THE ECONOMIC ANALYSIS OF GROUNDNUT PRODUCTION IN NIGERIA: SUPPLY RESPONSE AND POLICY CONSIDERATIONS

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Dedicated to My Mother

My Wife

Mojisola

and

Children

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CHAPTER I

INTRODUCTION

Since World War II, great attention has been placed on the process of economic growth and development. This is particularly true of the less developed countries where the need for increasing agricultural production, improvement of marketing systems, infrastructure, and the general economic welfare has been very pressing.

Tables I, II, and III show the position of agriculture in Nigeria's national economy. The various economic activities which constitute the country's Gross Domestic Product (GDP) have been growing steadily over the years; agriculture's contribution to the Gross Domestic Product has stagnated and even declined. Exports of major agricultural products have declined. Data in Table III indicates that palm produce, groundnuts, rubber and cocoa, which provide foreign exchange to support importation of both capital and consumer goods, failed to meet domestic demand during most years.

In recent years, since the advent of the military regimes in Nigeria, much attention has been devoted to increasing the production of food crops in the country. The problem of food shortages in the world is sensed with mixed feelings of optimism and pessimism. The specter of hunger is a dramatic reality for most sub-Saharan Africa (Futa, 1979).

Efforts to increase food production have been motivated in part by foreign exchange outflow to food imports. A number of problems have

TABLE I

SECTORIAL GROWTH RATE - (IN PERCENTAGES)

	Average Annual Growth Over Period in Real Terms						
	1950-1957	1958/59-1962/63	1962/63-1966/67	1966/67 1970/71	1970/71 1971/72	1972/73 1973/74	1974/75 1975/76
Gross Domestic Product	4.1	6.4	5.5	5.5	2.5	8	17.6
Agriculture	2.9	4.6	2.0	0.8	1.8	2	.98
Mining (including petroleum)	3.1	27.0	44.0	26.5	88	21	63
Power, Transport and Construction	15.1	12.1	5.5	3.8	40	25	20
Services	3.4	6.8	7.0	6.2	14*	14*	14*

Source: Wonter Tims, Nigeria: Options for Long-Term Development - Findings of Economic Mission by World Bank Team, p. 12; FOS, Digest of Statistics, Vo. 25, 1976; FOS. The Index of Economic Indicators, Vol. 12, #1,2,3, 1976.

*Approximates

TABLE II

GROSS DOMESTIC PRODUCT BY TYPE OF ECONOMIC ACTIVITY
(PERCENTAGE DISTRIBUTION)

	1958/59	1962/63	1966/67	1970/71	1971/72	1972/73	1973/74
Agriculture	68.4	61.5	54.4	50.0	42	38	34
Mining (including petroleum)	0.8	2.1	4.0	11.6	15	17	18
Manufacturing	4.4	5.8	7.3	8.0	6.5	7.8	8
Power, Transport and Construction	7.3	9.6	9.8	8.3	10.8	12.8	14.2
Services	19.1	21.0	23.5	22.1	14	13.5	15.4

Source: Wonter Tims, Nigeria: Options for Long-Term Development - Findings of Economic Mission by World Bank Team, p.13; FOS, Digest of Statistics, Vol. 25, 1976; and FOS, The Index of Economic Indicators , Vol. 12, #1,2,3, 1976.

TABLE III

EXPORTS OF MAJOR AGRICULTURAL COMMODITIES
FROM NIGERIA 1948 - 1976 (1,000 TONS)

Year	Palm-Kernels Q	Palm-Kernels %Δ	Groundnuts Q	Groundnuts %Δ	Rubber Q	Rubber %Δ	Cocoa Q	Cocoa %Δ
1948	327	--	245	--	719,000	--	68,776	--
1949	376	14.98	378	54.29	591,000	-17.80	102,078	48.4
1950	410	9.04	317	-16.14	2,834,000	379.53	90.671	-11.2
1951	547	15.37	141	-55.52	7,483,000	164.00	105,703	16.6
1952	374	- 7.78	260	84.39	4,138,749	-44.69	101,865	- 3.6
1953	403	7.75	326	25.38	3,286,522	20.59	102,584	0.7
1954	464	15.14	428	31.29	2,848,933	-13.31	83,311	-18.8
1955	433	- 6.68	397	- 7.24	5,566,859	95.40	68,570	-17.7
1956	451	4.16	448	12.58	6,382,422	14.65	92,984	35.6
1957	406	- 9.98	302	-52.59	7,012,201	9.87	117,721	26.6
1958	411	1.23	513	69.87	7,617,019	8.63	69,232	-41.2
1959	430	4.62	498	- 2.92	11,602,402	52.32	114,787	65.8
1960	418	- 2.79	333	-33.13	14,241,223	22.74	132,583	15.5
1961	417	- 0.24	494	48.35	11,011,145	-22.68	168,096	26.8
1962	367	-11.20	530	7.29	11,355,880	3.13	164,100	- 2.4
1963	398	8.45	614	15.85	11,781,911	3.75	160,008	- 2.5
1964	394	- 1.01	544	-11.40	12,168,000	- 9.66	192,062	20.0
1965	416	5.54	512	- 5.88	10,992,000	3.28	272,510	41.9
1966	394	- 2.29	573	11.91	11,472,000	4.37	160,218	-41.2
1967	163	-81.47	540	- 5.76	6,348,000	-44.66	232,120	44.9
1968								
1969			C I V I L W A R, N O F I G U R E S					
1970			R E C O R D E D F O R 1 9 6 8 - 1 9 7 0					
1971	272	--	114,000	--	51,000	--	271,000	--
1972	212	-22.1	104,000	- 8.8	41,000	-19.6	228,000	-15.9
1973	137	-35.1	129,000	24.0	49,000	19.5	211,000	- 7.0
1974	186	35.8	30,000	-76.7	61,000	24.5	180,000	-14.7
1975	172	- 7.5	--	--	61,000	0.0	192,000	6.7
1976	272	58.1	1,600	-94.7	44,000	-27.9	228,000	18.8

Source: S.O. Olayide and D. Olatunbogun, Trends and Prospects of Nigeria's Agricultural Exports, Niser, 1972, pp. 16-38; FDA, The Crop Subsector in the Fourth National Development Plan 1981-85, January, 1981.

been seen to result from these government activities and some counteracting public policy measures, such as import quotas, tarrifs, and complete import prohibitions have been established. Table IV shows Nigeria's balance of trade position as of 1979. The ensuing civil war in Nigeria made the balance of trade worse until the oil boom of early 1971. If the agricultural sector had made its contribution to the Nigerian national income as in the previous years (1950's and 1960's), the situation might have been better. Farmers in Nigeria have experienced increases in costs of production, partly due to government taxation to compensate for government technological subsidies for such items as fertilizer and improved yield programs.

The traditional rulers, district council chiefs, the Emirs, and landowners have seen their rights to landed property taken away by the central government agencies. It is alleged that illiteracy and lack of capital among farmers have retarded adoption of profitable and productive practices. Furthermore, farmer entry to a free market has been completely overridden by expensive marketing systems set up by the government. Table V shows estimates of actual and real producer income realized by Nigerian farmers compared to the potential money and real income that the farmers would have realized without the marketing boards (Helleiner, 1966).

Given these problems facing the Nigerian farmers, there is no doubt that most economists today would recommend expansion of the agricultural sector of a developing economy as a prerequisite for a sound economic base and for industrialization. It is often argued that modernization of agriculture, and also its mechanization, are necessary to free labor for industrial development (Ochala, 1974).

TABLE IV

VALUE OF NIGERIAN EXPORTS AND IMPORTS 1900-1979
(IN MILLION NIGERIAN NAIRA)
ONE NAIRA = $1.52

Selected Years	Total Exports	Total Imports	Visible Balance*
1900	1.9	1.7	0.2
1905	2.7	2.7	0.01
1910	5.3	5.1	0.2
1915	4.9	4.8	0.1
1924	14.4	10.9	3.5
1929	17.6	13.2	4.4
1945	17.1	13.5	3.6
1950	88.5	61.8	26.7
1955	129.8	136.1	- 6.3
1958	132.8	166.2	-33.4
1960	165.5	215.8	-50.2
1962	168.5	203.3	-34.8
1964	214.4	254.2	-39.8
1965	268.3	275.0	- 6.7
1966	284.1	256.0	28.1
1967	241.8	224.0	17.8
1968	211.1	193.1	18.0
1969	C I V I L W A R, N O F I G U R E S		
1970	R E C O R D E D F O R 1 9 6 9 - 1 9 7 0		
1971	181.6	151.0	30.6
1972	218.0	150.5	67.5
1973	346.6	186.5	160.1
1974	919.4	277.2	642.2
1975	799.4	604.1	195.3
1976	1077.1	821.3	255.8
1977	1183.8	1099.3	84.5
1978	947.6	1285.2	-337.6
1979	1807.3	1239.9	567.4

*Visible Balance: This represents balance valued purely on the basis of the merchandise, no account being taken of freight, insurance charges or carriage services.

Source: Helleiner, Peasant Agriculture, Government, and Economic Growth in Nigeria, pp. 492-493; FOS, Index of Economic Indicators, Vol. 12, No. 1,2,3, 1980; FOS, Digest of Statistics, Vol. 25, 1976.

TABLE V

MEASURES OF INSTABILITY OF INCOMES FROM MAJOR NIGERIAN MARKETING BOARD EXPORTS BY CROP

	Producers' Actual Money Income		Producers' Potential Money Income[1]		Producers' Actual Real Income	
	I_1	I2	I1	I2	I1	I2
	Av. Annual Change[2] %	Av. Annual Deviation[3] %	Av. Annual Change[2] %	Av. Annual Deviation[3] %	Av. Annual Change[2] %	Av. Annual Deviation[3] %
Cocoa 1947/48-1961/62	23.1	14.4	18.9	17.0	21.7	14.0
Groundnuts 1949/56-1960/61	29.9	24.9	27.8	19.9	31.1	22.4
Palm Oil 1949-1961	11.6	14.5	13.4	10.4	15.9	11.0
Palm Kernels 1949-1961	8.8	8.6	15.9	10.6	13.0	8.2
Cotton 1949/50-1960/61	26.3	21.0	22.6	13.9	32.2	22.0

Source: J. K. Helliner, Review of Economics and Statistics, Vol. XLVIII, No. 1, Feb. 1966, p. 74.

[1]Producers' money income plus export duties plus produce sales tax plus Marketing Board surplus (less deficit).

[2]Always taken as a percentage of the higher of the two figures being compared.

[3]Actual money income deflated by a consumer price index:
I_2 = average annual deviation of producers' actual money income from a five year moving average, expressed as a percentage of the moving average;
I_1 = average annual change of producers' actual money income always expressed as a percentage of the higher of the two figures being compared, viz:

$$I_1 = \sum_{t=2}^{n} X_t / N-1$$

TABLE V (Continued)

---

where

$$X_t = 100 \times \frac{V_t - V_{t-1}}{\max V_t, V_{t-1}}$$

where I_1 is the first instability measure (average percentage change), n = number of obesered years, V = variable under analysis; whether a price or income

$$I_2 = \sum_{t=3}^{n-2} Y_t / n-4$$

where I_2 is the second instability measure (the average deviation), where

$$Y_1 = 100 \times V_t - A_t / A_t$$

and where

$$A_t = V_{t-2} + V_{t-1} + V_t + V_{t+1} + V_{t+2}/5$$

where I_2 is the second instability measure.

Problem Statement

In the postwar years, as a result of the withdrawal of India from the groundnut world market, West Africa (especially Nigeria and Senegal) dominated the world groundnut market. It is estimated that about 75.7 percent of the internationally traded world groundnut supplies were West African in origin (Helleiner, 1966). Nigerian groundnuts accounted for 22 percent to 40 percent of world trade (Helleiner, 1966). During the same period, the value of Nigerian groundnut exports rose from ₦37.8 million in 1949 to a record of ₦73.2 million in 1964 (Helleiner, 1966). The groundnut producers' prices kept pace with world prices better than other Nigerian commodity prices; but, producer's incomes were reduced due to the government's export tax policy.

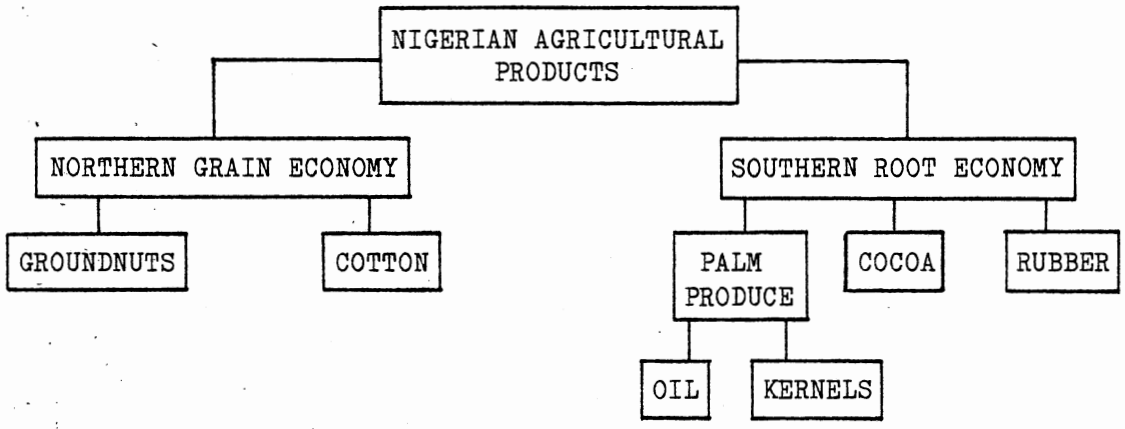


Figure 1. Structure of Nigerian Agricultural Economy

Since the late sixties and early 1970's, both the production and export of groundnuts have been declining. Groundnut production and marketing, which provide employment for more than 70 percent of Northern Nigeria's population (Famoriyo, 1979), have been a major concern to the National Government. Groundnut contribution to Gross Domestic Product has been low; and the government's policies on increasing groundnut production have not been successful (Wall Street Journal, October 15, 1980).

This study attempts to investigate the probable causes of the decline in groundnut production and to identify alternative policy measures to increase groundnut production. The main focus of this study is the investigation of alternative policy measures which might increase groundnut production. The rationale is that increased income from groundnut exports, all things being equal, is likely to raise producers' real incomes and consequently increase government revenues through groundnut export sales (Wall Street Journal, 1980, p. 31).

The Objectives of the Study

The objectives of the study are:

a. To review past studies on the economic constraints to groundnut production, marketing and consumption.

b. To describe and analyze the land tenure condition in Nigeria and the groundnut producing areas of Northern Nigeria in particular.

c. To re-examine the institutional arrangements set up by the Nigerian Government (Land Use Reform, Guaranteed Agricultural Credit Scheme, the Commodity Boards and Operation Feed the Nation) to step up agricultural production.

d. To examine the factors responsible for the continuous decline in the production and export of groundnuts.

e. To examine the degree of competition between subsistence and exchange crops on factors of production.

f. To investigate the means by which rural income can be increased in Northern Nigeria. Specifically, to study the groundnut economy of Northern Nigeria to delineate the potentials of groundnut production as a means of raising rural income and, consequently, gainful employment of the rural people of the states.

Hypotheses

The hypotheses to be tested include:

1. That competition for resource use by cotton, wheat, millet and guinea corn has accounted for part of the decline in groundnut production.

2. That constant policy changes and modification have had no impact on groundnut production.
3. That emphasis by the government on subsistence food production had a substantial impact on the production of export crops.
4. That the government's institutional arrangements to increase agricultural production, particularly for groundnuts, require re-appraisal and re-evaluation.
5. That Nigerian groundnut farmers are sensitive to price risk.

Organization of the Remainder of the Thesis

The importance of understanding the future consequences of the declining nature of agricultural exports in Nigeria cannot be underestimated. It has restrictive implications on the country's ability to earn foreign exchange needed to pay for its imports. Appropriate strategies need to be developed to correct past policies that contributed to the decline; and allocation of more resources to the agricultural sector. Therefore, Chapter II of this study reviews in greater detail the historical development of agricultural marketing and production in Nigeria. Chapter III describes the impact of marketing and land tenure systems on Nigeria's agricultural productivity. Chapter IV examines the theortical underpinnings underlying this study, model specifications, and a review of the relevant literature. The analysis and discussions of the results will be the focus of Chapter V, while Chapter VI summarizes the major findings and general conclusions that can be drawn from the study.

CHAPTER II

HISTORICAL DEVELOPMENT OF ACRICULTURAL MARKETING AND PRODUCTION IN NIGERIA

Agriculture and Nigerian Economy During the British Rule

From an historical perspective, Nigeria is a comparatively young nation, amalgamated in 1914, although the area had been separately ruled by various British interests a few decades prior to 1914. Agriculture has continued as the predominant economic pursuit of the natives (See Table VI.) Based on the historical perspective of British administration in Nigeria, there seem to be two very important changes in the country which could be characterized as an "economic revolution":

1. Although the changes were confined to the field of agriculture, these changes have been marked by the transition from the production of subsistence crops to the cultivation of export or exchange crops which, consequently, had involved the development of money economy.

2. The second change that occured had involved the creation of wants in a native population accustomed for centuries to rely largely on the products of its own fields and forests to supply its needs (Ademsimi, 1973, p. 1).

The general trend of the British colonial policy consisted of encouraging the Nigerian populace to produce farm crops which would find ready markets in Europe while the domestic food production was left unattended. The British government pursued a slow process of natural development which protected native institutions and allowed the natives

TABLE VI

GROSS DOMESTIC PRODUCT BY INDUSTRIAL ORIGIN AT CURRENT FACTOR COST
CONVERTED AT CURRENT YEAR-TO-YEAR EXCHANGE RATES (US $ MILLION)

Year	Total GDP	Agric.	Mining	Manufact.	Construct.	Commerc.	Transport	Others	Pub. Admin.
1960	3,142.4	1,984.6	36.4	164.6	132.7	397.0	139.3	158.2	129.6
1961	3,322.7	2,039.2	59.6	188.2	148.7	409.9	165.2	173.9	138.0
1962	3,683.0	2,253.4	75.0	229.3	161.0	451.1	170.5	199.1	143.6
1963	3,928.9	2,354.0	78.4	242.5	171.9	534.8	195.4	213.9	147.0
1964	4,079.7	2,349.2	114.2	255.4	177.0	583.0	198.0	250.0	152.9
1965	4,312.8	2,368.5	208.0	296.0	225.7	605.9	189.8	267.7	151.2
1966	4,494.1	2,498.2	228.8	302.1	231.6	605.1	183.4	293.7	151.2
1967	4,272.6	2,398.2	114.2	349.2	208.3	586.9	171.4	306.9	137.5
1968	4,397.0	2,417.0	126.0	405.0	216.0	593.0	172.0	325.0	143.0
1969	4,589.0	2,441.0	170.0	464.0	228.0	605.0	175.0	350.0	156.0

Source: UN Economic Commission for Africa, Survey of Economic Conditions in Africa, (1970, p. 127).

to retain control of the land. In pursuance of the colonial interest to promote the trade of the natives, which ostensibly meant guaranteeing the smooth flow of agricultural raw materials into European markets, Marketing Boards were created during World War II. The effects of these marketing arrangements on Nigerian agricultural productivity and export potentials are discussed in detail in Chapter III.

Nigeria's export crops commanded high world prices in post-World War II periods, the accumulation of which provided the regional governments with the bulk of the revenue required to execute their respective development plans. Thus, the 1950's marked the "Golden Age" in Nigeria's economic development history (Tables II and III). Until the current era of oil boom in Nigeria, the accumulation of the Marketing Board's reserves constituted the major source of government revenues and the major main-spring of Nigeria's economic development (see Table VI).

Modern Agricultural Developments

In the first decade of Nigeria's independence, agriculture continued to provide the largest source of the nation's foreign exchange. Export earnings, including forest products, for the first eight months of 1968 totalled 337 million dollars despite the effects of the Nigerian civil war during the same period (CBN Annual Report, 1969). Earnings from crude petroleum and other extractive products in the same period totalled less than 200 million dollars. The most important cash crops or exchange crops leading in the economic development of the country are distributed on a regional basis: cocoa, groundnuts, palm products including oil and kernels, and rubber from the West, North,

East and Bendel states respectively. Benniseed, wheat, millet and cotton were other important crops from the Northern states of Nigeria. The diagramatic representation of the structure of the Nigerian agricultural economy is shown in Figure 1 (p. 9). Effective marketing arrangements were developed for the exchange crops during the British rule in Nigeria. Since this study focuses on the potentials of groundnut production in Nigeria's national economy, the discussions, expositions and analysis henceforth will focus on groundnuts and its competitors.

Groundnuts (peanuts) are grown extensively in the light, sandy-loamy soils of Northern Nigeria, particularly in Kano, Bornu, Bauchi, Plateau, Maiduguri and Sokoto states. It is predominantly a peasant crop and cultivation on large estates, as in the case of cocoa in Western Nigeria, has never been encouraged due to mixed croping. The crop is produced predominantly for export, either in the form of shelled nuts, groundnut oil, or cake, with an estimated 5 - 10 percent of the total production for local consumption (Helleiner, 1966). Groundnut production is one of the major sources of farm income for more than 70 percent of the Northern Nigerian farmers (Ofiaja, 1979). The development of export markets for Nigeria's farm commodities resulted in the use of the services of over 200 licensed buying agents by the Northern Nigeria Marketing Boards for purchasing the crops at an annual fixed price. There has been a considerable decline in the Board's purchases over the years due mainly to low production. In 1966-1967 over one million tons were purchased by the Board, 600,000 tons in 1969-1970, and the purchase figure declined to less than 300,000 tons by the 1970-1971 seasons (Barclay's Bank Economic Survey of Nigeria, 1972). Despite the

TABLE VII

PRODUCTION, EXPORTS AND VALUE OF NIGERIAN GROUNDNUTS 1948 - 1976 (1,000 TONS)
ONE NAIRA = $1.70

	Production		Exports		Value	
Year	Q	Δ%	Q	Δ%	Q	Δ%
1948	329.6	--	245	--	19,612	--
1949	327.9	.52	378	54.29	27,832	92.90
1950	188.1	-42.63	317	-16.14	30,474	-19.45
1951	142.7	-24.14	141	-55.52	18,642	-38.83
1952	425.6	198.25	260	84.39	45,856	137.25
1953	430.7	1.20	326	25.38	49,856	18.72
1954	424.6	-1.42	428	31.29	59,800	19.95
1955	372.8	-12.20	397	-7.24	46,289	-22.62
1956	530.2	42.22	448	12.58	55,528	20.02
1957	357.9	-32.50	302	-32.59	40,272	-27.47
1958	714.8	99.72	513	69.87	53,904	33.85
1959	533.4	-25.38	498	-2.92	55,032	2.09
1960	445.5	-16.48	333	-33.13	45,744	-16.88
1961	619.1	38.97	494	48.35	64,464	40.92
1962	685.6	10.74	530	7.29	64,848	0.60
1963	871.5	27.11	614	15.85	73,200	12.89
1964	786.9	-9.71	544	-11.40	68,520	-6.39
1965	678.9	-13.73	512	-5.88	75,600	10.33
1966	978.1	44.07	573	11.91	81,624	7.97
1967	1,026.4	4.94	540	-5.76	70,824	-13.23
1968						
1969	CIVIL WAR, NO FIGURES					
1970	RECORDED FOR 1968-1970					
1971	285.8	--	115	--	16,872	--
1972	307.1	7.45	104	-8.7	16,016	-5.1
1973	559.1	82.06	129	19.38	29,154	82.1
1974	44.04	-92.12	30	-76.74	10,500	-6.4
1975	161.9	267.6	--	--	----	--
1976	100.0	-38.17	1.6	--	333	--

Source: S.O. Olayide and D. Olatunbogun, Trends and Prospects of Nigeria's Agricultural Exports, Niser, 1972, pp. 16-38; FDA, The Crop Subsector in the Fourth National Development Plan 1981-85, Lagos, Nigeria, 1981.

favorable world prices for groundnuts since the sixties, the production of groundnuts has since been in the downward direction. Beginning with the 1975 season, Nigeria, which had always maintained an average of 25 percent of the world's total production, no longer produced groundnuts in any commercial quantity (Table VII). The production has fallen from one to two million metric tons in 1967, to less than 2,000 metric tons in 1977 (Ofiaja, 1979).

