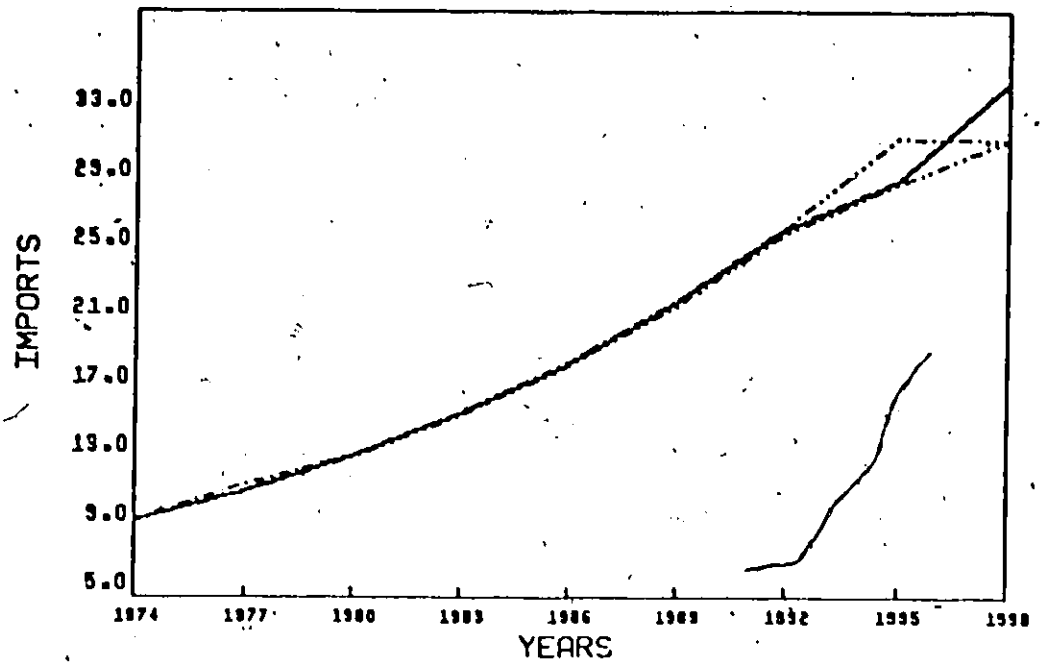
— · — · — Experiment 3: μ = 20% per period

— ·· — ·· — Experiment 4: μ = 15% per period

— ··· — ··· — Experiment 5: μ = 25% per period

FIGURE 6.6

THE EFFECT OF CHANGES IN THE SAVINGS RATE (s)
ON THE LEVEL OF TOTAL IMPORTS



Note: Values of Total Imports are in billions of Nigerian Naira.

——————— Experiment 3: s = 20% per period

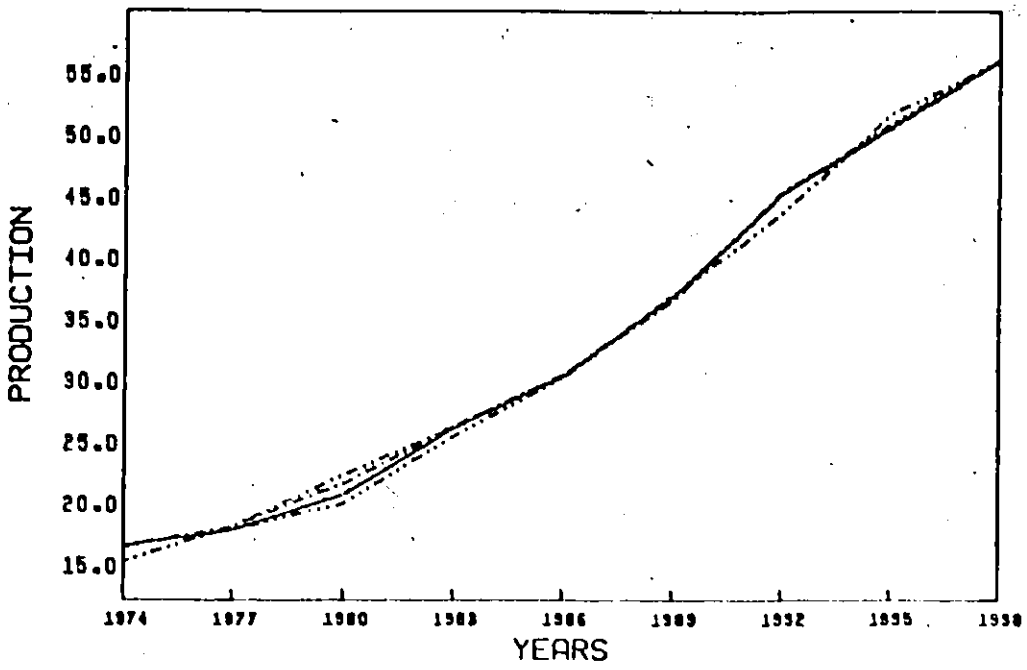
—·—·—·— Experiment 6: s = 15% per period

—··—··—·· Experiment 9: s = 18% per period

—···—···— Experiment 10: s = 22.5% per period

FIGURE 6.7

THE EFFECT OF CHANGES IN THE SAVINGS RATE (s)
ON THE LEVEL OF DOMESTIC PRODUCTION



Note: Values of Total Domestic Production are in billions of Nigerian Naira.

——————— Experiment 3: s = 20% per period

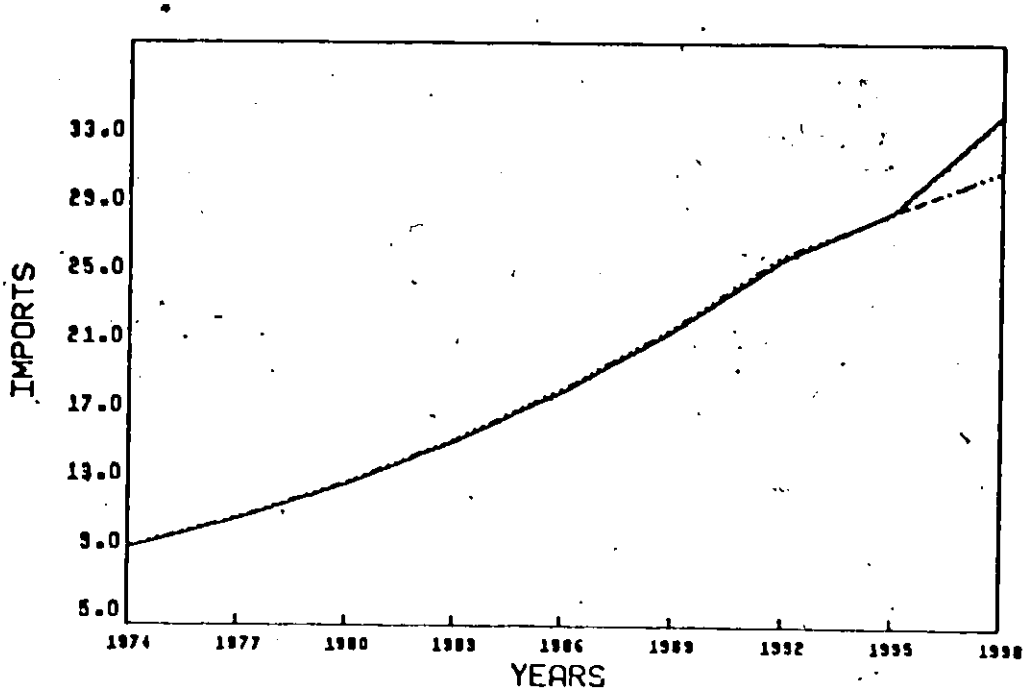
——·——·—— Experiment 6: s = 15% per period

——··——··—— Experiment 9: s = 18% per period

——···——···—— Experiment 10: s = 22.5% per period

FIGURE 6.8

THE EFFECT OF CHANGES IN THE INITIAL CAPITAL STOCK [$\Delta\bar{K}(1)$] ON THE LEVEL OF IMPORTS



Note: Values of Imports are in billions of Nigerian Naira.

