

MADIA

HOW IMPORTANT ARE THE RELATIVE EFFECTS OF ECONOMY-WIDE AND
SECTOR-SPECIFIC POLICIES IN EXPLAINING THE PAST
PERFORMANCE OF NIGERIAN AGRICULTURE?

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Recently, there has been a spate of literature that estimates the direct and indirect effects of distortionary macroeconomic policies on agriculture. It concludes that the indirect effects of such policies (overvalued exchange rates, import controls that increase the cost of living and the cost of agricultural inputs, etc.) are frequently greater than the direct effects (e.g., Krueger). While no explicit attempt is made to measure the extent to which agricultural performance is explained by these macropolicy distortions, it is implied that their effects are larger than those of sector-specific policies. The Nigerian case is often cited as an example of the adverse effects of Dutch Disease on agriculture (Pinto; Oyejide; and Collier).

Complementary to this line of analysis is the work of Hayami and Ruttan, and Mundlak. In quite different contexts of Asia and Latin America, these authors have argued that many of the sector-specific aspects of agricultural growth, including technological and institutional change, are themselves induced by changes in intersectoral terms of trade, and relatedly in the returns to capital. The issue of poor macroeconomic policies and their induced effects on agriculture are of particular interest in Africa, where rapid labor transfers out of agriculture occurred in the 1970s in response to pro-urban macroeconomic policies. More recently, structural adjustment programs are inducing massive labor transfers back into agriculture, as for instance in Nigeria.

In the context of intersectoral labor transfers, Lele and Mellor have shown the growth of employment in the nonagricultural sector as being influenced primarily by the supply of wage goods produced in the agricultural

sector, which in turn is a function of the state of technology in that sector. By assuming the existence of separate, but interacting labor and food markets in a dual economy framework, they have highlighted the adverse effects of a wage goods constraint on the rate of economic transformation even in the labor surplus economies of Asia. The problems posed by a wage goods constraint are, of course, compounded in Africa, where under conditions of handhoe technology and few biological innovations, labor dominates the production process. As a result, the marginal and average products of labor for foodcrops tend to be equal, while being substantially lower than in Asia (Mellor; see Figure 1a). The movement of labor out of agriculture leads to a fall in production, with the surplus food available for the non-agricultural sector declining more than proportionally to output because of rising agricultural wages, and their effect on demand within the agricultural sector. This causes the intersectoral terms of trade to move in favor of the foodcrop sector (Figure 1b). At the same time, however, Lele has demonstrated that substantial returns to labor are realized in export agriculture, despite heavy taxation, owing to the strong traditional comparative advantage enjoyed by African countries in export crop production (Lele).

Agriculture's role in Nigeria's overall economic development hardly needs emphasis. In this paper, by reviewing the past courses of agricultural failures in Nigeria, we shall show that (1) the terms of trade were highly favorable to the foodcrop sector, which dominates Nigerian agriculture, although they declined for the export crop sector; (2) in response to changes in relative prices between agriculture and nonagriculture, a la Hayami and Ruttan, and Mundlak, the government greatly increased its expenditures in the agricultural sector and implemented a variety of compensatory policies, to alleviate the adverse effects of the macroeconomic environment; (3)

nevertheless, agriculture did not respond to either the favorable food prices, or the large public expenditures, owing mainly to technological, institutional, and infrastructural constraints resulting from a lack of "public goods." The public goods constraint continued to operate because of the poor quality of the government expenditures. Thus, the rising urban demand for food, in the face of low factor productivity and a relatively inelastic supply, led to sharp increases in food prices, despite greatly increased food imports.

To achieve rapid growth in food and export crop production in Nigeria will require increases in factor productivity, which in turn will depend on sound public policies concerned more with the quality and composition of public expenditures, rather than their quantity. The reasons for the technological and other failures of the past and for the poor quality of the public expenditures are, however, themselves grounded in complex issues, in particular weaknesses in Nigeria's political and administrative institutions (Bienen).

The effectiveness of public expenditures requires a strong administrative capacity at the local, state, and federal levels. On the other hand, in Nigeria's case, the low level and erosion of the technocratic capacity, together with the increased role of the federal government in agriculture, without a clear delineation of responsibilities and authority among the federal, state and local governments and an active policy to develop their capacity, has greatly limited the quality of public expenditures.^{1/} In this context, it needs to be emphasized that the increased centralization of authority at the federal level was inevitable following the civil war and influx of oil revenues, and even necessary for nation building, given the successive changes in government associated with 5 military coups and only 4

years of civilian rule (1979-84). It is the problem of achieving a balance among the roles of federal, state and local governments, which now needs urgent attention, if a consistent agricultural policy is to be formulated. This is especially so given the incongruence between the structure of Nigeria's agricultural production, and the dynamics of demand contingent upon growing urbanization and incomes, which complicates the task of setting policy priorities to a greater extent than in Asia or Eastern Africa. Such factors are not adequately reflected in the largely neoclassical-based approaches of economists for analyzing country policies.

This paper is organized into 5 sections. In Section 1, based on production data from alternative sources, we bring out the poor past performance of the agricultural sector, even when the relatively more favorable interpretation of performance provided by FAO data is accepted. In Section 2, we discuss the government's macroeconomic policies, specifically the rapid growth in public expenditures and the overvaluation of the exchange rate. In Section 3, we examine the effects of those macropolicies on the agricultural sector. We focus especially on the trends in export and food crop prices, the labor transfers out of agriculture, shifts in the relative terms of trade between the food and non-food sectors, and the returns to labor from crop production. In Section 4, we review the government's compensatory policies in the agricultural sector, including those towards agricultural research and fertilizer promotion. We also explore the nature of the structural and institutional problems facing Nigeria's quite different food and export crop sectors, and the factors underlying these problems. We indicate that in those instances when the quality of public expenditures was good -- i.e., technological, institutional, and infrastructural impediments were reduced - the returns to factor use (labor) in agriculture were quite

competitive with alternative activities, even in the wake of the oil boom. In Section 5, we draw the policy implications of our analysis.

1. AGRICULTURAL PERFORMANCE

1.1 Production Record

Nigeria's agricultural statistics are poor and inconsistent even by the generally low standards of African countries. Nevertheless, all evidence indicates declines in export crop production, and in per capita food production, from 1970 to 1986. Only the magnitudes of these declines vary. In this vein, we review Nigeria's past agricultural production performance on the basis of data from the Federal Office of Statistics (FOS), and the Food and Agricultural Organization of the United Nations (FAO). These data are less consistent with each other for foodcrops, than for the traditional export crops, most of which were sold to commodity boards in the past.

1.1.1 Production Trends for Traditional Export Crops

There is agreement between FOS and FAO data that the production of cocoa, cotton, and groundnuts declined rapidly from 1970 to 1986 (1983 for FOS data). ^{2/} According to FAO data, rubber production also declined, and only the production of palm oil and palm kernels increased (Table 1). In the case of palm oil, however, we will show that the elasticity of supply with respect to prices has been very low, and explore the reasons why.

Consistent with the generally known lack of new cocoa plantings in Nigeria since the 1960s, FAO data indicate that the area under cocoa remained virtually unchanged, and rapid yield decreases led to falling production. For cotton also, these data suggest a relatively stable hectarage, but sharply declining yields. As for groundnuts, area and production evidently decreased

rapidly, reportedly because of declining rainfall and an outbreak of the rosette disease in Northern Nigeria. Surprisingly, yields are indicated to have increased substantially despite this.

1.1.2 Production Trends for Foodcrops

FOS data denote a production growth rate of -2 percent a year for all foodcrops combined, for the 1970-83 period. In contrast, FAO data suggest a growth rate of +2.3 percent a year (1970-86). Even this higher food production growth rate based on FAO data is well below the likely annual population growth rate. Nigeria has not had a population census since 1963. The World Bank, however, estimates the annual population growth rate to be about 3.3 percent.

In explaining the past performance of Nigerian agriculture, we shall accept the relatively more favorable FAO trends because (i) estimates of daily per capita calorie availability based on FAO production levels (adjusted for net food imports) seem more realistic than those based on FOS levels, which are unreasonably low (see Lele et al.); (ii) inasmuch as the area declines suggested by FOS data are usually attributed to the outmigration of agricultural labor during the oil boom (Paulino and Sarma), we shall indicate below that although there was a drop in agriculture's share of the total labor force, the agricultural labor force did not decline in absolute numbers; and (iii) the FAO-based trends, especially for maize and rice (Table 1), conform to the rapid production increases suggested by more qualitative information.

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1.2 Crop Export and Import Trends

1.2.1 Export Trends

performance led to poor performance of agricultural exports. Palm oil, groundnut and cotton exports stopped in the early 1970s (Figure 2). Since then, Nigeria has been a major importer of these commodities (Figure 3). Imports constituted 20 percent of the rapidly growing domestic consumption of palm oil in the early 1980s, while cotton imports are estimated variously to account for 20 to 65 percent of the requirements of the domestic textile industry. The exports of cocoa, rubber, and palm kernels declined significantly, with Nigeria's share of the world cocoa market falling by almost one-half, from 20 percent in 1971-73 to 11 percent in 1983-84.

1.2.2 Trends in Food Imports

Wheat imports increased six-fold between 1970 and 1985, and rice and sugar imports eight-fold each between 1976 and 1985 (Figure 3). Maize imports increased by a factor of 35 from 1976 to 1982, albeit from a low base.

Increased imports of maize characterized the derived demand for poultry, given the high income elasticities of demand for the latter, which were reinforced by the increased weight of the urban sector. Wheat and rice imports reflected substitution for traditional foodcrops, such as yams and cassava, by the growing urban population. In turn, this was a manifestation of the incongruence between the structure of Nigeria's agricultural production, and the nature of the commodities demanded in the urban sector. Had there been productivity increases through effective sectoral policies, more resources could have been released for the production of some of the crops for which internal demand was growing rapidly.

2. ECONOMY-WIDE POLICIES AFFECTING AGRICULTURE

A variety of public goods, including agricultural technology and its

effective extension, well functioning markets, and the availability of transport, are essential for increasing the productivity of smallholder agriculture. Similarly, the existence of an effective planning and implementation capacity is essential for the provision of these public goods. There is, however, no theoretical basis for judging the appropriateness, either of the shares of agriculture and other sectors in overall public expenditures, or of the levels of the sub-sectoral allocations within agriculture. This section demonstrates that although increased public expenditures in other sectors drew labor out of agriculture, a frequently overlooked fact is that the Nigerian government responded to rising food prices by also substantially increasing its expenditures on agriculture. The quality and composition of those expenditures was, however, a problem, as we shall show in this paper. Theoretical work by Mundlak and others, does not consider the issue of the quality of public expenditures. Also, it assumes all capital to be homogeneous, and does not take account of the problems posed by the poor composition of public expenditures which leads to an imbalance in capital accumulation.

In addition to the patterns of public expenditures, this section also considers the effects of the overvalued exchange rate on production incentives in the agricultural sector. While the overvalued exchange rate reduced incentives for export agriculture, its effects on the foodcrop sector per se are less clear.

2.1 Public Expenditures

There was a sharp increase in public expenditures after the oil boom, especially as oil revenues became concentrated in the hands of the federal government. This was in contrast to the earlier period when revenues,

acquired mainly through the taxation of export crops, accrued to state and local governments (Bienen). Consequently, the character and composition of the public expenditures on agriculture changed rapidly after the oil boom.

As Table 2 shows, the federal and state governments' combined total capital expenditures (in nominal terms) budgeted for 1981-85 (the fourth plan period) were 66 times greater than those actually incurred during 1962-68 (the first plan period). Even though the share of agriculture (rainfed crops, livestock, forestry, fisheries, and irrigation) in the total expenditures budgeted for 1981-85 declined to 9.4 percent, from the actual 1962-68 level of 14.4 percent, the budgeted 1981-85 expenditures for agriculture (8.9 billion Naira) were 57 times higher than the actual expenditures undertaken during 1962-68. In real terms (1976=100), the change from 1962-68 in the budgeted 1981-85 expenditures on agriculture (2.8 billion Naira vs. 460 million Naira) was less dramatic, but still substantial: the change was six-fold for agriculture, although it was seven-fold for the economy as a whole (22.2 billion Naira vs. 3.2 billion Naira).

