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AFRICAN RURAL ECONOMY PROGRAM

The African Rural Economy Program was established in 1976 as an activity of Michigan State University's Department of Agricultural Economics. The African Rural Economy Program is a successor to the African Rural Employment Research Network which functioned over the 1971-1976 period.

The primary mission of the African Rural Economy Program is to further comparative analysis of the development process in Africa with emphasis on both micro and macro level research on the rural economy. The research program is carried out by faculty and students in the Department of Agricultural Economics in cooperation with researchers in African universities and government agencies. Specific examples of ongoing research are, "Poor Rural Households, Income Distribution and Technical Change in Sierra Leone and Nigeria," "Rural and Urban Small-Scale Industry in West Africa," "Dynamics of Female Participation in the Economic Development Process in West Africa," and "The Economics of Small Farmer Production and Marketing Systems in the Sahelian Zone of West Africa."

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INCOME DISTRIBUTION AMONG FARMERS IN NORTHERN NIGERIA: EMPIRICAL RESULTS AND POLICY IMPLICATIONS*

by

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*Published under an Agency for International Development contract with Michigan State University (AID/ta-C-1328). Field work was conducted while the author was a research assistant in the Department of Agricultural Economics at Cornell University.

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> . . . the overwhelming need for data on income distribution is not so much for better data on income shares, as for better data on the sectoral distribution of the poor, their occupational characteristics and educational levels, their ownership of productive assets, and their access to key production inputs. These characteristics determine the processes of income generation in poverty groups and the constraints on these processes [Chenery, 1974].

1. INTRODUCTION

A more equal distribution of the gains from economic growth has emerged as an increasingly prominent development objective during the 1970s. This is reflected not only within the national plans of most low income countries, but also in mandates guiding the assistance programs of major external donors [USAID, 1975; McNamara, 1978]. Interest in distribution reflects a growing awareness that the income gap separating the rich and poor has widened substantially in all but a few developing countries during the past two decades. The continuing presence of substantial pockets of poverty has aroused both humanitarian concerns and fears of political instability. But it has also become increasingly evident that in the absence of strong foreign markets the domestic intersectoral linkages needed for rapid growth cannot be exploited by policies which result in a further concentration of income [Mellor, 1976].

In spite of the commitment towards more broadly based growth, efforts to operationalize equity as a planning objective have been hindered by insufficient knowledge of how to design policies which ensure broad participation, how to implement them, and how to measure their impact. Underlying these policy questions is a general paucity of information

on incomes, on the occupational and demographic characteristics of the poor, and on how the poor respond to and are affected by alternative development policies.

Although a disproportionate number of the poorest within developing countries live in rural areas and derive their incomes primarily from agriculture [Chenery, op. cit.], the problems of the rural poor have been especially hard to address. Because most rural populations are highly dispersed geographically, often working within widely varying ecological, institutional, and market conditions, it has proven difficult to design policy instruments which effectively reach more than a small proportion of the rural poor. Moreover, information on rural incomes are particularly inadequate in almost all low income countries.

The present study was conceived to partially fill this knowledge gap through an analysis of income in one area of northern Nigeria. During 1974-75, a comprehensive set of household data was collected in three villages of southwestern Kano State. This paper summarizes some of the empirical findings of the survey through a description of the levels, distribution, and structure of income in that region. The paper is intended to provide Nigerian planners with a better understanding of who constitute the rural poor, what are their sources of income, and why they remain in poverty. In a broader context, the paper serves as a case study of the distribution and structure of personal income within an essentially traditional society characterized by low population pressure and by a production system experiencing the first stages of technological change.

1.1. Rural Income, Growth, and Changes in Income Distribution

Before turning to an examination of the survey, it is useful to briefly place the analysis into a broader framework by relating rural incomes to patterns of national distribution. Numerous authors have concluded from cross-country evidence that economic growth is accompanied by an initial period of increasing national inequality followed at some point by a tendency towards a more equal distribution [Kuznets, 1955, 1963; Paukert, 1973; Adelman and Morris, 1973a; Ahluwalia, 1976]. A common model put forward to explain this secular trend relies upon intersectoral income differentials and changes in the structure of the economy which occur as part of the growth process. The dynamic of the model is a more rapid growth of personal incomes within the industrial sector accompanied by a shift of population out of the rural sector into industrial employment. It can easily be shown that an expanding high income population within an initially larger but proportionately diminishing lower income population automatically produces the U-shaped equality function [Lydall, 1977]. In short, although national inequality is amplified if incomes are less equally distributed within industry, the model suggests that the primary cause of national inequality is the income gap between the agricultural and industrial sectors, rather than disparities within either sector.

Results of recent decomposition analyses which separate national inequality into between-sector and within-sector components, however, have challenged the general validity of the intersectoral model [van Ginneken, 1976; Fields and Schultz, 1977; Fishlow, 1972]. Among the developing countries examined, inequality between sectors has typically

been found to explain well under one third of overall national inequality, with the greatest proportion attributable to factors related to withjn sector disparities. Particularly significant is the finding that in a number of low income countries representing a range of development stages, inequality within rural areas explains a greater proportion of overall inequality than either urban or between-sector disparities [van Ginneken, 1977].

These results reflect the combined effect of two sets of factors: the "pre-growth" distribution of income among traditional farm producers, and the emergence of economic dualism within agriculture — that is, the growth of small modern agricultural sub-sectors characterized by the application of new production techniques, within a larger, less productive, and lower income traditional sector [Oshima, 1975].

Both factors are, of course, closely interrelated. Experience in countries which have witnessed the introduction of seed fertilizer technologies has shown that the pattern of adoption is importantly affected by the existing distribution of resources and incomes. When such technologies have been introduced in areas already characterized by wide inequalities, not only has the productivity impact been weak, but the pattern of inequality has been reinforced [Ruttan, 1977]. If successful adoption requires increased use of factors which are positively related to current income (such as human or physical capital), or if access to modern inputs or extension assistance is influenced by institutional factors similarly related to income, a skewed traditional distribution can both retard modern sector expansion and contribute to greater overall inequality.

These patterns underline the need for detailed knowledge of the distribution of resources and incomes at the household level. Such information combined with an understanding of the factor requirements implicit in new production packages can assist in predicting adoption patterns and their distributional impac More important is the ex ante contribution micro-level data provides in the design of policy interventions. Understanding the determinants of incomes among traditional producers — or conversely, an identification of constraints limiting incomes — is clearly necessary for the development of appropriate packages. And to the extent that constraints vary across income strata, such knowledge disaggregated by income class can permit a more efficient targeting of interventions to specific poverty groups. Despite these considerations, very little micro data documenting rural incomes and examining households by income strata are available in most developing countries.

1.2. Income Distribution in Africa

Among the areas of the developing world perhaps least is known about the size distribution and structure of personal incomes in Africa. The available data are highly aggregated and have been used primarily to estimate national averages and to draw comparisons among regions or industrial categories [Phillips, 1975]. In very few instances are data available to examine the interpersonal distribution, or changes in distribution over time. Moreover, coverage is almost exclusively limited to the modern urban sector.

Table 1.1 summarizes data describing national and sectoral distributions for 13 countries in sub-Saharan Africa. Because of differences

Table 1.1 THE SIZE DISTRIBUTION OF INCOME IN 13 AFRICAN COUNTRIES[a]

Country	Gini Coefficient	Year	Population	Coverage
Botswana	.5740	1971-72	Active Population	National
	.5200	1974-75[b]	Household	Rural
Chad	.3687	1958	All	National
Benin	.4675	1959	All	National
Gabon	.6439	1968	Income Recipient	National
Ivory Coast	.5342	1970	Income Recipient	National
Kenya	.6368	1969	Income Recipient	National
	.4790	1968-69	Household	National
Malawi	.4696	1969	Household	National
Zimbabwe	.6627	1968	Income Recipient	National
Senegal	.5874	1960	All	National
Sierra Leone	.6117	1968-69	Household	(Excluding Urban Western Province)
	.3774	1974-75[c]	Household	Rural
	.4224	1974-75[d]	Household	Urban
Tanzania[e]	.3030	1969	Household	Rural
	.3260	1969	Household	Urban
Uganda	.3007	1970	African Male Employees	National
	.3978	1970	African Male Employees	Non-Agricultural
	.3968	1970	African Male Employees	Urban
	.2662	1970	African Male Employees	Agricultural
	.2716	1970	African Male Employees	Rural
Zambia	.5226	1959	Household	National

a. With the exception of rural Botswana, Sierra Leone, and Tanzania as indicated, all data are from Jain [1976].

b. Republic of Botswana [1976].

c. Farm survey results reported in Eponou [1979].

d. From survey of urban migrants reported in Eponou, op. cit.

e. From van Ginneken [1976].

in income concepts, survey methods, and coverage, it is difficult to derive meaningful cross-country comparisons. However, it is notable that estimates of distribution in rural areas exist for only four countries. Among these four countries, two points merit mention. Within each, rural incomes were less concentrated than the national or urban distributions. And with the exception of Botswana, the rural Gini coefficients are generally low reflecting consistently more equitable intra-sectoral patterns compared with the rural distributions in most Latin American and Asian countries [Jain, 1976].

Two factors help explain these low levels of rural inequality. Important changes in farm production technology have not been widespread in most African countries. Because the vast majority of producers still employ essentially traditional cultural practices, wide disparities in income attributable to technique based productivity differentials are uncommon. Second, most areas in Africa continue to enjoy access to surplus land. Thus problems of land tenure which can become most acute under conditions of land shortage are similarly uncommon. Existing inequalities are believed to reflect interregional variation in soils, climate, and population pressure, location with respect to markets, and institutional factors affecting access to and cost of production inputs [ILO, 1972; Heyer, 1975; Essang, 1970].

1.3. Growth and Income Distribution in Nigeria

During the past decade, the Nigerian economy has experienced extremely rapid aggregate economic growth. Fueled by the expansion of petroleum exports, between 1965 and 1974 the Gross National Product (GNP) is estimated to have increased at a real annual rate of 8.5 percent, and GNP

per capita at an annual rate of 6 percent (to an average of $280 in 1974) [World Bank, 1976]. Accompanying this growth, income disparities within Nigeria are believed to have widened substantially. Although the relative importance of within sector inequalities is not fully known, the impact of intersectoral differentials is clearly substantial.

During 1964/65, the agriculture sector accounted for 58 percent of Gross Domestic Product (GDP) and approximately 70 percent of the active work force [Federal Republic of Nigeria, 1975]. By 1970/71 agriculture's share in GDP had fallen to 36 percent; and by 1974/75 to only 23 percent. The proportion of the labor force employed in agriculture in the latter period remained high, however, at 64 percent.[1] Moreover, the rate of decline of relative incomes of the farm population has been most rapid during the 1970s. From 1970/71 to 1974/75, because of a range of factors including bad weather, crop disease, declining agricultural terms of trade, and excellerated rural-urban migration, total farm output, in fact, showed a slight fall. This is in contrast to an average annual growth rate of 21 percent in all non-agricultural sectors combined.[2]

The available data on income are unfortunately inadequate to measure the impact of these changes on the national size distribution directly. As is true elsewhere, most income data in Nigeria are limited to the modern industrial sectors and have been used to describe income differentials

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[1] In contrast, during the same period the petroleum and mining sector increased its share in GDP from 3 percent to 45 percent, while its proportion of total employment remained at less than 1 percent.