——————— Experiment 3: $\Delta\bar{K}(1) = 0$

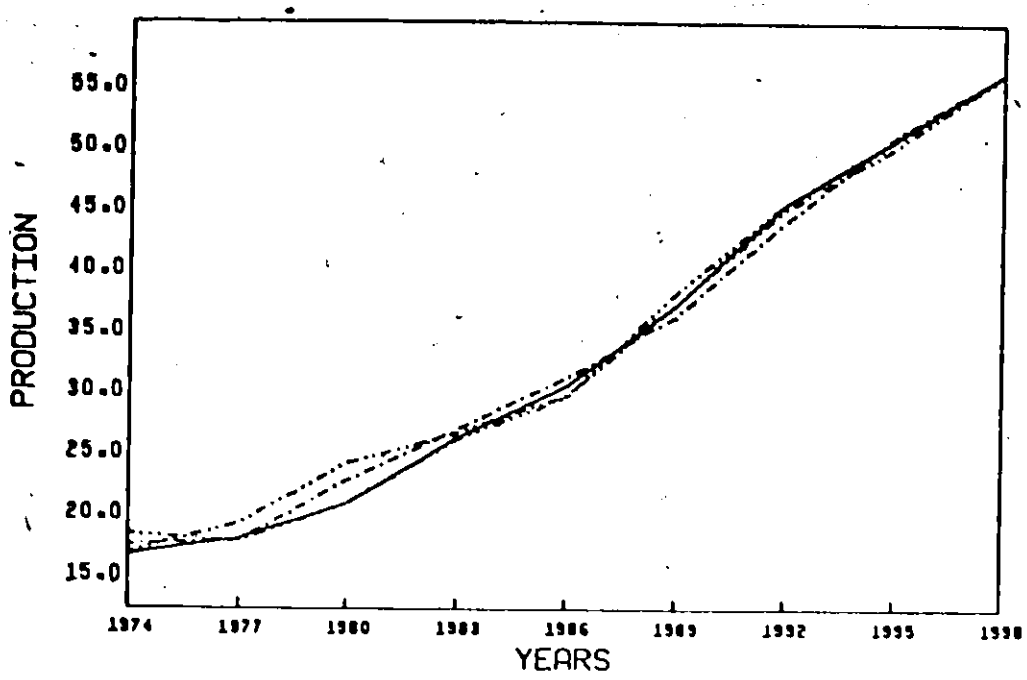
—·—·— Experiment 7: $\Delta\bar{K}(1) = 5\%$

—··—··— Experiment 8: $\Delta\bar{K}(1) = 10\%$

—···—···— Experiment 17: $\Delta\bar{K}(1) = 20\%$

FIGURE 6.9

THE EFFECT OF CHANGES IN THE INITIAL CAPITAL STOCK [$\Delta\bar{K}(1)$] ON THE LEVEL OF DOMESTIC PRODUCTION



Note: Values of Total Domestic Production are in billions of Nigerian Naira.

——————— Experiment 3: $\Delta\bar{K}(1) = 0$

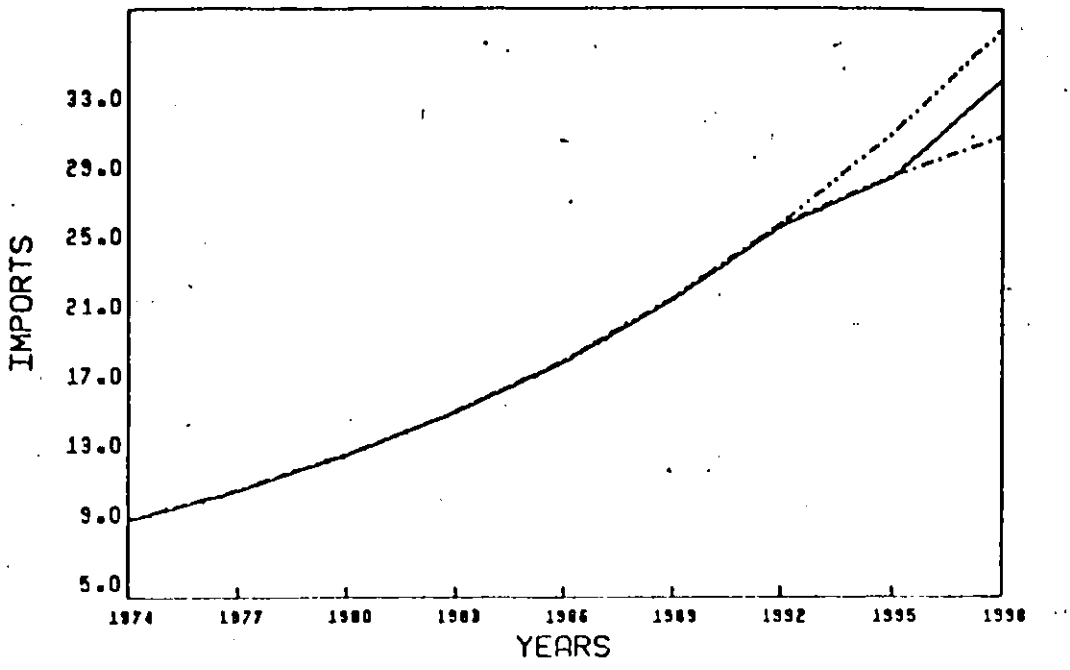
—·—·— Experiment 7: $\Delta\bar{K}(1) = 5\%$

—··—··— Experiment 8: $\Delta\bar{K}(1) = 10\%$

—···—··· Experiment 17: $\Delta\bar{K}(1) = 20\%$

FIGURE 6.10

THE EFFECT OF CHANGES IN THE RATE OF DISCOUNT (ω) ON THE LEVEL OF IMPORTS



Note: Values of Total Imports are in billions of Nigerian Naira.

——————— Experiment 3: ω = 5% per annum

——·——·—— Experiment 11: ω = 7.5% per annum

——··——··—— Experiment 12: ω = 10% per annum

FOOTNOTES
(to Chapter 6)

[1]Much of the data employed in executing the dynamic multi-sectoral planning model was gathered during the author's research trip to Nigeria in the summer of 1977. The financial support provided by the School of Graduate Studies in this regard is gratefully acknowledged.

[2]These publications are fairly comprehensive and it would be best to deal with each economic variable by its source rather than describe the scope of these publications in detail.

[3]Currently published under a 48-industry format, classified according to the ISIC code, the Industrial Survey is a fairly reliable data source with a high response rate. However, it covers only manufacturing activities employing at least 10 people. Furthermore, the 1967 survey was not used in this analysis because the Nigerian civil war prevented it from being conducted on a nation-wide scale as usual.

[4]The references are to Carter, N.G., "An Input-Output Analysis of the Nigerian Economy: 1959-60", Working Paper #29-63, M.I.T. School of Industrial Management, 1963; Clark, P.B., Planning Import Substitution, Amsterdam, North-Holland, 1970; and Kuyvenhoven, A., "Sector Appraisal Where Trade Opportunities are Limited" in K.R. Polenske and J.V. Skelka, eds., Advances in Input-Output Analysis (Cambridge, Mass., Ballinger, 1976), pp. 183-204.

[5]Carter, N.G., "An Input-Output Analysis of the Nigerian Economy: 1959-60", op. cit.

[6]Carter himself admits that the table was not particularly accurate and needed to be improved upon. See Carter (1963), pp. 27-32. A more detailed critique of Carter's table is presented in Ohiorhenuan (1975), Chapter 3.

[7]Clark, P.B., Planning Import Substitution, op. cit., p. 72.

[8]Kuyvenhoven's study indicates that, as of 1970, most of the potential industries were in existence and producing in Nigeria. See Kuyvenhoven, A., "Sector Appraisal Where Trade Opportunities are Limited", op. cit., pp. 192-193.

[9]It should be mentioned here that the Federal Government of Nigeria set up the National Accounts Commission in 1974 to construct detailed input-output and capital coefficients tables for Nigeria. The commission is currently working on the basis of a 30-sector format but its report has neither been published nor officially approved.

[10]For a more detailed review of these alternative techniques, see Bacharach, M., Bi-proportional Matrices and Input-Output Change, (Cambridge, Cambridge University Press, 1970), Chapter 1 and Granger, C.W.J., "Forecasting Input-Output Tables Using Matrix Time-Series Analysis", Working Paper #49, Australian National University, 1977.

[11]See M. Bacharach, Bi-proportional Matrices and Input-Output Change, op. cit., pp. 3-8.

[12]See M. Bacharach, ibid., p. 1.

[13]Department of Applied Economics, University of Cambridge, Input-Output Relationships 1954-1966, A Programme for Growth, No. 3, (London, Chapman and Hall, 1963).

[14]These tests and studies are reported in Bacharach, M., Bi-proportional Matrices and Input-Output Change, op. cit., pp. 27-30.

[15]Clark, P.B., Planning Import Substitution, (Amsterdam, North-Holland, 1970), pp. 73-77 and pp. 126-135.

[16]In all cases where data has been obtained on a time-series basis before 1967, especially in the update of the Nigerian table, 1967 has been left out of the analysis because data inaccuracies and the impact of the Nigerian civil war in this particular year.

[17]See Clark, P.B., Planning Import Substitution, op. cit., pp. 109-113.