The massive growth in expenditures itself partly explains their poor quality as reflected in poor returns (i.e., poor production performance), as well as in an imbalance between capital and recurrent expenditures, and in the different forms of capital created. The government's investment-related response to changes in relative prices, thus, resulted in relatively little accumulation of public capital in tangible terms, especially when considered in relation to the size of the investments made. For instance, the government's irrigation investments (mainly large-scale) after the oil boom and the Sahelian drought of 1973, amounted to about 3 billion Naira, and 40 percent of the government's total agricultural investments. They, however, succeeded in creating only an additional 30 thousand hectares of irrigated

area, denoting a per hectare irrigation development cost of 100,000 Naira (or roughly 100-180 thousand dollars at the official pre-devaluation exchange rates, and 30-50 thousand dollars at the purchasing-power parity exchange rates). Similarly, the huge expenditures on fertilizer subsidies and agricultural research during this period (discussed in section 4) did not have the desired impact on agricultural production. Institutional and organizational factors rendered the Nigerian agricultural research system largely ineffective, which in turn led to the evident unavailability of technologies that responded well to fertilizer and were acceptable to farmers.

Imbalance between recurrent and capital expenditures, and within the recurrent account between allocations for salaries and maintenance, has been a problem. Recurrent expenditures during 1981-84, for example, amounted to only 3-6 percent of the federal government's total expenditures on agriculture, although they accounted for a much larger share in the case of the states (30-56 percent). Nearly 90 to 95 percent of the recurrent expenditures of both the federal and state governments were, however, utilized for salaries, leaving little for operational expenses, particularly the maintenance of crucial public goods provided through the capital investments.

Furthermore, agriculture is a poor direct absorber of finances, and the composition of the capital investments in other parts of the economy is critical in determining the sector's absorptive capacity. For instance, theoretical and empirical research has shown that primary education increases producers' ability to adopt innovations rapidly (Schultz). In the same way, by augmenting the pool of technical personnel, investments in higher education greatly increase the public sector's capacity to effectively plan and implement agricultural development. Investments in transportation and

communications, on the other hand, are important for widening markets and making them more efficient. While expenditures in these sectors also increased, their composition and quality once again posed problems.

The share of education in the combined federal and state expenditures increased from 8 percent in the first plan period, to 11 percent in the subsequent plan periods. Nevertheless, inadequate previous investments in the training of higher-level personnel, poor salary incentives in the public sector and its failure to attract the most qualified individuals, and poor inter-regional labor mobility among skilled groups created by ethnic factors, resulted in the poor planning and implementation of government investments (see Lele et al.). Transport accounted for the largest share of government expenditures during the first three plan periods (around 23 percent), and was superseded by only mining (largely oil) and industry in the budget for the fourth plan period. Although investments in the construction of highways increased agricultural incentives by linking northern producers to urban centers in the south, the fact that feeder roads were underplayed deprived these investments of their full impact on agricultural production.

2.2 Exchange Rate Behavior

The exchange rate plays an important role in determining the overall incentive structure facing both export and food crop producers. In Nigeria's case, prevailing prices reinforced institutional weaknesses in the export crop sector (see Section 4), owing in part to the overvaluation of the exchange rate. An index of the trade-weighted, purchasing-power parity exchange rate computed for Nigeria declined from 106 in 1970 to 38 in 1985 (Figure 4). In October 1986, when the Naira was devalued and a floating auction-determined exchange rate instituted, the Naira declined in value by about 400 percent.

The overvalued exchange rate reduced the returns from export crops. in Naira terms. It also made the imports of those foods (e.g., wheat, rice and maize), for which domestic demand was growing rapidly as a result of the increased incomes and urbanization, relatively cheap. Thus, the incentives for producing domestic equivalents and substitutes were reduced. Assuming that the purchasing-power parity exchange rate index represents the degree of deviation from an equilibrium exchange rate in the base period (i.e., an index of 100), the computed index of 38 for 1985 means that the prices of Nigerian export crops, and of imported foodcrops, would have been 2.6 times higher in Naira terms with a more flexible exchange rate policy. Whether this would have affected internal demand, and import levels, is not clear, however.

While few estimates of price elasticities are available for West Africa, recent studies show the demand for rice and wheat to be relatively price inelastic in parts of West Africa (Reardon et al.). They also suggest that the shares of rice and wheat in the consumer expenditures of upper and lower income quantiles are not different, owing mainly to the labor-saving convenience of these two cereals. Thus, the higher prices resulting from a more appropriate exchange rate would have had an adverse income distribution effect, or the government would have had to increase imports further to bring down internal prices. As it is, however, by 1981-83, when Nigeria's trade balance had turned negative because of declining oil revenues, food imports accounted for about 20 percent of the total value of imports, and of exports (Lele et al.). Any further increases in food imports could have aggravated the balance of payments situation.

- 3. EFFECTS OF ECONOMY-WIDE POLICIES ON THE AGRICULTURAL INCENTIVE STRUCTURE

3.1 Export Crop Prices

Trends in commodity board prices (Table 3), and nominal rates of protection computed using official exchange rates (Table 4), indicate that producers were provided significant subsidies in recent years, to compensate them for the overvalued exchange rate. Nominal rates of protection computed using purchasing-power parity exchange rates, on the other hand, suggest that despite this, producers implicitly continued to bear a considerable tax burden (Table 4). All the same, the producer prices of export crops in Nigeria were comparable to, if not higher than, those prevailing in other African countries, including Cameroon which also witnessed an oil boom (Figure 5). Cameroon's production performance was, however, relatively better. We shall explore the reasons for this in section 4.

Palm oil was an exception to the general rule of the implicit taxation of export crops, owing to growing internal demand. Open market prices of palm oil were 2-8 times higher than the commodity board prices during 1976-85 (Table 3). The production response from the palm oil sector was, however, modest (the production growth rate being only 1.7 percent a year during 1970-86), implying a long run supply elasticity with respect to prices of only 0.06. We shall consider the reasons for this also in Section 4.

3.2 Food Crop Prices

Whereas the demise of export agriculture in Nigeria typically gets the most attention, it is important to note that foodcrops constitute 85 to 90 percent of the total cropped area, and accounted for well over 90 percent of the value of total agricultural output during 1985-87. Needless to say,

foodcrops also feature far more importantly in the generation of employment and incomes directly, as well as indirectly by determining the price of labor in the nonagricultural sector. This is because of the relatively high share of food in total consumer expenditures.

We pointed out earlier that in the absence of technological change in agriculture, the intersectoral terms of trade are expected to move in favor of the foodcrop sector. Nigeria conforms to this theoretical expectation. The price environment for foodcrop producers in Nigeria was very favorable in the 1970s and 1980s, and the nominal prices of foodcrops increased substantially (Table 5).^{3/} By 1985, the food index was 82 percent higher than the non-food index using 1976 as the base (Table 6), and three times higher using 1966 as the base (see Lele et al). Nigerian foodcrop prices were also substantially higher than those of other MADIA countries, even at purchasing-power parity exchange rates (Figure 6). Since the devaluation and the bans on the imports of rice, wheat and maize (1985-87), foodcrop prices have reportedly increased by 2 to 4 times in 1988, relative to 1986. Given the drought in 1987, the relative importance of various factors in explaining the price increases is, however, not easy to discern.

3.3 Rural-Urban Wage Differentials, Outmigration of Agricultural Labor and Returns to Labor from Crop Production

Theory suggests that increases in nominal wages resulting from rising foodcrop prices should lead to reduced demand for labor in the nonagricultural sector. In Nigeria, however, the demand for labor in the urban sector was largely determined by the size of the oil revenues, and the government's expenditures on construction and other activities. Five major consequences of the increased public expenditures, combined with the lack of

technological change in agriculture, were: (1) increased agricultural and urban wages in nominal terms; (2) a significant gap between rural wages (in the north), and urban wages (in the south); (3) large labor transfers from the rural to the urban sector; (4) declining real wages in both sectors (1976-85), except for a temporary rise during the period of the second oil boom (1979-81); and (5) low returns to agricultural labor from crop production by comparison with urban and rural wages.

Tables 7, 8 and 9 reveal these various phenomena, as well as the doubling of the urban labor force from 1970 to 1984. In actual size, however, the agricultural labor force continued to increase at a rate of 1.4 percent a year during 1970-84, although its share in the total labor force declined (Table 8).

The movements in real wages during 1976-86 tell a different story from those in nominal wages. Real agricultural wages (in terms of the consumer price index with 1976 as the base) fell, except for the 1979-81 period when oil revenues were buoyant. They fell by 32 percent between 1976 and 1978, and then again by 46 percent between 1981 and 1985 (Table 7). On the other hand, they almost doubled from 1978 to 1981, in which year they were well above the 1976 level. In 1985, however, the real agricultural wage (1.18 Naira) was only two-thirds of the 1976 level (1.75 Naira).

Real wages in urban construction declined more rapidly than those in agriculture, and were consistently below the 1976 level in subsequent years, although they too moved upwards in 1979 and 1980. This reflects the constraint imposed on urban employment by the supply of wage goods, except in those years (i.e., 1979-81) when increased oil revenues shifted the demand for urban labor outwards. Also, the fact that agricultural wages declined in real terms, while the intersectoral terms of trade moved in favour of the foodcrop

sector, is indicative of low and stagnant labor productivity in the agricultural sector. Indeed, except in the case of yams for which returns exceeded both agricultural and urban wage rates, and cassava (and rice on occasion) for which they exceeded only the agricultural wage rate, the returns to labor from other crops were invariably lower than either the urban or agricultural wage rate, during 1976-86 (Table 9). This tends to confirm that the constraints imposed by technological (non-price) factors on labor productivity were such that despite rising prices, the food supply turned out to be relatively inelastic.

The extent of the labor movements back into agriculture, as a result of the austerity introduced by the declining oil revenues since the early 1980s has, however, been just as rapid as the outmigration that occurred during the oil boom years. The size of the agricultural labor force is estimated to have increased from 17 million in 1984 to 24 million in 1985, i.e., by more than 40 percent in a matter of a single year (Table 8). Typically, young males migrate to the cities, whereas women, children, and older men remain in agriculture. Thus, in an agriculture characterized by an abundant supply of land, but mainly handhoe technology, physical force is an important determinant of labor productivity, and the elasticity of production with respect to labor input should be one. On the other hand, in Nigeria, total food production increased by only an estimated 17 percent from 1984 to 1986, while the agricultural labor force increased by almost 49 percent. ^{4/} This implies a short-run elasticity of production with respect to labor of only ¹⁷0.34. Against this, the year-to-year changes in total food production and labor from 1976 to 1986 imply a long-run elasticity of production with respect to labor of 0.63. Two hypotheses are possible in terms of explaining the difference between these two elasticity estimates: One, fertilizer

substituted for labor in production to a greater extent at the end of the period (1984-86), than during the 1976-86 period as a whole (see Section 4 for a discussion of fertilizer prices and the rising trend in its use in Nigeria). Indeed, the long-run elasticity of total food production with respect to nutrient use, implied by the year-to-year changes in total food production and nutrient use during 1976-86, is only 0.17. In contrast, the short-run elasticity implied by the changes in production and nutrient use between 1984 and 1986, is 0.61. Second, the returning labor was not yet adequately absorbed through area expansion, thus giving rise to a labor surplus situation on the existing cultivated land.