[2] Although the petroleum and mining sector accounted for a large part of this growth with an annual rate of increase of 27 percent, production in all other sectors (excluding agriculture and petroleum) also grew at an annual rate of 13.5 percent.

among occupational classes and administrative regions [Teriba and Phillips, 1971; Aboyade, 1973, 1974]. Far less effort has been directed at the measurement of size distributions nationally or within production sectors. However, the rough magnitude of recent changes in the national distribution has been estimated by Byerlee [1973] using an input-output model of the Nigerian economy. Dividing the population into seventeen production sectors and assuming perfectly equal intra-sectoral distributions, he calculated a base Gini ratio of .49 on income per capita. Through a simulation approach, he was further able to project the distributional impact of the expanding petroleum sector, as well as the effects of alternative food and export promotion strategies through the early 1980s. With development policies unchanged, structural changes within the Nigerian economy would increase the national Gini ratio to .64 by 1983. Even assuming the most optimistic national policies - balanced food and export promotion combined with lower non-agricultural wage rates - the Gini ratio was still projected to increase during the period to .51.[1]

1.4. Current Policies and Data Requirements

Official concern with the rise in income inequality is clearly present. In the most recent National Development Plan, the Federal Government assigned high priority to the development of the agricultural sector. Furthermore, this commitment was framed within the broader objectives of interregional and interpersonal equity. This statement

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[1]Substantial public and private sector wage increases, most notably following the Udoji awards in 1974, have made these projections overly optimistic.

of national purpose places particular emphasis on the development of farm policies affecting the northern region of the country where incomes have traditionally remained lowest. Although major agricultural programs have been introduced on several fronts, results to date have been mixed and their impact on income distribution within the farm sector is not yet clear.[1] Moreover, efforts to identify policies and projects which ensure a favorable distributional impact have been hindered by a lack of data on rural incomes generally, and more particularly by a lack of information on the characteristics of the rural poor.

No national rural surveys have been undertaken in Nigeria and only a few sample surveys have examined the structure of incomes at the village level. Consequently, only fragmentary evidence is available. From data collected between 1966 and 1969 in nine villages representing three areas of the north, Norman and Pryor [1979] have calculated village Gini coefficients ranging between .2648 and .5004 on household incomes. The average village coefficient was .3608 reflecting a relatively equitable within village distribution. Unfortunately, the respective village data sets were not pooled to provide a broader measure of distribution to include the effect of between village variation in mean incomes. The purpose of Norman's studies, however, was to develop

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[1] These programs include: (1) a reorganization of the marketing board system and increased producer prices; (2) introduction of the National Accelerated Food Production Program which involves distribution of higher yielding crop varieties through a coordinated package approach; (3) establishment of several large integrated rural development schemes; (4) investment in a number of state operated large-scale farms and irrigation projects; and (5) the construction of agro-service centers distributing subsidized inputs to small farmers under the auspices of Operation Feed the Nation.

a baseline understanding of farm production systems throughout the north, not to examine the structure and determinants of personal incomes. Therefore, while the studies provide accurate estimates of farm incomes derived from crop production, they did not directly measure incomes generated in off-farm employment or by females. Nor did they examine the characteristics and production constraints of households stratified by income class to permit the identification of policies most relevant to the needs of the rural poor.

A more focused study of economic inequality was conducted by the anthropologist Polly Hill [1972] in a single village of the former North Central State during 1967. Although income levels were not estimated, through the use of informants Hill classified all farming units into four groups according to their relative ability "to withstand the shock of an exceptionally poor or late harvest" [p. 58]. This subjective classification proved to be a useful framework within which to examine factors associated with relative poverty and, indirectly, to infer causal relationships. The limitations of the Hill study, however, are serious. Since she surveyed only a single village, she was unable to incorporate locational variables, such as market access and population density, into her analysis. Only crude farm management data were collected and no direct estimates of incomes were obtained. Indeed, Hill argues that "it is doubtful whether reliable statistics on income and expenditure . . . could ever be obtained in a Hausa village".[1]

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[1]Hill pointed to the following problems: (1) the difficulty of valuing domestic consumption given wide seasonal variation in grain prices, (2) the fragmentation of extended families into distinct

This brief overview reveals an urgent need for additional micro level research on the structure of rural incomes in northern Nigeria. For the design of policies which address the Plan's objective of more equitable agricultural growth, information is needed to answer the following questions: (1) What is the degree of relative income inequality at the village level? And what are the most important factors affecting patterns of distribution? (2) Are there indications pointing toward more or less concentrated incomes in rural areas as a result of national development? (3) Is there an important incidence of absolute poverty at the village level? If so, what are the underlying causes? (4) Do sources of income, and patterns of resource use and productivity vary importantly among rural income strata? And what does this imply for the design of credit, extension and technology policies?

The present study attempts to provide empirical evidence on each of these issues. The paper has been divided into seven sections. Section 2 reviews the data collection methodology employed in the survey and general characteristics of the study area. In Section 3 the levels,

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production and consumption units during the dry season, (3) the secrecy of some income generating activities, and (4) limited access to women due to wife seclusion thereby restricting information on female earnings. However, considerable experience in the collection of farm level data in the north has been accumulated, particularly through the work of the Rural Economy Research Unit at Ahmadu Bello University. The experience has suggested approaches which importantly reduce each of these problems in arriving at an accurate and conceptually valid measure of income. The present survey design has built on the lessons learned from these earlier efforts. Furthermore, this study employed a highly intensive data collection approach suggested by Hill but which she believed would prove too costly. In short, with the exception of the last problem area, female earnings, her caution was unduly pessimistic. For a discussion of the female earnings problem see Section 3.

distribution and sources of household income are examined by income class. The demographic structure of households are examined in Section 4 to determine the presence of life-cycle income determinants. Section 5 examines patterns of resource use and productivity among income strata. Selected farm and off-farm activities are analyzed in Section 6 to identify differences in choice of enterprise across income strata and to infer whether enterprise mix may be a determinant of income variation. Conclusions and policy implications are summarized in Section 7.

2. CHARACTERISTICS OF THE STUDY AREA AND SURVEY METHODS

Accurate data on income is extremely difficult to obtain in rural surveys. This is due both to the complexity of the income concept and because it is usually considered to be a highly sensitive and thus confidential type of datum. For both reasons it was believed necessary to employ an intensive cost-route approach.[1] Because the cost-route technique employs frequent interviews, it encourages the establishment and maintenance of rapport with participating households and reduces measurement error due to poor recall. However, it is extremely expensive which, given a budget constraint, restricts both the sample size and geographical scope of the study.

Location can be assumed to affect rural incomes through variation in the quality of natural resources (soil and climate), as well as through differential access to support services (extension) and markets. For the purpose of estimating the distribution and structure of incomes, as well as to identify determinants, it would be desirable to sample households displaying some diversity with respect to both sets of factors. Due to limited resources, however, this strategy could not be followed in the present study. Rather, villages were selected in an effort to minimize ecological differences while making it possible to examine the impact of differences in access to support services and markets. More specifically, three villages in southwestern Kano State were purposively selected to satisfy the following criteria: (1) that

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[1] The cost-route method involves repeated visits to respondents during an entire production cycle. During each visit data is obtained on all relevant activities which occurred since the most recent interview [Spencer, 1972].

the villages should differ significantly with respect to proximity to major roads and thus to the urban marketing centers of Kano City and Zaria; (2) that at least one of the villages should be the seat of an agricultural extension campaign effort; and (3) that the three villages should be sufficiently close together to control for differences in soils, climate and farming systems, as well as to allow the survey supervisor to visit each of the study villages on a daily basis.[1] The three villages chosen - Rogo, Zoza, and Barbeji - are shown in Map 2.1.

2.1. Climate and Soils of the Study Area

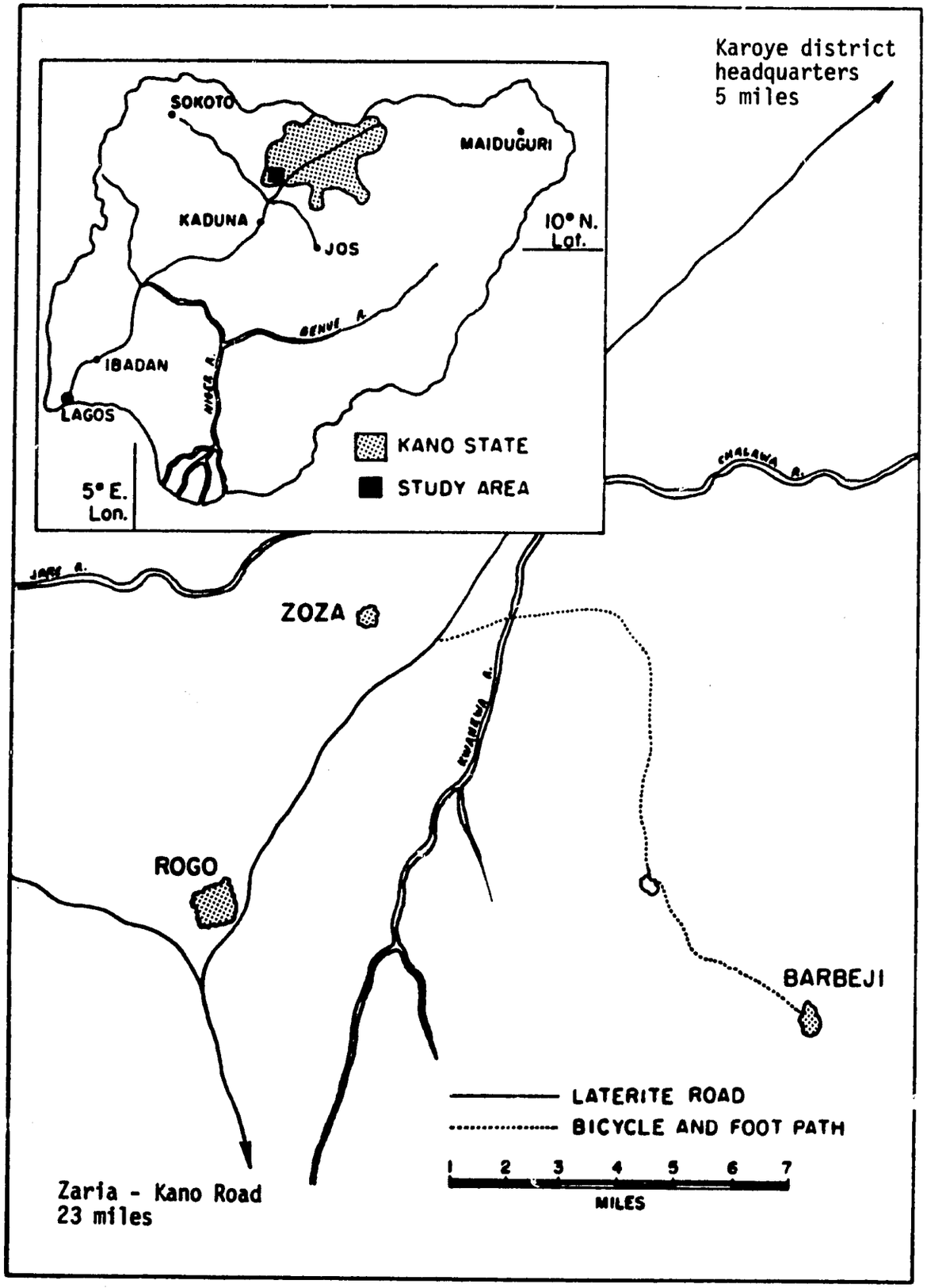
The villages are located in the Guinea-savannah ecological zone of Nigeria. One of the primary factors limiting agricultural production in this semi-arid region is low and highly variable rainfall. The study area receives an average annual rainfall of approximately 35 inches distributed over a 120 day period extending roughly from May to September. During the 1974-75 survey year total rainfall was very nearly equal to the 50 year mean.