[18]The book-values are net of depreciation and are the only form in which values of capital stocks are reported. See the Industrial Survey of Nigeria, Lagos, FOS, 1973 and 1974.

[19]See the Third National Development Plan, 1975-1980, Table 32.2 p. 370.

[20]See the Third National Development Plan, 1975-1980, ibid., Chapter 32.

[21]See the Third National Development Plan, 1975-1980, Table 5.18, p. 60.

[22]The computation was carried out at different installations at different times; it was started at the Central Computing Facility at the Brookhaven National Laboratory, Upton, New York and completed at the Institute of Computer Science, University of Guelph, Ontario. The provision of computer time by these two institutions is gratefully acknowledged.

[23]Since this study does not envisage the inflows of funds from external sources, the foreign exchange requirements refer to the amount of uncompensated transfers of export earnings that would have to be provided by the oil sector.

[24]It should be noted that the initial level of imports is unconstrained. Different results might have been obtained if the initial level of imports was specified. This additional constraint would be useful in preventing the model from piling up imports in earlier periods in order to satisfy the imports growth requirement in later periods.

[25]Note that, since the objective function includes the value of the terminal capital stocks, the need to invest in order to build up the capital stocks could also limit consumption.

[26]Business Week, April, 1979.

CHAPTER 7: CONCLUSION

7.1 Introduction

The basic objective of this study has been to develop a multi-sectoral planning model which can be used as a framework for the optimal utilization of oil revenues in Nigeria's economic development. This chapter offers a review of the main highlights of the study and the main results arising from it. These are in turn examined in terms of their policy implications and probable applications in decision making, with due qualifications to the context in which the model has been implemented. The last section of the chapter reviews some possible extensions to the model and the scope for future research.

7.2 Main Conclusions of the Study

The groundwork for this study was laid by an examination of the extent to which the oil sector has contributed to the economic development of Nigeria and the role it is expected to play in the future. It was found that, in order to accord the oil sector the special treatment it deserves as the major source of funds for Nigeria's future plans, a planning model would be needed as a framework for the optimal utilization of such funds over time. This called for a critical assessment of the Nigerian planning machinery and its predominantly "project-basket" approach to planning and the establishment of a multi-sectoral planning model as the approximate framework for the conduct of quantitative planning in Nigeria. The

multi-sectoral planning model was then developed and outlined in Chapter 4. Because of the complexity of the world oil industry and the inadequacy of forecasting the inflow of oil revenues on the basis of simple projections, a dynamic programming model of the world oil market with specific reference to the dominance of the residual market by OPEC was developed. This was used to forecast systematically the pattern of oil revenues that could accrue to Nigeria if Nigeria adhered strictly to OPEC norms and the assumptions made regarding the oil model itself and the market-sharing scheme are satisfied. In the final section of the study the proposed dynamic multi-sectoral model was applied to Nigeria for the period 1974-2001. Simulation experiments were also conducted in order to test the sensitivity of the model to its basic parameters as well as to develop alternative profiles of major macroeconomic variables that would result if there are any deviations from the base-case. Based on experience gained in the process of executing the various stages of this study outlined above, the following observations and conclusions are pertinent:

(a) The oil sector has been the dominant sector of the Nigerian economy since the early 1970's and will most likely remain so till the end of this century. However, as the dynamic linkage effects of this sector are diffused to the rest of the economy, this sector may begin to decline in its relative importance as the other sectors expand and are expected to grow faster.

(b) Because oil is an exhaustible resource, Nigeria needs to develop a production structure that can take full advantage of the dynamic external effects that arise from oil

production and enable it to transform its supplies of oil funds into human and physical capital in an optimal way over time. This will help ensure that Nigeria succeeds in establishing a firm basis for self-sustaining growth while the oil reserves still last.

(c) In order for Nigeria to accomplish the goal just outlined, substantial changes have to be made to the existing planning machinery as well as the current planning framework based on the collation of projects at a national level and simple econometric forecasts of the economy's prospects. A model with which this can be done is suggested in this study.

(d) The world oil market is so complex that simplistic forecasts of Nigeria's revenues from oil production are not only inadequate but could be misleading. This is the lesson to be learned from the recent effort made in Nigeria's Third National Development Plan. A model of the world oil market with which the prospects for OPEC as a supplier and for Nigeria as a member of OPEC can be assessed is suggested here. It should be noted that this model has been developed on the basis of simple assumptions regarding OPEC's motives, its reserves and some characteristics of the world oil market. It therefore should be used with this caveat in mind.

(e) The application of the planning model to intertemporal planning for Nigeria indicates that Nigeria has revenue

absorption capacity that far exceeds the current inflows of oil funds into the economy. This establishes Nigeria as a revenue-scarce member of OPEC and provides an explanation for its recent stance in OPEC. The results also indicate that because Nigeria already has sufficient capacity to produce enough oil to meet the foreign exchange requirements prescribed by the planning model, it will try either to increase the share of the market allocated to it by OPEC or it will seek increases in the price of oil while keeping oil production in accordance with OPEC norms. The results further indicate that such attempt on Nigeria's part are viable especially in the period up to 1986 after which the economy's absorptive capacity will probably reach its saturation point.

(f) The computation experience with the planning model indicates that alternative situations in which Nigeria could find itself in the future will depend on the goals embodied in the planning model as constraints and the extent to which they can be adhered to. The most significant among these include the rate of growth of imports that is permitted by explicit government policy, the savings rate that is set as a target and the manner in which foreign exchange is made available to the domestic economy. The results indicate that the specification of import growth limits should give specific attention to Agriculture, Food, Beverages and Tobacco, and Transport Equipment which

are most susceptible to the model's tendency to reduce the levels of domestic production in favour of imports when foreign exchange inflows are unrestricted. This implies that there must be harmonious coordination of import growth policies with the time-phasing of oil revenue inflows into the economy in order to promote domestic production. Also, changes in the savings rate have their greatest impacts on the pattern of investment and capital accumulation as well as the maximum levels of feasible consumption over time. Thus, the government must determine the desirable pattern of trade-offs between consumption and investment by systematic variations of the savings rate. The empirical implementation of the model suggests a savings ratio of 18%-20% as appropriate for Nigeria's present circumstances. The patterns of investment derived from the model also indicate that the oil sector must be given greater priority in the government's capital programme if it is indeed expected to play the special role accorded to it in this study.

The foregoing conclusions derive mainly from the special circumstances assumed in this study and should be so interpreted. It is quite possible that the results may not follow if any or some of the assumptions underlying the structure of the model or its empirical implementation are not satisfied. Thus, it is necessary to state these qualifications to the study as well as others arising from the nature of the

data employed in the analysis.

The major qualifications to the data used in implementing the planning model is that they are mostly up-dated data from existing studies and some variables have been based on estimates derived from historical trends. The propriety of assuming that these trends will continue into the future in a rapidly expanding Nigerian economy are questionable. But the essence lies in the design of the model and its implementation with available data in the hope that this procedure could be repeated once improved data become available; this exercise is justified by the potential usefulness of the model and the results derived from it. Furthermore, the National Accounts Commission is currently constructing a 30-sector input-output transactions and capital coefficients matrices for Nigeria and this model would prove readily adaptable when that work is completed.

Another qualification is with regard to the oil sub-model outlined in Chapter 5 and its main results. It should be remembered that the alternative pricing and production strategies derived from the model were based on specific assumptions regarding OPEC's dominance of the world oil market, its economic motives, the known reserves of OPEC and its individual members as well as an allocation formula based on historical market-shares. Some of the parameter values used in the model may differ in magnitude from the actual values but the model is sufficiently versatile to provide us insights into the consequences of such deviations.

The final qualification to the analysis concerns the pattern of simulation experiments carried out with multi-sectoral planning model. These experiments were conducted by the introduction of specific changes in the base-case parameters as if the sets of changes so introduced are

mutually exclusive. This is however not likely to be the case in reality; it is more likely that all these changes as well as others not looked into here will be simultaneous. In such an event, our model can only provide useful insights and guidelines to the patterns of changes observed but no more. This is not a shortcoming of the study or our approach; it is the general mode for the conduct of scientific inquiry in an imprecise science.

7.3 The Scope for Future Research

An important lesson learned from conducting thesis research is that the further the research is conducted, the more is discovered that needs to be done or can be done if the appropriate data and research facilities are available. This study has been truncated because of the limitations of manpower and research facilities. However, it is hoped that this study will constitute the beginning of an on-going long-term research into dynamic multi-sectoral planning for Nigeria.