4. EFFECTS OF SECTORAL AND SUB-SECTORAL POLICIES

SPECIFIC TO AGRICULTURE

To understand the reasons for the inelastic supply, and the low returns to agricultural labor, it is important to take a look at the government's policy responses in the agricultural sector, and their effects. At the sector level, the government responded to increased food prices by promoting the supply of fertilizers through increased imports and subsidies, and by increasing allocations for agricultural research. Also, in collaboration with the World Bank, it adopted the Agricultural Development Project (ADP) strategy, which is largely geared to increasing the production of rainfed foodcrops.

We pointed out earlier that the extent and nature of the public goods provided through investments in agricultural research, and programs such as the ADPs, depend on the quality of planning and implementation. We indicated that in Nigeria's case, political factors, and poor salary incentives in the public sector for trained manpower, among other things,

explain the poor institutional environment. The nature of that institutional environment, and the relative ineffectiveness of government interventions in improving agricultural performance as a result, will become especially clear from the discussion in this section. Specifically, this section focuses on the government's sector-specific interventions for foodcrops, as they have related to (i) fertilizer pricing and use, (ii) agricultural research and technology development; and (iii) the ADPs. It also discusses the problems with the existing market infrastructure, in order to show how they might have reduced the apparent incentives inherent in the high foodcrop prices that prevailed in Nigeria. Subsequently, it considers the interactions among institutional, organizational, and technological factors for export crops.

4.1 Policy and Institutional Environment for Foodcrops

4.1.1 Fertilizer Prices and Consumption

The importance assigned to fertilizer in Nigerian agricultural policy can be elicited from the fact that between 1976 and 1983, the government provided an explicit subsidy of over 80 percent (Table 10), in addition to the implicit subsidy resulting from the overvalued exchange rate. Fertilizer subsidies accounted for 25-43 percent of the federal government's budget for agriculture as a whole, and 25-75 percent of the budget for crops alone, during 1982-85 (see Lele et al.). As a result of these heavy subsidies, total nutrient use increased at an annual rate of almost 30 percent between 1976 and 1986, albeit from the very low 1976 base of 20,000 metric tons (Table 11). Fertilizer, in effect, became a substitute for the additional labor that might have obtained in agriculture, in the absence of out-migration.

Much of the fertilizer use in Nigeria has taken place on foodcrops,

and some unknown quantities have been smuggled to neighboring countries, because of price differentials arising from the subsidies. The north and the middle belt, where foodcrops dominate, account for almost 90 percent of all fertilizer use in Nigeria. ^{5/}

The profitability of fertilizer use depends on its price relative to that of output, as well on the physical response coefficients. Although fertilizer response coefficients are a matter of major controversy in Nigeria's case, the considerable incentives accruing to farmers from the government's subsidy policy, especially as output prices were already high, can be discerned from nutrient price/crop price ratios (Table 12). For all crops, these ratios were invariably well under one between 1980 and 1985. ^{6/} Even in 1986, when the much reduced fertilizer subsidy level was accompanied by large drops in food crop prices (because of bumper harvests), these ratios remained under two. The nutrient price/crop price ratios were also more favorable in Nigeria (about 2 to 9 times lower in 1986) compared to other MADIA countries, albeit these drops brought Nigerian foodcrop prices more in line with those of the other countries. ^{7/}

4.1.2 Agricultural Research and Technology Development

Given the complexity of Nigeria's predominantly rainfed, mixed farming systems, a highly effective national agricultural research system is fundamental for capturing all possible gains in productivity, however small. Inadequate public expenditures on research have not been a problem in Nigeria. Between 1976 and 1984, the Nigerian government spent a total of 702 million Naira on agricultural research (Table 13). This amounts to a total of 0.8 - 1.2 billion Dollars at the official pre-devaluation exchange rates, and 0.3 - 0.4 billion Dollars at the purchasing-power parity exchange rates. Moreover,

it amounted to 6-10 percent of the federal government's total expenditures on agriculture, and to over 1 percent of the agricultural GDP - these levels being well above those considered appropriate for agricultural research. The quality of the expenditures was, nevertheless, again a problem, and there is a general consensus that the once productive Nigerian agricultural research system has now become ineffective (see Lele et al.).

The reasons for this ineffectiveness indicate the extent to which the development and deployment of improved technologies are themselves a function of institutional and organizational factors. These reasons include the lack of consistent support from the highest levels of the Nigerian government for research as central to the process of agricultural development. Given the long-term nature of the payoffs from developing a research capacity, but the short time horizon of successive Nigerian governments, this is to be expected. The doubling of expenditures between 1979/80 and 1981, and then a large decline in 1984, reflects the consequent unstable and unpredictable nature of funding. Other reasons for the research system's ineffectiveness, besides the lack of esteem in the government for research scientists and their work, relate to (Idachaba, 1980; and Lele et al.): (i) frequent changes in the organizational structure for agricultural research (the structure having changed 6 times between 1970 and 1985); (ii) the lack of accountability of the Ministry of Science and Technology, which currently oversees agricultural research, for problems encountered in the agricultural sector, that in turn are the responsibility of the Ministry of Agriculture; (iii) ineffective links between research and extension; (iv) the rising share of recurrent costs, reflecting the need to meet increased salary costs, at the expense of having amounts available to actually execute research; (v) poor planning for research, as reflected in fluctuating and unpredictable shares of different

crops in the total budget; and (vi) poor location of research institutes.

The huge expenditures on agricultural research and fertilizer subsidies notwithstanding, the question of whether or not there are crop varieties that respond well to fertilizer, and are acceptable to farmers, continues to be surrounded by controversy as noted above, pointing to the general lack of reliable information for policy formulation in Nigeria. Nevertheless, what data exist suggest lower fertilizer responses in Nigeria than in other MADIA countries. In 1986, the Nigerian ratios of output to fertilizer prices for maize were 3 to 4 times more favorable compared to Kenya, and 10 times more favorable compared to Malawi (reflecting Nigeria's higher maize prices and an explicit and implicit subsidy on fertilizer of 82 percent). On the other hand, the benefit-cost ratios for Nigeria, at the lower end of the reported range of fertilizer response coefficients, are barely 3 for maize, and under 2 for sorghum and millet (Table 14). These three crops together constitute about 70 percent of the total cultivated area in Nigeria. Without the fertilizer subsidy, the computed benefit-cost ratios for all three crops would be well under one.

Sorghum, millet, and maize, however, account for as much as three-fourths of all fertilizer used in Nigeria. This, in particular, raises questions about the impact on aggregate agricultural productivity of the government's large expenditures on agricultural research and fertilizer subsidies. It may also explain why the elasticity of aggregate food production with respect to nutrient use, computed for 1976-86, turns out to be only 0.17, while that of labor is 0.03. A view in the World Bank is that the improved varieties (i.e., of sorghum and millet) available in Nigeria have not found acceptance with farmers, who have preferred to use fertilizer with less responsive, traditional varieties in crop mixtures. Nevertheless, the past

failure of research and extension to work in an integrated manner towards finding solutions to problems faced at the farm level has also been a major problem (Idachaba, 1980).

The large number of foodcrops grown in Nigeria complicates the task of prioritizing research, while at the same time placing a particular premium on carefully assigning priorities among crops. In this context, possible supply and demand criteria for prioritizing agricultural research could include crop shares in: (i) the total value of agricultural output, (ii) total area, (iii) the value of total crop exports, (iv) the value of total crop imports, (v) total calorie supply, (vi) the income elasticities of demand for individual crops, and (vii) possibilities for scientific breakthroughs.

The application of these criteria confirms the difficulties involved in prioritizing research in Nigeria, because of crop incongruence among criteria (Table 15). For instance, yams are dominant in terms of the total value of agricultural output. On the other hand, sorghum and millet together dominate all other crops from the standpoint of total area and calorie availability. As for export promotion (share in the value of total crop exports), cocoa leads all other crops. Similarly, under the import-substitution criterion (share in the value of total crop imports), wheat, sugar and rice dictate the highest priorities. Wheat (1.5), sugar (1.5) and rice (0.8), along with livestock and poultry (1.2), are also the commodities with the highest income elasticities of demand.

The unavailability of data precludes a congruence analysis comparing research expenditures on individual crops, with their values under different criteria. It is not even clear what such an analysis might mean in terms of research priorities alone, as distinct from the coordinated approach necessary for addressing all links in the development of a particular crop (see, Lele

and van de Walle; and Lele and Jammeh). Nevertheless, the past incongruence between research and production priorities is clear from the fact that annual food crops, which dominated the government's production policy, accounted for only 38 percent of the total agricultural research expenditures during 1981-84. On the other hand, tree crops (cocoa, oil palm, and rubber) which, as we will show, were neglected in other respects, accounted for a quarter of the budget (see Lele et al.). Owing to that neglect, the share of tree crops in the total value of crop output amounted to only about 5 percent in 1985-87 (Table 15). Similarly, their share in total area is likely to have been under 10 percent, although a firm estimate is not possible because of the lack of data on tree crop areas.

In prioritizing future agricultural research, a distinction needs to be made between crops for which improved technologies can be borrowed from abroad in the short run, and those for which technologies have to be developed domestically. This has implications also for increasing overall agricultural production. Conventional wisdom suggests that in the short-run, Nigeria could effectively borrow technologies for export crops such as cocoa, oil palm and cotton, in the production of which it has traditionally had a comparative advantage. For instance, in the case of cocoa and oil palm, such borrowing could be done from the Ivory Coast and Malaysia; indeed, Malaysia earlier borrowed technologies from Nigeria for oil palm. Similarly, for cotton, technologies could be borrowed from neighboring Cameroon, where yields have tended to be as much as 7 times higher than in Nigeria; for groundnuts, they could be borrowed from Senegal, where research may have made greater headway in developing drought resistant varieties. Borrowing technologies does not, however, mean that their fine-tuning to meet particular location-specific problems is not essential for growth. On the other hand, using borrowed

technologies in the short-run would allow Nigeria time for addressing the basic problems of technology development for both export and food crops. Also, to the extent that palm oil and cotton are currently imported, it would lead to import-substitution and foreign exchange savings.

In contrast to export crops, the potential for using borrowed technologies seems more limited in the case of foodcrops, given the predominance of mixed cropping in Nigeria. Most foodcrop technologies developed elsewhere are intended for sole crop conditions, and require very strong internal links between research and extension. Indeed, most improved technologies developed by research institutes in Nigeria have also been meant for sole crop conditions. In this context, a recent review performed by the Nigerian Institute for Agricultural Research (1988) indicates that very little has been achieved so far in the way of on-farm research on crop mixtures in northern Nigeria, where sorghum and millet dominate. Similarly, more on-farm research, combined with a greater extension effort, appears to be needed in relation to improved technologies, developed by the National Root Crops Research Institute and the International Institute of Tropical Agriculture, for yams (minisett) and cassava, the dominant foodcrops in southern Nigeria (World Bank, a).

The rapidly changing demand structure in Nigeria has also posed problems for the prioritization of production and research policies. The growing demand for rice, wheat, poultry and meat, as a result of income growth, urbanization and associated changes in consumer tastes, induced policymakers to assign priorities to these commodities in terms of production policies. Indeed, the earlier-mentioned large-scale irrigation schemes undertaken in the north were mainly intended to facilitate the production of wheat and rice. Nevertheless, Nigeria does not have a comparative advantage

in wheat production (see World Bank, a). On the other hand, from the perspective of future priorities, it may not be as inefficient for Nigeria to produce rice since the devaluation as it was earlier. Although the production of upland rice and irrigated rice in northern Nigeria may continue to be uneconomical, a domestic resource cost analysis (World Bank, a) suggests that the production of traditional and improved rainfed swamp rice in southern Nigeria could become competitive if the projected low levels of international prices do not materialize, and rice prices exceed \$325. If international rice prices continue to remain depressed, increases in yields, over the fairly low current levels, would be needed to achieve such competitiveness. ^{3/}

Maize, which, before the import bans, was being imported for poultry feed, also appears worthy of attention from a policy perspective. Demand projections for poultry and eggs, and direct human consumption, suggest that Nigeria could absorb about 9 million metric tons of maize by the year 2000, compared to the 1986 production level of about 3 million metric tons (see Obeya; and Lele et al.). On the other hand, the lack of a reliable internal supply of maize for the poultry industry, since the ban on imports, has led to plummeting poultry production.