The soils of the study area can be divided into upland soils (tudu), which comprise over 95 percent of the total land area of the region, and lowland soils (fadama), which are located near river basins and in valley bottoms. Whereas upland soils cannot be cultivated in the dry season unless irrigated, the alluvial fadama soils can often support dry

---

[1]The limitations of the village selection procedure are clear. The judgement sampling approach restricts the extent to which population characteristics can be validly infered for either Kano State or for the north of Nigeria. In particular, given the range of ecological conditions displayed in the north, it is expected that the income inequality observed in the present study would understate the actual inequality of the region as a whole.

MAP 2.1. DETAILED MAP OF THE THREE STUDY VILLAGES IN KANO STATE, WITH INSET OF NIGERIA



season farming without supplementary irrigation. The upland soils of the survey area are generally well drained and heavily leached feruginous tropical soils with chemical properties which make them poorly suited to agricultural use. Although a farming system which includes frequent bush fallow and organic manuring can maintain an adequate level of soil fertility, both the frequency of fallow and the amount of organic matter replacement necessary to maintain soil nutrient balance greatly exceed observed practices. While uncultivated plots of land were present in each of the study villages, the practice of incorporating a fallow period into a regular pattern of crop rotation was not common.[1]

A soils survey conducted in the three villages concluded that there were no significant intervillage differences in soils characteristics which would affect upland productivity. The population density of the survey area was approximately 130 persons per square mile.

2.2. Characteristics of the Study Villages

In spite of the ecological homogeneity of the study area, substantial intervillage variation was observed in both the sources and levels of incomes. To understand the factors underlying these patterns, it is necessary to review the characteristics of the three villages:

1. Rogo is a relatively large village (population 6405),[2] and is the location of one of the two most important village markets in Karaye

---

[1]On 80 percent of all fields cultivated by sample farmers during the survey period, no fallowing had occurred since the field had been acquired by the current owner. For the remaining fields on which fallowing had occurred, the mean period since the end of the most recent fallow was 8.9 years.

[2]Population estimates have been taken from the 1963 census.

District. Closely tied to external urban markets by daily lorry traffic throughout the year, the village was served by a resident agricultural instructor and several representatives of licensed buying agents purchasing groundnut. Strongly market oriented, Rogo farmers planted nearly three times the amount of groundnut seed relative to total cultivated hectares than did farmers in each of the other two villages. The largest plantings of sugar cane were also observed in Rogo reflecting the relatively larger holdings of fadama, 48 percent of the three village total. Pressure on the land was high, with a cultivated land per capita ratio of .24 hectares.

2. Zoza, a smaller village (population 2964) located six miles north of Rogo, is situated within one mile of the major laterite feeder road in the district. Lorry connections were infrequent during the survey year. One licensed buying agent's representative was a resident of the village. The Rogo agricultural instructor had worked with Zoza farmers most recently during 1973 when a package of improved groundnut seed and fertilizer was distributed as a part of a state-wide seed muliplication program. Cropping patterns were least cash oriented of the three villages with the highest relative plantings of sorghum and millet. Population pressure was the lowest, reflected in a land per capita ratio of .47 hectares.

3. Barbeji is intermediate in size (population 3744), and located 13 miles from the nearest all season road. Connecting trails were motorable with great difficulty during the dry season and impassable to any four-wheel motor traffic during the rains. Lorry contact was consequently rare with cash crops evacuated by headload, bicycle, and donkey. Although

smaller than that of Rogo, the Barbeji market is considerably larger than that of Zoza serving several satellite villages and hamlets. Neither an agricultural instructor nor a licensed buying agent or representative had worked in the village in recent years. Population pressure was intermediate with a cultivated land per capita ratio of .45 hectares.

2.3. Sampling and Survey Methods

The sample frame consisted of all household heads included on recently updated tax lists. Forty-five households were randomly selected from such lists in each village. The household was defined as those persons "eating from the same pot" (that is, sharing a common source of food), a convention commonly used in surveys conducted among the Hausa. An additional six households were purposively selected on the basis of elite status they enjoyed in the study villages.[1] This latter group was included in the survey to permit an analysis of how political position affects incomes as well as access to government services.

It was assumed that the types of data required vary considerably both with respect to the rate of memory loss and with respect to the sample size necessary for different types of analysis. Due to limited resources a two-tier sampling procedure was employed. From the results of a situational survey administered to all selected households, the

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[1]The non-random units include the village heads in two of the survey villages, a hamlet head in one village, and the head farmer (sarkin noma) in each village. For all subsequent analysis, these elite households are separated from the random sample and identified as a distinct sub-set. For a discussion of the positions of village head and sarkin noma, see Hill [1972, pp. 295 and 316].

general sample in each village was divided into "large sample" (between 33 and 35 households per village) and "small sample" (either 11 or 12 households per village) groups.[1] The interview frequencies employed for each sample and data type are summarized in Table 2.1.

Harvest weights of all crops as measured in local units were obtained from the small sample during the twice weekly interviews. Threshing percentages and size of land holding were also obtained through direct measurements made during supplemental farm visits. Seasonal retail prices of all crops grown in the area were obtained in monthly surveys conducted in each village market.

2.4. Characteristics of the Farming Households

The sampled farming units were generally representative of households throughout the northern region of Nigeria. The average household consisted of 6.7 persons holding usufructurary rights over 2.5 hectares of cultivated land.[2] Although nearly 40 different crops were grown in the area, the basic food staples, millet and sorghum, together with the dominant cash crop, groundnut, represented 75 percent of the total harvest value.

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[1]The small sample households were chosen based on a four-cell stratification matrix: (1) above and below mean land to worker ratios, and (2) use or non-use of both chemical fertilizer and seed dressing during the previous year. The approach was designed to ensure observations in the small sample with sufficient variation in these key production variables to increase estimation precision in the agricultural production analysis. Nine households were chosen for each cell of the stratification matrix. One small sample farmer was subsequently dropped from the survey reducing the sample size to 35.

[2]The average family size found by Norman [1974] in the three village Zaria study was 6.9 persons cultivating 3.5 hectares. In her Batagarawa survey Hill [1972] found an average household of 7.2 persons farming 2.6 hectares.

Table 2.1 TWO-TIER SAMPLING PROCEDURE: DATA TYPES, INTERVIEW FREQUENCY, AND SAMPLE SIZES.

Type of Data	Interview Frequency					
	Small sample				Large sample	
	2-3 weekly	Weekly	Monthly	Once	Monthly	Once
A. Agricultural						
1. Family labor	X					
2. Hired labor	X				X	
3. Non-labor inputs	X				X	
4. Harvests	X				X	
5. Non-labor input purchases		X			X	
6. Crop and livestock purchases (trading)		X			X	
7. Crop and livestock sales		X			X	
8. Land transfers			X		X	
9. Transport costs		X			X	
10. Assets inventory				X		X
B. Non-farm occupations						
1. Off-farm labor	X				X	
2. Service earnings	X				X	
3. Purchases		X			X	
4. Sales		X			X	
5. Assets inventory				X		X
C. Other flows						
1. Consumer expenditures	X				X	
2. Cash and kind loans given, rec'd, repaid		X			X	
3. Cash and kind gifts given and received		X			X	
4. Labor migration			X		X	

Village	Number of households	
	Small sample	Large sample
Rogo	11	34
Zoza	12	37
Barbeji	12	34

The technology of the local farming system was essentially traditional with only limited use of modern inputs. Chemical fertilizers were applied during the survey year by 40 percent of the sampled households, typically at well below recommended levels. Pre-planting seed treatment was used by 24 percent. Tractor cultivation was practiced by only one household in the random sample. None used animal traction. An improved groundnut variety, highly mixed with traditional varieties, was sown by nearly all of the sample households. However, the yield advantage of this improved groundnut variety was minimal, only 10 to 15 percent greater than local varieties on farmers' fields.

Average stocks of farm tools and equipment were valued at less then ₦9 replacement cost.[1] Average variable costs per farm (all costs, both cash and in-kind, excluding household labor and land) totalled nearly ₦65, of which two-thirds, or ₦43, was recorded as a cash expense. Average variable costs per hectare were approximately ₦26. The largest single cash expense, accounting for ₦31, paid for the hiring of non-family labor. Approximately 60 percent of farm labor was provided by household members.

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[1]The official foreign exchange rate during 1974 was ₦1 = US $1.64.

3. LEVEL, DISTRIBUTION, AND COMPOSITION OF INCOME

3.1. Definition of Farm Family Income

Although there is some variation according to family structure,[1] the household generally constitutes the primary production and consumption unit throughout rural Hausaland. Moreover, since most major decisions in both production and consumption activities are made by the household head (mai gida), the farm family was chosen as the most appropriate income recipient unit. With one exception discussed below, the survey obtained information on incomes generated by all family members in all enterprises. The components of aggregate household income are presented in Table 3.1.

The pricing procedures applied to evaluate those components which did not involve cash transactions are discussed in Appendix A. Although data on cash and in-kind gifts transfers were collected, the value of such flows were not included as income components. Unrealized capital gains which arose from the re-evaluation of owned assets during the survey period were also excluded. The twelve month period over which net flows were calculated was delimited by the annual agricultural cycle to capture one complete season.

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[1]Households were organized either as nuclear families (iyali) or as extended units (gandu). Gandu units can be defined as households which include two or more male adults, often married, with their wives and children. The gandu unit is typically paternal or fraternal, that is headed by the father or brother of the other members, though other arrangements do occur. Understood in the institution of gandu are a set of rights and obligations between members, primarily regarding the common production and sharing of a portion of the household's food. Adult males in gandu, however, have the right to farm their own fields (called gayaunna) over which these individuals, not the gandu head, control both planting and disposal decisions. Non-agricultural occupations pursued by other adults in gandu also generally fall outside the control of the gandu head.