Some of the future directions of research that are likely to follow this initial effort will involve the expansion of the model to include some other major concerns of planning in Nigeria. The structure of the model embodied in this study is such that it can be immediately applied to multi-skill manpower planning since the labour supplies used in the analysis have been aggregate forecasts of sectoral availabilities of labour. Also, the balance of payments constraints have been so specified to ensure that the economy's foreign exchange needs can be fully satisfied in each period of the long-term plan. It is possible to extend the model to a case where the country's payments need only be in balance over the entire planning period. The results from a model that allows inter-temporal borrowing and lending

will provide useful insights into the optimal planning of foreign exchange budgets for the country.

This study has also tried to relate the optimal determination of OPEC's pricing, production and market sharing strategies to the general context of national economic planning in an individual OPEC member country. This study envisages the possibility that the underlying model can be applied on an OPEC-wide basis to determine each country's revenue absorption capacity in an optimal way. These can then be compared to the results of the OPEC-wide oil model in order to determine an appropriate market sharing formula that meets the need of each OPEC member.

In terms of the computation techniques available for solving the large-scale linear program which the model embodies, it can be seen in Table 4.4 that the model has a block-angular stair-case structure and there is a proposal to solve the model by use of the nested decomposition algorithm designed by Ho and Manne (1973) and Ho (1974). It is hoped that this application will be the first extension of this study.

Any linear programming model set to maximize an objective function subject to the constraints imposed by resources (the primal problem) is accompanied by a dual problem in which the costs of the given resources are minimized. Thus, the dual solution computes shadow prices for each resource whose constraint is binding in the optimal solution to the primal problem. These shadow prices are particularly useful in evaluating the contribution of a unit increase in the constrained resources to the objective function and have therefore been very popular in project appraisal. However, because the 13-sector framework of our model is too aggregative to make this application meaningful and because these are not immediately

related to the primary focus of this study, the dual problem has not been explored. It is hoped that this can be done in another study especially when the number of sectors can be sufficiently increased to make such an exercise meaningful.

STATISTICAL APPENDIX

APPENDIX TABLE II.1

PRODUCTION AND EXPORTS OF CRUDE PETROLEUM

	PETROLEUM				NATURAL GAS			
	Volume in Barrels		Percentage of Crude Petroleum Exported	Value of Crude Exports ₦ millions	Volume in Million Cubic Feet			
	Production	Export			Production	Sales	% Flared	
1958	1,876,062	1,820,305	97.028	1.784	1,609.178	n.a.		
1959	4,095,611	3,959,446	96.675	5.270	4,938.937	n.a.		
1960	6,367,187	6,243,527	98.058	8.414	5,095.278	n.a.		
1961	16,801,896	16,505,985	98.239	22.664	10,943.331	n.a.		
1962	24,623,691	24,679,769	100.228	34.412	17,179.458	n.a.		
1963	27,913,497	27,701,320	99.240	40.352	22,015.792	n.a.		
1964	43,996,895	43,431,563	98.715	64.112	36,332.862	n.a.		
1965	99,353,794	96,984,975	97.616	136.194	79,438.052	3,210.000	95.959	
1966	152,428,168	139,549,969	91.551	183.884	102,659.781	5,650.347	94.496	
1967	116,553,292	109,274,855	93.755	142.100	93,025.789	6,038.808	95.508	
1968	51,907,304	52,129,855	100.429	77.696	51,628.085	4,837.424	90.560	
1969	197,204,486	197,245,641	100.021	301.366	145,713.524	1,341.957	99.079	
1970	395,835,689	383,455,353	96.872	514.168	283,868.026	2,189.509	99.228	
1971	558,678,882	542,545,131	97.112	1,135.120	458,174.401	3,919.928	99.144	
1972	672,702,280	635,363,910	94.449	1,156.960	604,657.730	5,615.032	99.071	
1973	759,462,960	712,633,840	93.834	1,893.483	735,816.400	5,403.144	99.265	
1974	831,641,490	712,078,840	85.623	5,287.030	1,017,733.400	9,040.555	99.111	
1975	652,255,000	627,638,898	96.226	4,047.527	658,830.430	11,456.078	98.260	

Sources: (i) Ministry of Petroleum Resources, Annual Report of the Petroleum Division: 1971-72, Lagos, Nigeria.
(ii) Federal Office of Statistics, Annual Abstract of Statistics (1974), Economic Indicators, March, 1976.

Notes: 1 ton = 7.4 barrels or 1 barrel = 0.135135 ton.
1 cubic foot = 0.028317 cubic metre.

APPENDIX TABLE VI.1

COMPARISON OF THE CLASSIFICATION SCHEME IN THE 13-SECTOR PLANNING MODEL WITH CLARK'S 86-SECTOR SCHEME AND KUYVENHOVEN'S 106-SECTOR SCHEME

13 Sectors of the Planning Model		Corresponding Sectors in Carter's 86-Sector Table		Corresponding Sectors in Kuyvenhoven's 106-Sector Table	
No.	Sector Name	No.*	Sector Name	No.**	Sector Name
1.	Agriculture, Livestock, Forestry and Fishing	01.01	Agriculture	1.	Agriculture, Livestock, and Forestry
		02.01	Oil Seeds	2.	Fishing
		03.01	Fresh Fish		
		04.01	Tobacco		
		26.01	Tea		
2.	Mining Excluding Oil	09.03	Mining	3.	Mining Excluding Oil
3.	Oil	10.03	Crude Oil Mining	4.	Oil Mining
		55.05	Crude Oil Refinery	6.	Petroleum Products
4.	Food, Beverages and Tobacco	05.02	Food, Drink	5.	Meat Products
		06.02	Beer, Stout	6.	Dairy Products
		07.02	Packed Meat	7.	Fruit Canning
		08.02	Butter	8.	Stock-Fish
		27.02	Sugar Refining	9.	Vegetable Oil Milling
		28.02	Flour Mills	10.	Grain Mill Products
		29.02	Tinned Milk	11.	Bakery Products
		30.02	Canned Goods	12.	Sugar and Confectionary
		31.02	Confectionery	13.	Sugar Refining
		32.02	Stock-Fish	14.	Candy and Confectionery
		33.02	Baked Goods	15.	Miscellaneous Food and Animal Feed
		34.02	Gin	16.	Tea
		52.05	Starch	17.	Starch
		61.05	Salt	18.	Salt
				20.	Soft-Drinks
				21.	Tobacco Manufactures
5.	Textiles and Apparel	11.04	Craft and Weaving	22.	Textiles
		12.04	Cotton Textile	23.	Craft, Weaving and Dyeing
		35.04	Shoes	24.	Jute Bags
		36.04	Apparel	25.	Cotton Yarn
		37.04	Jute-Bags	26.	Synthetic Yarns
		38.04	Cotton Yarn	27.	Synthetic Textiles
		39.04	Synthetic Yarn	28.	Made-Up Textile Goods
		40.04	Synthetic Textile	29.	Cotton Bags
		41.04	Cotton Bags	30.	Towels and Blankets
		42.04	Handbags	31.	Knitted Goods
		43.04	Hats	32.	Knit Goods
		44.04	Towels and Blankets	33.	Rope, Cord and Nets
		45.04	Knit-goods	34.	Weaving Apparel
		64.05	Cords and Nets	35.	Apparel
				36.	Hats
				37.	Tanning
				38.	Travel Goods
				39.	Handbags
				40.	Footwear
6.	Non-Metal Manufacturing	13.05	Non-Metal Manufacturing	41.	Sawmilling
		14.05	Cement	42.	Wooden Furniture and Fixtures
		15.05	Cement Goods	43.	Paper
		16.05	Wood Manufacturing	44.	Containers and Paper Boxes
		46.05	Paper	45.	Paper Products
		47.05	Paper Goods	46.	Printing
		56.05	Glass Manufacturing	58.	Matches
		57.05	Asbestos	62.	Tires and Tubes
		59.05	Tires and Tubes	63.	Other Rubber Products
		60.05	Matches	65.	Pottery and Glass
		63.05	Ceramics	66.	Glass Manufactures
		67.05	Pen, Pencil	67.	Ceramics
				68.	Sinks, Tubs and Toilets
				69.	Bricks and Tiles
				70.	Cement
				71.	Concrete Products
				72.	Asbestos Products
				101.	Stationery
				102.	Miscellaneous Manufacturing

APPENDIX TABLE VI.1

COMPARISON OF THE CLASSIFICATION SCHEME IN THE 13-SECTOR PLANNING MODEL WITH CLARK'S 84-SECTOR SCHEME AND KUYVENHOVEN'S 104-SECTOR SCHEME