Early Expansion of Groundnut Cultivation in Northern Nigeria

Available evidence now indicates that the origin of groundnut cultivation in Nigeria has been lost in historical obscurity (Hogendorn, 1978). This is obvious if one considers the difficulty experienced by agricultural historians in settling the question of the exact origin of groundnut cultivation in Northern Nigeria (Abesinni, 1973). Scrutinizing the available information on the origin of groundnuts, one is inclined to succumb to the latest researchers' theories that groundnuts were brought to Northern Nigeria from Latin America by the Portuguese slave traders in the sixteenth century (Hogendorn, 1978). The possibility remains, however, that the native species (bambara and hausa types) may have been cultivated on a small scale just for domestic consumption prior to the sixteenth century (Hogendorm, 1978).

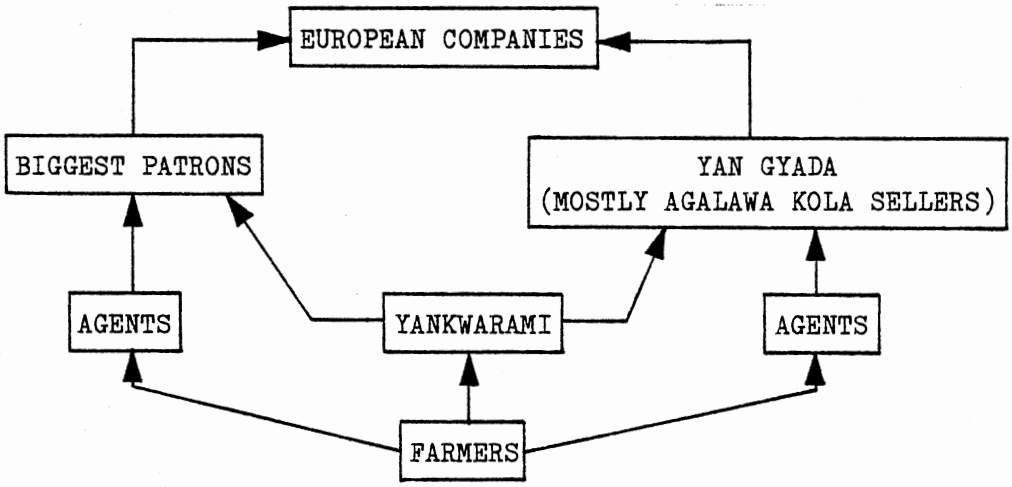
In contrast to cotton, the economic importance of the groundnut crop was not initially recognized by the colonial government. Despite this, the groundnut crop also received its share of government aids, especially when it was later recognized that groundnuts were a potential export crop just like cotton. Work on commercial groundnut cultivation

started as early as 1912 when some exotic species were introduced for trial. Even though the exotic varieties were not as good as the "banbarra and Hausa" varieties in their early cultivation, further attempts at commercial cultivation were made in 1927 and 1928 (United Africa Company, 1949).

The provision of transport facilities played a tremendous role in the expansion of groundnut production in Northern Nigeria. Before 1900, commercial cultivation of groundnuts was negligible. After the construction of the railway line from Lagos to Kano (the center of the groundnut producing areas) in 1911, many more acres of groundnuts were brought into cultivation and, in 1912, 2,500 tons of groundnuts were exported. Exports rose to 19,000 tons in 1913, which was a remarkable achievement on the part of the groundnut growers (United Africa Company, 1949). At that point, there seemed to be steep competition between cotton and groundnut production in Northern Nigeria as evidenced by the activities of the British Cotton Growers Association (BCGA) (Hogendorn, 1978).

A massive campaign to increase the production of groundnuts in Northern Nigeria started when the price of groundnuts was established early in the century. A number of marketing strategies were employed by rich "Hausa" merchants or Yan Gyada. The "Hausa" clientele network was used to secure supplies of groundnuts at harvest time from the rural areas (see Figure 2). Most of these people later became sub-buying agents for the rich "Hausa" merchants. This strategy was supplemented by the process of making available to local farmers expensive European trade goods that were absent from the local markets but in great demand among the "Hausa" population. These "Hausa" merchants used refined salt

and European cotton clothes as advertisements to induce the groundnut farmers or peasants in the rural areas to sell their products to them. Additionally, these promotional techniques were used to induce or lure cotton producers to divert their scarce resources to the production of groundnuts (Hogendorn, 1978).



Source: Hogendorn J., Nigerian Groundnut Exports: Origin and Early Development, p. 95.

Figure 2. Organization of the Groundnut Trade

As a result of industrial revolution in Western Europe with an accompaning increase in population, the demand for fats and oils for culinary and edible purposes increased. This demand could not be met by traditional supplies from animal and fish sources. The new vogue of cleanliness and of nocturnal illumination added tremendous weight to a rapid increase in the demand for fats in the manufacture of soap and

candles for the astronomical increase in population in Western Europe. Consequently, a transition from animal to vegetable oils in the manufacture of candles came about in the 1930's. By the turn of the century, vegetable oil became the principal raw material for the manufacture of the needed stearic candles (McPhee, 1971).

At the time when the industrial revolution was becoming the order of the day in Western Europe, the situation in France added to the increasing demand for vegetable oils. French industrialists recognized that vegetable oils were a good substitute for animal fats in the manufacture of soap. It was then recognized that means should be devised for processing groundnut oil on a large scale; hence, the industrialists in France established a mill for crushing groundnuts for the purpose of oil extraction in the middle of the nineteenth century.

Since the French government imposed high duties on most varieties of oil nuts with the exception of groundnut oil, Nigerian groundnut exporters found a new market for groundnuts. These economic opportunities for groundnut producers took place before the colonial ruler's continuous efforts to expand groundnut production in Northern Nigeria. The invention and consumption of margarine rose rapidly in industrial Europe between 1906 and 1913, and quickly spread to Western Germany by 1914 (Wilson, 1954). Such increases in the demand for groundnut oil stimulated the early development of groundnuts as a viable export commodity.

The Food and Agricultural Organization's 1965 report on Agricultural Development in Nigeria, 1965-1980 confirmed the earlier historical belief that there was room for expansion of groundnut production in Nigeria. The report stated that:

> An examination of the expected rate of expansion of the import market for the fats and oils closely competitive with groundnut oil suggests that Nigeria would have a reasonable prospect of expanding its groundnut exports over the period 1962-1980 by about 2.5 to 3 percent per annum with a mean of 2.75 percent per annum (FAO, 1965, p. 27).

The report showed that local crushing had increased rapidly and, over the five year period of 1961-1966, exports of groundnut oil had risen by 75 percent from 47,000 tons in 1960 to 80,000 tons of nuts by 1964. The current production of groundnut oil and nuts has failed to keep up with domestic consumption, not to mention export. Projections of possible earnings from major agricutural commodities were contained in the Food and Agricultural Organization's 1965 report (Table VIII) and they could be compared to the actual earning situation of the commodities as of 1974.

A glance at Table IX indicates a substantial reduction in the export figures of groundnuts and palm oil from 1976 to 1978. This is a departure from the estimates and projections made by the Food and Agricultural Organization report of 1965.

It has been emphasized by many authors and researchers that the decisions of farmers are indeed highly responsive to economic factors. For example, the Marketing Board's producer prices for groundnuts were N-73 and ₦59 per ton for 1968 and 1969 respectively, while the producer prices for cotton were rising from ₦85 to ₦108 per ton for the same two-year period (Hogendoren, 1978.)

As groundnut production faces stiff competition from cotton, so too does foodstuffs production, especially guinea corn which competes with groundnuts for the use of scarce resources. The persistent reduction in major export production since the early 1970's has become a major concern of both the government and the agricultural policy makers in

TABLE VIII

POSSIBLE EXPORT EARNINGS BY 1964, 1974, AND 1980 FROM PRINCIPAL CROPS

Crop	1964			1974			1980		
	Quantity (1000 tons)	Price (₦/Ton)	Value (₦ Million)	Quantity (1000 tons)	Price (₦/Ton)	Value (₦ Million)	Quantity (1000 Tons)	Price (₦/Ton)	Value (₦ Million)
Groundnut	579	122	70.8	535	120	64.2	550	120	66.0
Groundnut-oil	75	196	14.6	176	192	33.6	242	188	45.4
Groundnut-cake	112	66	7.4	120	68	8.2	---	68	---
Sub-Total			92.8			106.0			111.4
Palm Oil	130	154	20.2	170	150	25.4	350	130	45.6
Palm Kernels	396	106	41.8	95	94	9.0	135	92	12.4
Palm Kernel-oil	---	---	---	137	176	24.2	137	172	23.6
Palm Kernel-cake	---	---	---	140	56	7.8	140	56	7.8
Sub-Total			62.0			66.4			89.4
Cocoa	186	390	72.4	325	360	117.0	425	360	153.0
Rubber	68	354	24.0	120	308	37.0	220	252	55.4
Sub-Total			96.4			154.0			208.4
TOTAL			251.2			326.4			409.2

Source: FAO, Agricultural Development in Nigeria, Rome, 1966, p. 29 (₦ = $1.72).

Nigeria. In this regard, various questions regarding past and current agricultural policies have been raised; alternative policy options have been, and still are, being considered to rescue the unhealthy economic situation in the agricultural industry. Some of these options are considered elsewhere in this study.

TABLE IX

EXPORT FIGURES FOR MAJOR AGRICULTURAL COMMODITITES BY COMMODITY BOARDS (METRIC TON)

Commodities	1976 (1)	1977 (2)	1978 (3)	Percentage Change Between (1) & (2)	Percentage Change Between (2) & (3)
Groundnuts	148,200	140,000	NA	- 5.6	NA
Palm Oil	55,000	47,000	NA	-14.7	NA
Palm Kernel	295,000	301,900	239,030.82	2.3	-20.8
Cocoa	200,000	165,000	160,677.13	-17.6	- 2.7
Rubber	NA	NA	117,222	21.4	-35.3

NA--Export figures not available.

Source: CBN Annual Report and Statement of Account, 1978, p. 11, Table 4.

The State of Agriculture in Nigeria

Nigeria has a vast area of arable land in which most tropical crops can be grown. Due to the varied climatic conditions, there is also ample savannah for livestock grazing.

Of the total estimated land area of 231 million acres, 40 percent can be put to agricultural use. Over one half of this potential agricultural land is not utilized (FRN, 1970). In addition, both human and material resources in agriculture are underutilized due to inhibitive land tenure systems as will be discussed in Chapter III.

Studies reveal that about 70 percent of Nigerians are employed in agriculture. Agriculture also provided over 50 percent of the Gross Domestic Product prior to the launching of the Second Plan. Studies show that such commercial agricultural development that has taken place has been mainly oriented towards the production of agricultural products for export (which has reversed in the last five years). Oluwasanmi (1966) claimed that the engine of growth of the Nigerian economy for years has been an estimated five to six million small farms; plantation schemes have not played a very significant role. Since production by Nigerian farmers is mainly for consumption, it is not surprising that most of the investment in research and in infrastructure have been geared towards the production of food crops. This effort has tightened the foreign exchange needed for imports of producer and consumer goods for the development of the whole economy.

For the past decade, export production was generally left to develop on its own. A study by Okurume (1959), sponsored by CSNRD, showed that in spite of this neglect brought about by the government's

policy of focusing on the expansion of manufacturing and oil exploration sectors, cash crop output expanded less than that of manufacturing and oil production.

On the issue of domestic foods, both traditional staple food as well as nutritionally superior foods, CSNRD findings indicated that the major constraint on their expansion was the lack of effective per capita demand (purchasing power). The report pointed out that there were spurts of rapid growth in the production of nutritionally superior food industries, such as poultry, pork, and cattle in the early 1960's, but that low levels of income effectively limited expansion of domestic food crops and prevented them from appreciably influencing the overall value of the Gross National Product contributed by the agricultural sector (Johnson, et.al., 1969). Effective demand constraint, the report asserted, has major implications for agricultural planning.

Problems with Domestic and Export Production

The major recommendation of CSNRD was that Nigeria should concentrate on opportunities not previously exploited to expand agricultural production and export earnings by more fully meeting international demands for her export commodities. This recommendation is appropriate realizing that, until 1966, agricultural exports comprised between 52 to 86 percent of total exports and provided the bulk of the foreign exchange for Nigeria. Besides, considerable revenue accrued to both Federal and regional governments from taxes on agricultural export commondities.

Nigeria's export commoditites are diversified. The country is, therefore, lucky as it does not have to rely on one crop. However, the crops produced are sold in world markets at competitive prices and substitutes are being devised for some, like synthetic rubber.

The export commodities are produced under a system of land tenure as complex and diversified as the products themselves. Land is usually jointly owned by families or communities. Transfer is by inheritance and, except in urban areas, sale of land is an anathema. There is rigid immobility of farmers (except for hired workers), for once out of his place of birth a farmer is regarded as a stranger in his new environment and may not be allowed to plant permanent cash crops. In areas of high population density, such as in the Eastern States, the tenure system is claimed to be causing land fractionalization into uneconomic units.

Although much has been written about the constraints of communal land tenure practices on agricultural development, the fact that export crops have been declining and continue to decline in Nigeria led the CSNRD team to the conclusion that communal tenure is now a great threat to agricultural development in Nigeria.

Government Programs and Agricultural Planning

According to Waterston (1966), planning is a conscious and continual attempt to select the best available alternatives to achieve specific goals--the economizing of scarce resources. Planning is now widely believed to offer the means for overcoming obstacles to development and for ensuring systematic economic growth at high sustained rates. Indeed, only the United States of America and the Federal Republic of

Germany, among the more industrially advanced countries, have not formerly engaged in national development planning (Waterston, 1968).

How well development planning has helped in achieving economic development goals is another issue. Nigeria has accepted the concept of development planning and has had four plans since independence. This chapter will attempt to appraise the development planning of one of the high priority sectors of the Nigerian economy--the agricutural sector. This sector is of primary concern because in Nigeria, as in most other developing countries, there is a close relationship between agricultural policy and general economic growth.

Research in Agricultural Planning

The analysis of relevant facts and resources is essential to the process of agricultural planning. A prerequisite to this process is the availability of reliable information or statistical data. Available data on Nigeria's subsistence production are not too reliable; the chances are that the data are based largely on subjective judgements of officers. Up-to-date data are essential to agricultural planning because they are necessary for computation of targets to be attained and for the computation of such parameters as demand functions and income elasticities which are needed to project demand for agricultural products. It is necessary, therefore, to develop techniques for collecting current agricultural statistics which, in developed countries, are often available through modern techniques of sampling and objective enumeration.

Morojele (1967) has listed the basic and current agricultural statistics necessary for the above exercises. The former are usually

collected at long intervals by means of sample or complete enumeration of agricultural census; the latter are collected annually or at shorter intervals. The important data warrant a full listing. The basic agricultural statistics are as follows:

- Agricultural Holding, Holder, Tenure and Type of Holding--number, fragmentation and area of holdings, by tenure and size of holdings.
- Holder by age, class, legal status of holder by size of holding.
- Land Utilization--number and area of holdings by size and land utilization.
- Livestock and Poultry--number of livestock by age, sex and purpose.
- Employment in Agriculture--number of persons employed on holding by age and sex.
- Farm Population--members of the holder's household and other persons living on the holding by sex and age.
- Irrigation and Drainage--number of holdings with irrigation and drainage facilities, area irrigated and area provided with drainage facilities.
- Agricultural Power and Machinery and General Transport Facilities--use and source of power on holdings, stationary power-producing machinery, tractors, farm implements, etc.
- Fertilizers and Soil Dressings--area treated with fertilizers and soil dressings, amount applied by size of holding.
- Wood and Fishery Products--number of holdings reporting wood products and quantity produced; number of holdings reporting fishery output, source and quantities produced by size of holding.
- Association of Agricultural Holdings with other Industries--number of holdings reporting intergration with type of industry (Morojele, 1967, p. 26).

Current agricultural statistics are:

- Crops--area sown and harvested, yield and production; number of trees (and crops) of productive age, yield and production.
- Livestock--number of livestock by age and sex; production of meat, milk and other livestock products.
- Prices--prices received by farmers and prices paid by farmers for farm requisites and consumption.
- Forestry and Fisheries--volume of round wood removals, and number and output of fish hatcheries (Morojele, 1967, p. 26).

From the above list it is clear that much needs to be done to acquire more and better data in Nigeria; otherwise, according to Turnham (1971), there will continue to be a large gap between what the problems appear to be and what is actually known about them, so that much time and money is wasted in preparing plans and implementing programs without a clear idea of what is involved.

The widespread and uneven distribution of rainfall throughout the year (drought of 1973 to 1974 as an example) is another characteristic feature of Nigeria's agricultural sector worthy of note. While there is too much rainfall in the southernmost parts of the country causing excessive erosion of fertile, thin upper layers of the soil, and making bush clearing a tedious job, there is hardly enough rainfall in the northernmost parts of the country to sustain any but the poorest weeds and grasses.

Farmers' Education and Extension Services

Nigerian farmers are, in the main, illiterate. In the past there has been great ado about African farmers' illiteracy generally and Nigerian farmers are not an exception. It was assumed that the farmers are lazy and do not respond to economic opportunities. Dumont even proposed that irrigation projects as expensive as Nigerian office types would not be turned over to ignorant and lazy African peasants (Dumont, 1966). As long as peasants remain uneducated, they often present the most frightening inertia to all forms of progress (Dumont, 1966). The degree of response of African farmers to economic opportunities is very relevant to economic development and such knowledge is vital to planners. Fortunately, subsequent studies of African farmers have

proved Dumont and followers' claims to be based mainly on conjecture. Schultz et al. (1960) studies show that African farmers, given the opportunities available to them, do indeed respond favorably to economic opportunities. Nevertheless, Nigeria's agricultural sector is still characterized by a high illiteracy rate, poor health conditions, and poor access to markets.

The problem of education necessary for agricultural development however, is not limited to farmers alone. Lack of well trained personnel and administrative skills have hampered implementation of projects--agricultural and non-agricultrual (FDA, 1981).

The Nigerian farmer then may be hardworking but he faces a tremendous impediment--the inability to obtain credit to purchase inputs. This is true whether he is a subsistence farmer or producing for export. In the past, farmers had to rely on their own meager financial resources. Where this is not available, they may borrow from relatives or in extreme cases from local money lenders who charge exorbitant interest. The farmers have been highly discriminated against by commercial banks because they rarely have collateral for securities against loans.

Possible Planning Approaches

These problems were laid bare to the architects of the Second Plan, who chose as a goal a better life for the rural farmers in particular and the whole of the country in general. The major task for the planners, however, is what strategy should be adopted to achieve this goal.

Static and Dynamic Agricultural Sectors

The agricultural sector can be divided into two subsectors: the export crop sector embracing plantation workers and some five to six million farmers and, the subsistence farmers which comprises the majority of farmers. The export crop subsector can be designated as the "dynamic sector" since it supplies the foreign exchange needed in Nigeria, and the other subsector of subsistence farmers as the "static sector". Forgetting the industrial sector momentarily, a widening gap can be noticed between the dynamic and the static sectors.

Dynamic Sector Approach

One possible policy approach to the development of Nigeria's agriculture might be the concentration of available national resources and assistance on the dynamic sector. Incidentally, this sector has received more attention in the past, but is gradually losing momentum at present.

The likely effect of such a policy, all things being equal, would be a rapid growth in output of export commodities and of the gross national product. Export earnings would be higher and the income level of the farmers in this sector might be raised. However, such a policy would help to widen the already very evident income gap between the two subsectors. The government's intention is to narrow the gap.

Concentration on the dynamic sector was the recommendation of the CSNRD (in the short run) in the hope that such a policy would enable Nigeria to expand her agricultural production and export earnings by more fully meeting international demands for her export commodities (Johnson, 1969). The increased income, the report added, can eventually

be redistributed over a large number of rural people to provide the means of financing the expansion in production (Johnson, 1969).

This recommendation is very much in line with the classical theory of international trade and also is in line with the policy followed from colonial days. However, while there had been growth in trade, there had been little or no development in the agricultural sector. The growth in export has not been carried over to the other sectors in a significant manner.

There are many other problems to be taken into consideration in adopting this policy measure. Nigeria has experienced instability of export prices and earnings due mainly to low price elasticities on both world demand and domestic supply. This is an accepted characteristic of trade in primary export commodities. Apart from the problem of low real income elasticity of final demand for this group of exports, other products such as rubber and hides and skins have also had to face competition from synthetics.

Another factor of great importance is the lack of spread effect from our primary export trade. Adam Smith's specialization theory would lead to continuous improvement in skills, but the specialization on primary production has not had this effectin Nigeria. Writing about palm oil and groundnut production and exports of West Africa, McPhee (1926) stated that these commodities made little demand on the energy and thoughts of the natives and they effected no revolution in the society of West Africa.