Table 3.1 COMPONENTS OF NET HOUSEHOLD INCOME

		Cash payments	Imputed value
Farm sector	Plus:	1. Trees rented out or sold 2. Land rented out or sold	1. Field and tree crops harvested 2. Kind payments for land rented out or sold 3. Kind payments for trees rented out or sold
	Less:	1. Hired farm labor 2. Costs transporting crops for sale 3. Purchases of seed dressing, insecticide and fertilizer 4. Purchases and repairs of farm tools and storage bins 5. Rental of work animals 6. Land rented and purchased 7. Trees rented and purchased 8. Interest paid on farm loans repaid in cash	1. Seeds and cuttings planted 2. Fertilizers applied 3. Kind payments to hired labor 4. Kind payments for purchases and repairs of tools 5. Kind payments for rental of work animals and corralling 6. Kind payments for land rented and purchased 7. Kind payments for trees rented and purchased 8. Interest paid on farm loans repaid in kind
Off-farm sector	Plus:	1. Off-farm service earnings 2. Sale of purchased crops (trading) 3. Sale of purchased animals and animal products (trading) 4. Sales of tools and fertilizer purchased or produced 5. Sale of non-agricultural items purchased or produced 6. Interest on non-farm loans extended repaid in cash	1. Kind payments for off-farm service work 2. Interest on non-farm loans 3. Increases in inventories of traded crops, animals, animal products, and non-agricultural items
	Less:	1. Purchases of crops for later resale 2. Purchases of insecticide, seed dressing, tools, and fertilizer for later resale 3. Purchases of animals and animal products for later resale 4. Purchases of non-agricultural trading items 5. Costs transporting all traded items 6. Interest paid on non-farm loans received 7. Depletions in inventories of traded crops, animals, animal products, and non-agricultural items	1. Kind payments for purchases of crops, animals and animal products

Net household income = Net cash + Net imputed value

The household "farm-sector" has been defined in Table 3.1 to include only those activities related to field and tree crop farming in order to better identify the reliance of households on their own crop production. Activities involving the purchase for resale of livestock and animal products and purchase for resale of crops (that is, trading activities) have been assigned to the off-farm sector. Similarly, work as hired agricultural labor has also been included in the off-farm sector.

The only major source of income not recorded is that earned by women in trading activities. Due to the Moslem custom of secluding married women of childbearing age within their compounds, male enumerators were denied access to women engaged in food processing and petty trading activities. Further, household heads displayed a reluctance to discuss costs and returns of such female occupations. An accurate estimate of such earnings could only be obtained through an additional team of female enumerators, an expense which exceeded the project's resources. Payments received by women working outside the compound as pickers in the fields of other households are included, however. These data were generally known to the household head and were easily obtained. The effect of excluding female incomes generated in trading and commercial food processing is discussed later in this section.

3.2. Man-Equivalent Consumer Units

In order to make meaningful interpersonal comparisons it is necessary to adjust household income to take account of variation in size and composition of household membership. Three types of adjustments are possible. The first simply involves converting each household income figure to a per capita measure. A second, but rarely applied

adjustment, involves consideration of possible economies of scale in consumption. To the extent that such economies exist, smaller households would require greater income per capita to realize any given living standard. Due to difficulties in estimation [Kleiman, 1966] and recent evidence which indicates that such economies are probably of relatively small magnitude among rural African households [King and Byerlee, 1977], this latter correction for household size has not been made.

The third adjustment is to correct for variation in the age and sex composition of households. The use of consumer-equivalent scales has been thoroughly treated in the literature on household budget studies [Woodbury, 1944; Prais and Houthaker, 1955; Kleiman, 1966]. Several methodological problems are confronted in deriving appropriate conversion coefficients. Theoretically a unique conversion ratio is required for each major group of consumption items, income stratum, and type of consumer group (urban, rural, farm, non-farm, etc.). And in the absence of highly detailed consumption information, few objective criteria are available for demarcating appropriate age-sex classes.

Despite these problems, incomes have been converted to a consumer man-equivalent base in this study. Since the study villages are relatively homogeneous (in spite of their locational differences), all sampled households were engaged in farming, and the observed range in incomes was not exceptionally large, the problems cited above are not believed to be sufficiently important to invalidate the approach in the present study. Moreover, since food constitutes the largest single component of consumption across all income strata, tables of caloric needs provide a first approximation for constructing such a scale.

The coefficients used to calculate the number of consumer man-equivalents per household are shown in Table 3.2. Derived primarily from

Table 3.2 COEFFICIENTS APPLIED TO ESTIMATE THE NUMBER OF MAN-EQUIVALENT CONSUMER UNITS PER HOUSEHOLD

	Age			
	0-4	5-9	10-15	16+
Male	.2	.5	.75	1
Female	.2	.5	.7	.75

the standard calorie requirements for each age and sex group as suggested by the F.A.O. [1957], additional marginal adjustments were made on the basis of the author's knowledge of within household sharing patterns for consumer goods and of work allocation by age and sex.

The resultant income per consumer man-equivalent has been used throughout the study to stratify households into income classes. In order to facilitate comparisons with other studies per capita figure are also presented where relevant.

3.3. Mean Income Levels by Village and Household Sector

Table 3.3 presents average incomes per household, per capita, and per consumer disaggregated by village and source as calculated for the random large sample. The average household generated an annual income of nearly ₦350, or approximately ₦52 per capita.[1] Household income was

[1]This compares with a mean household income of nearly ₦206, and a per capita income of ₦31 found by Norman [1972] in his 1966 Zaria area

Table 3.3 MEAN NET INCOMES BY VILLAGE AND HOUSEHOLD SECTOR[a,b] (IN NAIRA)

Village	Per household			Per capita			Per consumer[c]		
	Farm	Off-farm[d]	Total	Farm	Off-farm	Total	Farm	Off-farm	Total
Barbeji	273.64	85.00 (23.7%)	358.64	41.46	12.88	54.34	61.71	19.17	80.88
Zoza	239.50	79.22 (24.9%)	318.72	42.05	13.90	55.95	61.41	20.31	81.72
Rogo	231.69	130.03 (36.0%)	361.77	29.66	16.66	46.30	42.20	23.69	65.89
All	248.95	97.52	346.47	37.21	14.58	51.79	54.17	21.22	75.38

a. Incomes per capita and per consumer have been calculated as weighted averages.

b. The components of each sector's income estimate are presented in Table 3.1 earlier.

c. Consumer man-equivalents were computed by applying consumption weights to each resident on the basis of the person's age and sex. The weights used, representing approximate caloric requirements, are shown in Table 3.2.

d. The percentage of off-farm income in total income is included in parentheses below.

highest in Rogo, the largest village, and lowest in Zoza, the smallest. For both income per capita and income per consumer measures, however, these village rankings are reversed due to intervillage differences in mean household size. In aggregate, off-farm income constituted 28 percent of net earnings.[1] Off-farm earnings were most important in the largest and most accessible village, where they constituted 36 percent of total income, and least important in the most remote village, Barbeji, at 24 percent.

A breakdown of income by type (cash or in-kind) is presented in Table 3.4. To calculate the proportions of cash and in-kind income, sales of field and tree crops were netted out of the imputed "in-kind" values of total harvests and assigned to the cash income side. All in-kind payments earned in off-farm occupations which were subsequently sold were similarly netted out of in-kind incomes and included as cash earnings.

The relatively high degree of monetization of the surveyed farmers is reflected in the fact that 53 percent of income was earned or converted into cash. Moreover, important intervillage differences underlie this total. Rogo farmers, enjoying the most advantageous market location as well as the largest proportion of lowland soils, generated 67 percent of their income in cash. In contrast, farmers in both Barbeji and Zoza generated less than half in cash, 48 and 42 percent, respectively. The sale of crops contributed less than half of all income earned in cash.

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study. The results of the two studies are nearly indentical given the annual rate of inflation of 8 percent experienced during the period.

[1] In comparison, in the three village Zaria study Norman [1972] found the following income composition: farm production - 62 percent; off-farm enterprises (excluding livestock) - 20 percent; and livestock - 18 percent.

Table 3.4 PERCENT OF NET HOUSEHOLD INCOMES IN CASH OR IN-KIND BY SECTOR

Income by type and sector	Village							
	All		Barbeji		Zoza		Rogo	
Total	100.0		100.0		100.0		100.0	
Cash	52.5	100.0	47.7	100.0	41.9	100.0	67.2	100.0
Farm		44.9		49.3		40.2		44.3
Off-farm		55.1		50.7		59.8		55.7
In-kind	47.3	100.0	52.3	100.0	58.1	100.0	32.8	100.0
Farm		95.1		92.5		95.4		98.6
Off-farm		4.9		7.5		4.6		1.4

This underscores the importance of off-farm occupations which supplied between 50 and 60 percent of household cash earnings among the three villages.

3.4. The Size Distribution of Incomes

Summary measures of inequality are normally employed either to rank a set of populations in order of the degree of incomes concentration or to compare the *ex ante* and *ex post* income distributions observed in a given population following the introduction of a particular policy or set of policies. There are, however, many attributes of inequality, attributes which some summary indices reflect better, or are more sensitive to, than others [Champernowne, 1974]. For example, one can distinguish among distributions which display either inequality due to extreme wealth or inequality due to extreme poverty. Conclusions as to whether one empirical distribution is more or less equitable than another presupposes knowledge of some social welfare function against which the alternative distributions can be objectively compared. However, because most summary indices already embody a concept of social welfare in their mathematical formulation they are biased measurement instruments.

Because of the demonstrated selectivity of various measures to each type of inequality a combination of approaches which communicate distinct aspects of the underlying distributions has been used in this paper. First, the large sample households are disaggregated into deciles. The average income earned by households in each decile is displayed along with the cumulative percentage of incomes, residents, and consumer units. Second, the frequency distribution of residents among discrete income per capita strata is shown in histograms for each village and for the

combined stratafication. Third, three summary indices are computed for each measure of income, and for incomes generated in the farm and off-farm sectors separately.

Table 3.5 presents average income per household, per resident, and per consumer unit for each decile in the total large sample. Similar statistics are also shown for the six purposively selected elite households. Households were distributed among deciles by arraying the large random sample according to income per consumer, then allocating the poorest 10 percent of the households to the first decile, the second poorest 10 percent of households to the second decile, and so on. Since there are exactly 100 randomly selected households in the large sample, 10 households constitute the sample in each decile for the three village total. Decile assignments within each village were accomplished similarly.[1]

By international standards and compared with the estimated concentration of income in Nigeria as a whole, these figures reflect a decidedly equal distribution. Examining the tails of the distribution, roughly the poorest quarter of the population (26.3 percent included in the bottom two deciles) earned nearly 12 percent of all income, compared with the richest quarter of the population (included in the top three deciles) which

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[1]Because incomes were not identically distributed within each village and because mean levels of income varied among villages there is unequal village representation within each decile of the combined stratification. Thus, the same household might be assigned to decile two in the combined stratification but to decile one in its village distribution if the poorer farmers in that village had higher incomes than similarly ranked farmers in the other two villages. For this reason the statistics calculated for the three village aggregate within a particular stratum are neither a simple nor weighted average of the respective village statistics for that same strata, and may in fact lie outside the range of the village specific statistics shown for the corresponding decile. It is also important to note that due to differences in family size, each decile does not contain exactly 10 percent of the large sample population.