7.	Basic Chemicals	17.05	Soap	47.	Basic Industrial Chemicals
		48.05	Pharmaceuticals	48.	Inorganic Chemicals
		49.05	Paints	49.	Organic Chemicals
		50.05	Inorganic Chemicals	50.	Fertilizer
		51.05	Organic Chemicals	51.	Insecticide
		53.05	Fertilizer	52.	Paints
		54.05	Insecticides	53.	Drugs and Medicines
		62.05	Perfume	54.	Pharmaceuticals
		65.05	Plastics	55.	Soaps, Perfumes and Cosmetics
		68.05	Waxes	56.	Soap and Glycerine
				57.	Perfume
				58.	Other Chemical Products
				60.	Waxes
				64.	Plastic Products
8.	Metal Manufacturing	18.06	Metal Manufacturing	73.	Steel Mills and Rolled Sheets
		53.05	Dry Cells	74.	Steel Bars and Angles
		66.05	Accumulators	75.	Aluminum Products
		69.06	Rolled Steel	76.	Enamel Utensils
		70.06	Steel Bars	77.	Hand Tools
		71.06	Steel Construction	78.	Metal Pipes
		72.06	Aluminum	79.	Cast Iron and Steel Castings
		73.06	Utensils	80.	Basic Metal Products
		74.06	Metal Furniture	81.	Metal Furniture and Fixtures
		75.06	Sewing Machine	82.	Structural Metal Products
		76.06	Metal Drums	83.	Metal Doors, Windows, etc.
		77.06	Radio Assembly	84.	Fabricated Metal Products
		78.06	Air Conditioning Assembly	85.	Metal Drums and Hoops
		80.06	Hand Tools	86.	Lamps, Lanterns, etc.
		81.06	Lamps	87.	Wire Products, Nails, etc.
		82.06	Machine Tools	88.	Special Machinery
		83.06	Sinks	89.	Machinery not elsewhere classified
		84.06	Wire Products	90.	Sewing Machine Assembly
		85.06	Pipe Works	91.	Machine Tools
		86.06	Steel Castings	92.	Radio, Television, etc.
				93.	Household Appliances
				94.	Dry-cell Batteries
				95.	Accumulators and Batteries
				96.	Air-conditioning Assembly
				100.	Watches and Clocks
9.	Transport Equipment	19.06	Bicycle Assembly	97.	Motor Body and Shipbuilding
		20.06	Vehicle Assembly	98.	Motor Vehicle Assembly
		79.06	Railwagon	99.	Railway Wagon Assembly
10.	Utilities	22.08	Utilities	103.	Utilities
11.	Construction	21.07	Construction	104.	Construction
		25.11	Housing		
12.	Trade and Services	24.10	Trade, Services	105.	Trade and Services
13.	Transportation	23.09	Transportation	106.	Transportation

Notes: *The sector numbers are as given by P.B. Clark, Planning Import Substitution, Amsterdam, North-Holland, 1970, pp. 103-104. Of the four digits, the first two refer to the serial number in the 84-sector list while the last two digits refer to the aggregate sector in which the sector has been included in the 11-sector aggregate table.

**These numbers correspond to the serial numbers given the sectors by Arik Kuyvenhoven in the appendix to his "Sector Appraisal Where Trade Opportunities are Limited", in Advances in Input-Output Analysis, edited by K.R. Polenske and J.V. Skolka, pp. 183-204.

APPENDIX TABLE VI.2

GLOSSARY OF MAIN VARIABLES AND PARAMETERS

$X_i(t)$	:	The value of gross production in sector i in period t
$M_T(t)$	:	Total imports in period t
$M_i(t)$	:	The sectoral level of imports in period t
$C_m(t)$	:	Imports of consumer goods in period t
$X_m(t)$	:	Imports of raw materials in period t
$J_m(t)$	:	Imports of investment goods in period t
$E_i(t)$	:	Exports by sector i in period t
$I_i^G(t)$	:	The value of gross investment by sector i in period t
$K_i(t)$	:	The value of capital stock in sector i in period t
$Y(t)$	:	The value of national income in period t
$\bar{L}_i(t)$	:	The estimated level of labour availability in sector i in period t
$A = [a_{ij}]$:		The input-output coefficients matrix
$B = [\beta_{ij}]$:		The capital coefficients matrix
ξ_i^C	:	The ratio of sectoral consumption to total consumption in 1974
k_j	:	The sectoral capital-output ratio
λ_j	:	The sectoral labour-output ratio
θ_j	:	The sectoral domestic oil-use ratio
δ	:	The rate of depreciation: assumed to be 8% per period
s	:	The savings rate
μ^*	:	The rate of growth of imports
c^*	:	The rate of growth of consumption
g^*	:	The rate of growth of national income
λ^*	:	The rate of growth of labour supply
ω	:	The rate of discount applied to the objective function

BIBLIOGRAPHY

Aboyade, O. Foundations of an African Economy. New York: Praeger, 1966.

-------- and A.A. Ayida. "The War Economy in Perspective", Nigerian Journal of Economics and Social Studies, XIII (1971), 13-37.

Adedeji, A. "Federalism and Development Planning in Nigeria" in Ayida, A.A. and H.M.A. Onitiri, eds. Reconstruction and Development in Nigeria. Ibadan: NISER/Oxford University Press, 1970.

Adelman, I., ed. Practical Approaches to Development Planning: Korea's Second Five-Year Plan. Baltimore: Johns Hopkins University Press, 1969.

-------- and E. Thorbecke, eds. The Theory and Design of Economic Development. Baltimore: Johns Hopkins University Press, 1966.

Adelman, M.A. The World Petroleum Market. Baltimore: Johns Hopkins University Press, 1972.

Almon, C. "Consistent Forecasting in a Dynamic Multi-Sector Model", Review of Economics and Statistics, XLV (1963), 148-162.

--------. "Investment in Input-Output Models and the Treatment of Secondary Products" in Carter, A.P. and A. Brody, eds. Applications of Input-Output Analysis. Amsterdam: North-Holland, 1970.

--------. "Use of the Maryland Inter-industry Forecasting Model to Project Petroleum Demand" in Searl, M.F., ed. Energy Modelling. Baltimore: Resources for the Future Inc., 1973.

Aluko, S.A. "Resource Allocation and Overall Strategy", Quarterly Journal of Administration, Symposium on Nigeria's Second National Development Plan, VII (1973), 267-283.

Arrow, K.J. "Import-Substitution in Leontief Models", Econometrica, XXII (1954), 481-92.

--------, L. Hurwicz and H. Uzawa, eds. Studies in Linear and Non-Linear Programming. Stanford: Stanford University Press, 1958.

-------- and M. Hoffenberg. A Time-Series Analysis of Interindustry Demands, Amsterdam: North-Holland, 1959.

Ayida, A.A. and H.M.A. Onitiri, eds. Reconstruction and Development in Nigeria. Ibadan: NISER/Oxford University Press, 1970.

Bacha, E. and L. Taylor. "Foreign Exchange Shadow-Prices: A Critical Review of Current Theories", Quarterly Journal of Economics, LXXXV (1971), 197-224.

Bacharach, M. Bi-proportional Matrices and Input-Output Change. Cambridge: Cambridge University Press, 1970.

Barr, J.K. and A.S. Manne. "Numerical Experiments with a Finite Horizon Planning Model", Indian Economic Review, XI (1967), 1-30.

Bergendorff, H., C.R. Blitzer and H.K. Kim. "Applications of Control Theory to a Leontief-Type Planning Model", Mimeographed, Development Research Centre, IBRD, Washington, D.C., 1973.

--------, P.B. Clark and L. Taylor. "Welfare Gains from Optimization in Dynamic Planning Models", Mimeographed, Development Research Centre, IBRD, Washington, D.C., 1973.

Bergsman, J. and A.S. Manne. "An Almost Consistent Inter-temporal Model for India's Fourth and Fifth Plans" in Adelman, I. and E. Thorbecke, eds. The Theory and Design of Economic Development. Baltimore: Johns Hopkins University Press, 1966.

Bhagwati, J.N. and S. Chakravarty. "Contributions to Indian Economic Analysis: A Survey", American Economic Review, LIX (1969), Supplement to No. 4.

Bhambri, R.S. "Second National Development Plan: A Selective Appraisal", Nigerian Journal of Economics and Social Studies, XIII (1971).

Blitzer, C.R. "A Perspective Planning Model for Turkey: 1969-1984", Mimeographed, Development Research Centre, IBRD, Washington, D.C., 1972.

--------, H. Setin and A.S. Manne. "A Dynamic Five-Sector Model for Turkey: 1967-1982", American Economic Association Papers and Proceedings, LX (1970), 70-75.

--------, P.B. Clark and L. Taylor. Economy-Wide Models and Development Planning. London: Oxford University Press/IBRD, 1975.

--------, A. Meeraus and A. Stoutjesdijk. "A Dynamic Model of OPEC Trade and Production", Journal of Development Economics, II (1975), 319-335.