A policy to expand exports should also take into consideration the fact that Nigeria is not the only producer of specific commodities. A look at Tables III and X shows that, out of the seven major export

TABLE X

NIGERIA'S EXPORTS OF PRIMARY AGRICULTURAL COMMODITIES
AS A SHARE OF WORLD EXPORTS (1000 TONS)

Commodities	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Cocoa Beans Raw or Roasted												
World	1,301	1,128	1,094	1,062	958	1,135	1,520	1,591	1,426	1,450	1,427	1,428
Nigeria	306	193	248	209	174	195	196	272	228	214	371	272
Percentage Share	23	17	23	20	18	17	12	17	16	15	25	19
Groundnuts: Total, Green, Shelled Basis												
World	1,367	1,507	1,493	1,573	1,280	980	1,927	1,621	1,802	1,965	1,984	1,880
Nigeria	520	582	549	648	525	291	286	559	70	230	100	12
Percentage Share	38	39	37	41	41	30	15	35	4	12	5	.6
Groundnut Oil												
World	4,099	4,515	4,223	5,131	3,832	4,331	3,598	5,246	5,007	3,732	3,988	6,200
Nigeria	922	1,055	722	1,109	994	903	430	396	107	234	2.7	---
Percentage Share	22	23	17	22	26	21	12	8	2.1	6.3	.1	0
Rubber												
World	2,828	2,933	3,062	3,424	3,810	3,748	3,085	3,120	3,505	3,445	3,315	3,565
Nigeria	69	71	48	53	57	59	61	76	81	91	72	80
Percentage Share	2	2	2	2	2	2	2	2.4	2.3	2.6	2.2	2.3

TABLE X (Continued)

Commodities	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Palm Nuts and Kernels												
World	6,698	6,280	3,814	4,402	4,267	4,842	4,907	4,071	3,154	3,829	3,390	4,248
Nigeria	4,222	4,003	1,651	1,616	1,790	1,853	2,416	2,122	1,375	1,856	1,733	2,720
Percentage Share	63	64	43	37	42	38	49	52	43.6	48.5	51	64
Palm Oil												
World	6,181	7,050	5,797	5,718	8,184	9,573	1,244	1,404	1,533	1,704	2,046	2,733
Nigeria	1,524	1,455	167	34	81	404	33	20	14	26	41	40
Percentage Share	25	21	3	1	1	4	2.6	1.4	.9	1.5	2	1.5

Source: FAO, Trade Year Book, Vol. 25, 1971.
CBN, Economic and Financial Review, 1976 - 1978.
FAO, Monthly Bulletin of Agricultural Economics and Statistics, Vol. 23 - 26, 1974 - 1975.
FAO, Monthly Bulletin of Statistics, Vol. 1 - 3, 1978 - 1980.

crops, Nigeria may be able, in theory, to influence only the price of palm nuts and kernels. Before the civil war in 1967, Nigeria's share of the world's total exports of palm nuts and kernels was over sixty percent. The reduction in Nigeria's exports during the civil war years, 1967-1970, reduced total world exports. This is not the case with palm oil where total exports rose by 55 percent between 1965 and 1970 as Nigeria's share dropped from 21 percent in 1966 to four percent in 1970 (Olayide, 1972).

These tables suggest that Nigeria faces rather elastic external demands for her exports. There is little chance of Nigeria exploiting a monopoly position in the supply of the various primary commodities she produces.

Gusten (1966, p. 25) in appraising Sudan's agricultural planning noted that "the feasibility of an expansionist policy (of cotton production) bears, in fact, an inverse ratio to a country's share in the market." Since Sudan is not the sole seller of cotton he argues, an expansion of production would result in her vying to obtain the market share of other sellers. Any quantity over and above her share would be sold at a reduced price.

Through increased output, Nigeria may increase her share of export, but not necessarily her revenue. Nigeria's primary export trade comes closest to perfect competition only at the firm level. If the simplistic assumption is made that Nigeria alone expands production and that the import demand of consuming countries does not change, she may export more--but at lower prices. Increased production, all things being equal, has often led to depressed prices in world markets. Since Nigeria is a price taker, the reduction in the prices of her exports may

not increase revenue enough to compensate for the increased cost of expanding production. But, job creation for the natives coupled with a sound economic base for the local peasant farmers is the major concern here. The best that can be expected from our analysis so far is growth in output that enhances development. The effect of such a policy of expansion of output would be the bridging of the income gap between the two sectors without leaving the mass of the rural population in worse condition. Another important consideration is the extent of employment such a policy could generate.

Static Sector Approach

A second policy approach would be to utilize a more sizeable portion of the country's resources for the improvement of the conditions of the millions of Nigerians, most of whom are subsistence farmers and who have the poorest standards of living. Concentration on the static sector will have the effect of mobilizing and more fully utilizing the most plentiful resource which is labor.

Numerous development theorists emphasize the use of labor for development in developing countries. Fuller utilization of labor, they argue, will result in expansion of output of food, a general reduction in food prices, and a reduction in the unemployment rate in the country (Anker, 1973). Another point in support of this argument is that uncultivated land still abounds in the country (FDA, 1966). It was noted earlier that one impediment to agricultural output has been the lack of effective demand. The objective of this policy measure will, therefore, be to bring about a better distribution of income which, in turn, will result in higher purchasing power. Higher purchasing power

will then result in a wider market for the country's consumer goods, creating revenue for the development of domestic industries (Anker, 1973)

However, the problems associated with this kind of policy measure are evident. Nigeria lacks all the grades of manpower resources necessary for the implementation of such a policy. It would also require tremendous institutional changes such as overhead investment in infrastructure, and these take a long time to materialize. The results of such a policy would be long in bearing fruit. Of course, a policy of neglect of the dynamic sector would have far reaching adverse consequences for the health of the economy.

Multi-Phase Planning Approach

A third approach would be a combined attack on the whole agricultural sector--the most difficult choice--but given the ever increasing wealth of the nation it is not too ambitious. If the human and financial resources to embark upon such elaborate planning for the agricultural sector were available, this policy approach would benefit from the "package of inputs" approach. This package approach ensures more effective utilization of surplus resources. It also recognizes that agricultural development will entail returns to farmers for their inputs, the need for a wide variety of inputs--fertilizers, implements, improved seeds, pesticides, livestock feed, water and credit; that progress will require incentives for the farmers by way of fair prices and an appreciation of the farmer's role; the necessity for public investment in roads, schools, research, education for extension workers, rural amenitites; and that agriculture and industry are complementary.

Evidences of Multi-Phase Approach and the Associated Problems

This multi-phase approach was successfully used by Taiwan in her agricultural development planning. According to United States Department of Agriculture reports (USDA, 1968), the agricultural development strategy followed in Taiwan can best be described as an integrated package approach which gives attention to all conditions standing in the way of agricultural progress. While being careful not to succumb to the fallacy of eclecticism, which according to Wolfe is the assumption that countries can borrow freely bits and pieces of policies that are alleged to have been successful in other countries, it is possible to find similarities between Nigerian agricultural problems and those which confronted Taiwan. Also, many economists share Kuznets (1961) views when he said that

> . . . except for a single pioneer nation, all nations participating in modern economic growth view the prospects initially as the task of adopting (and adapting) potentials already demonstrated elsewhere in the world; that no nation can grow in an international vacuum; and that the process of a nation's growth involves a pattern of sequential interrelations with others--more developed and less developed (p. 57).

The package of inputs approach to agricultural development planning has been championed by many writers such as Brown (1965), who propounded the agricultural take-off theory. Rostow defined the take-off stage as characterized by steadily rising yields, with rates of yield a function of:

1. literacy levels,
2. average level of income,
3. market oriented agriculture, and

4. level of development of the non-agricultural supporting sector. Gusten (1966) concluded by stressing that economic planners' desire to increase food output by raising yields is not in itself sufficient as the means to raise yields must also be available.

The important aspects of the package of inputs approach is the determination of all the forces which impede agricultural development coupled with the determination of a package of solutions. The merit of this system is that action in one field will give rise to action in other fields. Expansion in output would require good roads to transport products to the market. Such expansion would also necessitate the availability of adequate storage facilities and so the chain of reactions continues.

The package approach, as noted in Rostow, recognizes that agriculture cannot be planned in isolation, planning in the agricultural sector must simultaneously take into consideration other sectors of the economy. In this way, it is possible for the whole economy to benefit fully from the interchange and the use of scarce resources. But a planning approach of neglect, of export crops for instance, would have a very depressing effect on the income of farmers. So while every effort is made to increase the growth of each individual product, the country should aim to use these crops for the development of an elastic home demand for consumer goods, instead of exporting all output and depressing prices in world markets. A look at Table XI shows that between 1962 and 1972, the country spent between seven and twelve percent of her foreign exchange earnings on food imports, all of which can be produced in the country. By expanding domestic production of import substitution goods and thus reducing demand for imports, the

TABLE XI

VALUE OF IMPORTS (1000 ₦) c.i.f.

Year	(1)	(2) Food and Live Animals		(3) Sugar		(4) Milk and Cream		(5) Wheat and Spelt		
	Total Imports	Value	2 as % of (1)	Value	3 as % of (2)	Value	4 as % of (2)	Value	5 as % of (2)	3,4 and 5 as % of (2)
1962	406,434	46,986	11.56	7,526	16.02	4,586	9.72	3,080	6.56	32.29
1963	415,112	43,804	10.55	7,466	17.04	4,762	10.87	6,874	15.69	43.61
1964	507,760	41,240	8.12	6,732	16.32	5,968	14.47	4,484	10.87	41.67
1965	550,298	46,076	8.37	5,838	12.67	7,266	15.77	6,854	14.88	43.32
1966	512,744	51,568	10.05	5,922	11.48	8,051	15.61	11,436	22.18	49.27
1967	445,600	42,560	9.52	6,716	15.78	7,716	18.13	9,154	21.51	55.42
1968	385,162	28,392	7.37	3,476	12.24	7,646	26.96	6,974	24.56	63.74
1969	497,382	41,732	8.39	7,874	18.87	9,494	22.75	11,772	28.21	69.83
1970	756,420	57,694	7.63	11,410	19.78	14,154	24.53	15,350	26.61	70.92
1971	1,078,906	87,910	8.1	17,929	20.39	21,718	24.70	20,665	23.50	68.60
1972	990,064[1]	95,104	9.61	29,750	22.87	25,596	26.91	22,018	23.15	72.93

Source: Federal Office of Statistics, Nigeria Trade Summary. Lagos, Nigeria, 1976.

[1]Provisional

increase in real income as a result of expansion of export output will be augmented by the favorable effect of the related improvement in terms of trade.

The substitution of imports has yet more significant impact on economic growth. If large amounts of the country's basic requirements have to be imported, the income effect of increases in export earnings is dissipated very quickly. Gusten (1966) argued that to the extent an increasing proportion of the income from export earnings is spent domestically, the induced effects on production and investment are strengthened in such a manner that autonomous investment which still supports economic progress, may slaken off gradually in comparison with investment induced by the progress itself.

Goodman (1969) pointed out that

> the smaller the extent to which the primary products are processed prior to export, the less the demand by exporting industries for non-human, non-capital inputs of animal, vegetable or mineral origin that could be supplied domestically (p. 363).

He therefore suggests more processing of primary exports to eliminate the effect of lack of "backward linkages" and as a means of increasing and diversifying primary exports.

The multi-phase planning should therefore be able to make forecasts to determine which products will produce surpluses and which are doing poorly in world markets so that arrangements can be made to provide the necessary channels for their domestic market development. Increased agricultural product processing should not be a random effort; it should be directed toward the areas of greatest need. The problems of population growth, migration to the industrial sectors and depressed

farm income would definitely be addressed by a successful planning using the muti-phase "package of solutions" approach.

Education which involves the development of skills would increase productivity. Fewer farmers would eventually be needed to produce the food requirements of the country, given the necessary inputs and environment, and necessary incentives.

A planning approach, therefore, should anticipate these problems, determine their magnitude, and devise solutions. One possible suggestion to determine the degree of likely surplus farm labor population and of the achievement of rural planning would be the establishment of what can be considered a "viable farm" size.

What would be the size and nature of an average farm, a "viable farm", given a reasonable level of management and the necessary inputs and incentives, which could provide a farm family, working full time, a certain target income, which would bear a reasonable relationship to incomes in other sectors? Such farms should be used as terms of reference to determine to what extent the income objective is fulfilled. From an estimate of production from such farms and a projection of the food requirements of the country, it would also be possible to estimate, roughly, the magnitude of unemployment in the agricultural sector which the industrial sector would be expected to absorb.

The multi-phase approach to agricultural planning can be summarized as involving a comprehensive identification of the factors constraining agricultural development and developing a package of solutions for them. The objectives of this multi-phase planning policy would be the fuller employment of labor, which is the country's major resource, a higher development of skills, a greater use of the country's natural resources

as factor inputs, increased import substitution programs, increased processing improvement in terms of trade, the widening of the country's market for consumer goods as a basis for the development of domestic industry, more equitable distribution of income, and consequently, higher purchasing power for the rural people.

Main Features of Nigeria's National Development Plans as They Relate to Agriculture

The First National Development Plan (1962 - 1968)

The first national development plan (1962-1968) came into effect at the time of Nigeria's adverse trade balance. It should be recalled that, in addition to the unstable prices of Nigerian agricultural exports on the world market, among other things, the country passed through a ten-year period (1955-1965) of adverse trade balances (Table III). Nigeria's revenue from exports of her traditional commodities during the period of the First National Development Plan was very small in relation to revenue in other plan periods. From the oil sector, revenue as well as foreign exchange earnings was not even large enough for investment and importation of both consumer and development goods. The net result, therefore, was that it was difficult for the country to finance major development projects and also pay for the importation of certain consumer goods to supplement the shortage in local production; hence Nigeria has relied on foreign aid instead of trade surplus for her development.

The First Plan (1962-1968) did not spell out any agricultural policy in spite of the fact that agriculture was one of the three priority areas. Only the regional governments made priorities for investment in this sector. It has been suggested that the reason for this glaring neglect was that no feasibility studies of any major agricultural project were completed prior to the launching of the plan in 1962 (Eicher, 1970). This is not the case, however, with the Second Plan.

Before the Second Plan was launched in 1970, the government had at its disposal copious volumes of research findings and recommendations for developing Nigeria's agriculture, including that by the Consortium for the Study of Nigeria's Rural Development (CSNRD) Strategies and Policies for Nigerian Rural Development in the 1970's. The government also had ample time to make feasibility studies and determine strategies for developing the agricultural sector. It is stated that analysis of earlier developments is an important part of planning and that earlier development should be the starting point of development to be realized in a later period (Kuznets, 1961).

The Second National Development Plan (1970 - 1974)

As did the First Plan, the Second Plan considers the agricultural sector as a priority sector. However, the priority ranking, judged by the amount of financial resources allocated to this sector, declined from first in the First Plan to third in the Second Plan--from 13.6 percent of plan expenditures to 10.5 percent. In the Second Plan, the agricultural sector followed transport and education with 23.7 and 13.7

percent of plan expenditures, respectively. Agricultural output was projected to expand at an annual rate of 2.8 percent. The general agricultural policies of the Federal Government aimed at:

a. increasing food production to keep pace with population growth;
b. expansion of export crops;
c. propagation of production of agricultural materials for extensive domestic manufacturing activities, especially in the field of agro-based industris;
d. creating rural employment opportunities to absorb more of the increased labor force, and minimizing the tendency for inadequate and inefficient use of human resources in the rural areas generally; and,
e. evolving appropriate institutional and administrative appparatus to facilitate the smooth integrated development of the agricultural potential of the country as a whole (FRN, 1970).

Accordingly, the $123.4 million in Federal government capital expenditures in the agricultural sector was distributed as shown in Table XII. The planners attributed the low production of food crops to drudgery and crude tools. To improve the situation, the planners examined the use of improved tools, research into better seeds, storage, organized marketing, fertilizer supply, subsidies, and the application of pesticides.

TABLE XII

ALLOCATION OF FUNDS TO THE AGRICULTURAL SECTOR DURING NIGERIA'S SECOND NATIONAL DEVELOPMENT PLAN

Research Funds Designation	$ million
Research on food crops	4.572
Research on export crops	8.752
Research on crops for local industries (sugarcane)	.524
Metrological service	1.892
Agricultural credit	24.000
Agricultural grants to research councils and institutes	3.600
Federal assistance to agriculture	68.000
Special agricultural schemes	12.000
Total	123.340

Source: Federal Ministry of Information, The Second National Development Plan, Lagoa, Nigeria, 1970.

The Third National Development Plan (1975 - 1980)

This plan, like the previous plans, recognized the importance of agriculture and related activities as the mainstay of Nigeria's economy. The plan emphasized agriculture's contribution to employment, availability of food, integrated industrial development, and foreign trade, and proposed to achieve a rate of growth that would guarantee the effectiveness of these contributions within the framework of sustained economic growth as contained in the crop subsector of the Fourth Plan.

Taylor (1981) emphasized the main theme of the Third Plan as the integration of the major production constraints viz. manpower, agricultural inputs, extension services, feeder roads and transport facilities, farm credit and marketing facilities, land tenure systems, diseases and pest control, and rural and seasonal labor shortages. The reports of a workshop organized by the Federal Department of Agriculture in 1979 on The Crop Subsector in the Fourth National Development Plan 1981-1985 stated the policy and objectives of the Third National Development Plan (1975-1980) as:

1. Increase food supplies in terms of quantity and quality commensurate with population growth and distribution;
2. Expansion and diversification of the production of export crops;
3. Increased production of agricutural raw materials and integrated agro-industrial development;
4. Increased utilization of human resources, especially in rural areas; and,
5. Integrated development of the country's agricultural potential through administrative and institutional frameworks (p. 11).

The Fourth National Development Plan (1981 - 1985)

A comprehensive review of the achievements of the third plan shows that the agricultural production constraints which existed at the beginning of the 1975-1980 plan period have remained virtually unchanged, although some progress has been made, especially in the areas of agricultural input supplies, integrated development, land ownership, generation and application of packages of improved technology, disease and pest control, and labor devices (Taylor, 1981). Other important areas such as manpower, extension and supporting services, poor feeder roads and transport facilities still serve as impediments to

agricultural improvement. Therefore, the proceedings of the workshop organized by the Federal Department of Agriculture in 1981 recommended the following for the Fourth Plan:

- That substantial efforts be made to strengthen the National Accelerated Food Production Programme (NAFPP) and to establish for it a greater network of collaboration that would ensure its impact on food production throughout the country;
- Adequate provisions for the establishment of a network of functional agro-service centers in each state of the Federation;
- Improvement for the procurement and timely distribution of agricultural inputs (fertilizers, pesticides, seeds, etc.);
- Greater emphasis placed on the "small scale farmers" as the focus of increased food production than on Government Food Production Companies;
- That the National Grain and Root Crop Production Companies should focus more attention on storage, processing, distribution and marketing;
- That greater emphasis be placed on integrated rural development projects as a means of developing the agricultural potential of the rural communities; and
- That research and extension services be strengthened in the fourth plan (FDA, 1981, p. 11).

Chapter Summary and Conclusions

Agriculture has been the mainstay of Nigeria's economy providing employment for about 70 percent of the nation. It has contributed a sizeable portion of the country's Gross Domestic Product. Nigeria has abundant human resources and is blessed with varying climatic conditions which account for a diverse agricultural base.

Lack of data, among other things, has hindered effective planning, and the Nigerian government's current agricultural policies have been shown to favor food crops which have received substantial resource allocation in recent years, as illustrated in Table XII. Table IX suggests that the production of export crops has been largely neglected and their supply has dropped far below expectations.

In spite of the importance of agriculture to the country, Federal Department of Agriculture reports show the agricultural sector has remained backward--the farmers are among the poorest of Nigerians with poor sanitation, and poor diets. A great majority of them are illiterates. Growth in export crops has not brought much relief to the conditions of these farmers who, it is generally agreed, are hard working and respond favorably to economic incentives. Many factors have impeded agricultural development, including a paucity of data, shortage of human resources, and ill-conceived development plans.

One possible approach to agricultural planning to bring better living standards to the farmers in Nigeria would be to increase resource allocation for the development and output of export crops. The argument against this strategy is that development within this sector has, in practice, not rubbed off sufficiently on the static sector.

Another possible approach would be to intensify efforts to improve the lot of the majority of rural people, most of whom are subsistence farmers, without necessarily hindering the simultaneous development of the export crops sector. This policy, it was asserted, would be more difficult to enact since it would entail considerable human, material, and financial resources, while neglecting an important source of income for farmers in the dynamic sector as well as the importance of the foreign exchange earnings from the same sector.

A third approach, and the most difficult one yet, would be a multi-phase "package of inputs" method. With this approach, all the factors that stand in the way of agricultural development would be analyzed and a package of solutions found for them. This method fully recognizes and integrates the non-agricultural sector in its planning exercise since

agriculture cannot develop in isolation. It is believed that agricultural development would be accelerated by a progressive non-agricultural growth. The multi-phase approach should seek to devote attention to such activities as will improve the skills of the farmers, make use of more factor combinations, and lead to the creation of domestic demand for both consumer and producer goods. There should be import substitution programs and increased processing of primary export crops. No production development should be implemented unless a worthwhile market exists. Research into hybrid seeds should also be continued. As a point of reference from which to measure the degree of achievement of rural income objectives and to determine the magnitude of excess farm labor, it would be necessary to determine what would be considered a "viable farm".

Only such a multi-phase package approach will launch the country into an era of sustained growth in productivity and subsequently in the improvement of real income. The authors of the Second Plan had at their disposal volumes of studies and recommendations for the development of the agricultural sector. What emerged, however, were mere expressions of aspirations and lists of projects. The plan is macro-economic in approach to the neglect of precise and detailed knowledge of a micro-economic character. Promises of better life for all--including the farmers--are still far from becoming a reality.

It is suggested that more realistic planning of the agricultural sector would require a bigger role by a larger staff of the Planning Office. Nigerian agricultural economy does not easily respond to such forms of indicative planning (as used by the French) whereby forecasts

are made and indications of what planners consider feasible are given. The economy is not mature enough to support this approach.

Another problem with planning in general is the often complete neglect of plan targets or goals in formulating annual budgets. One would expect that the preparation of annual budgets would include the review of development plans. Annual budget adjustments could be made to development plans in the light of unexpected new circumstances and to account for performance defects.

CHAPTER III

THE IMPACT OF MARKETING AND LAND TENURE SYSTEMS ON NIGERIA'S AGRICULTURAL PRODUCTIVITY

The erratic nature of the fluctuations and a continuing decline in agricultural productivity in Nigeria for the past fifteen years (1964-1979) has led many Nigerian agricultural policy makers and researchers to believe that the Nigerian Agricultural Marketing Boards have completed their terms of office.

If export crops are important to the overall economic development of Nigeria, any effort to examine the country's past performance and future prospects must take into consideration the role of export crops in Nigeria's national economic development. An examination of past trends can serve two purposes :

a. to isolate the problems connected with export crops, and
b. to serve as a lesson for future efforts (Olayide and Olatunbosun, 1975).

Therefore, a study of past trends is not undertaken for its own sake, but as a means of isolating the problems of the past which need to be tackled in order to enhance future progress.