Hybrid maize provides considerable scope for increasing productivity. Especially given its annual seed replacement requirements, however, its widespread adoption by small farmers will necessitate substantial improvements in the seed production and distribution systems. Raising maize production to the projected level may also require a price support program, besides a coordinated poultry development policy, which allows the government to be an arbiter between the large number of small maize producers and the poultry industry. The need for a price support program arises from the fact that in the past, maize prices and supplies have fluctuated substantially.

This, combined with low international prices relative to domestic prices (and the high costs associated with transporting maize from the north where it is largely produced, to the south where the poultry industry is located), led the poultry industry to rely on imports. Nevertheless, the existence of effective demand from a developed poultry industry could, by itself, preclude the need for a price support program in due course.

4.1.3 ADP Strategy

Since 1975, the World Bank has allocated a total of \$3.5 billion to Nigeria, of which a little over 45 percent (\$1.6 billion) has been intended for the agricultural sector. In addition, almost 90 percent (\$1.4 billion) of the lending for agriculture has gone for the support of 15 ADPs, either directly, or indirectly through related allocations such as for the fertilizer import loan of 1983. During 1976-85, the Bank's share in the combined government-Bank expenditures on ADPs amounted to about 40 percent, but to only a little over 10 percent of the combined expenditures on agriculture as a whole, reflecting the greater priority assigned to large-scale irrigation by the Nigerian government.

The ADPs have played an important role in providing consistency and stability to the institutional environment for smallholder rainfed agriculture. This is especially so given the changing priorities of successive Nigerian governments, which have led to a number of other short-lived policy initiatives such as Operation Feed the Nation, the National Accelerated Food Production Program, the Green Revolution Strategy, and the River Basin Development Authorities. The World Bank's influence also helped to protect the share of expenditures on smallholder agriculture after the decline in oil revenues in the 1980s (Lele, et al). Nevertheless, the ADPs

have played only a limited long-term role in improving the planning and implementation capacity within the government, and that too mainly at the federal level through the creation of a few, albeit effective, agencies (e.g., FACU and APMEPU), largely outside the normal government apparatus.

The ADPs have been implemented at the state level by creating parallel administrative structures, again outside the normal government machinery. The line ministries in states lack the capacity to plan and implement projects, and obtain visible results, in the short time horizon (5 years) that is entailed by the project approach. Thus, the pace at which the ADPs have been implemented has been achieved largely through external input into both their planning and implementation, which the parallel administrative structures have facilitated. These structures were also expected to insulate the ADPs from the political influences of changing governments, especially in view of the weak technocracies at the state and local government levels (Lele et al.).

While some planning capacity is being created in Nigeria through this process, its progress is too slow in relation to the large needs of the agricultural sector. Similarly, the parallel structures have not succeeded in minimizing political "interference," while they have perhaps weakened the ability of the state administrations to harness political energies for development purposes. It is really only since 1986, with the initiation of the multi-state ADPs, that strengthening of the policy planning and implementation capacity within the state ministries of agriculture has begun to be made into an explicit objective of the ADPs. The problem of developing institutional capacity at the local government level, nonetheless, remains to be addressed in a concrete way, and largely explains the problems associated with the maintenance of feeder roads (Lele et al.).

The ADPs have also played a very small role in technology formulation, as they did not involve a complementary effort at developing Nigeria's agricultural research capacity. The limited amount of adaptive research undertaken and financed by the ADPs has been tantamount to a short-term approach for selecting technologies from the existing array, which was not developed specifically to fit into smallholders' mixed farming systems, as we pointed out earlier. The assessment of whether or not improved technologies exist in Nigeria has itself gone through numerous cycles of pessimism and optimism, reflecting the influence of personalities rather than of objective facts. The absence of a long-term capacity needed to fine-tune technologies, and find solutions to complex problems, on a continual basis, has had serious implications. For instance, a major problem encountered in the northern ADPs has related to farmers' preference for growing sorghum in mixture with millet. The adaptive research carried out with the improved dwarf varieties of sorghum available from the research institutes and formulated primarily for sole crop conditions has, however, not led to the development of improved varieties suited to mixed crop conditions. Indeed, whether there is need to breed special varieties suited to the photosynthesis and rainfall requirements of mixed farming conditions itself remains a controversial question among external experts.

In the context of building a long-term human and institutional capacity in Nigeria for agricultural policy planning and implementation, the contrasting emphasis of different donors is of interest, as they have influenced the internal allocation of resources. As much as 43 percent of the total assistance provided by USAID for Nigerian agriculture during 1963-84 went for education and training, especially the development of agricultural universities (Table 16). In contrast, the World Bank (even under the most

generous assumptions) has committed only about 3-4 percent of its total loan portfolio for Nigerian agriculture to building human capital through education and training. A review of the ADPs from this perspective suggests that the emphasis on implementation has meant that the development of human and institutional capacity has been relegated to the background, although such an emphasis had led to more rapid growth of expenditures on rainfed agriculture than would otherwise have been the case.

Despite their limitations, the ADPs have had a substantial impact on production when improved technologies and physical infrastructure have existed, although this impact has been less than commensurate with the expenditures incurred on them. Particularly noteworthy is their impact in northern Nigeria on the spread of maize, and on the introduction of low-cost, small-scale pump irrigation from India (the development costs for which amounted to about 1,500 Naira in 1985 (World Bank, b), compared to about 100,000 Naira per hectare incurred on the development of large-scale irrigation). The small-scale irrigation has led to increased land and labor productivity, especially by encouraging the production of horticultural crops in northern Nigeria for sale in urban centres in the south.

4.1.4 Market Infrastructure

Poor functioning of private markets has also limited the adoption of improved technologies. Although this is likely to apply to other African countries as well, an important factor contributing to the risks faced by producers in Nigeria relates to the lack of market integration, which leads to considerable spatial and temporal variability in foodcrop prices. This also reduces the apparent incentives inherent in the high prices discussed earlier, which refer to the mean for the year. Thus, inasmuch as we define marketing

efficiency in terms of both the spatial and temporal integration of markets, food markets in Nigeria cannot be considered efficient (Lele et al.). As opposed to this definition, other authors (e.g., Olayide and Idachaba, and Hayes and McCoy) have equated marketing efficiency with competition among large numbers of buyers and sellers in individual markets at a given point in time, and have concluded that Nigerian markets are efficient.

The spatial and temporal price variations in Nigeria exceed possible transport and storage costs, signifying market failure owing to inadequate transport and storage infrastructure, and credit facilities for farmers and traders (see Lele et al.). Crop prices in adjoining areas, during the same period, can at times vary by a factor of almost 2 (Table 17). Similarly, off-season prices can be 2-3 times higher than post-harvest prices (Table 18).

There are also inadequacies associated with the low level of market development in Nigeria (Wammali) which detract from marketing efficiency. Most markets in Nigeria are retail outlets that lack permanent structures, and on average meet only once a week, rather than daily (Gopala Rao). Moreover, the geographical density of markets is low, and farmers have to travel large distances to get to them. For instance, the density of markets per thousand square kilometers of area in the 3 middle belt states of Gongola, Kwara, and Niger, is only one-fourth to one-half of that in the Indian state of Karnataka (Gopala Rao).

The mobility of agricultural produce is further hampered by the poor availability of feeder roads, in turn a result of the erosion over time of the public works administration at the state and local levels. The experience of the World Bank-supported ADPs suggests that despite substantial investments in feeder road construction, maintenance continues to be a major problem (see Lele et al.). Finally, market intelligence, across both time and space, is

rendered meaningless in Nigeria by the lack of a uniform system of weights, measures, and grades.

4.2 Interactions Among Technological, Institutional, and Organizational Factors for Export Crops

We focus specifically on three commodities, cocoa, palm oil, and cotton, to show the effects on the productive environment for export crops of political instability and changing federal-state relations, as well as of organizational changes at the state-level including the increasing atomization of states. We demonstrate that in contrast to foodcrops, for which few known technologies exist, the available improved technologies for export crops could not be deployed for organizational and political reasons.

4.2.1 Cocoa

About the only improvement, since the 1960s, to the 700,000 hectares of cocoa reported to exist in Nigeria has consisted of some 65,000 hectares of new plantings and replantings undertaken under two World Bank-supported cocoa projects (approved in 1971 and 1974). This may explain the low, long-run elasticity of 0.113, estimated for cocoa production with respect to prices by Gbetibuou and Delgado. Despite the almost three-fold increase in the producer price of cocoa (from 1,600 Naira to 4,500 Naira per metric ton), following the devaluation, cocoa production is estimated to have increased by only 5 percent in 1987 (World Bank, c).

This raises questions about the extent to which new plantings of high-yielding cocoa will take place in Nigeria through private response to the improved price environment, and the extent to which complementary enlightened public action will be necessary. The experience of the two World Bank -

supported cocoa projects is instructive in this regard. It suggests that plantings of available high-yielding cocoa varieties, capable of yielding 1.0 - 1.5 metric tons of cocoa beans per hectare, against about 0.45 metric tons yielded by traditional varieties (Skoup and Company), can be promoted through (i) the provision of institutional credit, (ii) better input supplies, and (iii) adaptive research, given the many location-specific disease and soil problems in Nigeria. Nigerian cocoa yields (200-250 kilograms) in recent years have, in fact, been under one-half of those of Brazil and Ivory Coast (500-600 kilograms) -- the two countries that now dominate world cocoa production, and where large planting programs involving high-yielding varieties were undertaken in the 1970s and 1980s (Gbetibouo and Delgado).

Indeed, a major replanting and rehabilitation program involving improved varieties would reverse the returns to labor from cocoa to levels comparable with both agricultural and urban wage rates, and returns from competing foodcrops (see Lele et al). This explains why the two projects funded by the Bank were a major success, inspite of the oil boom and rapid increases in wage rates. Their actual plantings exceeded planned targets, a relatively rare occurrence in donor-funded agricultural projects in Africa.

The World Bank's decision to not finance the third cocoa project (1981) related largely to non-price (institutional) factors, and price expectations for cocoa. Administrative and management problems at the state level, caused by the breakup of states in 1976, were exacerbated by the disinclination of the participating states to guarantee adequate budgetary resources in the absence of the provision of substantial federal funds, similar to those provided to northern states for the ADPs. In addition, the federal government was unwilling to revise the interest rate structure, a condition of project approval by the Bank, given that institutional credit was

a critical component of the proposed replanting program involving smallholders. Finally, the World Bank's pessimistic world market forecasts led it to conclude that additional investments in cocoa were unlikely to yield high economic returns, although farm budgets suggested otherwise.

4.2.2 Palm Oil

In the case of palm oil, a major explanation for the slow production growth in Nigeria, despite the high prices and rising domestic demand, lies in the fact that the area planted to the high-yielding Tenera varieties (widely used in other countries such as Malaysia and the Ivory Coast) amounts to only about 170,000 hectares, or 5-10 percent of the total. Even of that, over 20 percent comprises of trees more than 25 years old (World Bank, d).

Nearly 90 to 95 percent of Nigeria's palm oil production is derived from wild Dura palm (estimated variously to cover between 1.7 and 3.5 million hectares). Yields of fruit bunches from wild Dura palms are, however, under one-fifth of those from Tenera palms, and their oil content only about one-tenth.^{9/} Thus, unattractive returns to labor, because of the predominance of the Dura variety, largely explain the slow growth in Nigerian palm oil production. An analysis, based on the Bank's appraisals for oil palm, suggests that the returns to labor from Tenera palms well exceed those from even the most profitable foodcrop (yams), and the urban wage rates (see Lele et al.).