Bowles, S. "Aggregation of Labour Inputs in the Economics of Growth and Planning: Experiments with a Two-Level CES Function", Journal of Political Economy, LXXVIII (1970), 68-81.

Bradley, P.G. Economics of Crude Petroleum Production. Amsterdam: North Holland Publishers, 1967.

Bruno, M. "Experiments With a Multi-Sectoral Programming Model" in Adelman, I. and E. Thorbecke, eds. The Theory and Design of Economic Development. Baltimore: Johns Hopkins University Press, 1966.

--------. "Optimal Patterns of Trade and Development", Review of Economics and Statistics, XLIX (1967), 545-54.

--------. "The Optimal Selection of Import-Substituting and Export Promoting Projects" in United Nations. Planning the External Sector: Techniques, Problems and Policies. New York: United Nations, 1967. Publication No. ST/TAO/SER. C/91.

--------, C. Dougherty and M. Fraenkel. "Dynamic Input-Output, Trade and Development" in Carter, A.P. and A. Brody, eds. Applications of Input-Output Analysis. Amsterdam: North-Holland, 1970.

Burmeister, E. and R. Dobell. Mathematical Theories of Economic Growth. New York: Macmillan, 1970.

Carter, A.P. Structural Change in the American Economy. Cambridge, Mass.: Harvard University Press, 1970.

Carter, A.P. and A. Brody. Contributions to Input-Output Analysis. Amsterdam: North-Holland, 1970.

-------- and A. Brody. Applications of Input-Output Analysis. Amsterdam: North-Holland, 1970.

Carter, N.G. "An Input-Output Analysis of the Nigerian Economy: 1959-60", Working Paper #29-63, School of Industrial Management, M.I.T., 1963.

--------. "A New Look at the Sandee Model" in Shell, K., ed. Essays in the Theory of Optimal Economic Growth. Cambridge, Mass.: M.I.T Press, 1967.

Chakravarty, S. "Optimum Savings With a Finite Planning Horizon", International Economic Review, III (1962), 338-55.

--------. "Optimal Programme of Capital Accumulation in a Multi-Sector Economy", Econometrica, XXXIII (1965), 557-70.

--------. Capital and Development Planning, Cambridge, Mass.: M.I.T. Press, 1969.

-------- and R.S. Eckaus. "An Approach to a Multi-Sectoral Inter-temporal Planning Model" in Rosenstein-Rodan, P.N., ed. Capital Formation and Economic Development. Cambridge, M.I.T. Press, 1964.

-------- and L. Lefeber. "An Optimising Planning Model", Economic Weekly, XVII (1965), 237-52.

Chenery, H.B. "Comparative Advantage and Development Policy", American Economic Review, LI (1961), 18-51.

Chenery, H.B. and M. Bruno. "Development Alternatives in an Open Economy", Economic Journal, LXXII (1962), 79-103.

-------- and W.J. Raduchel. "Substitution in Planning Models" in Chenery, H.B. ed. Studies in Development Planning. Cambridge, Mass.: Harvard University Press, 1971.

Clark, P.B. Planning Import Substitution. Amsterdam: North-Holland, 1970.

--------. "Inter-sectoral Consistency and Macroeconomic Planning" in Blitzer, C.R., P.B. Clark and L. Taylor. Economy-Wide Models and Development Planning. London, Oxford University Press/IBRD, 1975.

-------- and L. Taylor. "Dynamic Input-Output With Optimal End Conditions: The Case of Chile", Economics of Planning, XI (1971), 10-30.

-------- and A. Foxley. "Target-Shooting With a Multi-Sectoral Model" in Eckaus, R.S. and P.N. Rosenstein-Rodan, eds. Analysis of Development Problems: Studies of the Chilean Economy. Amsterdam: North-Holland, 1973.

Cox, J.C. and A.W. Wright. "The Determinants of Investment in Petroleum Reserves and Their Implications for Public Policy", American Economic Review, LVI (1976), 153-157.

Cremer, J. and M.L. Weitzman. "OPEC and the Monopoly Price of World Oil", European Economic Review, VIII (1976), 155-64.

Dantzig, G.B. and P. Wolfe. "The Decomposition Principle for Linear Programs", Econometrica, XXIX (1961), 767-778.

Dean, E. Plan Implementation in Nigeria: 1962-1966. Ibadan: NISER/Oxford University Press, 1972.

Dorfman, R. "An Economic Interpretation of Optimal Control Theory", American Economic Review, LIX (1969), 817-31.

--------, P. Samuelson and R. Solow. Linear Programming and Economic Analysis. New York: McGraw-Hill, 1958.

Dougherty, C.R.S. "Substitution and the Structure of the Labour Force", Economic Journal, LXXXII (1972), 170-82.

Duloy, J.H. and R.D. Norton. "Competitive and Non-Competitive Demand Structures in Linear Programming Models", Discussion Paper #3, Development Research Center, IBRD, Washington, D.C., 1973.

Eckaus, R.S. and K.S. Parikh. Planning for Growth: Multi-Sectoral Intertemporal Models Applied to India. Cambridge, Mass.: M.I.T. Press, 1968.

Ezzati, A. "Future OPEC Price and Production Strategies as Affected by its Capacity to Absorb Oil Revenues", European Economic Review, VIII (1976), 107-38.

Falegan, S.B. "The Impact of the Crude Petroleum Industry on Nigeria's Balance of Payments: 1960-1973", Central Bank of Nigeria Economic and Financial Review, XI (1973), 7-12.

Federal Government of Nigeria. Economic Development of Nigeria: 1959. Lagos: National Economic Council, 1959.

--------. National Development Plan: 1962-68. Lagos: Federal Ministry of Economic Development, 1962.

--------. Second National Development Plan: 1970-74. Lagos: Federal Ministry of Information, 1970.

--------. First Progress Report on the Second National Development Plan: 1970-74. Lagos: Central Planning Office, 1972.

--------. Guidelines for the Third National Development Plan: 1975-80. Lagos: Central Planning Office, 1973.

--------. Second Progress Report on the Second National Development Plan: 1970-74. Lagos: Central Planning Office, 1974.

--------. Third National Development Plan: 1975-80. Lagos: Central Planning Office, 1975.

--------. First Progress Report on the Third National Development Plan. Lagos: Central Planning Office, 1977.

Fischer, D., D. Gately and J.F. Kyle. "The Prospects for OPEC: A Critical Survey of the World Oil Market", Journal of Development Economics, II (1975), 363-86.

Friedman, S. "An Algorithm for Dynamic Programming of Economic Growth", Mimeographed, Centre for Research in Management Science, University of California at Berkeley, Berkeley, California, 1968.

Frisch, R. "A Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model With Many Sectors", Econometrica, XXVII (1959), 117-96.

--------. Planning for India: Selected Explorations in Methodology. Calcutta: Indian Statistical Institute, 1960.

--------. Economic Planning Studies: A Collection of Essays. Boston: D. Reidel Publishing Company, 1976.

Gale, D. "Optimal Development in a Multi-Sector Economy", Review of Economic Studies, XXXIV (1967), 1-18.

Gately, D. and J.F. Kyle. "Strategies for OPEC's Pricing Decisions", Discussion Paper #77-10, Center for Applied Economics, New York University, July, 1977.

de la Garza, G. and A.S. Manne. "ENERGETICOS: A Process Analysis of the Energy Sectors" in Goreux, L.M. and A.S. Manne, eds. Multi-Level Planning: Case Studies in Mexico. New York: North-Holland/American Elsevier, 1973.

Gilbert, R. "Optimal Depletion of an Uncertain Stock", Technical Report #207, Institute for Mathematical Studies in the Social Sciences, Stanford University, May, 1976.

Gordon, R.J. "A Reinterpretation of the Theory of Exhaustion", Journal of Political Economy, LXXV (1967), 274-286.

Goreux, L.M. "Ivory-Coast Research Project: An Outline of the Central Model", Mimeographed, Development Research Center, I.B.R.D., Washington, D.C., 1973.

-------- and A.S. Manne, eds. Multi-Level Planning: Case Studies in Mexico. New York: North-Holland/American Elsevier, 1973.

Green, J.N. "Four African Development Plans", Journal of Modern African Studies, III (1965), 249-79.

Hansen, L.M. "Methods of Economic Programming and Analysis in the Plan", Nigerian Journal of Economic and Social Studies, VI (1962), 92-109.

Hansen, T. and T.C. Koopmans. "On the Definition and Computation of Capital Stock Invariant Under Optimization", Journal of Economic Theory, V (1972), 487-523.

Harvard Economic Research Project. "Estimates of the Capital Structure of American Industries", Mimeographed, Harvard University, 1953.