Introduction

In order to appreciate the problems of the agricultural marketing

arrangements in Nigeria, a short history of Nigerian Marketing Boards Systems is appropriate. The West African Marketing Boards had their origins in war-time arrangements for the orderly marketing of West African produce and the protection of the United Kingdom's supply of raw materials (Helleiner, 1966). After the war, however, the Marketing Boards assumed further responsibilities for the stabilization of producer prices, development of the agricultural export sector, and stabilization of producers' incomes. At their inception, these Marketing Boards acted as trading agents established by various governments of West Africa to control the purchase and sale of agricultural products and, in some countries, processed agricultural commodities as well. The golden age of Nigerian Commodity Marketing Boards was the period from 1947 to 1954, when they accumulated large surpluses. Over $882 million was realized as profits during the 1947-1954 period (Abbott, 1971). It later became obvious that between 40 and 60 percent of potential producers' incomes were withheld as export taxes (Table XIII).

Before the reorganization of the Marketing Boards, a sizeable part of the Marketing Boards' reserves were set aside for stabilization reserves in the form of United Kingdom and Commonwealth securities, the proceeds of which were spent on research and economic development. Many other research institutions, development corporations, purchases of equity, and loans to private companies took a larger part of the Board's reserves on trading surpluses. It was then observed by some economists that the greatest beneficiaries of the reserve program were the regional governments. They made loans to private companies, invested in private

TABLE XIII

NIGERIA: SUPPLY, DEMAND AND PRICES OF COCOA

SEASON	Production (1000 tons) (1)	Local Grindings (1000 tons) (2)	Export Availability (1)-(2) (3)	Producer Prices (₦/ton) (4)	Average fob sales prices (₦/ton) (5)	Producer Price as percentage of fob price (6)
1966/67	267	--	267	169	380	45
1967/68	238	23	215	179	417	43
1968/69	189	26	163	189	502	38
1969/70	222	23	199	288	593	49
1970/71	304	24	280	297	447	67
1971/72	254	25	229	297	364	82
1972/73	241	28	223	297	496	60
1973/74	211	28	183	294/443[3]	856	46/52
1974/75	213	28	185	660	966	68
1975/76	215	22	203	660	n.a.	--
1976/77	210	30	180	660	n.a.	--

Sources: (1) Nigerian Produce Marketing Company, Lagos, Nigeria, 1977.
(2) Gill and Duffus, Cocoa Market Report. London, 1977.

n.a. = not available
1 = Delivery to local processing industries
2 = Taxes have been deducted where applicable
3 = The original price for the season was ₦394/ton; this was increased to ₦443/ton from April 5, 1974 following the abolition of export duty on export crops.

companies and financed regional political campaign expenses (Helleiner, 1966).

Disappointment over the misuse of some of the Marketing Board's accumulated funds invariably jeopardized the success of the Marketing Boards (Gill and Duffus, 1966). Therefore, the following can be annotated as the major difficiencies of the Nigerian Produce Marketing Boards:

a. inability of the Marketing Boards to stabilize producers' incomes which resulted in the cobweb effect on the production of commercial export products (Table XIV);
b. inability of the Marketing Boards to stabilize producers' prices which led to a decline in productivity. The Marketing Boards were able to stabilize producer prices within seasons, but not between seasons (Table XIII);
c. misuse of the Marketing Board's trade surpluses; and
d. the Marketing Board's activity as a tax collecting agency for the regional governments (Abbott, 1971).

All-in-all, it could be hypothesized that the Marketing Boards failed in their pursuit of producer income stabilization.

Before the current Federal Military Government's proposals for reform of the Marketing Boards, many economists had the following reservations with respect to Nigerian Produce Marketing Company activities (Olayide and Olatunbosun, 1975):

a. the extent of supply elasticity with respect to prices on the part of the peasant producers (Table XIII, 1973-77);
b. the uses to which marginal increases in peasant incomes are put.

TABLE XIV

MARKETING BOARD PRODUCE SEASONAL PURCHASES (IN METRIC TONS)

COMMODITY	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75
COCOA	184,639	267,231	238,799	191,835	222,977	307,296	256,700	241,299	215,217	215,469
GROUNDNUTS	993,834	1,042,958	694,728	775,663	655,772	285,772	306,050	559,075	44,039	162,606
PALM KERNELS	424,918	223,336	211,130	177,168	190,154	274,932	275,981	231,289	305,937	278,116
PALM OIL	130,943	32,592	4,842	13,842	25,439	33,828	20,326	13,897	25,686	40,906
BENNISEED	23,612	16,180	13,472	13,223	17,740	5,806	3,227	3,656	3,131	4,298
SOYABEANS	18,883	15,340	8,825	4,613	10,897	4,723	907	2,003	872	1,534
SEEDCOTTON	128,775	150,148	80,439	179,088	260,212	114,616	110,900	143,497	86,110	140,026
COFFEE	1,966	306	144	3,077	1,460	3,013	1,369	963	47	2,780
COPRA	1,839	311	(x)	(x)	(x)	1	8	13	5	(a)
TOTAL	1,909,409	1,748,402	1,252,103	1,358,509	1,384,651	1,030,669	975,468	1,195,692	681,144	845,735

Source: Statistics Section, Sales Promotion and Market Research Division, Nigerian Produce Marketing Company Limited, 72 Campbell Street, Lagos.

(x) Copra is obtained from River State only and no purchases could be made during the Nigerian Civil War.

(a) No exportable surplus.

Nigerian agricultural market organization is characterized by inefficient distribution between production and consumption. There are numerous middlemen and retailers with small working capital. Producers are many, but scattered, and as they are not yet organized into cooperative societies, they possess very little bargaining power. There are two main elements of marketing inefficiencies as can be observed in Nigeria (FDA, 1981):

1. There is a general consensus that a large proportion of the crops produced in Nigeria are lost due to inadequate marketing facilities. This estimated loss may amount to 10 - 35 percent of the total annual production.
2. The numerous intermediaries in the marketing system also create situations in which farmers receive a low proportion of producer income. This low farm price, lack of facilities, coupled with a complete absence of infrastructures in the rural farming areas, encourages the exodus of young people from agricultural and rural areas in favor of non-agricultural, urban employment.

There is a consensus among agricultural policy makers and agricultural economists that inconsistent marketing arrangements for agricultural commodities, coupled with poor pricing policies for Nigeria's agricultural export commodities, have accounted for the decline in agricultural production in Nigeria.

Tables V and VII suggest that farmers are paid on the average, 45 percent of the Free on Board prices of agricultural products, the difference of 55 percent remains with the marketing agents and the commodity boards. This made investment in export commodities,

especially groundnuts, unprofitable. The absolute lack of incentives in the agricultural sector, poor roads and lack of other infrastructural amenities, coupled with the fact that farmers could not pay for their cost of production, dampened the farmers' interest in export production.

The Marketing Board's purchases of the major export crops have been declining steadily over the years except for palm kernels, which have been relatively stable (Tables XIV and XV). Groundnut production and exports have shown a dramatic decrease since 1970. In the period 1950 to the 1966/1967 crop year, Nigeria was the second largest producer of groundnuts and was the number one exporter of groundnut oil. It has been alleged, as reflected in Tables XVI and XVII, that the disparity between export prices and producer prices was the dominating factor that dampened famers' interest in export production in Nigeria. Since the Nigerian Marketing Boards have failed to stabilize producer prices, the Nigerian Government took a bold step in 1976 to reorganize the marketing boards into commodity boards.

Current Commodity Marketing Systems

Following the report of the special task force set up by the Federal Military Government of Nigeria in 1976, the Federal Government issued a "Commodity Boards Decree of 1977". The report analyzed the past activities and functions of the former Nigerian Produce Marketing Company and recommended instead, seven Commodity Boards effective April, 1977. The Federal Government (Laws of the Federal Government of Nigeria, 1977) felt that:

a. Economies of scale will be achieved under the new system since fewer commodity boards will operate instead of 19 (one for each

TABLE XV

MARKETING BOARD PRODUCE EXPORTS (IN METRIC TONS)

YEAR	COCOA	GROUNDNUTS	PALM KERNELS	COTTONSEED	COTTONLINT
1966	181,315	588,457	371,380	64,644	24,212
1967	249,390	508,987	151,468	65,580	31,159
1968	211,130	638,578	160,758	26,673	13,582
1969	177,168	479,995	186,431	40,511	16,145
1970	190,154	244,562	182,026	104,008	28,692
1971	274,932	177,249	247,844	99,066	22,833
1972	207,151	92,466	220,357	44,748	989
1973	218,724	163,889	141,257	6,916	8,213
1974	177,156	26,765	179,156	34,741	--
1975	177,989	--	179,529	--	--

Source: Statistics Section, Sales Promotion and Market Research Division Nigerian Produce Marketing Company Limited, 72 Campbell Street, Lagos, 1977.

TABLE XVI

PRODUCER PRICES OF MARKETING BOARDS' PRODUCE PER METRIC TON (₦)

Produce	1965/66 crop	1966/67 crop	1967/68 crop	1968/69 crop	1969/70 crop	1970/71 crop	1971/72 crop	1972/73 crop	1973/74 crop	1974/75 crop	1975/76 crop
Cocoa Grd. I	132.00	182.00	194.00	204.00	305.00	305.00	315.00	315.00	457.00	550.00	66.00
Groundnuts	89.00	89.00	78.00	53.00	64.00	69.00	69.00	82.00	96.00	165.00	250.00
Seedcotton Grd. I	100.00	96.00	90.00	117.00	117.00	117.00	123.00	137.00	137.00	201.60	308.00
Palm Kernels	58.00	58.00	58.00	61.00	61.00	65.00	65.00	66.00	134.00	150.00	150.00

Source: Statistics Section, Sales Promotion and Market Research Division, Nigerian Produce Marketing Company Limited, 72 Campbell Street, Lagos, 1977.

TABLE XVII

AVERAGE F.O.B. PRICES PER TON FOR SELECTED PRODUCE (₦)

Produce	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75
Cocoa	237.52	385.52	424.29	509.88	603.87	454.87	369.93	484.82	831.80	969.69
Groundnuts	126.64	116.72	105.05	122.17	131.95	149.21	156.69	229.53	----	----
Cottonseed	51.99	53.73	47.22	37.85	51.42	49.68	48.55	104.39	112.62	----
Cottonlint (a)	399.40d	406.94d	412.60d	352.50d	306.95d	----	24.65k	30-8k	----	----
Palm Kernels	104.23	102.12	111.86	98.17	105.24	88.17	60.33	161.08	256.31	99.46

Source: Statistics Section, Sales Promotion and Market Research Division, Nigerian Produce Marketing Company Limited, 72 Campbell Street, Lagos, 1977.

(a) Average Free on Board (F.O.B.) price per pound,
d: Old Sterling pence or,
k: Nigerian Kobo.

state) as was formerly the case.

b. Specialization will be an added advantage since each board will be responsible for one or two commodities as opposed to the old system where the central marketing board handled the sales, marketing and production development of all export crops.

c. Federal Government owned commodity boards will foster national unity as board operations will cut across state boundaries.

The seven new commodity boards are:

1. Cocoa Board, which handles cocoa and coffee;
2. Groundnut Board, which handles groundnuts (peanuts), soybeans, benniseeds, sheanuts and ginger;
3. Cotton Board to handle cotton, kenaf and similar fibres;
4. Palm Produce Board to deal with palm produce and copra;
5. Rubber Board to deal with rubber;
6. Grains Board to handle all grain crops; and,
7. Root Crops Board to handle tubers and root crops (Laws of the Federal Government of Nigeria, 1977).

Each Board will have a chairman and other members including one representative each from the State Government in the major producing areas, the Central Bank, the Ministry of Agriculture and Rural Development, and the Ministry of Co-operatives and Supply and Trade.

Functions of the Commodity Boards

The Functions of the Commodity Boards as outlined by the Laws of the Federal Government of Nigeria (1977) are:

1. to establish buying centers in all major producing areas for all commodities under their control;

2. To buy produce either directly from the farmers or from their co-operatives at prices fixed by the Price Fixing Authority (PFA);
3. to sell locally, including direct sales to local processors, all unprocessed scheduled agricultural produce at prices fixed by the PFA;
4. to arrange overseas sales of all unprocessed commodities that are surplus to local requirements;
5. to ensure adequate supply to farmers of the necessary inputs, such as fertilizers and seeds, supplied by the Government;
6. to ensure quality control and inspection of produce through state Ministries of Agriculture; and,
7. to promote, through joint ventures and other means, the production and development, including semi-processing, of the relevant commodities.

Price Fixing Authority

As in the old system, price fixing will continue to be the responsibility of the Head of State in consultation with the National Council of States. The Technical Committee on Produce Prices (TCPP) will continue to be the instrument for advising the Price Fixing Authority on producer prices. The Central Bank of Nigeria will continue to finance produce purchases as well as the purchase of semi-processed agricultural commodities. The Commodity Boards will obtain funds directly from the Central Bank for produce purchase under the usual Federal Government guarantee as well as commercial bills drawn against registered sales contracts with the Bank.

The Price Commission would be responsible for the implementation of a dynamic and well-structured pricing policy essential to support the anticipated increases in production arising from a promise of priority attention to agriculture by the national government. The salient objectives of the Price Commission should be:

a. to induce a vigorous expansion in food and fibre production to meet both the immediate and future needs of the government and the public at large;
b. to generate a marketable surplus of food and fibre, to be siphoned into food reserves with minimum dislocation to the economy;
c. to ensure that farmers receive fair prices for their crops
d. to stabilize both the inter-season and intra-season producer and consumer prices; and,
e. to control or regulate agricultural input prices (by subsidies on inputs) so that uncontrolled input prices do not destabilize food prices (Helleiner, 1966).

Land Tenure Arrangements and Agricultural Policy

One of the major institutional constraints to agricultural development in Nigeria has been the land policy. The history of land use in Nigeria is extensive, and an attempt will be made to annotate the relavent land use policies that have affected agricultural policies both in the past and at present.

The consequences of land tenure in Nigeria were summed up by Charles (1911) when he wrote:

> All lands in the country are in the keeping of the chiefs for the members of the community to whom the land belongs.

> There is not a foot of land that is not claimed or possessed by some community or another, and the members of each community can apply to their respective chiefs for a grant of land to be used and cultivated for farming purposes. The land so granted becomes property of the grantee for life, and for his heirs after him in perpetuity, with all that grows on it and all that lies underneath it. But such land must be made use of; ie. it must be cultivated beneficially; if not, the grantee is liable to loose it, and it may then be given to another grantee who will make use of it (p. 244).

The rights to land held by the Fulanis who ruled Northern Nigeria for most of the nineteenth century were seized when the British conquered Nigeria. The title to land became vested in the crown by the Public Land Proclamation Act of 1902 (Hogendorn, 1978). But there was a clause in that proclamation, reported Adesimi (1973), that prohibited non-natives from acquiring an interest in any public lands except with the consent of the High Commissioner; all rentals from such lands were to go to the public revenue. This clause, of course, protected the natives of the protectorate from complete alienation of their lands by private individuals or corporations.

There were controversies over "rights" to land and "rights to the use" of land which were resolved in 1908 and 1910. In 1910, a proclamation entitled the "Natives' Right Proclamation" was drawn. The proclamation declared that the whole of the lands of the protectorate, whether occupied or unoccupied (except those designated as "Crown Lands"), were native lands under the control of the governor, who should hold and administer them for the benefit of the people with all due regard to native law and customs. In essence, this was a confirmation of the 1902 Lands Proclamation. However, the administration of land law was left largely in the hands of the native authorities, where the strict customary rules of tenure continued to be observed. It seems

reasonable to hypothesize that customary Hausa land law, as reinforced by the British Proclamation, influenced five main aspects of the development of the groundnut trade:

a. A reasonable security of tenure meant that there was no reason to fear expropriation, even on the very best groundnut soils. All efforts were aimed at using all available lands judiciously.

b. The existence of individual plots on the communal farms, plus the growing proportion of nuclear family farms as opposed to the group (gandu), was a vent for the farmer's initiative.

c. Fragmentation of group (gandu) land, to be expected under existing inheritance laws, was avoided to a significant extent by keeping the group or gandu members together after the death of its head.

d. Non-compliance with the restrictions against the sale of land to other farmers also retarded fragmentation. This phenomenon encouraged the mobility of both entrepreneurial effort and farm labor. More energetic farmers could increase their holdings of land.

e. Strict enforcement of the laws against the acquisition of land by foreigners (Europeans and Africans alike) meant that the plantation system of farming, run on European lines, was not to take root in Northern Nigeria (Hogendorn, 1978).

Due to the astronomical population growth in Nigeria, especially in the Northern States, coupled with increasing economic development in the country, more attention is now paid to land use and land tenure systems than ever. With a population of 52 million, 63 million and 82 million

in 1960, 1970, and 1975 respectively, opinions seem to vary in both official and non-official circles as to whether land tenure problems in Nigeria really exist.

While it is not the purpose of this study to substantiate the validity of the various schools of thought, the different stands on this issue will be noted (Famoriyo, 1979):

a. The first school of thought suggests that land tenure problems are of little or no importance, therefore, it is a waste of time to give them any consideration whatsoever.

b. Others believe that as economic development continues, any land tenure problems will automatically be solved during the process.

c. Another school of thought believes that very little, if anything at all, can be done in the field of agricultural improvement unless far reaching or radical changes take place in land tenure procedures and practices. Oluwasanmi argues that the small farm is "a very unlikely vehicle for accomplishing the urgent changes desired in agricultural productivity in tropical Africa." This argument implies that only sweeping changes, such as a deliberate policy of redistributing rights in land as part of a land reform movement, will do.

d. The last school of thought believes that land tenure systems differ so much in all parts of the country that it will be necessary to carry out large scale research before any prescriptive measures can be taken.

For example, the anomalies in land use patterns, as illustrated in

Table XVIII, in the Northern States can be summarized thus (Famoriyo, 1979).

Since by law, all lands in the Northern States (groundnut producing states) were said to belong to the state, it might be expected that no ownership problem exists. Individuals in the Northern States do acquire what they consider to be absolute rights to land however. Also, both civil servants and businessmen in the Southern States acquire lands from farmers at very low prices. Such exploitation has been hypothesized to exist due to two reasons:

a. there is little information about contemporary land tenure principles and practices in the Northern States; and
b. Because of defective government machinery, there seems to be little coordination or cooperation between State Ministries of Land and Survey and Agriculture when, in fact, they should work hand-in-hand in all states to execute a coherent policy on land.

If this situation continues unchecked, the Federal Military Government believes that more and more poor farmers are likely to lose their lands to wealthy farmers and this might eventually lead to concentrated ownership of land which is detrimental to peasant agriculture. The question which is yet to be addressed is: if, as stated under the Land Proclamation Law of 1910, "all land in the then Northern Nigeria are under the control and subject to the disposition of the Government" under what legal provisions do wealthy citizens purport to acquire these lands through purchase?

The Federal Military Government being conscious of the inhibitive danger of the present land use pattern to both econonic and agricultural

TABLE XVIII

ALIENATION OF ABSOLUTE INTERESTS IN LAND IN NIGERIA

State	Purchase (% of Holdings) 1968/69*	1969/70**	1970/71***
N. Central	19.20	11.70	7.20
N. Eastern	10.99	10.16	7.26
N. Western	11.35	9.81	9.39
Benue Plateau	3.56	19.36	7.10
Kano	12.88	22.04	12.44
Kwara	1.06	0.34	0.49
Western	na	2.53	1.79
E. Central	nc	nc	6.87
S. Eastern	nc	19.50	21.40
Rivers	nc	11.50	8.68
Mid-Western	9.10	4.84	9.59
Lagos	na	0.21	--
Nigeria	10.82	9.59	8.70

Source: FOS. Rural Economic Survey of Nigeria, Lagos, Nigeria, 1972

* Number of farming households covered = 2,310
** Number of farming households covered = 2,864
***Number of farming households covered = 3,225
na: Not available.
nc: Not covered.
--: Nil

development in Nigeria, swiftly enacted the Land Use Decree of 1978, which states:

> Whereas it is in the public interest that the rights of all Nigerians to the land of Nigeria be asserted and preserved by law:
> And whereas it is also in the pubic interest that the rights of all Nigerians to use and enjoy land in Nigeria and the natural fruits therof in sufficient quanity to enable them to provide for the sustenance of themselves and thier families should be assured, protected and preserved:
> Now therefore, the Federal Military Government hereby decrees as follows:
> Subject to the provisions of this decree, all land comprised in the territory of each state in the Federation are hereby vested in the Military Governor of that state and such land shall be held in trust and administered for the use and common benefit of all Nigerians in accordance with the provisions of this decree (FRN, 1978, p. 1).

The five objectives which have been claimed for the enactment of the Land Use Act are:

a. To remove the bitter controversies, resulting at times in loss of lives, which land is known to generate (Omotola, 1978),
b. To streamline and simplify the management and ownership of land in the community,
c. To assist the citizenry, irrespective of his soical status, to realize his ambition of owning the place where he and his family will live, produce for their livelihood, and maintain a secure and peaceful life.
d. To enable the government to bring under control the use to which land can be put in all parts of the country and thus facilitate planning and zoning programs for particular uses.
e. To make land available to agriculture and facilitate the efforts of the Operation Feed the Nation program.

The Land Use Decree, Agricultural Credit Guarantee Scheme, the creation of the Commodity Boards, Productivity Prices and Income Board

were some of the bold steps taken by the Military Government between 1977 and 1978 to prevent the "Undesirable Disaster" facing Nigeria's agricultural industry in this century.

Chapter Summary and Conclusions

The various features of the customary land tenure systems in Nigeria have laid the framework within which the process of agricultural production may proceed unhindered. While the institutional framework for agricultural production had its inception long before the establishment of a viable Nigerian nation as it is known today, the government's major pre-occupation was to guarantee access to rights in land for food production and to sustain such access.

In historical perpective, the unwritten codes of the native laws and customs have been beneficial to the people by giving them an impetus toward agricultural development. But in modern times, the need to accelerate agricultural production and to increase areas of cultivatable land has made land tenure a national, rather than a local, issue.

One could claim that a panacea for solving Nigeria's farm problems are in sight, but it must be remembered that in order to catch a fish, one must first venture bait; so Nigeria must continue to venture her bait until an acceptable solution is found for her agricultural problems. Farm problems and farm prices are problems not only to Nigeria but to other nations (even those with advanced economies) as well (Tweeten, 1979).

A good theory not rightly understood may prove as harmful as a bad theory. We must, therefore, educate the farmers about Marketing Boards and their various workings. The only way to do this is to afford the

farmers an opportunity to be involved themselves in the crucial matters that affect their work and existence.