Table 3.5 AVERAGE AND CUMULATIVE INCOME, NUMBER OF RESIDENTS AND CONSUMER UNITS BY DECILE

Decile	Average income per household (₦)	Cumulative % of income	Average income per capita (₦)	Average income per consumer (₦)	Average number of residents per household	Cumulative % of residents	Average number of consumers per household	Cumulative % of consumers	Number of observations			
									Barbeji	Zoza	Rogo	All
1	177.73	5.1	19.12	27.78	9.3	13.9	6.4	13.9	3	2	5	10
2	234.21	11.9	28.22	39.77	8.3	26.3	5.9	26.7	4	2	4	10
3	231.27	18.6	34.01	49.21	6.8	36.5	4.7	36.9	3	4	3	10
4	328.93	28.1	42.72	61.25	7.7	48.0	5.4	48.6	3	1	6	10
5	247.33	35.2	52.62	71.69	4.7	55.0	3.5	56.1	2	6	2	10
6	385.80	46.3	55.91	82.26	6.9	65.3	4.7	66.3	4	6	-	10
7	404.78	58.0	63.25	89.95	6.4	74.9	4.5	76.1	5	3	2	10
8	433.96	70.5	72.33	105.59	6.0	83.9	4.1	85.0	3	2	5	10
9	394.01	81.9	87.56	125.48	4.5	90.6	3.1	91.8	5	2	3	10
10	626.59	100.0	99.46	168.46	6.3	100.0	3.7	100.0	3	5	2	10
Elites	2715.59		139.26	208.89	19.5		13.0		2	3	1	6

earned 42 percent of all income. A comparison of the poorest and richest deciles shows that the poorest 13.9 percent of the population received 5.1 percent of all incomes, whereas the most wealthy 9.4 percent earned 18.1 percent.[1] The ratio of average incomes per capita between extreme deciles is also not wide, only 5:1. Moreover, it is important to note that because incomes were not highly concentrated and varied around a low overall mean level, all of the income strata were poor by national standards. Thus, even among the households included in the richest decile of the random sample, the mean per capita income (₦99) was less than 60 percent of the national average (₦171).

The elite households represent a clearly atypical subset of the population. Extremely large, these six units were composed of nearly twenty residents per household, compared with the random sample average of less than seven. They were also economically atypical with mean household income nearly eight times greater than average, and income per consumer four times larger. Nevertheless, it should be noted that the mean income per capita of this group of rural elites was still only four fifths of the national average.

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[1]The following comparisons help place the observed distribution into a broader perspective: In an examination of data from the 1950s and 1960s, it was found that among the developing countries surveyed the average income share of the poorest 40 percent of the population was only 12.5 percent, compared with 16 percent and 25 percent among developed, non-socialist and socialist countries respectively. Among African countries the following income shares of the poorest 40 percent were estimated: Kenya (1969) 10.0%; Sierra Leone (1968) 9.6%; Senegal (1960) 10.0%; Ivory Coast (1970) 10.8%; Dahomey (1959) 15.5%; Tanzania (1967) 13.0% Zambia (1959) 14.5%; Chad (1958) 18.0%; Niger (1960) 18.0%; Uganda (1970) 17.1% [Chenery, 1974 pp. 8-9]. Adelman and Morris [1973b] estimate a comparable figure for Nigeria of 14.0%, though they do not indicate the year for which the data are based.

3.5. Intervillage Comparisons

In Table 3.6 a modified tableau is presented disaggregating incomes by village. Equality comparisons between villages are facilitated through the addition of an equity index in the last column. The equity index has been calculated by dividing the income share of each decile by its share of the population thereby standardizing for intervillage differences in household size across deciles. A value of one represents perfect equality. Values tending toward zero represent disproportionately low shares of income earned by those strata, while values greater than one reflect shares of income exceeding an equitable allocation. It is apparent from the equity index that income was in general more equally distributed in Zoza throughout the income range. Barbeji, the most isolated village, showed greater inequality in the extreme lower income range, while Rogo, the largest village with the most favorable market location, was somewhat less equal in the upper income strata.

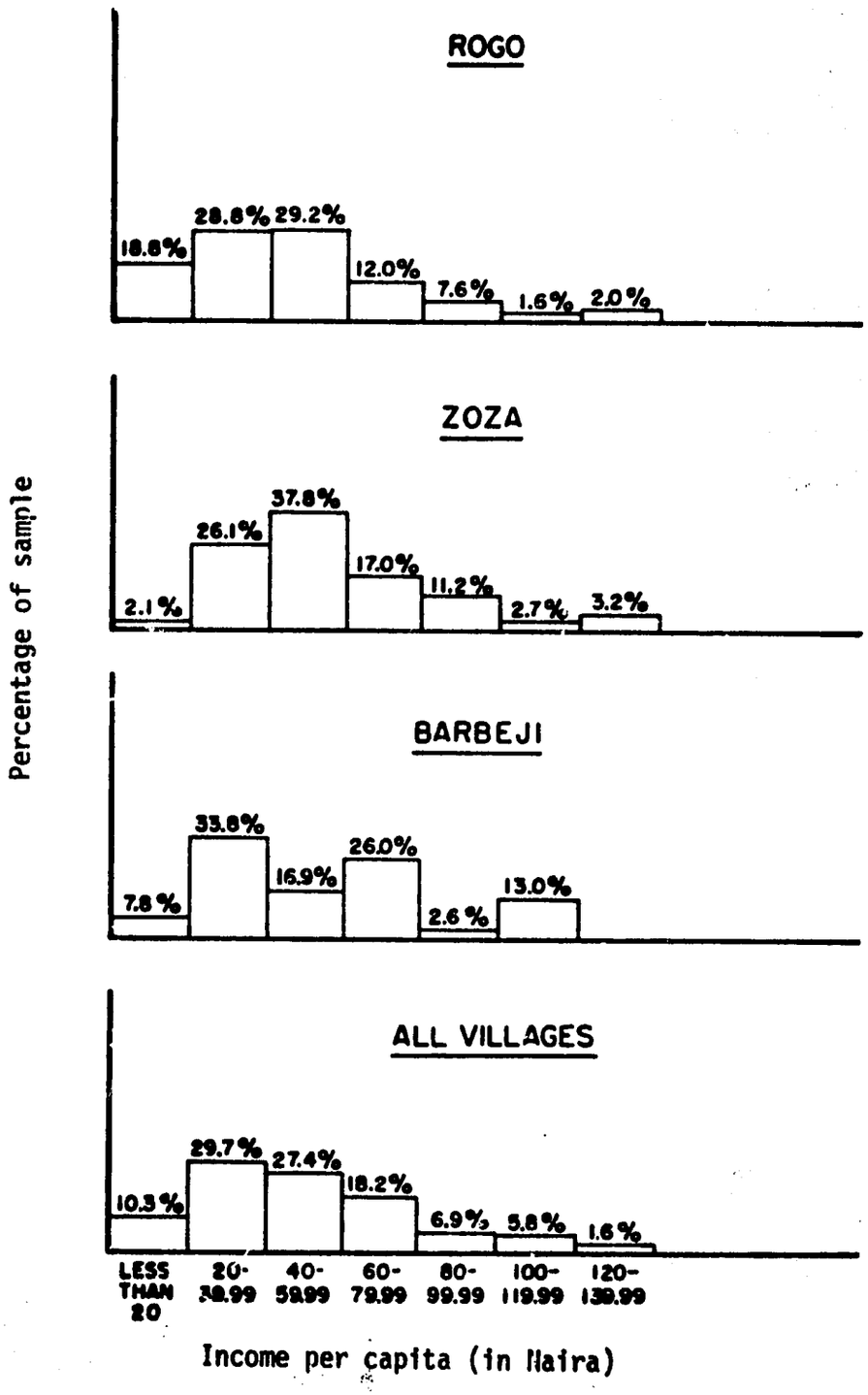
These relationships can also be seen in Figure 3.1. All villages display distributions which are positively skewed to the right as would be expected in a population where mean earnings do not greatly exceed a minimum subsistence level. The Zoza distribution is more peaked in the median range, confirming indications from its equity index. In contrast, both Barbeji and Rogo show significantly higher proportions of residents in the under ₦20 category, 7.8 percent and 18.8 percent, respectively. Considering its low mean income, the Rogo distribution also has a relatively high proportion of population in its right tail reflecting inequality due to disparities in the high income range.

Table 3.6 AVERAGE AND CUMULATIVE INCOMES, NUMBER OF RESIDENTS AND CONSUMER UNITS BY VILLAGE DECILES

Village decile	Village	Number of house-holds	Average income per household (₦)	Cumulative % of income	Average income per capita (₦)	Average income per consumer (₦)	Average number of residents per household	Cumulative % of residents	Equity index[a]
1	Barbeji	4	233.72	7.5	21.84	32.02	10.7	18.6	.40
	Zoza	4	188.20	7.1	27.68	36.90	6.8	14.4	.49
	Rogo	3	105.71	2.7	17.62	23.49	6.0	7.2	.38
2	Barbeji	3	120.00	10.4	24.00	40.00	5.0	25.1	.43
	Zoza	3	238.28	13.8	34.03	47.64	7.0	25.5	.60
	Rogo	3	346.38	11.7	21.65	31.49	16.0	26.4	.47
3	Barbeji	3	173.85	14.6	36.99	49.67	4.7	31.2	.69
	Zoza	3	191.76	19.2	44.60	58.11	4.3	32.4	.78
	Rogo	3	238.69	17.9	28.76	39.78	8.3	36.4	.62
4	Barbeji	4	364.06	26.2	38.32	62.77	9.5	47.6	.71
	Zoza	4	279.28	29.7	50.78	69.82	5.5	44.1	.90
	Rogo	4	266.17	27.1	33.27	49.29	8.0	49.2	.72
5	Barbeji	3	398.27	35.7	56.90	81.28	7.0	56.7	1.04
	Zoza	4	344.74	42.7	53.04	78.35	6.5	57.9	.94
	Rogo	3	332.33	35.7	43.16	61.54	7.7	58.4	.93
6	Barbeji	4	305.21	45.4	67.82	84.78	4.5	64.5	1.24
	Zoza	3	273.97	50.4	54.79	85.62	5.0	65.9	.96
	Rogo	3	311.95	43.8	54.73	66.37	5.7	65.2	1.19
7	Barbeji	4	396.73	58.0	62.97	92.26	6.3	75.3	1.17
	Zoza	3	307.69	59.1	61.54	90.50	5.0	73.9	1.09
	Rogo	3	555.62	58.1	59.74	85.48	9.3	76.4	1.28
8	Barbeji	3	481.26	69.5	76.39	114.59	6.3	83.5	1.40
	Zoza	3	404.83	70.4	71.02	115.67	5.7	82.9	1.27
	Rogo	4	507.34	75.6	69.50	99.48	7.3	88.0	1.51
9	Barbeji	4	372.68	81.4	93.17	128.51	4.0	90.4	1.72
	Zoza	3	474.32	83.9	89.49	139.51	5.3	91.4	1.58
	Rogo	3	343.33	84.4	79.84	122.62	4.3	93.0	1.71
10	Barbeji	3	780.96	100.0	106.98	185.94	7.3	100.0	1.96
	Zoza	3	532.14	100.0	100.40	166.29	5.3	100.0	1.76
	Rogo	3	593.58	100.0	104.14	156.21	5.7	100.0	2.26

a. The Equity Index has been calculated for each decile as the ratio of its share of total earnings in each village to its share of the village sample.