The slow growth in Nigerian palm oil production is also explained by the lack of adoption of existing modern processing technologies by the private sector. About three-fourths of the production is processed using traditional methods, which yield only about half of what is potentially extractable through modern means. There have, however, been no investments in

a modern processing industry in response to the high returns that appear to be implicit. Although there is little analysis of the precise reasons for this, evidence suggests that, as in the case of other crops and poultry, the unreliable supply of raw materials (oil palms), in turn resulting from the overriding influence of institutional and other non-price factors even in the face of strong price incentives, is an important explanation.

The experience of the 4 World Bank-supported oil palm projects (1975 to 1978) attests to this. In all four projects, an important institutional constraint related to the communal system of land tenure and the unwillingness of community elders to either sell land for estates, or permit smallholders to plant perennial crops. A second constraint, ensued from the requirements of sole cropping of palms and a minimum farm size of one hectare. Because a majority of the farmers in the project area cultivated under one hectare, and were reluctant to abandon the practice of intercropping foodcrops with palms for subsistence reasons, the actual adoption rates failed to meet expectations. A third, and most important, constraint arose from the lack of political and financial commitment on the part of the state governments (as in the case of cocoa). Problems in project implementation also resulted from the break-up of the 12 Nigerian states into 19 in 1976.

4.2.3 Cotton

Nigerian producer prices of cotton were consistently higher than those of Cameroon during the 1970s. On the other hand, because of higher yields, the returns to labor were much better and exceeded urban wages in Cameroon, which also experienced an oil boom. Cameroon's superior performance is a result of SODECOTON's association with the excellent French CFDT - supported cotton research system and an integrated system of services, whereby

farmers are provided seeds, credit and other inputs, as well as extension know-how, by a well coordinated cotton development program. Lele and Van de Walle have discussed how these factors explain Cameroon's high yields, and their lack, Nigeria's low yields.

Yayock's and Kumar's recent analysis of cotton in Nigeria confirms Lele's and Van de Walle's conclusions. Privatization of the cotton market, since the abolition of the commodity boards, has led the textile industry in Nigeria to seek a more "integrated" system, with mills making purchases directly from farmers. Yayock and Kumar, nevertheless, stress the fundamental importance of better seed distribution, and research and extension -- functions performed by the public sector -- for raising the productivity of cotton. The evidence to date suggests that because of scale economies in collecting output from farmers, the private sector will work effectively for large commercial producers, although it is unlikely to provide the necessary assistance to the majority of small cotton producers. Thus, public sector involvement will be essential for providing the required services to small producers.

5. CONCLUSION

Macroeconomic factors adversely affected agricultural performance by causing labor shifts out of agriculture. On the other hand, this paper has shown that the terms of trade strongly favored the foodcrop sector, which dominates Nigerian agriculture, although they deteriorated for the export crop sector, which has received the most attention in other assessments of Nigeria's poor agricultural performance. The Nigerian government's expenditures on agriculture also increased considerably after the oil boom, in response to the favorable terms of trade for the foodcrop sector.

Nevertheless, despite the increased expenditures and the favorable terms of trade for foodcrops, the performance of the agricultural sector was disappointing, owing mainly to the absence of an effective, coherent and long-term strategy towards the agricultural sector reflecting its fundamental role in the economy. This absence has been manifested in the patterns of public expenditures, and technological and institutional factors. In addition, as we have shown, a complex set of political and organizational factors have also prevented the application of known technologies to the export crop sector, which would have compensated for the adverse price environment. In particular, changing governments and complex federal-state government interactions, were responsible for poor sectoral and sub-sectoral policies.

Alleviating the constraints imposed on agricultural growth by the lack of long-term policy priorities, and institutional limitations, is more difficult and will take longer than changing relative prices. Relative prices have changed as a result of the macroeconomic reforms initiated in 1986, and have created a more favorable incentive structure for agriculture as a whole. Those changes have, however, once again highlighted the importance of non-price factors. They have stressed the long overdue need for focusing on the formulation of a sound and internally coherent agricultural policy, if the sector is to become more dynamic. This will require particular emphasis on technological factors, with clear priorities in terms of crops for which quick technological solutions exist in the short run. Similarly, it will also require identification of crops, for which a consistent and well-focused emphasis, can lead to technological improvements in the long run. Steps are needed as well to improve the functioning of markets, and the public sector's capacity for planning and implementing development policies. We have shown that these factors have received little attention in Nigeria's own policies,

and even in the otherwise worthy role that the World Bank has played in protecting smallholder agriculture.

Although the fundamental problem of the short time horizon of policy makers, tied closely to political instability, remains, the Nigerian government's commitment to agriculture has apparently increased as oil revenues have dropped. The government, and especially the body of Nigerian technocrats that influence policy regardless of the regime, may now be in a better position to address the inherently complex and long-term problems of federal-state relations, and develop a planning and implementation capacity. This will, nevertheless, require appropriate and sensitive support from the only important external actor in Nigerian agriculture, namely the World Bank.

The need for building an institutional and research capacity in Nigeria, for achieving sustained production growth, cannot be overstated. In contrast to other countries where one or two crops dominate production and consumption (e.g., maize in East Africa and rice in South-East Asia), the large number of crops grown in Nigeria places a particular premium on developing such a capacity for policy formulation and implementation, and research prioritization. The systemic problems relating to technology development, especially questions of how to deal with (i) the incongruence between potential supply, and internal and external demand, (ii) the unavailability of technical packages for mixed farming, and (iii) the organizational constraints imposed by infrastructure, have meant that even the existing demand has not been arbitrated effectively. This has, indeed, reduced the impact of the World Bank - supported ADPs. On the other hand, Nigeria's diverse resource base, large and growing internal market, and a pool (albeit small) of highly trained nationals, confers upon it a considerable growth potential that other countries in Africa do not possess.

NOTES

- 1/ Idachaba (1987) mentions a number of factors that increased the federal government's role in agriculture. "First, states were willing to abdicate their traditional responsibilities in agriculture to the federal government if it meant increased inflow of federal funds ... Second, the creation of 12 states in 1967 brought in new administrations that had little or no knowledge of the traditions and culture of state-federal relations in Nigerian agriculture. Third, inherent unitary government tendencies of military administrations have drastically eroded state powers and responsibilities for agriculture."
- 2/ Consistent data series from the FOS are available only for the 1970-83 period. Thus, the computed trends refer to 1970-83 for the FOS data, and to 1970-86 for the FAO data.
- 3/ Although the data on foodcrop prices, shown in Table 5, refer to the retail level, they are likely to approximate producer prices quite closely as they are for rural areas.
- 4/ Total food production is defined as the sum of the production of sorghum, millet, pulses, maize, rice, yams, and cassava. The production of yams and cassava has been converted to cereal equivalent terms using factors of 0.25 and 0.303, respectively.
- 5/ There are several other reasons for this regional configuration, besides the priority assigned to foodcrops by the government. One may relate to the longer familiarity with fertilizers of farmers in the north, where it was being used on cotton and groundnuts as early as the 1950s. Two, the intensely leached ferralitic soils found in large parts of the southern region are not amenable to fertilizer, whereas it helps to maintain the

fertility of the ferruginous soils dominant in the north. Three, the ADPs, which have been instrumental in promoting fertilizer use on foodcrops, have to date been located mostly in the north. A final reason might relate to the better price environment that has obtained for foodcrops relative to tree crops.

6/ Stated differently, farmers had to sell well under one bag of any crop to pay for a bag of nutrient. It, however, needs to be noted that these ratios have been computed using the average annual prices of crops. Given the seasonal variations in foodcrop prices in Nigeria, the ratios would be higher, and the inherent incentives lower, if post-harvest prices were used instead.

7/ The special incentives enjoyed by Nigerian farmers because of the government's fertilizer subsidy policy emerge in sharper perspective when the nutrient price/crop price ratios for Nigeria are compared with those for other MADIA countries. For instance, in the case of maize, which is important to varying degrees in all six countries, the computed ratio for 1986 for Nigeria (1.38) is almost one-half of that for Cameroon (2.39) and Senegal (2.58), just over one-third of that for Kenya (3.70) and Tanzania (3.30), and about one-tenth of that for Malawi (11.90). (See Lele, Christiansen and Kadiresan).

8/ With reference to the 1988 international price of \$242, the estimated DRCs are 1.34 and 1.15, respectively, for traditional and improved swamp rice (World Bank, a). Assuming yield increases of 20 percent over the 1988 levels, and a projected international price of \$265 for 1995, the DRCs decline to less than one.

9/ The following demonstrates the large differences between the fruit and oil yields of the Tenera and Dura palm varieties in Nigeria (Skoup and Company):

	<u>Fresh Fruit Bunch Yields</u> (metric tons per hectare)	<u>Oil Yields</u>
Tenera	15-18	4-5
Improved Dura	15-18	2
Wild Dura	3	0.5

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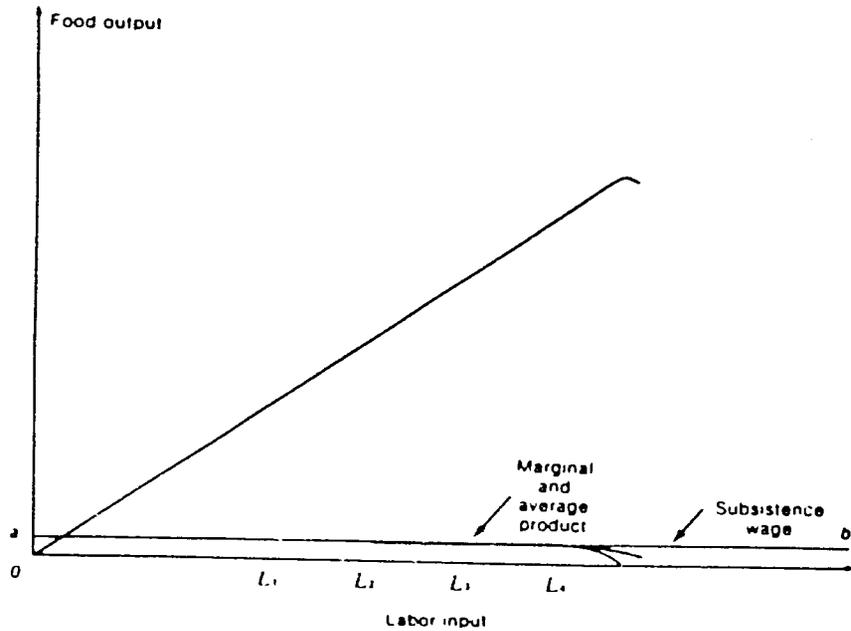
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Figure 1a

Hypothetical Relation Between Food Output and Labor Input in Africa

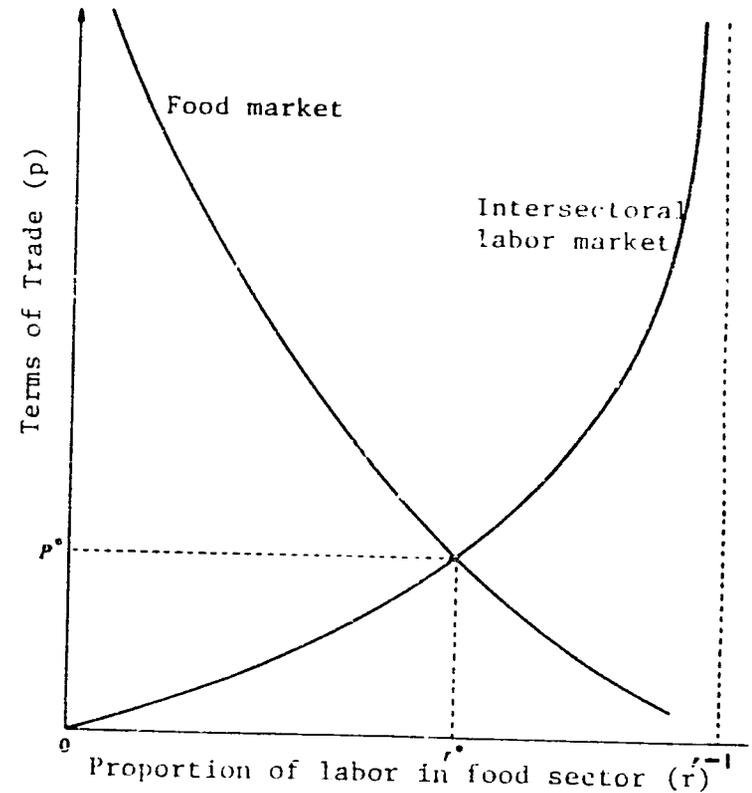


Source: Mellor

Note: As the marginal product, average product and subsistence level are all equal (a), total food output depends on increased levels ($L_1 - L_4$) of land and labor input.