CHAPTER IV

LITERATURE REVIEW AND MODEL SPECIFICATIONS FOR GROUNDNUT SUPPLY RESPONSE

This chapter examines the factors determining the annual groundnut supply in Nigeria, both for export and local consumption. The estimating supply model will be specified using the time series data for 1937 - 1977. The economic time series used is the summation of the individual farmer's annual production as represented by both the Federal Office of Statistics (FOS), Central Bank of Nigeria Annual Report and Trade Summary, and Food and Agricultural Organization (FAO) trade and production statistics. Reasons for the importance of estimating groundnut supply functions are:

a. The research should provide insight into the decision making process of farmers since groundnut supply is determined by individual grower decisions which, in turn, depend on continuously changing groundnut production conditions,

b. A supply model helps to identify the factors which the government, and the Groundnut Commodity Board (GCB) in particular, could use to expand groundnut production.

The study will investigate how peasant farmers form price expectations. The economic and institutional limitations for expansion of the groundnut crop will also be investigated. Prior to specifying

the supply function for groundnuts in Nigeria, some of the production conditions surrounding groundnut production are summarized.

The two factors most important to Nigeria's groundnut production are land and labor (Adesimi, 1973; Eturk, 1979). Agricultural lands are of two types (Norman et al., 1973):

a. upland (gona) fields which are cultivated only during the wet season with low value, less labor intensive crops such as millet, guinea corn, cotton and groundnut; and
b. lowland (fadama) fields which are permanently wet and can support high value, labor intensive crops such as sugar cane, rice and onions.

Since virtually all farmland in the groundnut production areas of Northern Nigeria is of the gona or upland type, only upland crops will be considered.

There are various subsistence crops that are important in the diet of the rural Hausa people, such as guinea corn, millet, and wheat (Eturk et al., 1979). Adesimi (1973) showed that there is some overlap in timing of groundnut field preparations and the sowing of millet and guinea corn. Furthermore, the weeding operations for both food crops and groundnuts take place at the same period of the year. Therefore, any meaningful supply model must take into account this observed competition for labor.

Cotton is another important crop that is grown in the same type of soil as groundnuts. It is hypothesized that the relative profitability between the cultivation of groundnuts and cotton plays an important role in the farmers' decision making processes. It is hypothesized that Northern Nigeria farmers will shift to cotton cultivation if it becomes

more profitabile. The supply model will therefore recognize the competition offered by cotton cultivation.

Economic theory of supply assumes instantaneous adjustment of supply in response to changes in economic stimuli. In the case of groundnut producers in Nigeria, groundnut production cannot respond instantaneously to price increases because of a shortage of labor (Adesimi, 1973; and Bateman, 1965). Therefore, full adjustment spans beyond one crop year and thus the traditional static (timeless) supply function is an inappropriate model for Nigeria's groundnuts (Nerlove, 1979). Consequently, a dynamic model is hypothesized to be the most appropriate for explaining Nigeria's groundnut production conditions.

There is a consensus that no significant technological progress has taken place over the past two decades in peasant cultivation of groundnuts in Northern Nigeria; however, the modest improvements that have taken place in terms of the farmers' better understanding of husbandry techniques, improved yield varieties, innovations in fertilizer applications, rural education and extension services should not be completely ignored. The influence of these innovations and improvements is evident from the increase in yields shown in Table VII of Chapter II. The supply response model specification shall take note of these factors.

Nigeria produces only 3.3 percent of total world groundnut supplies and accounts for 3.7 percent of total world trade in oils and fats (Adesinmi, 1973). It is therefore appropriate to assume that Nigeria is a price-taker rather than a price-maker. The annual variations in Nigerian supply alone will tend to have an insignificant effect on world prices of oils and fats since sunflower, corn, and cotton oil now

compete with groundnut oil, and since there is perfect competition in the world market for groundnut.

It has been alleged that the periods of military rule have had a devastating effect on the agricultural industry and consequently on groundnut production in Nigeria. Since agriculture as a subsector of Nigerian economy competes for investment funds and labor (unskilled), it is also appropriate to note these structural changes in supply response specifications.

Frequent changes of the political system in Nigeria, as in many other African countries, have brought about enormous policy changes and ramifications. The green revolution (OFN), Guaranteed Agricultural Credit Schemes (GACS), Land Use Decree, and the reorganization of commodity marketing arrangements were some of the policy innovations introduced by the military administration in Nigeria over a period of twelve years. The effectiveness of these programs on the agricultural industry has been debated. The groundnut supply model will take into account these commodity programs.

Model Specification for Groundnut Supply Response

In specifying the supply response relationship, there is a need to abstract from economic theory and observed production conditions and prices of groundnuts in Nigeria. As suggested earlier, labor scarcity problems prevent immediate and full adjustment (expansion) in groundnut production in response to economic stimuli. Adequate labor inputs are unavailable because of labor scarcity (due to low return to farm labor), or farmers' poor financial position during the planting season.

Furthermore, labor scarcity may also be due to a high degree of competition for labor by groundnut producers and the producers of competing crops. Etuk in 1970 showed that labor and land are the more limiting factors in groundnut production. Etuk's result is in contrast with Norman's findings in 1972. But the World Bank Project in Gusau (a town in the study area) has been reported to have hired 37 percent of the project's labor force. Abalu (1978) found that groundnut farmers hired about 73 percent of their labor inputs; while Hay et al. (1977) have reported that up to 56 percent of total labor input employed by cowpea farmers was hired.

Therefore, it is alleged that the Nigerian groundnut supply is conditioned by the operation of a partial adjustment mechanism. That is, some time longer than one crop season is hypothesized for the grower to fully realize his intended adjustments in response to changes in economic conditions of groundnut cultivation.

The inadequacies of the Nigerian Commodity Marketing Boards (Helleiner, 1976), meant that there was some degree of price uncertainty with regards to groundnut production. Producer prices are sometimes not announced in advance of the planting season and when they are, most farmers are not aware of the prices until marketing season. Laurent's study (1969) of kano groundnut farmers shows that less than 2 percent of the farmers interviewed in Northern Nigeria in 1967 were aware of the published groundnut producer price for that year.

Schultz' hypothesis (1978) says that:

> farmers the World over, in dealing with costs, returns, and risks, are calculating economic agents. Within their small individual, allocative domain they are fine-tuning entrepreneurs, tuning so subtly that many experts fail to see how efficient they are. . . (p. 4).

Under this kind of situation, current, last or previous year's producer prices are not the only variables that influence the supply decisions of the majority of peasant growers. It seems only reasonable that farmers would formulate their current price expectations on the deviations between the previous observed prices and their past price expectations (Askari and Cummings, 1977).

From the theory of a multi-product firm under perfectly competitive product and input markets, it can be shown that the supply function for product i is a function of its own product price, product prices of competing crops and input prices.

Under the above assumption we may specify the long-run supply for Nigeria's groundnut as:

$$Q_t = f_1(P_i^*, W_j). \quad (1)$$

Equation 1 states that groundnut supply is a function of expected and input prices; since other factors other than input and expected prices are considered in our supply equation, Equation 1 can be modified thus:

$$Q_t = f_2(P_j^*, W_j, WE, PL_{ki}, TC) \quad (2)$$

where:

P_i^* = Expected price of product i

i = groundnuts, cotton, guinea corn, wheat

W_j = Input price for input j

WE = A measure of weather variability (measured by average annual rainfall in the groundnut producing areas)

PL_{ki} = Policy variable k influencing the production of product i.

A dummy variable is employed for modelling policy variable, such that:

D = 1, if civilian government, and

= 0, if otherwise

where k = 1.

TC = Technological changes (as measured by time trend)

Q_t = Groundnut production/supply in current period (measured in tons)

Due to lack of cost data, input prices will not be considered. As shown in Equation 2, input prices are among the factors determining growers' supply response function. Family labor constitutes the greater labor input into groundnut production in Northern Nigeria. Fertilizer is another input in groundnut production; but, fertilizer application is subsidized by the Federal Government by almost 90 percent of the cost. Therefore, it is hoped that the opportunity cost of family labor in this part of the world, which is close to zero (Little and Mirrlees, 1974), and the highly subsidized fertilizer price account for most of the effects of other input prices on supply/production determinations. We therefore argue that the use of the consumer price index (CPI) to deflate all prices in the supply response equation will mitigate the effects of specification error bias. The deflated prices will be uncorrelated with the input costs; hence, less upward bias (Pindyck and Robinfeld, 1976). Therefore, Equation 2 can be modified thus:

$$Q_t = f_3(P_g^*, P_{gc}^*, P_{cott}^*, P_w^*, PL_1, WE, TC) \quad (3)$$

where:

P_g^* = Expected price of groundnuts,

P_{cott}^* = Expected price of cotton,

P_{gc}^* = Expected price of guinea corn,

P_w^* = Expected price of wheat.

Formation of Price Expectation

In the agricultural sector, production decisions are usually made before the realization of product prices (Laurents, 1969 and Mlay, 1981). Since the prices are market determined, producers have to base their production decisions on expected prices. Various models of price expectation formation have been proposed (Nelson, 1977; Muth, 1961; and Young, 1980) and all have had problems in empirical applications. Muth's (1961) proposed approach of rational expectation and Nelson's (1977) approach of "weakly" rational expectation are reviewed below. The partial adjustment and adaptive expectation models (Nerlove, Young, and Lin, 1977; Cagan, 1956) approach to expectation formation are also reviewed. The extrapolative model proposed by Ryan, Jennings and Young, and Goodwin will also serve as a frame of reference in our attempt to model expectation formation.

The rational expectations hypothesis implies that the economic agents take into consideration all the important aspects of the market structure in forming their expectations. We know that, for all practical purposes, the economic agents do not possess perfect information and foresight and consequently, they must adjust their expectations as new information becomes available. All the present known models that have been tried for modelling expectations do have their pitfalls.

Rational Expectation Model

The influence of expectation on economic behavior is so pervasive that the mechanism for the formation of expectations necessarily appear in almost any econometric models (Nelson, 1975). In practice, it is always convenient to assume that expectations take the form of extrapolation based on past values of the variables in question. The most popular device for presenting or modelling expectation has undoubtedly been the exponentially weighted moving average scheme (Cagan, 1956). But in recent years more complex lag structures have been introduced.

Muth (1961) asserted that expectations will be formed in a way which is consistent with the structure of the relevant system. This implies that expectations may not only be extrapolative and that the relevant information set upon which expectations are based will include more than just the past histories of the variables.

For example, Muth (1961) postulated that the rational expectation of a variable, say P, will depend on the reduced form expression for P in the "relevant system" and on the information set available to the economic agents. Therefore, the reduced form expression for P at time t will be of the form

$$P_t^* = E\,(P_t/\Omega_{t-1}) \tag{4}$$

Let Ω_{t-1} = all information sets relevant in forecasting P_t^*

V_{t-1} = a subset of Ω_{t-1} (contains only past realized values of P)

P_t^{**} = the forecast made by using only V_{t-1}.

Therefore,

$$P_t^{**} = E(P_t/V_{t-1}). \tag{5}$$

Rewriting equations 4 and 5, we have

$$P_t^* = E(P_t + U_t/\Omega_{t-1}) \tag{6}$$

$$= P_t^{**} + U_t^*$$

where P_t^{**} and U_t^{**} are uncorrelated (orthogonal).

P_t^{**} can therefore reasonably be used as a proxy for P_t^* (weakly rational expectation) and,

U_t^* = portion of P_t that cannot be predicted from past histories of P but can be predicted given full information set Ω_{t-1}.

How then is the unobservable P_t^{**} obtained? Time series methods can be used which embrace the choice of a suitable model from a general class of autoregressive integrated moving average models [ARIMA (p, d, q)].

Where P = order of autoregressive part

d = number of difference needed to induce stationarity.

q = order of the moving average part.

Therefore,

$$P_t^{**} = E(P_t/V_{t-1}).$$

Now, the appropriate model can be identified by Box-Jenkins methods for the variable in question:

a. For groundnut (peanut) price

$$P_t = P_{t-1} + \Psi P_{t-1} - \Psi P_{t-2} + E_t, \text{ ARIMA } (1, 1, 0) \tag{7}$$

$$P_t - P_{t-1} = \Psi(P_{t-1} - P_{t-2}) + E_t \tag{8}$$

Let $W_t = P_t - P_{t-1}$

$W_{t-1} = P_{t-1} - P_{t-2}$.

Therefore, Equation 8 becomes

$$W_t = W_{t-1} + E_t \tag{9}$$

and Equation 7 can be represented by

$$P_t^{**} = P_{t-1} + \Psi P_{t-1} - \Psi P_{t-2} \quad (10)$$

Nelson (1975) in his article says that

> . . . if the information set is limited to the past histories of the variable appearing in the system, then P will be a linear combination of extrapolative prediction of P and of U (since the disturbance may be autocorrelated with the explanatory variables (p. 556).

Nelson (1975) reasonably claimed that if a purely extrapolative predictor exploits only information available from the past histories of P alone, then this expectation can be termed a "weakly rational" expectation since such expectations are conditioned on a natural subset of Ω_{t-1} (Equation 6).

b. Cotton and food crops compete with groundnut for resource utilization in the study area. It is, therefore, appropriate to identify a useful model for both cotton price and food price indexes in the usual way as for groundnut.

The approach followed in both cotton and food price under model specification is in line with the Jennings and Young (1980) approach, which is still consistent with the method which relies on data to suggest or identify the lag structures. Therefore, Box-Jenkins methods were employed to identify the lag structures for both cotton and index of food prices. Hence for cotton, the model identified is:

$$P_t = P_{t-1} + E_t \quad (11)$$

So that

$$P_t^{**} = P_{t-1}$$

c. For Food Price Index, the model identified is

$$P_t = P_{t-1} + E_t \quad (12)$$

so that,

$P_t^{**} = P_{t-1}$, where all prices are in constant or real terms (Jennings and Young, 1980; Nelson, 1975; Mlay, 1981; Bryan, 1981).

$$P_t^{**} = E[P_t/V_{t-1}] \tag{13}$$

where V_{t-1} is a set of past realized prices.

$$P_t^{**} = E[P_t/P_{t-1}, P_{t-2}, P_{t-2}, \ldots] \tag{14}$$

Based on the above justifications, rational expectation can be specified as follows:

$$Q_t = \Psi_0 + \Psi_1[P_{t-1,g} + \alpha_1(P^*_{t-1,g} - P_{t-1,g})] + \Psi_2 P_{t-1,cott} + \Psi_3 INF_{t-1} + \Psi_4 RR_t + \Psi_5 D_{t_1} + \Psi_7 TC + RISK + e_t. \tag{15}$$

where

INF_{t-1} = Deflated Index of Food Prices lagged (₦/Ton)

RR_t = Mean annual rainfall (inches)

D_{t_1} = Dummy variable = 1, if civilian government,
= 0, otherwise

TC = Trend variable depicting technological change (measured in years)

RISK $= \sum_{j=1}^{3} \partial_j (P_{t-1} - P^*_{t-j})^2$
where j = 1, 2, 3
$= \partial_1 (P_{t-1} - P^*_{t-1})^2 + \partial_2 (P_{t-2} - P^*_{t-2})^2 + \partial_3 (P_{t-3} - P^*_{t-3})^2$
$= \sum_{j=1}^{3} \partial_j = 1$

$\alpha_1(P_{t-1,g} - P^*_{t-1,g})$ = Proportion of the price deviation between the observed price of groundnut in time t-1 and the expected price of groundnut in time t-1, where:
$\alpha_1 \geq 0$.

Alternative Model Specifications

Economic agents form price expectations in a number of ways, one of which--rational expectation formation--has been considered. Other price expectation formations include:

$$P_t^* = P_{t-1} \text{ (cobweb model)} \tag{16}$$

$$P_t^* = P_{t-1} + \gamma(P_{t-1} - P_{t-2});\ \gamma \geq 0 \text{ (extapolative)} \tag{17}$$

$$P_t^* = P_{t-1}^* + \phi(P_{t-1}^* - P_{t-1}):\ 0<\phi<1 \text{ (adaptive expectation)} \tag{18}$$

$$Y_t^* = \beta_0 + \beta_1 X_t + e_t \text{ (partial adjustment)} \tag{19}$$

In the above situations, production decisions are assumed to be based on prices which are expected to prevail at the end of the production process. It then becomes extremely difficult for researchers to specify a useful or workable relation between construction of the history and the variables which can actually be observed (Nerlove, 1961).

The early price expectation formation expressed the expected price, at time t, as being the same as the price observed at time t-1, an implicit assumption in cobweb models. This assumption, which prevailed for some time, became questionable as a result of other research works. These assumptions are only viable if prices at the current period are based only on prices of the last period. Therefore, information contained in other past prices does not influence the decision making process.

Due to strong criticism of the cobweb type model, Goodwin (1947) presented an extrapolative model in which the expected price at period t is defined as $P_t^* = P_t + \alpha(P_{t-1} - P_{t-2}):\ \alpha \geq 0$. Ryan (1977) incorporated this model in a risk model for United States pinto beans, and the results were consistent with <u>a priori</u> expectations. The major criticism of the extrapolative approach to modelling price expectation

is its lack of theoretical justification. Muth (1961) criticized extrapolative models. He said a geometric representation of price expectations is an appropriate tool for reflecting price formulation only if the price series follows a moving average process in its first differences. Otherwise, imposition of the scheme will generate measurement errors which will be reflected by correlation between expectational variables and regression disturbances. Aware of the above criticism Muth (1961) and Young and Jennings (1980) stated that specification of extrapolative model/predictors could be based on time series analysis of the relevant series. Thus some distributed lag models of P_t and X_t would be constructed such that:

$$P_t^* = (B)\ P_{t-1} + U_t \qquad (20)$$

where U_t is a zero means white noise, i.e., successive observations are uncorrelated to one another. $E(U_t) = 0$, $EU_tU_s = \sigma^2_u$ where $t = s$; $EU_tU_s = 0$ when $t \neq s$; and B = backshift operator. Nelson (1975) suggested that although a geometric lag may not be appropriate, expectations can reasonably be modelled by some type of extrapolative predictor, linear in past prices. Extrapolative models determined entirely from the data could be obtained using the Almon Lag structure (Johnston, 1972) or the more general techniques developed by Box and Jenkins (1970).

Partial Adjustment Model

Economic theory specifies that the desired, rather than the actual, value of the dependent variable is determined by the independent variables. There may be difficulties in estimating this relationship directly because the desired level of the dependent variable is unknown.

This could be resolved by specifying that the actual value of the dependent variable adjusts to the desired level according to some simple rule. That is, the actual value adjusts by some constant fraction of the difference between the actual and the desired results. For example,

$$\overline{Q}_t = \alpha + b_1 P_{t-1,g} + b_2 P_{t-1,cott} + B_3 INF_{t-1} + b_4 RR_t + b_5 D_{t_1} + b_6 TC + b_7 Q_{t-1,g} + u_t \quad (21)$$

where:

$\overline{Q}_t$ = Long-run desired groundnut output (tons)

$P_{t-1,g}$ = Deflated groundnut price lagged (₦/ton)

$P_{t-1,cott}$ = Deflated cotton price lagged (₦/ton)

INF_{t-1} = Deflated index of food prices (₦/ton)

RR_t = Mean annual rainfall (inches)

D_t = Dummy variable (as defined earlier)

TC = Trend variable (measured in years)

Q_{t-1} = Groundnut production lagged (tons).

If the above partial adjustment model is applied to the groundnut supply response, then, the supply adjustment relationship is:

$$Q_t - Q_{t-1,g} = \gamma(\overline{Q}_{t,g} - Q_{t-1,g}) \quad (21b)$$

$$Q_t = Q_{t-1,g} + \gamma\overline{Q}_{t,g} - \gamma Q_{t-1,g}$$

$$= \gamma\overline{Q}_{t,g} + (1-\gamma)\, Q_{t-1,g} \quad (21c)$$

where: γ = coefficient of adjustment.

Substituting for $\overline{Q}_t$ in equation 21c, and rearranging terms, the following estimating equation is formed:

$$Q_t = \alpha\gamma + b_1\gamma\, P_{t-1,g} + b_2\gamma\, P_{t-1,cott} + b_3\gamma\, INF_{t-1} + \gamma b_4 RR_t + \gamma b_5 D_t + \gamma b_6 TC + (1-\gamma)\, Q_{t-1} + \gamma u_t^*. \quad (22)$$

where: $\gamma u_t^* = u_t^*$

and u_t^* is $NID(0, \sigma^2 u_t^*)$

where all the variables are as defined in Equation 21.

Estimation Procedure and Associated Problems. A possible estimation procedure for the partial adjustment model, Equation 22 follows: One of the assumptions underlying the classical linear regression is that the independent variables are uncorrelated with the error term; that is,

$$EX'u = 0.$$

Other assumptions include:

$$Eu_t = 0$$

$$E(u_t u_s) = 0, \text{ for all } t \neq s$$

$$= \sigma^2 I_T, \text{ for all } t = s$$

$$E(u_t^2) = \sigma^2, \quad t = 1, 2, \ldots, T.$$

Thus Equation 22 assumes no serial correlation of disturbances. If the error term is autoregressive, then the assumption of independence of the independent variables and the disturbance term is violated; hence serial correlation is a problem.

Serial Correlation or autocorrelated disturbances exist when the disturbance terms from successive time periods are correlated. First-order (positive) autocorrelation or serial correlation will not affect the unbiasedness or the consistency of ordinary least squares (OLS) estimates only if the model does not contain lagged dependent variables. In the case of Equation 22, there are lagged variables and autocorrelated disturbances might make the estimated parameter biased and inconsistent.

Tests for Serial Correlation. It has been shown that D.W. d-statistics may not be used to detect (first-order) serial correlation in autoregressive models because the computed d-statistic in such models is usually biased toward 2 - which is the value of d expressed in a truly random sequence (Huang, 1980). Durbin has proposed the use of the h-statistic (which is a large sample test) of first-order serial correlation in autoregressive models. It has been argued by Huang (1980) that the exact distribution of D.W. d-statistics depends on the correlation structure of the regression in any given problem; therefore, Durbin proposed the use of the h-statistic;

$$h = \hat{\rho}\sqrt{\frac{T}{1-T[\text{var}(\hat{\alpha})]}} \quad \text{and}$$

$$D.W.d = \frac{\sum_{i=1}^{T}(\hat{u}_t - \hat{u}_{t-1})^2}{\sum_{i=1}^{T}\hat{u}_t^2}$$

where: T = sample size

var $(\hat{\alpha})$ = variance of the coefficient of the lagged dependent variable, Y_{t-1}

$\hat{\rho}$ = estimate of first-order autocorrelation, we can show that:

$$\hat{\rho} = \frac{\Sigma \hat{u}_t \hat{u}_{t-1}}{\Sigma \hat{u}_{t-1}^2}.$$

1. It has been shown that regardless of how many x variables or how many lagged values of the dependent variable Y are included in the model, to compute h, we need only to consider the variance of the coefficient of Y_{t-1}.
2. The test is not applicable if $[1-T(\hat{\alpha})]>1$.
3. If $[1-T(\hat{\alpha})]>1$, the Durbin h cannot be computed as we cannot

take the square root of a negative number. The alternative test proposed by Durbin is to:

a. Obtain the residual vairable $\hat{\varepsilon}_t$ from the ordinary least squares regression,

b. Create the lagged residual variable $\hat{\varepsilon}_{t-1}$,

c. Then regress $\hat{\varepsilon}_t$ on all the independent variables including the lagged residual variable, e.g.,

$$\hat{\varepsilon}_t = \alpha + \rho^*\hat{\varepsilon}_{t-1} + \beta^* y_{t-1} + \gamma^* X_t + u_t,$$

d. Then do a t test of the null hypothesis that ρ^* is not significantly different from 0. If the null hypothesis is rejected, it implies first-order serial correlation is present.