Heal, G.M. "Planning Without Prices", Review of Economics and Statistics, XXXVI (1969), 347-62.

---------. The Theory of Economic Planning. Amsterdam: North-Holland, 1973.

Heesterman, A.R.G. Allocation Models for National Economic Planning. Dordrecht, Holland: D. Reidel Publishing Company, 1970.

---------. Forecasting Models for National Economic Planning. Dordrecht, Holland: D. Reidel Publishing Company, 1970.

Helleiner, G.K. Peasant Agriculture, Government and Economic Growth in Nigeria. Homewood, Illinois: R.D. Irwin, 1966.

Herfindahl, O.C. "Depletion and Economic Theory" in Gaffney, M., ed. Extractive Resources and Taxation. Madison: University of Wisconsin Press, 1967.

Ho, J.K. "Nested Decomposition of Large-Scale Linear Programs With the Staircase Structure", Technical Report #74-4, Systems Optimization Laboratory, Department of Operations Research, Stanford University, Stanford, California, May, 1974.

-------- and A.S. Manne. "Nested Decomposition for Dynamic Models", Technical Report #96, Institute for Mathematical Studies in the Social Sciences, Stanford University, Stanford, California, 1973.

Holland, E.P. and R.W. Gillespie. Experiments on a Simulated Underdeveloped Economy: Development Plans and Balance of Payments Policies. Cambridge, Mass.: M.I.T. Press, 1963.

Hopkins, D.S.P. "Sufficient Conditions for Optimality in Finite Horizon Linear Economic Models", Technical Report #69-3, Operations Research House, Stanford University, Stanford, California, 1969.

Horowitz, M., M. Zymelman and I.L. Herrnstadt. Manpower Requirements for Planning: An International Comparisons Approach. Mimeographed, Department of Economics, North-Eastern University, Boston, Mass., 1966, 2 vols.

Hotelling, H. "The Economics of Exhaustible Resources", Journal of Political Economy, XXXIX (1931), 137-75.

Hughes, B., M. Mesarovic and E. Pestel. "World Oil: Model Description and Scenario Assessment", Multi-Level Regionalized World Modelling Project, April, 1974.

Hnyilicza, E. and R.S. Pindyck. "Pricing Policies for a Two-Part Exhaustible Resource Cartel: The Case of OPEC", European Economic Review, VIII (1976), 136-54.

International Bank for Reconstruction and Development. The Economic Development of Nigeria. Baltimore: Johns Hopkins University Press, 1955.

Intrilligator, M.D. Mathematical Optimization and Economic Theory. Englewood-Cliffs, New Jersey: Prentice-Hall, 1971.

Johansen, L. "Explorations in Long-Term Projections of the Norwegian Economy", Economics of Planning, VIII (1968), 70-117.

Johansen, L. "The Rate of Growth in Dynamic Input-Output Models: Some Observations Along the Lines Suggested by O. Lange and A. Brody", Mimeographed, Institute of Economics, University of Oslo, 1972.

--------. A Multi-Sectoral Study of Economic Growth. Amsterdam: North-Holland, 1973.

Jorgenson, D.W. "A Dual Stability Theorem". Econometrica, XXVIII (1960) 892-99.

--------. "The Structure of Multi-Sector Dynamic Models", International Economic Review, II (1961), 276-93.

--------. "The Economic Theory of Replacement and Depreciation", Mimeographed, Harvard Institute of Economic Research, Harvard University, 1971.

Kalecki, M. Introduction to the Theory of Growth in a Socialist Economy. Oxford: Blackwell, 1969.

Kalymon, B.A. "Economic Incentives in OPEC Oil Pricing Policy", Journal of Development Economics, II (1975), 337-362.

Keesing, D.B. and A.S. Manne. "Manpower Projections for DINAMICO" in Goreux, L.M. and A.S. Manne, eds. Multi-Level Planning: Case Studies in Mexico. New York: North-Holland/American Elsevier, 1973.

Kennedy, M. "An Economic Model of the World Oil Market", The Bell Journal of Economics and Management Science, V (1974), 540-77.

Kendrick, D.A. "Mathematical Models in Planning", Mimeographed, Department of Economics, University of Texas, Austin, Texas, 1970.

--------. "On the Leontief Dynamic Inverse", Quarterly Journal of Economics, LXXXVI (1972), 693-96.

-------- and L. Taylor. "Numerical Solution of Non-Linear Planning Models", Econometrica, XXXVIII (1970), 453-67.

-------- and L. Taylor. "Numerical Methods and Non-Linear Planning Models", in Chenery, H.B., ed. Studies in Development Planning. Cambridge, Mass.: Harvard University Press, 1971.

Klein, L.R. "On the Interpretation of Professor Leontief's System", Review of Economics and Statistics, XX (1953), 1313-36.

Koopmans, T.C. "Economic Growth at a Maximal Rate", Quarterly Journal of Economics, LXXVIII (1964), 355-394.

Kornai, J. Anti-Equilibrium. Amsterdam: North-Holland, 1971.

Kornai, J. Rush Versus Harmonic Growth. Amsterdam: North-Holland, 1972.

---------. Mathematical Planning of Structural Decisions, Amsterdam: North-Holland, 1974.

Kubursi, A.A. "The Strategy and Tactics Under Excess Capital", Thought, III (1977), 175-190.

Kuller, R.G. and R.G. Cummings. "An Economic Model of Production and Investment for Petroleum Reservoirs", American Economic Review, LXIV (1974), 66-79.

Kyle, J.F. and W.E. Moskowitz. "The Economics of OPEC: A Theoretical Discussion", Research Paper #7521, Federal Reserve Bank of New York, October, 1975.

Lefeber, L. "Comment on 'An Almost Consistent Inter-temporal Model for India's Fourth and Fifth Plans' by J. Bergsman and A.S. Manne" in Adelman, I. and E. Thorbecke. The Theory and Design of Economic Development. Baltimore: Johns Hopkins University Press, 1966.

Leontief, W.W. "The Dynamic Inverse" in Carter, A. and A. Brody, eds. Contributions to Input-Output Analysis. Amsterdam: North-Holland. 1970.

Loucks, D.P. "Planning for Multiple Goals" in Blitzer, C.R., P.B. Clark and L. Taylor. Economy-Wide Models and Development Planning. London: Oxford University Press/IBRD, 1975.

MacEwan, A. Development Alternatives in Pakistan: A Multi-Sectoral Study of Planning Models. Cambridge, Mass.: Harvard University Press, 1971.

Mahalanobis, P.C. "The Approach of Operational Research to Planning in India", Sankhya, XVI (1955).

Manne, A.S. "Capacity Expansion and Probalistic Growth", Econometrica, XXIV (1961), 632-49.

---------. "Key Sectors of the Mexican Economy: 1960-1970" in Manne, A.S. and H.M. Markowitz, eds. Studies in Process Analysis. New York: John Wiley and Sons, 1963.

---------. Investment for Capacity Expansion: Size, Location and Time-Phasing. Cambridge, Mass.: M.I.T. Press, 1967.

---------. "Sufficient Conditions for Optimality in an Infinite Horizon Development Plan", Econometrica, XXXVIII (1970), 18-38.

Manne, A.S. "DINAMICO: A Dynamic Multi-Sector, Multi-Skill Model" in Goreux, L.M. and A.S. Manne, eds. Multi-Level Planning: Case-Studies in Mexico. New York, North-Holland/American Elsevier, 1973.

--------. "Multi-Sectoral Models for Development Planning: A Survey", Journal of Development Economics, I (1974), 43-69.

-------- and T.E. Weisskopf. "A Dynamic Multi-Sectoral Model for India: 1967-75" in Carter, A. and A. Brody, eds. Applications of Input-Output Analysis. Amsterdam: North-Holland, 1970.

Martens, A. and R.S. Pindyck. "An Application of Optimal Control to Investment Allocation for Development Planning", Mimeographed, International Institute for Quantitative Economics, Sir George Williams University, Montreal, Canada.

Marshalla, R.A. "Inter-temporal Efficiency and the World Price of Oil: An Empirical Model", Annals of Economic and Social Measurement, VI (1977), 203-224.

Mirless, J.A. "Optimal Growth When Technology is Changing", Review of Economic Studies, XXXIV (1967), 95-124.

Moody, R.W. and R.W. Esser. "World Crude Resource May Exceed 1500 Billion Barrels", World Oil, September, 1975, 48-54.

Murakami, Y., K. Tokoyama and J. Tsukui. "Efficient Rates of Accumulation and the Turnpike of the Japanese Economy" in Carter, A. and A. Brody, Applications of Input-Output Analysis. Amsterdam: North-Holland, 1970.

National Planning Association. Capacity Expansion Planning Factors. Washington, D.C.: National Planning Association, 1966.