FIGURE 3.1. THE PERCENTAGE DISTRIBUTION OF RESIDENTS WITHIN INCOME PER CAPITA STRATA



A set of summary measures describing the size distribution of income is presented in Table 3.7. Three measures have been calculated, the Gini ratio, the coefficient of variation, and the standard deviation of the natural log of income.[1] Each has been selected due to its sensitivity to various types of inequality. The coefficient of variation is particularly effective in discriminating among distributions where weight is given to differentials in the high income range. In contrast the log measure gives greater weight to incomes in the lower range and is thus more appropriate for purposes of ranking where priority is given to the incidence of extreme relative poverty. The most commonly used index, the Gini ratio, is more sensitive to differentials in the broad middle income range. To facilitate comparisons two values are given for each index. Presented first is the absolute value of each coefficient. Second, and written in parentheses, each coefficient has

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[1]These measures of distribution are defined as follows:

Coefficient of Variation

$$\frac{V}{u}$$

Standard Deviation of the Natural Logarithm of Income

$$\int_0^{\bar{y}} [\log (\frac{y}{u*})]^2 \, f(y) \, dy$$

Gini Coefficient

$$(1/2 \, n^2 \, u) \sum_{i=1}^{n} \sum_{j=1}^{n} |y_i - y_j|$$

where,

V = standard deviation of income,
$u*$ = harmonic mean of income,
y = an income observation,
y_i = income of observation i,
y_j = income of all other observations j,
n = number of observations.

Table 3.7 THREE SUMMARY MEASURES OF THE SIZE DISTRIBUTION OF PERSONAL INCOME BY HOUSEHOLD SECTOR AND VILLAGE

Income measure	Village	Gini coefficient	Coefficient of variation[a]	Standard deviation of the natural log of income[a]
Total income per household	Barbeji	.3426	.6553 (.4584)	.637 (.2886)
	Zoza	.2624	.5179 (.4084)	.508 (.2055)
	Rogo	.3176	.6381 (.4535)	.638 (.2895)
	All	.3156	.6113 (.4450)	.586 (.2559)
Total income per capita	Barbeji	.2898	.5143 (.2098)	.566 (.2426)
	Zoza	.2251	.4142 (.1464)	.423 (.1518)
	Rogo	.3034	.5558 (.2360)	.555 (.2355)
	All	.2823	.5052 (.2033)	.535 (.2225)
Total income per consumer	Barbeji	.2899	.5432 (.2278)	.544 (.2284)
	Zoza	.2691	.4872 (.1918)	.504 (.2026)
	Rogo	.3034	.5867 (.2561)	.547 (.2303)
	All	.2947	.5490 (.2316)	.544 (.2284)
Farm income per capita[b]	Barbeji	.3298	.5923 (.2604)	.636 (.2880)
	Zoza	.2108	.3835 (.1282)	.395 (.1350)
	Rogo	.3504	.6475 (.2954)	.653 (.2989)
	All	.3183	.5718 (.2464)	.619 (.2770)
Off-farm income per capita	Barbeji	.4588	.9502 (.4745)	1.111 (.5524)
	Zoza	.5562	1.0660 (.5319)	1.616 (.7231)
	Rogo	.5464	1.1717 (.5786)	1.229 (.6017)
	All	.5306	1.1014 (.5481)	1.323 (.6364)
Non-agricultural income per capita[c]	Barbeji	.5574	1.1751 (.5800)	1.208 (.5923)
	Zoza	.6759	1.2948 (.6265)	1.730 (.7496)
	Rogo	.5775	1.2376 (.6050)	1.228 (.6013)
	All	.6097	1.2707 (.6176)	1.406 (.6641)

a. In parentheses each measure has been standardized on a scale between zero and one. Zero represents perfect equality and a value of one represents perfect inequality.

b. Farm income is the net income obtained from field and tree crop production.

c. Non-agricultural income is equal to off-farm income less earnings obtained through hired farm labor employment.

been standardized such that zero equals perfect equality and a value of one equals perfect inequality. The Gini coefficient is already so standardized.[1]

The Gini coefficient for income per capita computed for the entire village sample is .2823. Village coefficients range between .3034 in Rogo and .2251 in Zoza. Overall these are relatively low values reflecting somewhat greater equality than the results reported by Norman for other areas in northern Nigeria. All three indices rank incomes in Zoza as the most equally distributed whether measured on a household, per capita, or per consumer base. The changes in village rankings when applying different measures, however, should be noted. The coefficient of variation ranks Rogo as less equal compared with Barbeji. These rankings are reversed when using the standard deviation of the logarithm of income. The switch in rankings accurately captures the relatively greater inequality in the extreme high income range in Rogo compared with the inequality among lower income households found in Barbeji.

Within each village and overall, household incomes were less equally distributed than income per resident or per consumer. This is to be expected if household income and family size are positively correlated. The very minor differences in the degree of inequality between income

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[1]Standardized values have been calculated for the other two measures as follows:

1. Coefficient of Variation: $(\frac{V}{u})/[(\frac{V}{u})^2 + 1]$
2. Standard Deviation of Ln Income: $(V\ln Y)^2/[V\ln Y)^2 + 1]$

where

V = standard deviation,
u = mean income,
Y = income.

per resident and income per consumer give a preliminary indication that variation among income strata with respect to family composition is probably not great.

Farm and off-farm incomes considered individually were less equally distributed than their total. This is reflected in Gini ratios of .5306 and .3183 for off-farm and farm incomes per resident, respectively, compared with .2823 for their aggregate. This points toward a degree of household specialization between these two sectors. When off-farm income earned through hired farm labor is deducted, non-agricultural earnings display an even greater degree of inequality, reflected in a Gini coefficient of .6097.

3.6. Female Earnings in Trading and Commercial Food Processing

Although data on female earnings in nonfield work were not directly obtained in the survey, information on female participation in all such activities was obtained. By combining these data with information on returns to women's occupations obtained through secondary sources, a rough estimate of female incomes can be calculated and the effect of excluding this income source can be assessed.[1] Given the most reasonable

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[1] Twice during the year household heads in the present survey provided information on which women in the household were active in any income-earning occupation, the types of occupations each woman pursued, and during what part of the year each woman was active in each activity. In an intensive survey of female occupations conducted during 1969/70 in three villages near Zaria, Simmons [1976] estimated that the average monthly return to all occupations was ₦2.14. Given a 31 percent period rate of inflation (derived from the difference in mean food grain prices observed in the 1969/70 survey villages and the current year prices observed in the present survey villages), a mean monthly return per occupation of ₦2.80 was applied to the reported female employment patterns of the present survey to estimate annual female earnings. For a more detailed discussion of methodology see Matlon [1978].

assumptions regarding the intensity with which women worked, it is estimated that females contributed an average of ₦78 to household incomes. If added to the predominantly male-generated incomes reported above, this would represent an increment of 23 percent.

Particularily interesting is the distribution of estimated female earnings among income strata shown in Table 3.8.[1] Because females in

Table 3.8 ESTIMATED FEMALE EARNINGS GENERATED IN TRADING AND COMMERCIAL FOOD PROCESSING BY INCOME STRATUM

	Decile		Quintile			Decile	
Variable	1	2	2	3	4	9	10
Average number of occupation-months per household[a]	37	29	31	27	30	21	19
Average annual female earnings per household (in Naira)	103	80	87	76	84	59	52
Female income as a percent of predominantly male income	58	34	31	24	20	15	8

a. Occupation-months represent the total number of occupations worked by all females in the household multiplied by the months each occupation was pursued.

lower income households tended to pursue a larger number of occupations over a greater part of the year, such earnings reflect an inverse

[1]Following a visual examination of the variation with income of a large number of variables, it was seen that interesting trends frequently occurred at both extremes of the income distribution. To capture these patterns while avoiding repetitiveness in middle income presentation, the data has been aggregated into the following strata:

relationship with household income status. The highest mean female income, ₦103 per household, was calculated among households in the poorest decile, and the lowest, ₦52, was calculated among the richest decile of households. In percentage terms the inverse relationship between male and female earnings is particularily strong with the proportion of female to male earnings falling from 58 percent in the first decile to only 8 percent in the tenth decile. While these data are highly speculative, they seem to suggest that female occupations play an important supplemental function among the poorest households, with lower income families relatively and absolutely more dependent on female earnings than higher income households.

Because these estimates were not believed to be sufficiently accurate for subsequent analysis, female earnings have not been included as a component of household incomes in the present study. But it is important to note that if included, the aggregate level of inequality would be even lower than that reflected in Tables 3.6 and 3.7. The effect of including estimated female earnings on the relative ordering of households was examined to determine the stability of the decile and quintile stratification set out above. It was found that inclusion would have resulted in only a

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Decile 1
Decile 2
Quintile 2 (Decile 3 plus Decile 4)
Quintile 3 (Decile 5 plus Decile 6)
Quintile 4 (Decile 7 plus Decile 8)
Decile 9
Decile 10

This approach best represents the most important patterns in the middle income groups while permitting a more focused examination of the characteristics of the extreme poor and extreme rich. The cost of retaining a decile disaggregation in the extreme income ranges is, of course, reduced sample size and thus reduced statistical precision in the resulting decile means. The reader should keep in mind the varying sample sizes for decile and quintile strata when interpreting the following results.

marginal restratification of households, with the effects concentrated in movements between the lower three deciles.

3.7. Sources of Earnings by Income Stratum

In order to determine how the three major household sectors contributed to overall income inequality, the contribution of each sector to aggregate incomes (both cash and in-kind) is shown by income stratum in Table 3.9. The percent of off-farm income remains nearly constant in

Table 3.9 PERCENT OF HOUSEHOLD INCOME EARNED IN OFF-FARM EMPLOYMENT BY VILLAGE AND INCOME STRATUM

Village	Type of Employment	Decile		Quintile			Decile	
		1	2	2	3	4	9	10
Rogo	Total Off-Farm	36	19	37	26	25	64	63
	Hired Farm Labor	5	5	2	3	a.	a.	0
	Non-Agricultural	31	14	35	23	25	64	63
Zoza	Total Off-Farm	9	10	28	15	31	39	32
	Hired Farm Labor	9	10	6	2	3	3	1
	Non-Agricultural	0	0	22	13	29	36	31
Barbeji	Total Off-Farm	19	41	22	19	34	24	16
	Hired Farm Labor	6	9	8	4	2	8	1
	Non-Agricultural	13	32	14	15	32	16	15
All	Total Off-Farm	20	25	23	23	27	40	37
	Hired Farm Labor	8	4	4	5	1	4	1
	Non-Agricultural	12	21	19	18	26	36	36

a. Less than .5 percent.

the lower four quintiles of the combined three village stratification varying between only 22 and 27 percent of total income, but rises to nearly 40 percent in the highest quintile. The proportion contributed by work on the fields of other households on the other hand decreases

as expected, from 8 percent of all income in the poorest decile to only 1 percent in the richest decile.

It is apparent that an important factor contributing to inequality of the relative high income type was non-agricultural incomes generated off the farm. In contrast earnings from hired farm labor tended to reduce income inequality by partially compensating for low farm earnings among poorer households. The regular pattern displayed for the entire sample, however, masks intervillage differences in income profiles. No consistent association between income and the proportion of off-farm income was found in Barbeji. In contrast to the aggregate pattern, off-farm incomes were relatively less important among richer households in that remote village, falling to less than 16 percent in the tenth decile. In Zoza the proportion of off-farm incomes and income per consumer were directly related throughout most of the income range. And in the largest village, Rogo, a strong positive association was evident with non-agricultural earnings contributing more than 60 percent of total income in both the ninth and tenth deciles. Earnings from hired farm labor were of importance in Barbeji throughout its distribution, but of declining importance in both Zoza and Rogo among the higher income strata. In Zoza in particular, hired farm labor generated the only off-farm income realized by households in the lowest two deciles.