4. Since the h-statistic is a large sample test, its use in small samples is not justified.

Estimation Method for Partial Adjustment in the Presence of Autocorrelated Disturbance

If the Durbin h-statistics indicate autocorrelated disturbances as mentioned above, the researcher may have to adopt one or a combination of any two of the following nonlinear estimation approaches:

1. Direct search--in this approach the sum-of-squared-errors function is evaluated for the alternative sets of coefficient values. Those values which result in a minimum are chosen as the estimates; this approach is very effective if one or two coefficients are to be estimated. For a large number of coefficients, as in the partial adjustment model, the method becomes uneconomical;

2. Direct optimization--in this case, the parameter estimates are obtained by differentiating the sum-of-squared-errors function with respect to each coefficient, setting the derivatives equal to zero (thus defining a minimum), and solving for the resulting set of nonlinear equations (which are called the normal equations). This approach is also seldom used due to computational difficulties.
3. Iterative linearization method--with this method, the nonlinear equation is linearized (using the Taylor series expansion) around some initial set of coefficient values; then, ordinary least squares (OLS) is performed on this linear equation, generating a new set of coefficient values; the nonlinear equation is again relinearized around these new coefficient values, ordinary least squares is again performed to generate new coefficient values and the equation is relinearized around these values; this iterative process is repeated until convergence is attained; the main advantage of this approach is efficiency; it also provides a clear guideline for applying the statistical tests usually applied to linear regression. The R^2, t-statistics and F-ratio can be used in the conventional manner to evaluate the overall fit of the linearized equation.

Extrapolative Model

If we assume an extrapolative model in expectation formation, the relation in Equation 17 becomes:

$$Q_t = \beta_0 + \beta_1[P_{t-1,g} + \alpha_1(P_{t-1,g} - P_{t-2,g})] +$$
$$\beta_2 [P_{t-1,cott} + \alpha_2(P_{t-1,cott} - P_{t-2,cott})] +$$
$$\beta_3 [INF_{t-1} + \alpha_3(INF_{t-1} - INF_{t-2})]$$
$$\beta_4 RR_t + \beta_5 D_{t_1} + \beta_7 TC + RISK + e_t \quad (24)$$

where $RISK = \sum_{j=1}^{3} \partial_j (P_{t-j} - P^*_{t-j})^2$ where $j = 1, 2, 3,$

$$= \partial_1 (P_{t-1} - P^*_{t-1})^2 + \partial_2 (P_{t-2} - P^*_{t-2})^2$$
$$+ \partial 3 (P_{t-3} - P^*_{t-3})^2 \quad (25)$$
$$\sum_{j=1}^{3} \partial_j = 1.$$

Since the price of cotton and the index of food prices exhibit random walk, Equation 25 is reduced to:

$$\Sigma \partial_j (P_{t-j} - P^*_{t-j})^2 = \Sigma \partial_1 (P_{t-1} - P^*_{t-1})^2$$

Stochastic Assumptions and Estimation Methods for the Extrapolative Method. Stochastic assumptions and estimation methods for the extrapolative method include:

1. Spherical disturbances - neither heteroskedastic or autocorrelated.

   $E\ e_t^2 = \delta^2,\ t = 1,2,\ldots,T$

   $E\ e_t e_s = 0,\ \forall t \neq s$

   $E\ e_t e_s = \delta^2 I,\ \forall t = s$

   $E\ e_t = 0$

2. Exogeneous variables are assumed independent of the error term (non-stochastic).

3. The matrix of exogeneous variables is of full column rank (linear independent) T>K.

Under these assumptions, the use of OLS will lead to unbiased parameter estimates (Behman, 1968; Johnston, 1972; et al.). From Equation 24, it is known that:

$$Q_t = \beta_0 + \beta_1 P_{t-1,g} + \beta_1\alpha_1(P_{t-1,g} - P_{t-2,g}) +$$
$$\beta_2 P_{t-1,cott} + \beta_2\alpha_2(P_{t-1,cott} - P_{t-2,cott}) +$$
$$\beta_3 INF_{t-1} + \beta_3\alpha_3(INF_{t-1} - INF_{t-2}) +$$
$$\beta_4 RR_t + \beta_5 D_{T_1} + \beta_6 TC + RISK + e_t \qquad (26)$$

where RISK is defined as in Equation 25; i = 1,2,3; and α_i enters the equation in non-linear fashion.

Definitions of variables in the extrapolative model are:

$P_{t-1,g}$ = Groundnut price lagged and deflated (₦/Ton).

$P_{t-1} - P_{t-2}$ = Change in Groundnut price deflated (₦/Ton).

α_i = Partial adjustment coefficients, where i = 1, 2, 3.

$P_{t-1,cott}$ = Deflated cotton price lagged (₦/Ton).

$P_{t-1,cott} - P_{t-2,cott}$ = Changes in cotton price deflated (₦/Ton).

INF_{t-1} = Index of food prices deflated lagged (₦/Ton).

$INF_{t-1} - INF_{t-2}$ = Change in index of food prices deflated (₦/TON).

D_{T_1} = Dummy variable; = 1, if civilian government,
= 0 otherwise.

TC = Trend variable (year 1937 through 1977).

EXPGP = Deflated expected groundnut price lagged.

RR_t = Mean annual rainfall in the study areas (inches).

RISK = RISK variable as defined in Equation 25.

e_t = Random disturbance.

To simplify the notation in Equation 26, let:

$A_0 = \beta_0$

$A_1 = \beta_1$

$A_2 = \beta_1\alpha_1$

$A_3 = \beta_2$

$A_4 = \beta_2\alpha_2$

$A_5 = \beta_3$

$A_6 = \beta_3\alpha_3$

$A_7 = \beta_4$

$A_8 = \beta_5$

$A_9 = \beta_6$

$A_{10} = \beta_7$

Also let:

$X_1 = P_{t-1,g}$

$X_2 = P_{t-1,g} - P_{t-2,g}$

$X_3 = P_{t-1,cott}$

$X_4 = P_{t-1,cott} - P_{t-2,cott}$

$X_5 = INF_{t-1}$

$X_6 = INF_{t-1} - INF_{t-2}$

$X_7 = RR_t$

$X_8 = D_{t_1}$

$X_9 = TC$

$X_{10} = RISK$

Therefore, Equation 26 can now be re-written in a linear form:

$$Q_t = A_0 + A_1X_{t_1} + A_2X_{t_2} + A_3X_{t_3} + A_4X_{t_4} + A_5X_{t_5} + A_6X_{t_6} + A_7X_{t_7} + A_8X_{t_8} + A_9X_{t_9} + A_{10}X_{t_{10}} + e_t \quad (27)$$

We can now express:

$$\underset{\sim}{Q} = XA + e \quad (28)$$

The OLS estimates of equation 28 would be:

$$\hat{A} = (X'X)^{-1} X'Q$$

$$\tilde{S}^2 = [Q'-XA]'(Q-X\hat{A})/T-K$$

$$Var(\hat{A})_{est} = S^2(X'X)^{-1}$$

If we assume autocorreleted disturbances (first-order autoregressive process) as discussed earlier:

$$e_t = \rho e_{t-1} + \rho_t \text{ , where } -1<\rho<1$$

$$Ee_t e_s \neq 0 \text{ or } \alpha^2 I$$

$$= 0; \; s \neq t$$

$$Ee_t = 0$$

$$Ee_t^2 = \sigma^2 e$$

$$E(ee') = \sigma^2 e \Omega$$

If OLS is used under the above assumptions, the parameter estimates will not be biased and it is consistent; but the variances of the estimates will be biased (Johnston, et al). The t and F statistics are unreliable, viz:

$$\hat{A} = (X'X)^{-1} X'Q$$

It is known that $Q = XA + e$;

$$E(\hat{A}) = E(X'X)^{-1} X'Q$$

$$= E[\underbrace{(X'X)^{-1} X'X}_{I} A + (X'X)^{-1} X'e]$$

$$= A + (X'X)^{-1} X'Ee$$

$$= A \; .$$

This implies that $\hat{A}$ is an unbiased estimate of A.

$$Var(\hat{A}) = Var[(X'X)^{-1} X'Q]$$

$$= Var[(X'X)^{-1} X'XA + (X'X)^{-1} X e]$$

$$= \sigma^2 (X'X)^{-1} X'E(ee') X(X'X)^{-1}$$

$$= \alpha^2(X'X)^{-1}X' \quad X(X'X)^{-1} \neq \alpha^2(X'X)^{-1}$$

If confronted with problems of autocorrelated disturbances, the options are a) use generalized least squares (GLS) or b) transform the data and use OLS. For GLS estimation:

$$A = (X'\Omega^{-1}X)^{-1} X'Q$$

$$S = \frac{\hat{u}'\Omega \quad \hat{u}}{T - K}$$

For transformation of the data and using OLS, we have:

transform matrix T such that,

$$T^{*\prime}\Omega^{-1}T^{*} = I_T$$

$$T^{*} T^{*} = \Omega^{-1}$$

$$T^{*}Q = T^{*}XA + T^{*}U$$

$$W = Q'\beta + \nu$$

$$\hat{\beta}_{OLS} = (Q^1Q)^{-1} Q^1W$$

$$S^2 = \hat{V} \hat{V}/T - K$$

After the above transformation, our parameter estimates B_{GLS} is BLUE; if ρ is assumed to be known. But B_{GLS} is biased and inconsistent if the estimated ρ, i.e., $\hat{\rho}$, is used in the transformation.

Correcting for Possible Serial Correlation in Extrapolative Model. If the test for serial correlation shows serial correlation problems, the following procedure can be applied to correct for it (Johnston, 1972; Kmenta, 1971; Pindyck and Robenfield, 1981; et al.):

1. Cochrane - Orcutt Procedure:
   a. Use OLS to estimate the original model and obtain the residual,
   b. Regress the estimated residual ($\hat{u}$) on $\rho\ \hat{u}_{t-1}$ and obtain $\hat{\rho}$,

eg. $Y_t = \beta_1 + \beta_2 X_{2_t} + \beta_3 X_{3_t} + \ldots + \beta_k X_{k_t} + u_t$. (29)

$u_t = \rho u_{t-1} + V_t$; $0 < \rho < 1$,

c. The estimated ρ value is used to perform the generalized differencing transformation process and a new regression is run.

eg. $Y_t^* = \beta_1(1-P) + \beta_2 X_{2_t}^* \ldots + \beta_k X_{k_t}^* + V_t$ (30)

where $Y_t^* = Y_t - \hat{\rho}\, Y_{t-1}$

$X_2^* = X_{2_t} - \hat{\rho}\, X_{2_{t-1}}$

$X_{kt}^* = X_{k_t} - \hat{\rho}\, X_{k_{t-1}}$

d. The estimated transformed equation yields parameter estimates for the original intercept β_0, and other slope parameters $\beta_2 \ldots \beta_k$.

e. These revised parameter estimates are substituted into the original equation and a new regression residual is obtained as:

$\hat{\varepsilon} = Y_t - \hat{\beta}_1 - \hat{\beta}_2 X_{2_t} - \ldots - \hat{\beta}_k X_{k_t}$ (31)

By running the regression, $\hat{\varepsilon} = \rho\, \hat{\varepsilon}_{t-1} + V_t$ a new ρ is obtained and the iteration continued for as many times as necessary. This process can be stopped when the new ρ differs from the old one by less than .01 or .005.

2. The Hildreth-Lu Procedure:

a. The researcher obtains a set of "grid" for the ρ. These are spaced guessed values for ρ, eg., .1, .2, .3, ..., .9, 1.0, assuming there is positive serial correlation.

b. For each value of ρ, the transformed equation is estimated, eg.,

$Y_t^* = \beta_1 (1 - \rho) + \beta_2 X_{2_t}^* + \ldots + \beta_k X_{k_t}^* + V_t$. (32)

The procedure in equation 31 selects the equation with the lowest sum of squared residuals as the best equation. This technique is practical and, if used carefully, the MLE of ρ will be obtained. Care should be exercised in the grid selection such that the minimum sum of squared residual is global, not local.

3. Durbin Procedure: The generalized differencing form of the linear model is

$$Y_t - \hat{\rho}\, Y_{t-1} = \beta_1(1-\rho) + \beta_2(X_{2_t} - \rho X_{2_{t-1}}) + \beta_k(X_{k_t} - \rho\, X_{k_{t-1}}) + V_t. \quad (33)$$

Rewriting Equation 33, we have:

$$Y_t = \beta_1(1-\rho) + \rho\, Y_{t-1} + \beta_2\, X_{2_t} + \rho\beta_2 X_{2_{t-1}} + \ldots + \beta_k X_{k_t} + \rho\beta_k X_{k_{t-1}} + V_t \quad (34)$$

Equation 33 implies that ρ can be obtained by treating the above model directly as a linear regression model. The estimated coefficient of Yt-1 will yield an acceptable estimate of ρ which is consistent in large samples, as well as parameter estimates of $\beta_1, \beta_2, \ldots, \beta_k$. The parameter estimates can be improved by substituting ρ into the following equation:

$$Y_t - \hat{\rho}Y_{t-1} = \beta_1(1-\hat{\rho}) + \beta_2(X_{2_t} - \hat{\rho}X_{2_{t-1}}) + \ldots + \beta_k(X_{k_t} - \hat{\rho}X_{k_{t-1}}) + V_t. \quad (35)$$

These estimates will possess the usual assymptotic efficiency.

The Multicollinearity Problem

One of the critical and common problems associated with time series data is multicollinearity. This is the situation when there is a linear relationship among independent variables. Technically, assumption five

of the classical linear regression as stated earlier is violated when this happens. Multicollinearity is a data problem. Multicollinearity could occur for a variety of reasons:

1. the independent variable may share a common time trend;
2. one independent variable might be the lagged value of another that follows a trend;
3. some independent variables may have varied together because the data were not collected from a wide enough base; and
4. due to errors in variables or measurement errors, eg., at the data collection level, field surveys, etc.

From the nature of the three models specified above, the rational expectation, partial adjustment and extrapolative models, it is apparent that multicollinearity may be a problem. The influence of multicollinearity on research results makes it imperative that this problem be detected in the data and appropriate steps taken to mitigate its effect on the research results.

Consequences of Multicollinearity.

1. The OLS estimator in the presence of multicollinearity remains unbiased and in fact is still Blue. The R^2 is still unaffected and the OLS estimator retains all its desirable properties.
2. The variances of the OLS estimates of the parameters of the collinear variables are very large which, therefore, leads to low t-values.
3. Multicollinearity may lead to specification errors if variables are dropped to reduce multicollinearity. This may be very serious, since parameter estimates are sensitive to model

specification when a high degree of multicollinearity is present.

Testing for Multicollinearity in the Extrapolative Model. There are many ways of detecting the presence of multicollinearity, viz:

1. Insignificant coefficients of all independent variables in the presence of a high R^2 suggests multicollinearity of the independent variables.
2. A high simple correlation coefficient between pairs of independent variables would indicate multicollinearity. Klein (1962) has suggested that if $r_{i,j} < R$, where $r_{i,j}$ is the sample correlation between x_i and x_j, say i = 1, 2, ..., k, and R is the square root of the coefficient of multiple determination, R^2, then multicollinearity is tolerable. If otherwise, multicollinearity is a problem.
3. However, a high degree of multicollinearity may be present even when simple correllation coefficients are low. A variable may be a linear function of more than one other independent variable.
4. If the independent variables share a common time trend, there is usually a multicollinearity problem.

Correcting for Multicollinearity. To correct for multicollinearity, one can:

1. Do nothing if it does not affect the estimates of the parameters of interest, or if the R^2 from the regression result exceeds the R^2 obtained by regressing the dependent variable on any of the independent variables, or if the t-statistics are

all greater than 2.

2. Obtain more data. Increasing the sample size many times may reduce the variance of the estimates.
3. Drop the variable causing the problem if the true coefficient of that variable in the equation being estimated is truly zero; otherwise, specification error is created. Omitting a relevent variable causes estimates of the parameters of the remaining variables to be biased unless some of the remaining variables are uncorrelated with the omitted variable.
4. Use a principal component - the variables that are collinear could be grouped to form a composite index capable of representing this group of variables by itself.
5. Use a ratio of two variables - transform the variables causing the problem such that their ratios are included as the independent variables.
6. Use extraneous information - bring in some previously obtained results or some cross-section estimates for the estimation, using the time-series data, eg.:

$$E_t = \alpha + \beta Y_t + \gamma P_t + u_t$$

where

E_t = consumption expenditures on a certain commodity,

Y_t = consumer income,

P_t = price of the commodity,

t = annual time subscript.

if Y_t and P_t are highly correlated so as to make OLS estimtion of the parameters impossible, one might use a cross-section estimate of β, say b, and estimate the following equation:

$$(E_t - bY_t) = \alpha + \gamma P_t + u_t.$$

The interpretation of the OLS result with the use of extraneous information is usually a problem.

7. Use ridge regression - the main purpose is to reduce the variance of the estimates. The ridge regression estimator is given by $(X'X + K')\ X'Y$, where the variables have been standardized and k is a very small number.

CHAPTER V

DATA, ANALYSIS, AND DISCUSSION OF RESULTS

Introduction

General production supply models were developed in Chapter IV. The models are summarized in Equations 15, 22 and 26. The explanatory variables being considered in the models are expected price of groundnuts in Naira per ton; price of groundnuts lagged one period, price of cotton lagged one period, change in groundnut and cotton prices; the index of food prices lagged one period, the weather variable, a policy variable, the trend variable depicting technological changes over time, and the risk variable (depicting the squared deviation of price variance).

This chapter presents the data needs and construction of the explanatory variables. Rational expectation, extrapolative and partial adjustment estimation methods are used to empirically specify the models. A discussion of the results and their implications is presented. A procedure for testing the hypotheses indicated in Chapter I is presented and the test results are evaluated. This chapter ends with the presentation of an overall evaluation of the methodology

and the empirical results in line with the problem identified in Chapter I.

Data Needs and Variable Construction

The secondary (published) data that are used and the construction of variables are presented in the following section.

Secondary Data

The secondary data used in this study cover the period 1937-1977. The data are as follows:

1. Groundnut (peanut) production figures which include both exports and domestic consumption of groundnuts (in long tons),
2. Groundnut prices which are the annual average producer prices of groundnuts in Nigeria (in Naira per ton); they are a fraction of world's annual and/or monthly prices,
3. The prices of competing crops, such as cotton; these are the annual average producer prices of cotton in Nigeria; which are also a fraction of world's annual or monthly prices of cotton (in Naira per ton),
4. Index of food prices is an index of prices for guinea corn, millet and wheat; these are the food crops that compete with groundnut in resource utilization in the study area,
5. The consumer price index (CPI) based on 1975 prices,
6. The average annual rainfall figures for the groundnut producing areas of Northern Nigeria (in inches); these areas include Kano, Kaduna, Sokoto, Katsina, Jos, and Niaiduguri.

Sources of Data

The above secondary data were obtained and aggregated from a variety of sources:

a. Federal Office of Statistics, Lagos, Nigeria, "Index of Economic Indicators" (up to 1977),

b. Federal Office of Statistics, Lagos, Nigeria, "Digest of Statistics" (up to 1977),

c. Central Bank of Nigeria, "The Annual Reports and the Economic Indices" (up to 1977),

d. G. K. Helleiner, "Peasant Agriculture, Government and Economic Growth in Nigeria", pp. 429-590,

e. United Nations Economic Commission for Africa, "Survey of Economic Conditions in Africa", (1970, p. 127),

f. Food and Agricultural Organization, Production and Trade Summary (up to 1977),

g. Federal Republic of Nigeria, Office of Meteorological Services, Lagos, Nigeria, 1979.

Variable Construction

In estimating supply response models by econometric methods, data problems and multicollinearity among variables prevents the inclusion of a large number of variables in the models. Any attempt to drop variables when they are supposed to be included introduces specification errors, hence, biased estimates. In this analysis, some of the highly collinear variables will be combined. Thus, for a given crop like groundnuts, the price of groundnuts for the previous year plus the difference between the observed and the expected groundnut price last

year will be combined into the expected groundnut price. The rainfall averages for the different geographical locations of the study area are also combined. The prices of competing food crops that are grown in groundnut producing areas are combined into an index of food crop prices. The procedures for constructing the variables are detailed below.

The Expected Groundnut Price. Expected groundnut price is obtained by utilizing Equation 5. Therefore, expected groundnut price (EXPGP) will equal the observed groundnut price in the previous period plus the difference between the observed groundnut price in the previous period and the price expected last period. The expected cotton and index of food prices will be set equal to the observed cotton and food price index of the previous period respectively (Equations 11 and 12). The adjusted price series are the desired proxies for the various expected crop prices.

Risk on Expected Groundnut Price. The desired risk variable is constructed according to Equation 25. By substituting the expected groundnut price and the realized groundnut price into Equation 24, risk is then expressed as a weighted moving average of the squared deviation of the expected price from the realized price over an appropriatly chosen moving period using chosen weights. A three year moving period has been chosen for this study, and the weights are $\delta_1 = 0.5$, $\delta_2 = 0.333$, $\delta_3 = 0.167$. The choice of these weights is ad hoc. The reasoning behind the choice of the weights is that the last year's price variance carries more weight than the more distant price variances.

Government Policy Variable. Government involvement in the agricultural crop subsectors, as discussed in previous chapters - especially in Chapters II and III - took different forms:

a. Price and income stabilization objectives through the marketing boards;

b. Development of high-yielding varieties;

c. Marketing and markets development for Nigeria's export commodities;

d. Direction of the general nature and performance of the marketing and storage subsector of Nigerian agriculture.

Each of these activities has to be incorporated into this analysis, either directly or indirectly. Therefore, the frequent changes in the political system in Nigeria have made it necessary for researchers to investigate the effects of such changes not only on the state of agriculture in general, but on groundnut production in particular. The desired policy variable is constructed with the use of a dummy variable. One of the most common applications of the dummy variable in economic analysis has been to account for seasonal shifts in demand and/or supply relationships. Dummy variables are also used in time series analysis to account for shifts in relationships over time.