Figure 1b

Relationship Between the Food and Nonfood Terms of Trade and the Proportion of Labor Employed in Food Production



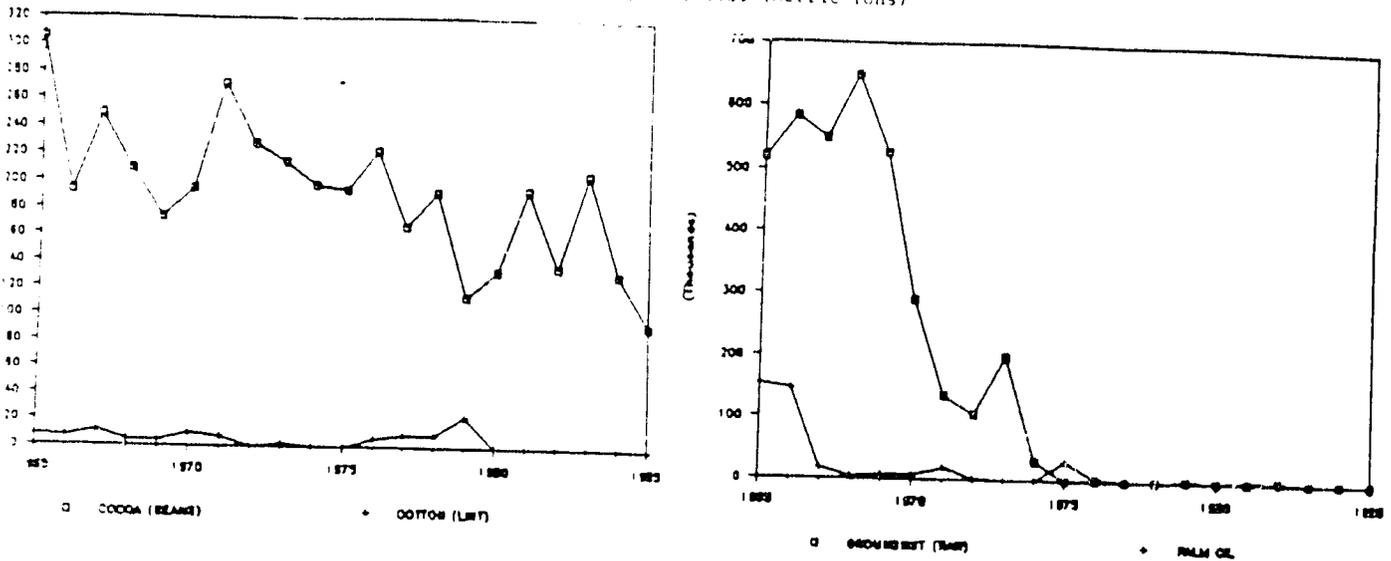
Source: Lele and Mellor

Note: As r declines with respect to the food market, the price of food relative to non-food (p) increases.

4/10

Figure 2

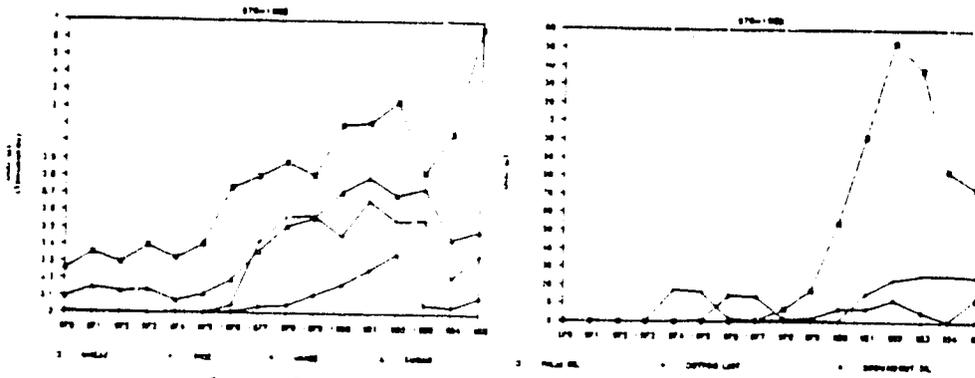
Nigeria: Agricultural Exports, 1965-1985 (Metric Tons)



Source: FAO Trade Yearbooks

Figure 3

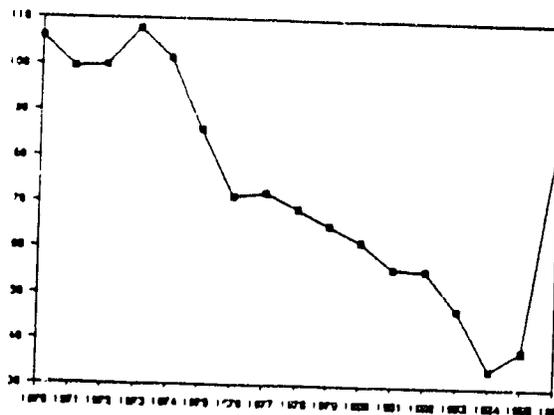
Nigeria: Selected Agricultural Imports, 1970-1985



Source: FAO, Trade Yearbook, (various years)

Figure 4

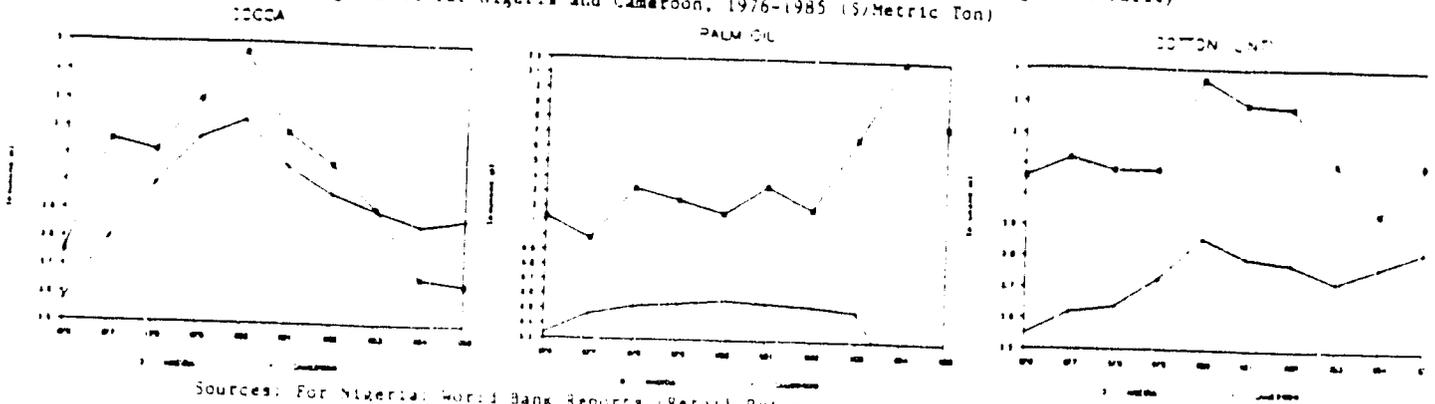
Trade-Weighted Purchasing-Power Parity Exchange Rate Indices
1970-1986



Source: U. Lala, and P. Saka, External Shocks and Macroeconomic Adjustments: A Case Study of Three West African Countries: Cameroon, Nigeria, and Senegal (MADIA, 1988).

Figure 5

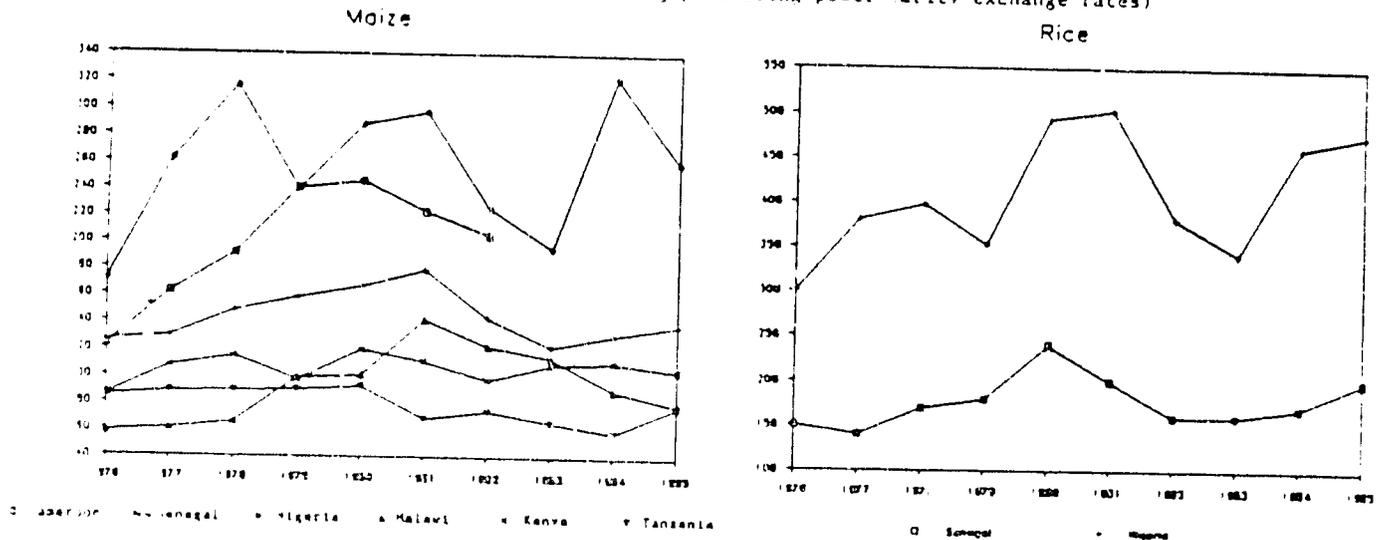
Producer Prices for Cocoa, Oil Palm, and Cotton (Lint) at Purchasing Power Parity Exchange Rates for Nigeria and Cameroon, 1976-1985 (\$/Metric Ton)



Sources: For Nigeria: World Bank Reports (Retail Prices). For Cameroon: Ministry of Agriculture, as cited in "Bilan Diagnostic" for data before 1979; and various issues of the Bank's "Country Economic Memorandum" for data after 1979. For Cotton Prices: U. Lele and M. van der Walte, "Cotton in Africa: A Comparative Analysis of Performance in the MADIA Countries (MADIA, 1988).