Relating these income profiles to the village characteristics presented earlier, several observations can be made. Of the three villages, the greatest concentration of income was evident in Rogo. This is the largest village, characterized by the most advantageous market location,

the highest population density, and the highest proportion of income derived from off-farm occupations. Inequality in Rogo was marked by a few extremely high incomes, incomes which were generated primarily in non-agricultural occupations. The lowest concentration of incomes on the other hand was observed in Zoza. In contrast to Rogo, Zoza was the smallest of the study villages with low population density, and with a substantially lower proportion of income derived from off-farm employment.

One must be cautious in drawing inferences from only three observations about the impact of village level factors on the equity of intra-village distributions. Nevertheless the data suggest that village level inequality is associated with increased pressure on the land, with the attendent emergence of even small urban centers, and with an increasing proportion of income generated off-farm. These results are consistent with the macro structural change model set out in Section 1.

At the village level, these results may occur for the following reasons. Given an egalitarian land tenure system and diminishing returns to labor, as land becomes a scarce factor through population growth, farm households would be expected to allocate an increasing proportion of their labor to off-farm employment. However, because of low available capital, poorer farmers are restricted to labor intensive enterprises characterized by low returns to labor. If the demand for hired labor fails to provide a level of employment sufficient to fully occupy the excess labor, off-farm earnings may not compensate for the low farm incomes caused by the relative land shortage. In contrast, higher income households are in a better position to exploit the market advantages of

a more concentrated population by investing revenue earned through surplus farm production in more capital intensive off-farm enterprises. If in the latter case off-farm incomes more than compensate for their reduced farm production (due to land scarcity) inequality would increase in the high income range.

This explanation relies upon a changing composition of off-farm employment across strata such that both capital intensity and returns to labor are higher in those activities pursued by rich households. Both factors are examined in Section 6.

3.8. Gift Transfers By Income Stratum

The exchange of gifts in the form of money, food, cloth, or other in-kind items is ubiquitous in Hausaland. Contributions of food and cash (biki) are commonly made in connection with marriage, naming-ceremonies, and funerals to assist those households incurring large ceremonial expenditures [Hill, p. 211]. In addition, Islamic custom requires the giving of grain during prescribed periods to religious leaders, but also to the poor and disabled (zakka) [Smith, 1962]. Indeed, the transfer of gifts serves to some degree as an informal welfare or insurance system.

Cash and in-kind gifts data are presented by village and income stratum in Table 3.10 to determine whether the magnitude and direction of gift flows importantly altered the distribution of earned income. The results show that only the extreme deciles and elite households reflected a clear net flow of gifts down the income spectrum. Moreover, the net amounts involved were relatively minor compared with the

Table 3.10 NET CASH AND IN-KIND GIFTS PER HOUSEHOLD REPORTED BY VILLAGE AND STRATUM (IN NAIRA)

Variable	Village	Decile 1	Decile 2	Quintile 2	Quintile 3	Quintile 4	Decile 9	Decile 10	Elites
Value of Net Cash Gifts Received (in Naira)	Barbeji	-10.23	-6.26	-8.81	-13.63	-17.40	-15.38	-104.93	-6.05
	Zoza	-29.78	-17.01	-5.04	+4.34	-6.39	-7.12	-17.16	
	Rogo	-4.00	+13.06	-9.26	-14.12	-20.80	-5.82	-4.74	
	All	+.54	-17.98	-12.04	-4.01	-14.32	-9.88	-39.72	
Value of Net In-Kind Gifts Received (in Naira)	Barbeji	+9.49	-1.69	-6.61	+.93	-7.14	-5.39	-14.54	-63.99
	Zoza	-3.59	+1.16	-.79	+1.15	-3.64	-3.61	-10.19	
	Rogo	+.69	+9.23	-9.69	-1.30	+2.34	-1.82	-6.65	
	All	+3.66	-1.28	-4.70	+.50	-2.21	-4.95	-9.70	
Total (in Naira)	Barbeji	-.74	-7.95	-15.42	-12.70	-24.54	-20.77	-119.47	-70.04
	Zoza	-33.37	-15.85	-5.49	+5.49	-10.03	-10.73	-27.35	
	Rogo	3.31	+22.29	-18.95	-15.42	-18.46	-7.64	-11.39	
	All	+4.20	-19.26	-16.74	-3.51	-16.53	-14.83	-49.42	
Total Gifts as a Percent of Generated Income	Barbeji	-0.3	-6.6	-5.7	-3.6	-5.6	-5.6	-15.3	-2.6
	Zoza	-17.7	-6.6	-2.5	+1.8	-2.8	-2.3	-5.1	
	Rogo	-3.1	+6.4	-7.5	-1.1	-3.5	-2.2	-1.9	
	All	+2.4	-8.2	-6.0	-1.2	-3.9	-3.8	-8.0	

differentials in generated earnings. Although it appears that respondents either over-reported gifts given and/or under-reported gifts received, if it can be assumed that all strata tended to overestimate net gift outflows in roughly the same magnitude it is clear that the inclusion of gift transfers would not have significantly decreased the degree of income inequality.

3.9. Monetization of Households by Income Stratum

Monetization, or the degree of integration into the cash exchange market, is sometimes used as a measure of the modernization or development of a peasant economy. While it may be empirically valid to use the proportion of cash income as a proxy to compare societies with respect to the progress made toward Western-style development, it is not clear that this criterion is equally valid for interhousehold comparisons within a peasant society at a particular point in time. The motivation to enter the market economy may differ importantly among income classes. For example, a high ratio of cash to in-kind income may reflect production in excess of household consumption requirements, and thus relative economic success. Conversely a high ratio may reflect short-term liquidity problems forcing a high level of crop sales which must be replenished later through the purchase of food. Differences in monetization are also a reflection of the relative emphasis given food and cash crops in the farming systems of poor and rich farmers. This balance is determined by a number of crop characteristics including relative factor intensity, land type, and differences among crops with respect to purchased input requirements, as well as price and yield

variance - the net effect of which may not necessarily result in a close association between income and emphasis on cash crops.

The percent of net income represented by cash earnings for each village and income stratum are shown in Table 3.11. Within each village

Table 3.11 CASH INCOME AS A PROPORTION OF TOTAL HOUSEHOLD INCOME AND THE SOURCES OF CASH EARNINGS BY SECTOR

Variable	Village or Sector	Decile		Quintile			Decile	
		1	2	2	3	4	9	10
Percent of Total Income Earned in Cash	Rogo	58	63	66	42	74	75	79
	Zoza	32	8	37	49	46	47	43
	Barbeji	50	62	29	45	55	49	50
	All	60	50	35	50	58	57	55
Percent of Cash Income Earned by Sector (for three village total)	Farm	63	48	37	54	52	30	35
	Hired Farm Labor	14	7	11	8	1	3	2
	Non-Agric.	23	45	52	38	47	67	63

and for the three-village stratification a U-shaped function is apparent; that is, relatively high cash orientation is seen in the lower income strata, falling within the middle strata, and then rising again in the upper strata. Also shown is the proportion of cash generated within each household sector for the three-village combined stratification. Farm cash earnings (crop sales less farm cash expenses) constitute the highest proportion of cash income in the poorest decile, 63 percent, but decline with rising incomes to only 35 percent in the tenth decile. This is mirrored in the cash contribution of the non-agricultural sector, which increases from 23 percent in the first decile to 63 percent in the

tenth decile. Examining similar data disaggregated by village, the same reversal pattern was found within both Rogo and Zoza.

Two factors account for the high percentage of cash income among the poorest 20 percent of households. First, low income farmers in each village allocated a greater than average proportion of their resources to the production of the cash crop groundnut. Reasons underlying this pattern are discussed later in Section 6. Second, poorer households also sold an important proportion of their subsistence grains, with the bulk of these sales occuring somewhat sooner after harvest than among higher income households. Cash expenditure patterns during the immediate postharvest period indicate that an important part of the early sales were incurred to pay taxes, repay debts, and to cover Islamic holiday expenses.[1]

The occurence of distress sales had important implications for the welfare of the poorest households, as well as implications for overall inequality. To meet their consumption objectives, poorer households matched their early grain sales with even larger purchases of food grains preceeding the next harvest (Table 3.12). The timing of sales and purchases with respect to seasonal price movements resulted in a reduction in the real incomes of poorer households and an increased cost of calories. Moreover, the bulk of the preharvest grains supplied to the market were supplied by farmers in the ninth and tenth deciles who captured the benefits of higher grain prices. This not only increased

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[1]For a more detailed discussion of marketing and expenditure relationship see Chapters VII and XI in Matlon [1977].

Table 3.12 TOTAL ANNUAL SUBSISTENCE GRAINS PURCHASES AND SALES PER HOUSEHOLD BY INCOME STRATUM[a]

Variable	Units	Decile 1	Decile 2	Quintile 2	Quintile 3	Quintile 4	Decile 9	Decile 10
Observed during data collection period[b]								
Subsistence grains sold as a percent of production (by weight)	%	11.3	13.4	4.4	13.4	9.0	9.8	8.5
Kilograms of subsistence grains sold per household	kg.	103.0	151.6	60.9	197.4	152.0	149.2	185.1
Kilograms of subsistence grains purchased per household[d]	kg.	196.5	198.0	51.9	85.1	67.2	111.2	96.8
Ratio of sales to purchases		.52	.76	1.17	2.32	2.26	1.35	1.91
Estimated potential minimum[c]								
Subsistence grains sold as a percent of production (by weight)	%	11.3	13.4	4.4	22.5	27.2	42.0	48.0
Kilograms of subsistence grains sold per household	kg.	103.0	151.6	60.9	331.9	460.1	639.8	1040.8
Kilograms of subsistence grains purchased per household[d]	kg.	196.5	198.8	51.9	85.1	67.2	111.2	96.8
Ratio of sales to purchases		.52	.76	1.17	3.90	6.85	5.75	10.75

a. Subsistence grains include early and late millet and tall and short sorghum.

b. Sales as of early May, 1975.

c. Potential sales were estimated by assuming the sale of all grains held in stock as of May, 1975, which were in excess of the amount required to meet the average caloric intake per consumer of the sampled households. See Matlon [1977], Appendix G.

d. Based on actual purchases observed during the 12 month survey period.

overall income inequality, but placed poorer households in a position of dependence on high income producers with regard to meeting their subsistence requirements.[1]

3.10. Available Calories by Income Stratum

A meaningful appreciation of any given distribution of income requires combining information about the relative inequality among recipients with knowledge of the absolute levels of income attained by recipients in each stratum. An approach which has received increasing attention to systematize problem identification as well as to guide policy design has been the application of basic needs standards whereby levels of economic sufficiency are defined for a range of goods (food, shelter, clothing, health, education, etc.) [Streeten and Burki, 1977]. The incidence of shortfalls below each standard can then be measured both in terms of the number of persons experiencing the shortfall, and in terms of its absolute magnitude.

While undernutrition is only one reflection of poverty, it is probably the most pervasive as well as being causally related to other manifestations such as morbidity, mortality, and low labor productivity. Because estimates of minimum calorie requirements exist, undernutrition is also one of the few basic needs for which reasonably objective standards can be established.