Nordhaus, W.D. "The Allocation of Energy Resources", Brookins Papers in Economic Activity, IV (1973).

O'Brien, S. and R. Myers. "The Progress of the Economy", Quarterly Journal of Administration, Special Issue on the Progress of Nigeria's Second National Development Plan, VII (1973).

Ohiorhenuan, J.F.E. "Structural Factors in the Macroeconomic Planning Process: A Study of Planning in Nigeria", Unpublished Ph.D. Dissertation, McMaster University, 1975.

Okigbo, P.N.C. Nigerian National Accounts: 1950-57. Enugu: Federal Ministry of Economic Development, 1961.

Onitiri, H.M.A. and A.A. Ayida. Reconstruction and Development in Nigeria Ibadan: NISER/Oxford University Press, 1970.

Organization for Economic Co-operation and Development. Energy Prospects to 1985. Paris: O.E.C.D., 1974, 2 vols.

Pearson, S.R. Petroleum and the Nigerian Economy. Stanford, California: Stanford University Press, 1970.

Phelps, E.S. "The Golden Rule of Accumulation: A Fable for Growth Men", American Economic Review, LI (1961), 638-43.

Pyatt, G. and E. Thorbecke. "Principles of Planning", Mimeographed, International Labour Organization. Geneva, 1973.

Qayum, A. Techniques of National Economic Planning. Bloomington: Indiana University Press, 1975.

Radner, R. and S. Friedman, "An Algorithm for Dynamic Programming of Economic Growth", Mimeographed, Center for Research in Management Science, University of California at Berkeley, Berkeley, California, 1965.

Raduchel, W.J. "A General Equilibrium Model for Development Planning", Ph.D. Dissertation, Harvard University, 1972.

Rasmussen, P.N. Studies in Inter-sectoral Relationships. Amsterdam: North-Holland, 1956.

Reardon, W.A. "Input-Output Analysis of U.S. Energy Consumption" in Searl, M.F., ed., Energy Modelling. Washington, D.C.: Resources for the Future, Inc., 1973.

van Rijckeghem, W. "An Inter-sectoral Consistency Model for Economic Planning in Brazil" in Ellis, H.S., ed. The Economy of Brazil. Berkeley: University of California Press, 1969.

Rimler, J., Zs Daniel and J. Kornai. "Macrofunctions Computed on the Basis of Planning Models", Acta Oeconomica, VIII (1972), 375-406.

Robinson, S. and B.N. Song. "A Dynamic Input-Output Model of the Korean Economy", Discussion Paper #30, Research Programme in Economic Development, Woodrow Wilson School, Princeton University, 1972.

Rouhani, F. A History of OPEC. New York, Praeger, 1971.

Rustow, D.A. and J.F. Mungo. OPEC: Success and Prospects. New York, New York University Press, 1976.

Samuelson, P.A. "A Catenary Turnpike Theorem Involving Consumption and the Golden Rule", American Economic Review, LV (1965), 486-96.

Sapit, D. "Multi-Objective Linear Programming", Mimeographed, Operations Research Center, University of California at Berkeley, Berkeley, California, 1966.

Scarf, H.E. "An Example of an Algorithm for Calculating General Equilibrium Prices", American Economic Review, LIX (1969), 669-77.

Schatzl, L.H. Petroleum in Nigeria. Ibadan: Oxford University Press, 1969.

Searl, M.F., ed. Energy Modelling. Washington, D.C.: Resources for the Future, Inc., 1973.

Sen, A.K. "Terminal Capital and Optimum Savings" in Feinstein, G.H., ed. Socialism, Capitalism and Economic Growth: Essays Presented to Maurice Dobb. London: Cambridge University Press, 1967.

Smith, V.L. "Economics of Production from Natural Resources", American Economic Review, LVIII (1968), 409-431.

Solow, R.M. "Competitive Valuation in a Dynamic Input-Output System", Econometrica, XXVII (1959), 20-53.

--------. "The Economics of Resources and the Resources of Economics", American Economic Review, LXIV (1974), 1-14.

Spulber, N. and I. Horowitz. Quantitative Economic Policy and Planning. New York: W.W. Norton Co., 1976.

Stolper, W.F. Planning Without Facts: Lessons in Resource Allocation From Nigeria's Development. Cambridge, Mass.: Harvard University Press, 1966.

Stone, R. Input-Output and National Accounts. Paris: O.E.C.D., 1961.

--------. Mathematical Models of the Economy and Other Essays. London: Chapman and Hall, 1970.

Sydsaeter, K. "Remarks on Some Methods of Choosing Terminal Conditions in One-Sector, Finite Horizon, Optimal Growth Models", Economics of Planning, X (1970), 171-176.

Taylor, L. "Investment Timing in Two-Gap Models" in Chenery, H.B., ed. Studies in Development Planning. Cambridge, Mass.: Harvard University Press, 1971.

--------. "Theoretical Foundations and Technical Implications" in Blitzer, C.R., P.B. Clark and L. Taylor, eds. Economy-Wide Models and Development Planning. London: Oxford University Press/I.B.R.D., 1975.

Tilanus, C.B. Input-Output Experiments: The Netherlands, 1948-61. Rotherdam: Rotherdam University Press, 1966.

Tims, W. "A Growth Model and Its Application: Pakistan" in Papanek, G.F., ed. Development Policy: Theory and Practice. Cambridge, Mass.: Harvard University Press, 1968.

--------. Nigeria: Options for Long-Term Development. Baltimore: Johns Hopkins University Press, 1974.

Tinbergen, J. Development Planning. New York: McGraw-Hill, 1967.

Tsukui, J. "Turnpike Theorem in a Generalized Dynamic Input-Output System", Econometrica, XXXIV (1966), 398-407.

--------. "Application of a Turnpike Theorem to Planning for Efficient Accumulation: An Example for Japan", Econometrica, XXXVI (1968), 172-86.

Uhler, R.S. "Costs and Supply in Petroleum Exploration: The Case of Alberta", Canadian Journal of Economics, IX (1976), 72-90.

--------. "The Rate of Petroleum Exploration and Extraction", University of British Columbia Resources Paper #14, October, 1976.

United Nations. Problems of Input-Output Tables and Analyses. New York: United Nations, 1966. Document #ST/STAT. SER.F/14.

Usoro, E.J. "The Oil Sector", Quarterly Journal of Administration, VII (1973).

Uzawa, H. "Time-Preference and the Penrose Effect in a Two-Class Model of Economic Growth", Journal of Political Economy, LXXVII (1969), 628-52.

Vanek, J. Estimating Foreign Resource Needs for Economic Development: Theory, Method and a Case Study of Colombia. New York: McGraw-Hill, 1967.

Von-Neumann, J. "A Model of General Economic Equilibrium", Review of Economic Studies, XIII (1945), 1-9.

Watanabe, T. "A Test of the Constancy of Input-Output Coefficients", in Carter, A. and A. Brody, eds. Applications of Input-Output Analysis. Amsterdam: North-Holland, 1970.

Waterston, A. Development Planning: Lessons from Experience. Baltimore; Johns Hopkins University Press, 1975.

Wein, H.H. and V.P. Sreedharan. The Optimal Staging and Phasing of Multi-Product Capacity. East Lansing, Michigan: Michigan State University Press, 1968.

Weisskoff, R. "A Multi-Sector Simulation Model of Employment, Growth and Income Distribution: A Re-evaluation of a Successful Development Strategy", Mimeographed, Economic Growth Center, Yale University, New-Haven, Connecticut, 1972.

Weisskopf, T.E. "A Programming Model for Import Substitution in India", Sankhya, XXIX (1967), 257-306.

--------. "Alternative Patterns of Income Distribution in India" in Chenery, H.B., ed. Studies in Development Planning. Cambridge, Mass.: Harvard University Press, 1971.

Weitzman, M.L. "Shiftable Versus Non-Shiftable Capital: A Synthesis", Econometrica, XXXIX (1971), 511-529.

Westphal, L.E. Planning Investments With Economies of Scale. Amsterdam: North-Holland, 1971.

--------. "An Inter-temporal Planning Model Featuring Economies of Scale" in Chenery, H.B., ed. Studies in Development Planning. Cambridge, Mass.: Harvard University Press, 1971.

Whinston, A.B., G.J. Koehler and G.P. Wright. Optimization Over Leontief Substitution Systems. Amsterdam: North-Holland,

Zauberman, A. Mathematical Theory in Soviet Planning: Concepts, Methods and Techniques. London: Oxford University Press, 1976.

Zsuzsa, D., A. Jonas, J. Kornai and B. Martos. "Plan Sounding", Economics of Planning, XI (1971), 31-58.