Figure 6

Maize and Rice Producer Prices in Nigeria Compared to Other MADIA Countries, 1971-1986 (Converted to US \$/Ton using purchasing-power parity exchange rates)



Sources: U. Lele, R. Christiansen, and K. Kadiresan, "Issues in Fertilizer Policy in Africa: Lessons From Development Policy and Adjustment Lending Experience in MADIA Countries, 1970-1987 (MADIA, forthcoming)

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Table 1
Annual Growth Rates of Area, Output and Yield, 1970-86 ^{a/}

		Area	Output	Yield
		----- (Percent) -----		
=====				
Millet	FAO	-1.23	1.29	2.52
	FOS	-4.45	-0.54	3.91
Sorghum	FAO	-0.75	1.40	2.15
	FOS	-3.36	2.02	5.38
Yams	FAO	0.71	2.36	1.65
	FOS	-4.31	-2.45	1.86
Cassava	FAO	2.23	1.85	-0.38
	FOS	-3.99	-3.04	0.96
Maize ^{b/}	FAO	3.34	5.67	2.33
	FOS	-5.61	-1.98	3.63
Rice	FAO	7.67	9.93	2.26
	FOS	-5.81	-4.96	0.85
Beans ^{b/}	FAO	0.72	2.11	1.39
	FOS	-9.82	-0.75	9.07
Cocoa	FAO	-0.24	-5.16	-4.92
	FOS	-	-4.03 _{c/}	-
Groundnuts	FAO	-7.03	-2.49	4.54
	FOS	-13.42	-9.11	4.31
Cotton	FAO	-0.60	-8.11	-7.51
	FOS	-	-5.46 _{c/}	-
Palm Oil	FAO	-	1.72	-
Palm Kernels	FAO	-	1.84	-
Rubber	FAO	-	-1.32	-
=====				

^{a/} 1970-86 for FAO data; 1970-83 for FOS data.

^{b/} FAO Trends refer to 1970-85.

^{c/} Refers to marketings.

Source: Lele et al.

Table 2

Distribution of Public Capital Expenditures during the Periods of the First,
Second, Third and Fourth National Development Plans, and the Federal
Capital Budget Allocation for 1986 and 1987
(million Naira)

	First Plan (1962-68)			Second Plan (1970/71-73/74)			Third Plan (1975/76 - 79/80)			Fourth Plan (1986/85) d/			1986 ^{e/}	1987 ^{e/}
	Federal	States	Total	Federal	States	Total	Federal	States	Total	Federal	States	Total	Federal	Federal
Economic Services	412.7	262.6	675.3	606.0	493.0	1,099.0	14,578.3	2,608.9	17,187.2	29,596.5	10,794.5	40,381.0	2139.0	1,162.3
Rainfed Agriculture ⁺	21.9 ^{a/}	83.1 ^{a/}	105.0 ^{d/}	64.6	108.6	173.2	414.8	500.8	915.6	2,962.7	2,471.5	5,434.2	275.1	243.2
Livestock, forestry and fisheries	-	-	-	4.8	40.6	45.4	118.1	185.1	303.2	437.3	701.3	1,138.6	44.6	22.0
Irrigation	1.4 ^{a/}	48.1 ^{a/}	49.5 ^{a/}	c/	c/	c/	778.1	50.1	828.2	2,000.0	254.8	2,254.8	141.1	99.9
Mining & Industry	24.8	70.3	95.1	41.2	68.2	109.4	3,727.2	312.5	4,039.7	11,777.0	1,440.0	13,221.0	1,162.1	452.0
Transport	193.4	48.8	242.2	306.7	210.1	516.8	5,770.8	1,043.3	6,814.1	6,790.5	3,916.1	10,706.6	418.3	313.0
Communications	22.1	0	22.1	54.2	-	54.2	1,779.1	-	1,779.1	2,000.0	-	2,000.0	97.8	52.2
Others*	149.1 ^{b/}	12.3 ^{b/}	161.4 ^{b/}	134.5	65.5	200.0	1,990.2	457.1	2,447.3	3,619.0	2,006.8	5,625.8	n.a	n.a
Social Services	90.5	71.8	162.3	211.9	403.6	615.5	3,315.6	3,846.8	7,162.4	8,439.5	15,254.0	23,693.5	1,825.8	959.6
Education	49.4	42.9	91.3	99.1	155.5	254.6	1,731.6	1,262.9	2,994.5	2,450.0	5,253.1	7,703.1	442.0	139.1
Health	6.0	8.9	14.9	39.3	62.8	102.1	269.9	333.0	602.9	1,200.0	1,843.9	3,043.9	81.2	69.5
Water & Sewerage	-	-	-	24.0	105.1	129.1	87.3	867.8	955.1	-	3,746.2	3,746.2	n.a	n.a
Housing, Trans. & Country Planning	29.8	9.5	39.3	16.0	33.8	49.8	1,012.8	953.9	1,966.7	4,240.0	3,358.9	7,598.9	804.8	533.2
Others**	5.3	11.5	16.8	33.5	36.4	69.9	214.0	429.2	643.2	549.5	1,051.9	1,601.4	497.8	217.8
Administration	182.6	26.9	209.5	368.2	108.2	476.4	4,437.7	646.4	5,084.1	4,474.0	1,727.8	6,201.8	356.6	249.8
Defense	-	-	-	231.7	-	231.7	2,852.4	-	2,852.4	3,940.0	-	3,940.0	164.7	92.1
General	-	-	-	136.5	108.2	244.7	1,585.3	646.4	2,231.7	534.0	1,727.8	2,261.8	191.9	157.7
Financial Obligations	9.6	16.2	25.8	46.0	-	46.0	-	-	-	-	-	-	1,166.5	1,638.3
TOTAL	<u>695.4</u>	<u>377.5</u>	<u>1,072.9</u>	<u>1,232.1</u>	<u>1,004.8</u>	<u>2,236.9</u>	<u>22,331.6</u>	<u>7,102.1</u>	<u>29,433.7</u>	<u>42,500.0</u>	<u>27,776.3</u>	<u>70,276.3</u>	<u>5,487.9</u>	<u>4,030.0</u>

Source of basic data: Government of Nigeria, First, Second, Third and Fourth National Development Plans, World Bank, Nigeria Public Expenditure Review (1988-1992) (Western Africa Department, Country Operations Division, June 2, 1988).

+ May include some expenditures on small-scale irrigation through the ADPs.

a/ Includes both irrigation and water supply.

b/ Electricity.

Includes expenditures on livestock, forestry and fisheries.

* Includes commerce and finance, fuel and power, cooperatives and supply and resettlement & rehabilitation.

** Includes information, labour, youths and sports and community development.

n.a Not applicable.

c/ Included in Agriculture
d/ Budgeted, not actual

e/ Federal Capital Budget Allocation

Table 3
Official Producer Prices for Cocoa, Groundnut, Seed Cotton,
Palm Oil, Palm Kernels and Rubber, and the Retail Price for Palm Oil
(Weights per tonne)

	Cocoa	Groundnut	Seed Cotton	Palm Oil	Palm Kernels	Rubber	Retail Palm Oil Price
1955	400	90		130	60		
1956	300	90		100	60		
1957	300	90		100	60		
1958	300	88		100	60		
1959	320	88		100	58		
1960	224	88	110	96	58		
1961	204	90	96	96	58		
1962	212	84	84	96	58		
1963	232	78	88	80	50		
1964	222	78	92	80	54		
1965	179	82	94	82	54		
1966	139	84	84	82	56		
1967	155	68	86	84	56		
1968	155	58	98	84	56		
1969	197	52	110	84	58		
1970	297	53	102	76	61		
1971	197	67	102	76	61		
1972	352	75	123	84	61		
1973	427	81	122	204	130		
1974	660	145	156	265	150		
1975	660	150	308	265	150		
1976	660	150	306	295	150		987
1977	1,010	150	330	355	150	365	872
1978	1,030	275	330	355	150	365	1,226
1979	1,200	290	330	450	180	420	1,156
1980	1,300	350	400	495	200	485	1,031
1981	1,300	420	465	495	200	600	1,485
1982	1,300	450	510	495	230	700	1,455
1983	1,400	450	560	495	230	700	2,568
1984	1,500	650	700	600	400	750	4,955
1985	1,500	650	700	600	400	750	4,115
1986	1,600	750	750	600	400	1,300	--
Post- Devaluation	4,500	NA	1,200	1,800	400	2,200	--
Average							
1955-59	324	88	--	104	61	--	--
1960-69	234	76	94	86	56	--	--
1970-76	488	133	176	81	109	--	--
1977-84	1,258	392	450	468	218	568	1,846
1985-86	1,550	700	775	600	400	1,025	--

Sources: 1. Marketing Commodity Board records.
2. Central Bank of Nigeria, Annual Report and Statement of Accounts, several years.
3. Federal Office of Statistics, Economic Indicators, several years.
4. World Bank Sector Reports

Table 4
Comparison of Nominal Rates of Protection
for Traditional Export Crops Based on Official and
Purchasing Power Parity Exchange Rates, 1977-84

	COCOA		GROUNDNUTS		COTTON ^{a/}	
	Official	Parity	Official	Parity	Official	Parity
1977	-45	-59	145	79	-42	-58
1978	-51	-66	n.a	n.a	-35	-55
1979	-47	-62	32	-5	-6	-32
1980	31	-	n.a	n.a	28	-1
1981	-6	-10	n.a	n.a	14	-10
1982	15	-34	71	-4	11	-38
1983	27	-45	56	-32	19	-39
1984	9	-68	n.a	n.a	59	-54
	PALM OIL ^{a/}		PALM KERNELS		RUBBER	
	Official	Parity	Official	Parity	Official	Parity
1977	-27	-46	-15	-38	-12	-16
1978	-9	-37	-6	-15	-15	-41
1979	3	-22	-16	-19	-42	-58
1980	23	-5	41	9	-28	-44
1981	16	-29	50	-7	-4	-41
1982	22	-11	81	1	33	-26
1983	18	-49	-8	-37	11	-52
1984	5	-69	32	-51	5	-68

^{a/} The nominal rates of protection are based on import unit values for cotton and palm oil, while for the other crops they are based on export unit values.

Sources: Based on Table 3, and Import/Export Unit Values computed using data from FAO Trade Yearbooks on volumes and values.

Table 5
Nominal Prices of Major Food Crops
(Naira per MT)

Year	Maize	Cowpea	Sorghum	Millet	Rice	Yams	Cassava ^{a/}
1976	151	269	153	149	265	234	263
1977	234	363	204	316	340	340	394
1978	292	513	292	334	366	445	466
1979	221	452	209	278	326	434	353
1980	255	525	194	255	439	407	439
1981	326	944	346	419	551	463	675
1982	273	892	297	394	463	463	605
1983	300	921	255	332	524	698	543
1984	729	1784	784	833	1040	1,321	958
1985	605	1546	628	768	1110	808	755
1986	415	1646	328	377	1176	727	473

^{a/} In terms of garri.

Source: Kaduna ADP for Maize, Cowpea, Sorghum, Millet and Rice; and Bida ADP for Yams and Cassava.

Table 6
Consumer Price Indexes for Food and Non-Food Items
(1976 = 100)

	Composite	Food	Non-Food
1976	100	100	100
1977	123	129	105
1978	146	153	125
1979	163	167	147
1980	179	182	167
1981	216	227	181
1982	232	244	203
1983	286	300	250
1984	400	422	337
1985	423	445	363

Source: World Bank, "Agricultural Sector Review 1987", Volume II (WAPAB, March 13, 1987).

Note: The composite CPI has been decomposed into separate indexes for food and non-food commodities assuming a 75 percent share of food in the composite CPI, and using the ratios of the indexes for food and non-food prices presented in Table 1 (p.8) of the source.

Table 7
Agricultural Wage Rates, 1976-86 (Naira per day)

	Agriculture		Construction	
	Nominal	1976=100 ^{a/}	Nominal	1976=100 ^{a/}
1976	1.75	1.75	5.00	5.00
1977	1.75	1.42	5.00	4.07
1978	1.75	1.20	5.00	3.42
1979	3.25	1.99	3.00	4.91
1980	3.25	1.82	3.00	4.47
1981	4.70	2.18	3.00	3.70
1982	4.70	2.03	3.00	3.45
1983	4.70	1.64	10.00	3.50
1984	5.00	1.25	10.00	2.50
1985	5.00	1.18	10.00	2.36
1986	7.00	n.a.	n.a.	n.a.