In this study, the period 1937 through 1977 will be characterized as a period when two political systems existed. A dummy variable will be constructed such that:

D_1 = 1, if civilian government (1937 through 1965),

= 0, otherwise (1966 through 1977).

The variables included in the three models are identical except for the inclusion of a lagged dependent variable in Model 3. The inclusion

of the lagged dependent variable is based upon a partial adjustment hypothesis. The use of this hypothesis when modelling groundnut supply response is considered to be justified by grower, technology and government policy implementation practices in the study areas. Groundnut farmers in the study area found that groundnut production and/or supply is reasonably profitable through time.

Price Variables. In the estimation of the various supply response models 1, 2, and 3, the groundnut prices and alternative crop prices which were entered were (groundnut) tonnage average annual prices. The average annual prices were those reported by the marketing boards. The world market prices were not used since they do not provide accurate representative prices received by the producers. The competing crop prices were collected in the same manner and are consistent with the price of groundnuts used (all prices are reported in Naira per ton).

Technological Change. According to Hayami and Ruttan (1971):

> ... the process of technical change in agriculture can best be understood as a dynamic response to the resource endowments and economic environment in which a country finds itself ... (p.26).

For this analysis, it is necessary to consider some areas of technical change that have occured in Nigeria:

a. changes of a yield improving nature;

b. changes in the increased use of fertilizer, pesticides and herbicides;

c. changes in improved marketing systems; and,

d. changes which have occured in the processing stage of groundnut oil production.

Various proxy variables are available in order to at least

partially account for the dynamic role technological change has taken. A time trend is frequently used in analyses based on aggregate level data. For convenience, a time trend is used in this analysis as a measure of technological change.

Analysis and Discussion of Results

The aggregate production/supply response models in Chapter IV, Equations 15, 22, and 26 are not all linear with respect to parameters (especially Equation 22, which is a partial adjustment model). Two estimation methods are proposed--ordinary least squares (OLS), and a non-linear estimation technique. The OLS parameter estimates will be unbiased and consistent when applied to both the rational and the extrapolative models. But, OLS parameter estimates will be biased if applied to the partial adjustment model due to the presence of lagged variables, but such estimates will be consistent. The OLS parameter estimates of the extrapolative and rational expectation models will be more efficient than the OLS parameter estimates of the partial adjustment model.

In the initial estimation, OLS was applied to the extrapolative, rational expectation, and partial adjustment models. All the signs before the parameter estimates are consistent with a priori expectations based on economic theory. The decision to apply OLS to the partial adjustment model was based on the assumption of no serial correlated disturbances. The test for serial correlation was carried out as discussed in Chapter IV and the test detected no serial correlation problem. It is known that the OLS parameter estimates of a partial adjustment model are biased but consistent even though inefficient. The

empirical results of the three models are as shown in Equations 36 to 40 and Table XIX.

The extrapolative model, Equation 26 in Chapter IV, was estimated with and without the risk variable. The empirical results of the extrapolative model are as shown in Equations 36 and 37. The results in Equation 37 contain the risk variable while Equation 36 does not contain the risk variable.

Model I: Extrapolative Model

$$
\begin{aligned}
Q_t = {} & 179052259 + 4661.4\ \text{RNUTP} - 4166.52\ \text{LGNUTP} \\
& \quad (6.98) \qquad (4.38) \qquad (-3.67) \\
& - 8353.39\ \text{MOTTP} + 6319.1\ \text{LCOTTP} - \\
& \quad (-8.1) \qquad (5.2) \\
& - 1135.01\ \text{MOODPI} + 576.414\ \text{LFOODPI} \\
& \quad (-2.74) \qquad (1.8) \\
& - 255.64\ \text{MRAIN} - 42809.5\ D_1 \\
& \quad (-3.12) \qquad (3.3) \\
& - 89685.1\ \text{TC} \qquad (36) \\
& \quad (-6.95)
\end{aligned}
$$

$F = 10.05$

$R^2 = 0.78$

$DW = 1.9$

TABLE XIX

ALTERNATIVE MODELS FOR GROUNDNUT SUPPLY RESPONSES IN NIGERIA

VARIABLES	EXTRAPOLATIVE EQ 1	EQ 2	PROB>|T|	RATIONAL EXPECTATION EQ 1	EQ 2	PROB>|T|	PARTIAL ADJUSTMENT EQ 1	PROB>|T|
INTERCEPT	179052259	186627632	.0001	97656116	97036264	.00023	65160968	.0025
RNUTP	4661.4	5217.4	.0002				2520.8	.0021
LGNUTP	-5166.52	-4705.24	.0012					
MOTTP	-8353.39	-8932.55	.0001	-5745.95*	-5845.9	.0001	-3011.32	.0025
LCOTTP	6319.1	6541.28	.0001					
MOODPI	-1135.01	-966.9	.0112	-180.39*	-76.9*	.6659* .8602	-603.6	.0343
LFOODPI	576.41	371.63	.0800					
MRAIN	-235.64	-234.9	.0045	-59.95*	-32.86	.5617* .7616	-94.76	.2002*
MTRAIN								
D_1	-42809.5	-45148.6	.0030	-19737.8*	-18707.6*	.2248* .2734*		
TC	-89685.1	-93578.3	.0001	-48922.1	-48662.8	.0024		
EXPGP				1951.01	1956.42	.041		
RISK		-6.57	.0965		-5.35	.3968*		
Q_{T-1}							0.7408	.0001
R^2	.78	.81		.53	.54		.85	
DW	1.9	2.2		1.54	1.6			
F-RATIO	10.05	10.07		5.23	4.55			

*Not significant at 10%.

$$Q_t = 186627632 + 5217.4\ RNUTP - 4705\ LGNUTP$$
$$\qquad\quad (7.4) \qquad\quad (4.9) \qquad\quad (-4.1)$$
$$- 8932.55\ MOTTP + 6541.28\ LCOTTP$$
$$\qquad\quad (-8.5) \qquad\quad (5.5)$$
$$- 966.9\ MOODPI + 371.63\ LFOODPI$$
$$\qquad\quad (-2.4) \qquad\quad (1.1)$$
$$- 234.9\ MRAIN - 45148.1\ D_1$$
$$\qquad\quad (-2.9) \qquad\quad (-3.6)$$
$$- 93578.3\ TC - 6.57\ RISK \qquad (37)$$
$$\qquad\quad (-7.4) \qquad\quad (-1.7)$$

$F = 10.07$

$R^2 = 0.81$

$DW = 2.2$

The rational expectation model as specified by Equation 15 in Chapter IV was estimated with and without the risk variable. The results are as shown in Equations 38 and 39 respectively.

Model 2: Rational Expectation Model

$$Q_t = 97036264 + 1956.42\ EXPGP - 5845.88\ MOTTP$$
$$\qquad\quad (3.36) \qquad\quad (2.14) \qquad\quad (-4.9)$$
$$- 76.88\ MOODPI - 5.35\ RISK - 32.86\ MRAIN$$
$$\qquad\quad (-0.18) \qquad\quad (-0.86) \qquad\quad (0.31)$$
$$- 18707.6\ D_1 - 48662.8\ TC \qquad (38)$$
$$\qquad\quad (-1.12) \qquad\quad (-3.34)$$

$F = 4.55$

$R^2 = 0.53$

$DW = 1.6$

$$Q_t = 97656116 + 1951.01\ EXPGP - 5745.95\ MOTTP$$
$$(3.4) \qquad (2.14) \qquad (-4.86)$$
$$- 180.39\ MOODPI - 59.93\ MRAIN - 19737.8\ D_I$$
$$(-0.44) \qquad (-0.59) \qquad (-1.19)$$
$$- 48922.1\ TC \qquad (39)$$
$$(-3.38)$$

$F = 5.23$

$R^2 = 0.52$

$DW = 1.54$

Model 3: Partial Adjustment

$$Q_t = 65160968 + 2520.8\ RNUTP - 3011.32\ ROTTP$$
$$(3.3) \qquad (3.34) \qquad (-3.3)$$
$$- 603.6\ ROODPI - 94.76\ MRAIN - 14851.4\ D_1$$
$$(-2.2) \qquad (-1.3) \qquad (-1.4)$$
$$- 32683.7\ TC + 0.7408\ Q_{t-1} \qquad (40)$$
$$(-3.3) \qquad (6.8)$$

$F = 12.24$

$R^2 = 0.85$

Figures in parenthesis are the 't' values.

Variable Definitions

Q_t = Aggregate groundnut production/ supply (metric tons).

RNUTP = Groundnut price lagged and deflated (₦/ton).

LGNUTP = Deviation in groundnut price in last and previous time period deflated (₦/ton).

MOTTP = Cotton price lagged and deflated (₦/ton).

LCOTTP = Deviation in cotton price in last and previous time period deflated (₦/ton).

MOODPI = Index of food prices lagged and deflated (₦/ton).

LFOODPI = Deviation in food price index deflated (₦/ton).

MRAIN = Mean annual rainfall (inches).

D_1 = Policy variable = 1, if civilian government, and zero otherwise.

TC = Time trend to measure technology (measured in years).

EXPGP = Expected groundnut price; measured by the groundnut price in the previous season plus the proportion of the expectation in groundnut price and the realized price last year.

The expected sign of the coefficient of each variable is placed immediately before it. Both the extrapolative and rational expectation models were estimated with and without the risk variables; while the partial adjustment model contains no risk variable.

Discussion of the Extrapolative Model

The following observations can be made from the results given in Equations 36 and 37. Equation 36 shows that 78 percent of the variation in the production and/or supply of groundnuts in Nigeria was explained by all the explanatory variables taken together. The predictive power of Equation 36 in explaining the variations in production and/or supply of groundnuts in Nigeria is significant at the five percent level. Additionally, all the signs before each of the coefficients of the variables are consistent with a priori expectations. The absence of auto-correlation was verified by use of Durbin Watson statistics.

An evaluation of Equation 37 which includes a risk variable (where risk is as defined in Chapter IV) shows a better predictive power for the model. The inclusion of the risk variable increased the predictive power of the equation to 81 percent. The sign before the risk variable is negative as expected, which implies that Nigerian groundnut farmers are averse to risk. An increase in risk associated with groundnut price variations will induce the farmers to reduce production. In terms of resource allocations, for example land, labor and capital, farmers will divert these resources to competing crops with minimum price variances. The risk aversion behavior of groundnut farmers has serious policy implications to both the Nigerian Marketing Boards and the Nigerian government, Therefore, the Nigerian government through the Groundnut Board must give price stabilization policies a top priority if expansion of groundnut production is to be achieved.

The signs on the rest of the variables are consistent with a priori expectations. The parameter estimates are also statistically

significant at the five percent level. A null hypothesis on the test of auto-correlation was not rejected at the 95 percent level of confidence.

Discussion of the Rational Expectation Model

The rational expectation model was estimated with and without the risk variable as shown in Equations 38 and 39. Equation 38 shows that 53 percent of the variation in the production and/or supply of groundnuts in Nigeria was explained by all the information available to groundnut producers while making their production decisions; while 52 percent of the variation in groundnut production and/or supply was explained by Equation 39 without the risk variable. The predictive power of both equations is statistically significant at the five percent level. The signs on each of the variable coefficients are consistent with a priori expectations. The test for auto-correlation shows an indecisive result. The equations were corrected for auto-correlation, and the model became unstable with very low R^2. Consequently, our initial results with an indecisive auto-correlation problem were retained. The risk variable in the rational expectation model carries a negative sign, which implies that a rational groundnut producer is also averse to risk; this is consistent with the extrapolative model result. The expected groundnut and cotton prices and technological change over time are all significant at the one percent level. The policy variable is significant at the five percent level. These estimates indicate an interesting policy implication. It can be concluded from these results that groundnut producers pay greater attention to instabilities in both groundnut and cotton prices. Additionally, the result of the policy

variable signifies that constant changes in the policy instruments that affect the groundnut industry have had a significant negative impact on groundnut production.

Discussion of the Partial Adjustment Model

As regards the estimation properties of OLS when used to estimate partial adjustment models, OLS estimates are generally biased in small samples (Johnston, 1971). The statistical tests used to evaluate the fit of a linear equation are inappropriate in a non-linear regression. The F statistics cannot be used in a usual way to perform a significance test on the overall fit of a non-linear regression, nor can t statistics be used in the usual manner (Pindyck and Robinfeld, 1981). However, OLS estimates have all the desirable asymptotic properties, assuming the disturbance term is well behaved (that is, $u \sim iid(0,\sigma^2)$. The R^2, however, can be applied in its conventional sense to a non-linear regression. A test of serial correlation on the partial adjustment was carried out as stated in Chapter IV and it shows no presence of auto-correlated residuals. The results of the partial adjustment Equation 40 show that 85 percent of the variation of groundnut production and/or supply was explained by all the explanatory variables taken together. All the signs on the parameter estimates are consistent with a priori expectations. Also, a one standard deviation change in the independent variable will lead to a 0.7 standard deviation change in the dependent variable. This implies that a period longer than one crop season is needed for full adjustment.

Comparisons of the Three Models

Comparing the three models, we know that the reduced form of the equations used the same or identical variables. The variable constructions for both rational expectation and extrapolative models are similar except for groundnut expected price in the rational expectation model, which follows from the general class of autoregressive integrated moving average ARIMA (p,d,q). The percentage of the observed variation in groundnut supply explained by all models varies. The coefficient of determination ranges from .53 for the rational expectation model to .81 and .85 for the extrapolative and partial adjustment models respectively. The results suggest some interesting findings, for the rational expectation model it can be deduced that there are other important variables that influence the farmers' expectation formation other than the variables considered in this specification. The subset of information available to groundnut farmers when decisions are made could not explain more than 54 percent of the total variation in groundnut production and/or supply.

The results of the extrapolative and partial adjustment models better explain the variation in groundnut supply. This could be attributed to the fact that groundnut farmers based their price expectations on past histories of the variables under consideration; in this case, groundnut, cotton, and food crop prices. These factors plus other institutional variables were considered in the extrapolative model. In the partial adjustment model, apart from the expected prices, the desired level of groundnut production helps to explain more of the total variation in groundnut production. The index of food prices, weather and risk variables were not significant at 10 percent in the

rational expectation model, which could be due to multicollinearity problems. These variables are retained in the model since their inclusion is justified by economic theory. In addition, all the signs on these variables are consistent with a priori expectations.

Short and Long Run Elasticities

To evaluate the responsiveness of groundnut production to changes in relative prices, short and long run elasticities are computed for the various supply equations and presented in Table XX. For the rational expectation, extrapolative and partial adjustment models, the short run price elasticities at the mean are:

Rational Expectation Model. The rational expectation model from Equation 15 is

$= \hat{\Psi}_j \bar{P}_j/\bar{Q}_j =$

own-price elasticity

$= \hat{\Psi}_i \bar{P}_i/\bar{Q}_j =$

cross-price elasticity

where $i \neq j$.

Extrapolative Model. The extrapolative model from Equation 26 is

$= \hat{\beta}_j \, P_j/Q_j =$

own-price elasticity

$= \hat{\beta}_i \, P_i/Q_j =$

cross-price elasticity

where $i \neq j$.

TABLE XX

LONG AND SHORT RUN ELASTICITIES

Models	Groundnut Price	Expected Groundnut Price	Cotton Price	Food Crop Price
Extrapolative				
Equation 1	1.3		-4.5	-1.31
Equation 2	1.4		-4.8	-1.1
Rational Expectation				
Equation 1	-	.6	-3.1	-0.2
Equation 2	-	.6	-3.2	-0.1
Partial Adjustment				
Equation 1	.68		-1.63	-0.67
Equation 2	2.68*		-6.23*	-2.58*

*Long run elasticities.

Partial Adjustment Model. The partial adjustment model from Equation 22 is

$$= \hat{\beta}_j \hat{\gamma}_j \overline{P}_j / \overline{Q}_j =$$

own-price elasticity

$$= \hat{\beta}_i \hat{\gamma}_i \overline{P}_i / \overline{Q}_j =$$

cross-price elasticity

where $i \neq j$.

The long run elasticity estimate at the mean for the partial adjustment

model from Equation 22 is:

$$\frac{\text{LR Elasticity}}{(1 - \hat{\gamma})}$$

where $\hat{\gamma}$ is the coefficient of the lagged dependent variable Q_{t-1}.

The results in Table XX show that both the own-price and cross-price elasticities for the extrapolative model are very elastic. The short run cross-price elasticities with respect to cotton are elastic, but the own-price and cross-price elasticities with respect to the food price index are inelastic in the rational expectation model. The short run own-price and cross-price elasticities for Index of Food Prices in the partial adjustment model are inelastic, while the short run cross price elasticity for cotton is elastic. The long run own-price and cross-price elasticities in the partial adjustment model are very elastic, which suggests that, in the long run, groundnut farmers will be more sensitive to changes in cotton and food crop prices. There are no significant differences in elasticities for those equations with or without the risk variable.

The results of the supply elasticities have important policy implications. For the extrapolative model, a one percent increase in groundnut price will lead to a 1.3 percent increase in the production of groundnuts. On the other hand, a one percent increase in the price of cotton will lead to a 4.5 percent decrease in groundnut production. This is consistent with the rational expectation cross-price elasticity results. Furthermore, a one percent increase in the expected groundnut price will lead to a 0.6 percent increase in groundnut production. For the partial adjustment model, a one percent increase in groundnut price will lead to a less than one percent increase in groundnut supply.

Also, a one percent increase in cotton and food prices will lead respectively to a 6.3 and 2.6 percent decrease in groundnut production.

Comparing the short run own and cross-price elasticities to the results obtained in previous similar studies (Table XXI), certain conclusions can be drawn. The short run and long run own and cross-price elasticities with respect to the partial adjustment models are consistent with those of the previous studies (Olayide, Mlay, Blakeley and Hill, et al.) except for cotton price elasticity. But the short run own-price and cross-price elasticities in this study are higher than those obtained in the previous studies (Tables XX and XXI). The implications of these results are that both the groundnut and cotton producers are now more sensitive to price changes than before as shown by the three models.

The Priority Model

The Extrapolative Model. The extrapolative model with the risk variable is chosen as the priority model for this study. The extrapolative model as shown in Chapter IV shows that the estimated parameters are unbiased and consistent and also possess all asymptotic efficiencies. The null hypothesis test for auto-correlation is not rejected, implying that the disturbances are independently and identically distributed with mean zero and constant variance. The overall fit of the equation indicates that 81 percent of the variation in groundnut supply is explained by all the defined explanatory variables taken together. All the explanatory variables except one are significant at the one percent level.

TABLE XXI

PREVIOUS STUDIES OF OWN PRICE ELASTICITIES
BY CROPS AND REGIONS FOR SELECTED YEARS

Regions and Crops	Period	Author	Short-Run	Long-Run
Groundnut				
Nigeria	1948-67	Olayide, S.O.	.24 to .79	-
Sudan	1951-67	Medani	.72	1.62
India	1938-57	N.C.A.E.R.	.22	-
India	1953-68	Boon-raung et.al.	.22	-
U.S.A.(S.East)	1951-78	Mlay, Gilead	.29	2.3
Cotton				
Nigeria	1948-67	Olayide, S.O.	.03 to .04	-
Nigeria	1948-67	ONI	.38	.28
Sudan	1951-65	Medani	.39	.50
Egypt	1899-1937	Stern	.38	-
India	1938-57	N.C.A.E.R.	.75	-
Uganda	1922-38	Freerick	.25	-
U.S.A.(10 States)	1883-1914	Decanio	.13 to .34	.23 to .85
U.S.A.(S.East)	1905-32	Brennan	.33	-
U.S.A.(S.West)	1905-32	Brennan	.37	-
Oklahoma	1929-57	Blakley & Hill	1.05	-
Panhandle	1951-78	Mlay, G.I.	.25	1.14

Source: Askari and Cummings, Inter. Econ. Review, Vol. 18, 1977; and Gilead Mlay, O.S.U., 1981 (unpublished Ph.D. dissertation).

Table XX shows that a one percent increase in groundnut price will lead to a 1.3 percent increase in groundnut production. This implies that an increase in the real price of groundnuts will lead to expansion of groundnut production. The cross-price elasticities for cotton and food crops are of interest as well; the result shows that cotton provides steep competition for groundnut production, since a one percent increase in the price of cotton and food crops will lead to a 4.5 and 1.3 percent decrease in groundnut production respectively. Therefore, the grains marketing boards which administer groundnut and competing crop prices have to set and adjust the producer prices of those commodities such that a balance is maintained if groundnut production is to increase.

Another interesting aspect of these results is the effect of rainfall on groundnut output. The highly significant estimated coefficient of rainfall variable suggests that rainfall is very crucial to groundnut output. This implies that a program of irrigation in Northern Nigeria might be a viable recommendation. The continuous drought in groundnut producing areas of Northern Nigeria has had a significant negative impact on groundnut production over time.

The adoption of fertilizer and other methods of improved yield practices would also seem to be important to groundnut production expansion. This is revealed by the highly significant coefficient of the trend variable which stands as a proxy for yield increasing technologies. The negative sign before the technology variable indicates a poor adoption of improved technological practices. This is evidenced by the poor fertilizer programs over the years, lack of credit

facilities, and poor extension services as refered to in Chapters II and III.

The sign on the risk coefficient is negative as expected and is significant at the one percent level; this implies groundnut producers are risk averse. An increase in risk associated with groundnut price variations will induce groundnut producers to reduce their investments in groundnut production. This, as a matter of policy, is a signal to the groundnut board that price stabilization should be viewed as a tool to increase production.

Hypotheses Test Results

In Chapter I, five areas of concern were hypothesized to be responsible for variations in the annual production and supply of groundnuts. On this basis four hypotheses were proposed to evaluate the validity of the assertion; while the fifth hypothesis is a qualitative or conceptual hypothesis regarding the ability to define, delimit and analyze the problem (Tweeten, 1982). These hypotheses are restated below. It is hypothesized

1. that competition for resource use by cotton, wheat, guinea corn, and millet has accounted for part of the decline in groundnut production;
2. that constant policy changes and modifications have had little or no impact on increasing groundnut production;
3. that emphasis on subsistence food production has had a substantial impact on exchange crops production; and,
4. that Nigerian groundnut farmers are risk averse.