Sources: Agricultural wages from Kaduna ADP
Construction wages from, FACU, Benin (cited in Altaf, "Nigeria Labor Markets", Paper prepared for World Bank, WAINI, June 6, 1988).

a/ The nominal wage rates have been deflated using the composite consumer price index shown in Table 6.

Table 8: Agricultural and Non-agricultural Labor Force, 1970-86

	Agricultural Labor Force		Non-agricultural Labor Force	
	'000	Percent of Total	'000	Percent of Total
1970	13,825	62.1	8,452	37.9
1975	14,236	57.7	10,429	42.3
1976	14,324	56.8	10,877	43.2
1977	15,089	56.0	11,877	44.0
1978	15,218	55.1	12,420	44.9
1979	15,355	54.2	12,982	45.8
1980	15,475	53.3	13,585	46.7
1981	15,602	52.1	14,221	47.9
1982	15,736	51.4	14,879	48.6
1983	16,583	50.5	16,257	49.5
1984	16,722	49.6	16,986	50.4
1985	24,316	65.5	12,252	33.5
1986	24,852	66.2	12,716	33.8

Source of data: FAO Production Yearbooks (Various Years). The data refer to the economically active populations in the agricultural and non-agricultural sectors.

Table 9

Net Returns per Hectare per day to Labor for
Individual Food Crops, and for Cocoa and Cotton(Naira)

	Maize ^{a/}	Cowpeas	Sorghum	Millet	Rice	Yams	Cassava	Cocoa ^{a/}	Cotton ^{a/}
1976	0.67	0.37	0.55	0.51	1.45	4.53	2.93	1.34	2.01
1977	1.09	0.52	0.74	1.14	2.15	6.44	4.35	3.52	3.12
1978	1.38	0.91	1.10	1.21	1.69	8.60	4.94	2.68	1.62
1979	3.78	0.58	0.78	1.03	1.60	8.66	3.70	3.52	2.22
1980	1.30	0.73	0.72	0.95	2.22	8.08	4.41	3.50	2.14
1981	1.60	1.34	1.28	1.54	3.04	9.14	6.86	4.12	2.16
1982	1.31	1.26	1.06	1.47	2.65	9.41	6.11	3.48	1.64
1983	1.46	1.29	0.92	1.24	3.02	14.53	5.63	2.89	1.80
1984	3.24	2.34	1.67	2.69	5.78	25.54	9.16	3.91	1.55
1985	2.84	2.13	1.70	3.59	5.89	16.76	7.79	2.88	1.60
1986	2.84	2.24	1.96	1.77	6.50	17.82	5.56	3.49	2.31
Assumed Labor Input (mandays/hectare)	110	100	106	106	230	320	180	82	115

Sources: Tables 3 and 5 for prices
FAO for yields
World Bank SAR's for farm input use
Table 10 for fertilizer price
Other input costs from Bank SAR's

a/ For cocoa and cotton, it is assumed that labor is the only input.

Table 10

Farm-Gate Price of Fertilizer and
the Rate of Subsidy, 1976-86

	Price (N per 50 kg. bag)	Subsidy Rate (%)
1976	1.80	85
1977	1.80	85
1978	1.80	85
1979	1.80	85
1980	1.80	85
1981	3.50	85
1982	3.50	85
1983	4.00	83
1984	9.50	50
1985	9.50	34
1986	13.00	28
Post-Devaluation 1986	13.00	82 ^{a/}

a/ Derived using the actual cost of fertilizer and an exchange rate of 4 Naira=1 U.S. dollar.
Source of fertilizer prices: Kaduna ADP.

Table 11

Nigeria: Consumption of Nutrients, 1972-86

Year	Metric Tons of Nutrients
1973	15,200
1974	28,900
1975	54,300
1976	79,000
1977	74,000
1978	71,400
1979	108,300
1980	173,900
1981	213,200
1982	201,800
1983	166,000
1984	221,300
1985	355,667*
1986	282,000*

Source: FAO for 1972-82.

IFDC (1985) for 1983 and 1984.

Nigerian Government sources for 1985 and 1986.

* Converted from product terms to nutrients assuming a conversion factor of 0.33; the reported consumption in product terms is 1,067,000 metric tons for 1985 and 846,000 metric tons for 1986.

Table 12

Nutrient Price/Crop Price Ratios, 1980-86

	Maize	Rice	Cotton	Groundnuts	Sorghum	Yams	Cassava	Cocoa
1980	0.31	0.18	0.20	0.23	0.41	0.20	n.a.	0.06
1981	0.48	0.28	0.34	0.38	0.46	0.31	0.23	0.12
1982	0.60	0.33	0.31	0.36	0.53	0.31	0.26	0.12
1983	0.60	0.34	0.32	0.40	0.69	0.25	0.33	0.13
1984	0.58	0.41	0.60	0.65	0.54	0.32	0.44	0.28
1985	0.69	0.38	0.49	0.56	0.67	0.52	0.56	0.26
Pre-devaluation								
1986	1.38	0.36	0.68	0.22	1.76	0.80	1.22	0.36
Post-devaluation								
1986/87	-	-	0.48	0.48	-	-	-	0.14

Based on Tables 3, 5, and 10

Table 13

Total Agricultural Research Expenditures
and Agricultural Research Expenditures
as percent of Agricultural GDP, 1954 to 1984

Year	Research Expenditures		Research Expenditures as percent of Agricultural GDP
	Million Current Naira		
1954-55	0.7		n.a.
1959	1.3		n.a.
1962	2.4		n.a.
1965	3.6		0.21
1968	3.5		0.23
1971	6.1		0.24
1974	7.6		0.23
1976/77	59.9		1.22
1977/78	72.8		1.42
1978/79	61.3		1.14
1979/80	59.7		1.05
1981	135.5		1.73
1982	114.0		1.64
1983	115.5		1.83
1984	32.9		1.28

Source of Basic Data:

Research Expenditures:

1955 (i.e., 1954-55): Idacnaba.

1959 to 1974: Evenson. (Evenson presents the expenditures in terms of 1980 constant US dollars. We have converted his estimates to current and constant Naira terms using the official exchange rate and the CPI for Nigeria).

1976/77 to 1979/80: Nigeria, National Committee on Green Revolution.

1981 to 1984: Skoup and Co.

Agricultural GDP: Nigeria Central Bank and World Bank reports.

Table 14

Benefit-Cost Ratios for Fertilizer Use Computed at the Lower and Upper Ends
of the Reported Response Coefficient Ranges (Based on 1986 Prices)

	Lower End		Upper End	
	Response Coefficient	B/c Ratio	Response Coefficient	B/c Ratio
Maize	4	2.9	11	8.0
Sorghum	2.5	1.4	12	6.8
Millet	2.5	1.6	21	13.6
Groundnut	1.5	3.1	21	43.8
Rice	3	6.1	13	26.5
Yam	14	17.5	30	37.5
Cassava	20	16.4	46	37.7

Sources: Response coefficients from Lela, Christiansen and Kadiresan; and Table 12 for Nutrient price/output price ratio

Note: Widely varying fertilizer response coefficients are reported for individual crops by different sources (the World Bank at different times, the FAO and Nigerian research institutes). This table uses the lowest and highest response coefficients reported for each crop.

Table 15

Commodity Values for Production, Trade and Consumer Demand Criteria

	Production Criteria		Trade Criteria		Demand Criteria	
	Share In Value of Output ^{a/}	Share In Total Area ^{b/}	Share In Total Value of Exports ^{c/}	Share In Total Value of Imports ^{c/}	Share In Calorie Availability ^{d/}	Income Elasticity of Demand ^{d/}
Yams	40.9	5.3	-	-	7.5	0.4
Cassava	19.0	4.6	-	-	10.0	0.2
Sorghum	12.5	32.9	-	0.2	13.4	0.4
Millet	8.5	30.2	-	-	12.2	0.4
Beans	4.5	11.1	-	-	3.4	0.5
Maize	4.4	6.1	-	6.2	7.4	0.4
Groundnut	3.4	4.8	-	1.3	1.1	0.4
Palm Oil	2.5	n.a.	-	7.8	8.6	0.2
Palm Kernels)	n.a.	11.8	-	-	-
Rice	1.5	1.4	-	23.4	8.5	0.8
Cocoa	1.2	n.a.	79.7	-	-	-
Rubber	1.1	n.a.	8.1	-	-	-
Cotton	0.3	3.7	0.4	5.9	-	-
Wheat	-	-	-	27.9	7.5	1.5
Sugar	-	-	-	27.4	1.9	1.5
Total	100.0	100.0	100.0	100.0	81.5	-

a/ 1985-87 average based on 1984 constant prices (Source: FOS).

b/ 1981-83 average (Source: FOS).

c/ 1982-84 average (Source: FAO).

d/ The calorie shares refer to 1980 and are from "The Green Revolution: A Food Production Plan for Nigeria;" The income elasticities of demand are also from the same report.

Table 16

Sectoral Distribution of the World Bank's (1971-84) and USAID'S (1961-84) Assistance to Nigerian Agriculture

	Bank		USAID	
	\$M	Percent of Total	\$M	Percent of Total
Crop Production	849.7 ^{a/}	93.3 ^{a/}	-	-
Storage and Processing	-	-	1.3	1.2
Marketing	-	-	-	-
Inputs	-	-	0.3	b/
Agricultural Research	-	-	5.4	5.0
Agricultural Extension	-	-	11.9	10.9
Training	-	-	-	-
Management	-	-	8.9	8.2
Irrigation	-	-	7.5	6.9
Livestock	21.0	2.3	12.4	11.4
Forestry	31.0	3.4	-	-
Fisheries	-	-	0.7	0.6
Infrastructure	-	-	9.2	8.4
Health	-	-	3.7	3.4
Education	9.0	1.0	46.7 ^{c/}	42.9 ^{c/}
Water	-	-	-	-
Community Dev.	-	-	-	-
Credit	-	-	1.1	1.0
TOTAL	910.7	100.0	108.8	100.0

a/ Includes all ADP - related activities and assistance for export crops.

b/ Negligible

c/ Includes training

Sources: Jaeger for USAID and 1985 Agricultural Sector Memorandum for World Bank.

Table 17

Price Variations Among Zones of the Kaduna ADP, 1986

	Trough Price				Price Spread (N/M.T.)	Percent Difference ^{a/}	Peak Price				Price Spread (N/M.T.)	Percent Difference ^{a/}
	Zonal Price (N/M.T.)						Zonal Price (N/M.T.)					
	I	II	III	IV			I	II	III	IV		
Maize	367	328	288	416	128	44.4	619	525	542	705	180	34.3
Sorghum	325	300	299	579	280	93.6	461	421	506	684	263	62.5
Cowpeas	1,351	1,395	1,441	1,879	528	39.1	1,964	1,984	2,197	2,767	803	40.9
Groundnuts	1,422	1,175	1,351	1,010	412	40.8	1,595	1,175	1,673	1,850	675	57.4
Rice	--	1,094	1,091	1,222	131	12.1	--	1,368	1,558	1,827	459	33.6
Millet	414	421	479	679	265	64.0	475	428	552	739	311	72.7

Source: Kaduna ADP

I, II, III, and IV refer to the four zones of the Kaduna ADP

^{a/} between the highest and lowest prices

Table 18

Intra-Year Variations in Food Crop Prices
(Average 1984-86)

	Highest Prices (Naira/MT)	Lowest Prices	Ratio of Highest to Lowest
Maize	937	408	2.3
Millet	987	481	2.0
Sorghum	1,001	400	2.5
Rice	1,766	874	2.0
Cowpeas	2,447	1,362	1.8
Groundnuts	2,043	1,000	2.0
Yams	1,793	533	3.4
Gari	1,133	420	2.7

Note: The highest price usually refers to June-July, and the lowest price to January-February.

^{a/} Computed around the mean price for the year.

Source of Data: Kaduna and Bida ADP s.