In order to test the above hypotheses, a priority model signified

by Equation 37 is employed. Equation 37 is therefore referred to as the hypothesis testing equation, viz:

$$Q_t = 186627632 + 5217.4\ RNUTP - 4075\ LGNUTP$$
$$(7.4) \qquad (4.9) \qquad (-4.1)$$
$$- 8932.55\ MOTTP + 6541.28\ LCOTTP$$
$$(-8.5) \qquad (5.5)$$
$$- 966.9\ MOODPI + 371.63\ LFOODPI$$
$$(-2.4) \qquad (1.1)$$
$$- 234.9\ MRAIN - 45148.1\ D1 - 93578.3\ TC$$
$$(-2.9) \qquad (-3.6) \qquad (-7.4)$$
$$- 6.57\ RISK$$
$$(-1.7)$$
$$F = 10.07$$
$$R^2 = .81$$
$$D.W. = 2.2,$$

where the figures in parenthesis are the "t" values, and all variables are as defined in Equation 40 in Chapter IV. Testing the first hypothesis is equivalent to testing the null hypothesis that:

$H_0: \beta_2 = 0$ $\qquad$ $H_0: \beta_3 = 0$

$H_A: \beta_2 < 0$ $\qquad$ $H_A: \beta_3 < 0$

Tabulated $t_{40,.05} = 2.021$.

That is, the coefficient of the cotton price and the index of food prices are equal to zero. We fail to accept the null hypothesis and conclude that competition for resource use by competing crops has accounted for part of the decline in groundnut production expansion. This result is consistent with our a priori expectation.

Hypotheses 2, 3, and 4 were also tested by employing the use of

t-statistics, viz:

$H_0: \beta_k = 0$

$H_A: \beta_k \neq 0.$

We fail to accept the null hypothesis in each case, which implies that:

1. constant policy changes and modifications have reduced groundnut expansion;
2. government emphasis on subsistence food production has reduced the expansion of exchange crop production. This is also confirmed by the result of the cross-price elasticities with respect to the index of food prices in Table XX;

3. Nigerian groundnut farmers are risk averse. This result has an interesting implication for the Nigerian Groundnut Board. Producer price stabilization should be given a top priority if the national goal, in this case expanding export production, is to be achieved.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Introduction

The aim of this chapter is to summarize the particular findings of the previous chapters and to suggest some general conclusions with respect to supply response relationships for groundnut production and supply in the Northern States of Nigeria. The procedure is to: 1) restate the purpose and objectives of the study; 2) briefly describe the procedures used in achieving the objectives; 3) report the main findings of this study; and 4) identify the limitations of the study and possible directions for future research.

Purpose and Objectives of the Study

Behrman (1968) said that:

> The need to implement policies which will induce the expansion of agricultural production in underdeveloped countries is becoming continually more urgent. The selection of the proper policies is a matter of considerable dispute, however, partly because of widespread disagreement over the responsiveness of the agricultural sector in underdeveloped countries to various incentives. The degree of such responsiveness is, of course, an empirical question (p.334).

This issue forms the principal base upon which this study stands. In this study it is shown how the rational expectations hypotheses can be used as an alternative to the ad hoc models of expectation formation to empirically specify producers' price expectation formation. Alternative

models such as extrapolative and partial adjustment models were also employed to specify producers' price expectation formation. The study reviews past investigations of the economic constraints to groundnut production, marketing and consumption. In the process, the study notes some of the institutional constraints that inhibit agricultural production, such as land tenure problems, poor marketing arrangements, competition for factors of production, and farmers' response to price risk (variance). An investigation of the means by which rural income in Northern Nigeria can be increased through gainful employment of rural people of the study area was an integral part of the study.

Summary

The aggregate supply response model used herein is developed from the theory of a multi-product firm facing product price uncertainty. For groundnuts, supply is shown to be a function of expected product prices, input prices, time trends (to depict technological changes over time), and risk (price variance). It is shown that the supply of groundnuts is an increasing function of expected price, and a non-increasing function of price risk. The supply function in the model is modified to incorporate policy variables and expected crop yield.

Specification of the Explanatory Variables

The rational expectations hypothesis is used as an alternative to the ad hoc models in modelling producers' price expectations. The rational expectations hypothesis implies that economic agents take into account all relevant information in forming their expectations. Two methods which conform to the rational expectations hypothesis are

presented for empirical specification of expectations. The partial adjustment model is also specified for empirical estimation. For the rational expectation model, the realized groundnut supply is regressed on the lagged values of the explanatory variables, and the price at time t, plus some proportion of the expected and realized price at t - 1 is used as the expected price for period t at period t - 1. In the presence of a large number of explanatory variables, considering more than one lag will pose data problems. The explanatory variables considered are: competing product prices, a policy variable and a time trend.

The second approach for constructing rational expectations is the extrapolative predictor discussed in Chapter IV. This approach relies solely on past realized values of the expectation variable. This method requires the identification of the stochastic process that generates the realized values of the expected variable. By applying the Box-Jenkins methods mentioned in Chapter IV, an appropriate lag structure can be identified from the general class of ARIMA models. The expectations so constructed are termed weakly rational since they are a subset of the relevant information for expectation formation. This method is specified and empirically used in this study.

The partial adjustment model, which justifies that the desired, rather than the actual, value of the dependent variable determined by the explanatory variables is considered. This model is also presented for empirical estimation of groundnut supply response. The major policy variable used in the supply response model is the system of government. The policy variable is modelled with a dummy variable which divides the period of observation into two periods: the period 1937 through 1966 as

a period of civilian administration and the period 1967 through 1976 as a period of military rule. It is shown that government programs throughout the period of observation have a negative impact on total groundnut production. The use of input prices in the model was impractical due to data limitations. It is proposed that the consumer price index be used to deflate all prices to mitigate the effect of specification biases.

In the case of more than one competing crop, the number of exogenous variables to be considered grows enormously. In order to minimize multicollinearity and conserve degrees of freedom, an index of food prices was constructed to serve as a proxy for food prices in the study area. The final supply function which is subjected to empirical specification has as explanatory variables: the expected groundnut, cotton and index of food prices, risk on the expected groundnut prices, the policy variable, the time trend, and the weather index.

For the groundnut supply response equation, identical sets of explanatory variables for rational, extrapolative and partial adjustment models are used.

Evaluation of Results

The evaluation of the empirical results is based on how well the equations conform with the restrictions specified by economic theory and on the overall statistical fit. The three models satisfied the restrictions on the estimated coefficients as expected. All the signs before each of the estimated coefficients in the three models are

consistent with a priori expectations. The risk variable, time trend and policy variable show the hypothesized signs in all the models.

The percent of the observed variation in groundnut production explained by all the explanatory variables in the models (indicated by R^2) varies for the three models. The overall predictive power of the rational expectation model is .54, the extrapolative model shows .81, while the partial adjustment model has a predictive power of .85. The result suggests that for the rational expectation, there are other important explanatory variables in addition to the ones considered in the analysis.

The results of the influence of changing risk on groundnut supply response are consistent in both the rational and extrapolative models. The elasticity estimates show that, on the average, the short-run own-price elasticities for both rational and extrapolative models are elastic. The short-run own and cross-price elasticities are very elastic across the three models except for the cross-price elasticities for the index of food prices in the rational and partial adjustment models; while the long run own and cross-price elasticities are elastic for the three models. The comparison of these elasticity results with previous studies on groundnuts and cotton show that responsiveness to price changes is higher than any of the other results reviewed in Table XXI.

Implications of the Hypotheses Test Results

All the stated hypotheses in Chapter I conform with a priori expectations of the direction of change of the relevant variables. The rational expectation results show that two of the estimated parameters

are not significant at the .10 probability level. By employing the elasticity estimates for each of the three models used in specifying groundnut supply response, the differential in policy prescriptions required to achieve a given goal can be determined.

In conclusion, it is evident from these results that well organized marketing arrangements, improved yield varieties, and systematic price stabilizaiton policies should be an integral part of the Agricultural Commodity Board's activities.

Limitations of the Study

The supply response function, derived from the theory of a competitive firm facing price uncertainties, has input prices as factors influencing supply. Due to a lack of cost data, the influence of changing production costs on production and/or supply response was not empirically investigated. The problem of specification error bias that could result from omission of relevant variables is discussed in Chapter IV. Criticism of the lack of theoretical justification for the extrapolative model is discussed in Chapter IV, but no known model is at present without some pitfalls.

In this study, some variables were combined to conserve degrees of freedom and to mitigate the degree of multicollinearity. While the method allows the inclusion of most competing crops in our groundnut supply response model, specification of the influence of individual competing crops on variations in groundnut production and/or supply becomes impractical.

Directions for Future Research

Three approaches for empirically estimating groundnut supply response were proposed in this study and their relative performance in supply analysis was investigated. The ordinary least square (OLS) estimating method was applied to the partial adjustment model on the assumption that no serially correlated disturbances existed. This assumption was upheld by the result of the Durbin h test. Therefore, future work on groundnut supply analysis should be directed toward the estimation of the partial adjustment model using nonlinear techniques. The result so obtained might be different from the results of this study. The evaluation of alternative methods for construction of the rational expectation and extrapolative models and the performance of the models under alternative expectation schemes, such as Almon polynominal lags, should be investigated. The restrictions imposed on the risk variable construction were ad hoc but were consistent in both the rational expectation and extrapolative models. These restrictions should be varied in future work and the result compared to the results obtained in this study.

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APPENDIXES

APPENDIX A

DATA FOR CHAPTER VI

TABLE XXII

GROUNDNUT PRODUCTION (TONS) AND PRODUCER PRICES (₦/TON) OF SELECTED FARM CROPS, NORTHERN NIGERIA, 1937 THROUGH 1976

Year	Groundnut Production	Groundnut Prices*	Cotton Prices*	Groundcorn Prices	Millet Prices	Consumer Price Index**
1937	207449	4.70	27.44	4.10	6.40	7.58
1938	145632	3.38	29.10	5.00	6.40	7.46
1939	146422	5.58	28.19	6.42	6.27	7.85
1940	134112	5.37	26.89	8.00	9.42	8.19
1942	105009	6.50	31.38	7.25	7.49	8.51
1943	172288	9.00	30.73	8.00	6.92	9.02
1944	211425	12.00	28.57	10.00	7.61	9.24
1945	287219	12.00	32.00	11.21	8.02	8.77
1946	305109	16.00	33.42	9.30	8.00	9.96
1947	315192	16.00	35.10	8.73	9.22	10.02
1948	315397	19.20	35.65	10.79	11.59	10.35
1949	327864	21.20	37.33	12.88	11.24	9.99
1950	188154	21.20	35.46	14.42	13.00	13.86
1951	142743	36.00	37.33	16.25	15.35	12.48
1952	425588	36.00	37.33	20.55	18.12	11.07
1953	430696	35.00	56.00	18.20	17.10	26.60
1954	424648	35.50	56.00	28.80	30.30	27.40
1955	372776	35.40	56.00	19.60	22.60	28.80
1956	530215	32.40	54.50	19.90	20.40	31.10
1957	357932	37.40	54.50	20.90	21.20	31.60
1958	714698	33.90	51.30	23.70	24.70	31.90

TABLE XXII (Continued)

Year	Groundnut Production	Groundnut Prices*	Cotton Prices*	Groundcorn Prices	Millet Prices	Consumer Price Index**
1959	533354	36.40	56.00	22.70	24.20	33.10
1960	445441	37.40	55.00	17.30	20.809	35.00
1961	619651	33.70	48.00	17.90	19.00	37.30
1962	685519	30.30	42.00	23.30	22.60	39.20
1963	871524	30.30	44.00	19.70	21.90	38.20
1964	786727	32.67	46.00	17.30	17.50	38.50
1965	675884	34.44	47.00	19.30	20.20	40.10
1966	977320	34.33	45.00	29.12	30.40	44.00
1967	1027122	29.00	43.00	32.80	28.00	42.30
1968	648213	26.60	55.00	30.44	32.40	42.10
1969	764032	29.90	55.00	33.82	32.33	46.40
1970	630101	33.80	55.00	34.33	35.18	52.80
1971	285837	39.50	59.00	34.00	43.50	61.30
1972	307142	39.50	66.00	36.00	51.00	62.90
1973	559047	46.50	66.00	42.70	54.50	66.50
1974	44039	72.50	78.00	47.22	41.17	74.80
1975	161927	115.00	154.00	35.51	34.80	100.00

TABLE XXII (Continued)

Year	Groundnut Production	Groundnut Prices*	Cotton Prices*	Groundcorn Prices	Millet Prices	Consumer Price Index**
1976	100050	125.00	154.00	40.06	39.90	122.00
1977	11893	137.00	165.00	40.00	41.30	148.00

Sources: Federal Office of Statistics, Lagos, Nigeria, "Index of Economic Indicators" (up to 1977); Federal Office of Statistics, Lagos, Nigeria, "Digest of Statistics" (up to 1977); Central Bank of Nigeria, "The Annual Reports and the Economic Indices" (up to 1977), G. K. Helleiner, "Peasant Agriculture, Government and Economic Growth in Nigeria", pp. 429-590; United Nations Economic Commission for Africa, "Survey of Economic Conditions in Africa", (1970, p. 127); Food and Agricultural Organization, Production and Trade Summary (up to 1977); Federal Republic of Nigeria, Office of Meteorological Services, Lagos, Nigeria, 1979.

*Net Producer Prices
**1975 = 100

TABLE XXIII

AVERAGE ANNUAL RAINFALL (INCHES) IN FOUR SELECTED AREAS OF THE GROUNDNUT PRODUCING STATES OF NIGERIA

Year	Kano	Jos	Maiduguri	Katsina
1937	35.22	52.45	21.10	33.47
1938	30.50	60.11	18.21	26.89
1939	33.42	54.01	15.07	20.12
1940	31.94	57.00	14.90	24.55
1941	32.93	57.00	20.33	22.96
1942	24.48	57.33	19.80	25.00
1943	31.24	62.53	22.51	31.87
1944	19.06	56.86	20.58	18.32
1945	39.04	55.24	28.58	36.78
1946	41.55	56.68	30.26	29.88
1947	31.40	55.41	25.11	26.64
1948	28.34	68.09	21.33	27.47
1949	23.17	46.89	17.61	19.94
1950	36.35	42.77	27.16	30.15
1951	31.41	53.70	21.24	24.18
1952	40.74	54.59	24.82	32.00
1953	28.12	49.59	24.82	32.00
1954	43.47	60.93	27.45	35.53
1955	42.28	54.62	33.84	25.68
1956	29.82	49.25	25.06	29.69
1957	39.69	66.82	28.81	36.39
1958	32.56	54.32	29.52	34.16

TABLE XXIII (Continued)

Year	Kano	Jos	Maiduguri	Katsina
1959	40.19	61.63	34.11	33.66
1960	29.79	57.63	28.82	27.67
1961	30.68	37.24	28.46	30.34
1962	44.86	52.70	26.68	27.20
1963	27.73	62.55	27.10	30.91
1964	29.54	52.26	17.80	39.12
1965	35.60	47.83	22.77	29.08
1966	30.64	48.07	24.54	25.14
1967	30.26	53.04	34.84	23.33
1968	29.22	50.49	26.71	24.18
1969	26.02	44.68	22.40	25.44
1970	28.16	46.37	23.69	25.01
1971	27.80	56.39	19.79	19.23
1972	26.32	54.06	17.33	18.69
1973	16.38	53.57	17.03	17.36
1974	26.02	52.59	24.13	24.83
1975	28.07	50.20	26.43	22.20
1976	27.45	53.60	27.16	21.60
1977	24.90	51.70	25.21	20.40

Source: Nigerian Meteorological Service, OSHODI, Lagos State, Nigeria, 1979.

APPENDIX B

SUGGESTIONS FOR IMPROVING NIGERIA'S AGRICULTURAL COMMODITY MARKETING

The reduction of the many Marketing Boards into seven is no panacea. Neither is the additional power to oversee and set minimum prices for local food stuffs and export products a remedy to totally solve and improve the efficiency of the various Boards. Change is necessary only when the change in itself will effect a change in that which it was meant to change. Replacing a crippled driver with one who is deaf and dumb is not a solution to a businessman who desperately needs to get to the airport to catch his flight. Thus, the State Marketing Boards must not merely be replaced by Commodity Boards just for change without significant changes in operation, personnel attitudes and functional efficiency. It is hoped that the such changes result in benefits not only for the corporate farmers but for the grassroot farmers as well.

In pursuit of this idea, the following suggestions should be made part of the overall objectives of the Marketing Boards.

a. The non-oil sector of Nigeria's exports, which is composed of agricultural products, is not performing to expectations. It has been shown that about 90 percent of the country's exports in 1975/1976 came from the oil sector. This means that nearly 10 percent of the country's exports are derived from the non-oil sector. A question often asked is, what would have been the country's economic situation without oil exports? Nigeria would have been handicapped in pursuing her economic policies and other development programs. Nigeria would have taken her cue on foreign aid lines. Nigeria should hence forth cease to neglect the agricultural sector which employs about 70 to 80 percent of the labor force. Efforts should be made to

eradicate all factors, marketing or otherwise, that inhibit agricultural production for both domestic consumption and for exports.

b. The importance of agricultural cooperatives cannot be underestimated, even in developed economies. The Government should, therefore, reorganize the agricultural cooperatives through the new Commodity Boards. Through these cooperatives, adequate subsidies in terms of modern farming equipment, improved-yield variety crops, price supports to stabilize producers' incomes, fertilizers, and other incentives could be channeled to the farming sector.

c. While the government continues full backing of the Commodity Marketing Boards, the Boards should be owned by the farmers through active participation by the Farmers Cooperatives. The Boards should not only be the "bills handler" to the farmers; but instead, the farmers should be allowed to take an active role in the decision making process that effects them. The previous State Marketing Boards were plagued by inadequacies in informational links between the farmers and the various Boards. As such, the farmers suffered from various types of internal hardships reminiscent of the old colonial era, which added to the extreme uncertainty about payment for their products. This situation will be reversed with the active participation of farmers cooperatives in the new Commodity Boards.

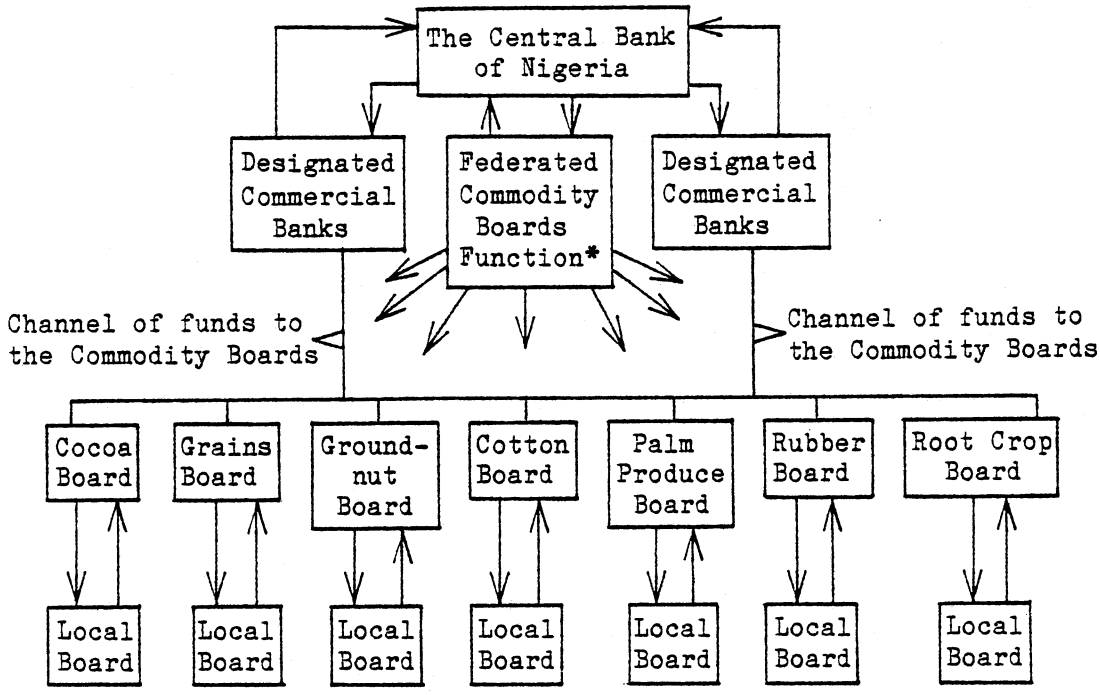
d. The old Marketing Board paid the farmers too small a price for their produce when compared to the prices in the world market. (See Tables XIII to XVII.) For instance, between 1966 and 1977

alone, the Nigerian Government kept more that 50 percent of the income earned from the sale of cocoa, 40 percent of the income from groundnut, 42 percent of the income from cotton, and 29 percent of the income from palm kernel (Cocoa Market Report, 1977). These types of accumulations were used to put up gigantic skyscrapers as offices for various State and Federal Boards. This kind of conspicuous spending served no purpose to the farmers. In this respect, it is felt that these surpluses should be used to stabilize prices during years of low world prices for such commodities. They could also be used for marketing research and development which is, and has been, nonexistent.

e. To make the activities of the Commodity Boards more effective and efficient, there should be a complete integration of the Federal Commodity Board, the seven single Produce Commodity Boards, and the Local Boards at the grassroot level. The Local Boards should be made up essentially of farmers, local buying agents, Commodity Cooperatives, and one representative from the appropriate Commodity Board. Federal assistance to farmers, such as federal guaranteed loans, fertilizer subsidies and improved varieties of crops, should be made directly to the farmers through the cooperatives. This approach will eliminate wastage, red tape, and unusual delays experienced by individual farmers trying to benefit from government programs through the old channels. Channeling of funds (loans) should be achieved in one of two ways: (i) the agricultural guaranteed credits could go directly from the Central Bank to Federated Commodity

Boards who will pass it on to the seven individual boards based on the Government "priority formulas"; or (ii) the loan could also be obtained through the "designated" commercial banks. In each of the designated commercial banks, there should be a Central Bank's loan officer who is assigned to such a commercial bank to carry out the government's priority formulas. It is hoped that the Central Bank representatives should be able to reduce the problems of red tape and political constraints always experienced by small farmers in most of the commercial banks. It must be noted that the extension workers in the office of the agro-credit, should make periodic visits to some of the farm sites of those farmers who have been granted loans for the purpose of giving them advice and checking the progress of their operations. The agro-credit officer should make a bi-annual review of credit operations and forward their reports to the Central Bank.

f. As opposed to the Price Fixing Authority that forms part of the current seven Commodity Boards, it is proposed that the Federated Commodity Board determine prices paid to farmers based on the world prices of those commodities and input costs. For long-run adjustments for producer price and income stabilization, the advice of the Technical Committee on Produce Prices should be valuable. This will keep the agricultural industry an open system in which demand and supply determine prices as opposed to a closed system where prices are just handed down by some government appointed technical committee.



Local Boards are made up of farmers, Commodity Cooperatives, Licensed buying Agents (LBAs), and one representative of the Commodity Boards.

*Function: Dissemination of information from and to all seven boards.

Figure 3. Nigerian Agricultural Production and Marketing System

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