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[1]While the net impact of these transactions was to increase overall inequality, the magnitude of the impact was found to be relatively small. An analysis of the seasonal marketings of subsistence grains and of the cash crops groundnut and pepper, led to the conclusion that differences in timing resulted in loss of sales revenue amounting to only 2.7 percent of the incomes for households in the poorest decile, and an increase of only 1.3 percent in the incomes of households in the richest decile [Matlon, 1977, pp. 250-265].

The data on food production, purchases, sales, and gift transfers were examined to determine whether caloric needs were being met and their relation to income.[1] Although on average the sample households consumed nearly 11 percent more calories than the required level suggested by the FAO, there was considerable uneveness across income strata. Among households in the first and second deciles it was found that domestic food crop production was approximately 70 percent and 50 percent below requirements, respectively. Furthermore, after netting out sales and adding food purchases and gift transfers, the first and second deciles still experienced calorie deficits of approximately 25 percent and 15 percent. That is, to meet minimum requirements, purchases and gift transfers well in excess of observed levels during the previous year's pre-harvest period would have been required.

It can be concluded that while the income distribution does not reflect a high degree of relative inequality, because of the generally low level of income overall the distribution does reflect a serious degree of absolute impoverishment among the poorest households.

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[1]Caloric intake was calculated using the residual method by subtracting annual sales, gifts given, and storage losses from the total food crops harvested plus annual purchases and gifts of food received. Caloric requirements were calculated as 2954 per man equivalent. This figure was derived from a consumption survey conducted among similar rural households in the Zaria area [Simmons, 1976]. The analysis of caloric sufficiency is described in detail in Matlon [1977, pp. 277-283].

4. HOUSEHOLD DEMOGRAPHIC CHARACTERISTICS

An accurate identification of poverty group characteristics is of direct value in the design and delivery of programs assisting low income households. Research conducted in the United States as well as in other developed countries has shown that poverty households can be distinguished by a fairly common set of structural characteristics [US Government Printing Office, 1969]. Attributes found to be associated with poverty status include: (1) a high dependency ratio; (2) a greater number of households headed by the elderly, disabled, or by females; (3) low educational achievement; and (4) membership in ethnic minority groups. Very few rural income surveys conducted in developing countries have collected sufficiently detailed household information to construct profiles of family characteristics differentiated by income. This section examines the extent to which a set of socio-economic characteristics of the sampled households vary with income status and tests a set of hypotheses explaining their interaction with income.

4.1. Family Structure and The Life Cycle

The size, composition, and stage of development of the household are hypothesized to be associated with income through a number of relationships. On the consumption side, the number of persons to be provided for importantly determines the level of household income considered to be adequate. Thus, family size would be expected to directly influence production objectives. On the production side, family size would be expected to vary closely with the available work force. The association between household size and income per capita or per consumer,

however, is less clear. Importantly affecting this relationship is whether or not household composition varies systematically with household size; in particular, whether the proportion of working age persons is associated with changes in the number of residents. A second determining factor is whether labor productivity is associated with the size of the family work force. This in turn depends upon whether or not there exist economies of scale in production, whether complementary factors (especially land) increase in proportion with household size, and whether worker efficiency and managerial competence are correlated with family size through variation in the age and experience of the work force.

Several authors have suggested that these relationships are systematically interrelated with the demographic cycle of family formation, growth, and decline. Hedges [1963] has distinguished three stages in the growth of farm firms in developed economies: learning, maturity and optimum performance, and postmaturity during which the manager's effectiveness declines. Chayanov [1966] has presented a framework for peasant farming systems within which variation in income per consumer is explained as a function of household size and composition, both of which are in turn associated with a family's development. Formulated for application to a land surplus environment, Chayanov's life-cycle model is based upon changes in the ratio of consumers-to-workers which accompany household growth. Assuming normal fertility behavior the consumer-to-worker ratio has an inverted U-shape when plotted against the number of years since the family's inception. Controlling for variation in work intensity, production per consumer declines during that stage of household development when the consumer-to-worker ratio is high.

The life-cycle hypothesis of income variation has also been explored by Kuznets [1976] in an examination of aggregate U.S. data. Finding strong evidence of a close non-linear correlation between age and personal income, Kuznets concluded that valid normative judgments regarding the personal distribution of income must take into account the earnings life-cycle.

To determine the presence of a life-cycle earnings pattern one would ideally trace the characteristics and incomes of actual cohorts through time series data. Unfortunately such data are not available. As a second best alternative, households have been jointly stratified by size of household and by age of household head. The stages of family development can be roughly inferred by tracing patterns across these two dimensions. To control for differences in family organization, nuclear and extended (gandu) household units have been separated. Due to limited sample size, the number of observations per cell is in most cases too small to draw valid statistical inferences regarding the strength of these relationships. Rather, the purpose of this discussion is to determine whether general patterns indicate that life-cycle factors contribute to the observed distribution of income.

The variation in consumers per worker was examined using this framework (see Appendix B, Table B. 1).[1] Among nuclear households, it was

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[1]The number of "workers" in each household is equal to the number of persons who engaged in weeding (the primary task during the agricultural labor bottleneck period) weighted by a productivity coefficient. The following worker productivity weights were employed:

Worker Equivalent Weights by Age and Sex

Sex	5-9 years	10-15 years	16+ years
Male	.25	.8	1.0
Female	.25	.5	.6

found that the ratio of consumers-to-workers was directly related to both the size of family and the age of head, reflecting both additional wives and children. Furthermore, compared with nuclear families, consumer-to-worker ratios were generally more favorable among extended (gandu) units. Among smaller gandu units headed by men in their twenties and among units headed by men in their forties, households were composed of a greater proportion of workers. The first group was composed predominantly of small households united in fraternal gandu, while the latter included primarily paternal gandu in which the sons of the household head had joined the adult work force. This compositional advantage was lost, however, for gandu heads in their fifties as their sons established families thereby increasing the dependency burden. Among the most elderly gandu heads the consumer-to-worker ratio increased even more rapidly as sons broke away from the extended unit and the gandu unit began to fragment.

The variation in farmed hectares per consumer was also examined within the life-cycle framework revealing a well defined pattern of accumulation then loss of land for nuclear households (Appendix B, Table B.2). Cultivated area per consumer was found to increase until the head was in his thirties, then decline, most rapidly after age fifty. A similar but less well defined trend is evident for extended families. Furthermore, the reduction in holdings occurred at a somewhat later stage in the development of the extended units. From the earlier discussion it is likely that this was the result of a more favorable consumer-to-worker ratio in larger extended families reflecting the availability of sons in paternal gandu units.

The effect of these factors on mean incomes per consumer is displayed in Table 4.1. In view of both the consumer per worker and land per consumer patterns, it is not surprising that among nuclear units the highest incomes were realized by small families in relatively early stages of development. As nuclear families expand, a fairly consistent inverse relation with income is evident with a particularly rapid decline in incomes for large nuclear families with heads 50 years and older. An important exception is among families with very young household heads, aged 24 or less, for whom incomes were also relatively low. This latter group may have been characterized by inexperience and thus below average management skills.

The decline in incomes for extended families occurred later with respect to the age of head. Incomes were fairly uniform through 50 years of age, though they decline noticeably for heads aged 60 or greater. The sharp reduction in gandu size associated with the low incomes of this age group again points toward the disintegration of the extended unit.

In Table 4.2 the distribution of the poorest 30 percent of households is shown as a proportion of the total number of observations per cell. Three sets of households are disproportionately represented in this poverty group: (1) households headed by persons aged 60 years or older, (2) households headed by persons less than 25 years of age, and (3) nuclear households consisting of seven or more residents (the average household size). As a group these households constitute only 18 percent of the sample but include 47 percent of those households included in the poorest three deciles.

Table 4.1 MEAN INCOME PER CONSUMER BY SIZE OF HOUSEHOLD AND AGE OF HEAD FOR NUCLEAR AND EXTENDED FAMILIES[a] (IN NAIRA)

Number of Residents Per Household	Age of Household Head													
	Nuclear Households							Extended Households						
	-24	25-29	30-39	40-49	50-59	60+	Total	-24	25-29	30-39	40-49	50-59	60+	Total
1-2	115.00	141.00	79.50				95.67							
3-4	38.50	83.00	119.60	99.33	94.50	54.00	92.50			98.00		95.67		96.60
5-6	46.00	108.00	75.17	56.60	102.50	51.00	73.65			90.67	86.38		25.00	82.33
7-8		165.00		92.50	32.00		82.80	34.00	231.00	66.50		101.00		100.33
9-10			52.00				52.00			59.50	86.00		37.00	71.43
11-12			24.00		40.00		32.00					99.00	52.00	86.50
13-14										50.00		58.00		54.00
15-16										61.00				71.50
17-18										38.00				38.00
19-20											87.00			87.00
21+												27.00		27.00
Total	59.50	106.75	84.88	81.84	76.33	52.50	82.85	34.00	231.00	72.42	88.81	89.58	41.50	82.52

a. Calculated as simple means.

Table 4.2 FREQUENCY DISTRIBUTION OF POOREST 30 PERCENT OF HOUSEHOLDS BY SIZE OF HOUSEHOLD AND AGE OF HEAD FOR NUCLEAR AND EXTENDED FAMILIES[a]

Number of Residents Per Household	Age of Household Head													
	Nuclear Households							Extended Households						
	-24	25-29	30-39	40-49	50-59	60+	Total	-24	25-29	30-39	40-49	50-59	60+	Total
1-2	0/1	0/1	0/4				0/6							
3-4	2/2	1/4	0/5	1/6	0/4	1/1	5/22			0/2		0/3		0/5
5-6	1/1	0/2	1/7	3/5	0/2	1/1	6/18			1/3	3/8		1/1	5/12
7-8		0/1		0/2	2/2		2/5	1/1	0/1	1/2		0/5		2/9
9-10			1/1				1/1			1/2	2/4		1/1	4/7
11-12			1/1		1/1		2/2				0/2	0/2	1/2	1/6
13-14										1/1		0/1		1/2
15-16										0/1	0/1			0/2
17-18										1/1				1/1
19-20											0/1			0/1
21+														0/1
Total	3/4	1/8	3/18	4/13	3/9	2/2	16/54	1/1	0/1	5/12	5/16	1/1	3/4	15/46

a. Within each cell, the numerator represents the number of households included in the poorest 30 percent of family units, and the denominator represents the total number of households in the cell.

Although a larger sample would have facilitated a more rigorous test of the life-cycle hypothesis, it can be concluded from the available evidence that systematic changes in demographic factors and access to land, both of which are associated with household growth and development, contribute to a life-cycle income pattern. Moreover, it is clear that the form of household structure importantly affects both the sequence and rate in which households experience these general income stages. Households which maintain or adopt a gandu structure as the household develops enjoy consistently higher incomes than did advanced nuclear units. However, the number of exceptions to these patterns suggest that life-cycle factors account for only a limited proportion of incomes variation.

To summarize the association between demographic factors and income per consumer, average household characteristics have been calculated for each income stratum overall and by village in Table 4.3. Regardless of the measure employed, household size was inversely related to income per consumer. It is important to note the exception to this pattern posed by the village elites among whom household size by each standard was nearly three times the random sample average.

No association is apparent between the number of consumers per worker and household income status. The hypothesized inverse relationship was not supported because workers faced with a high dependency ratio tend to increase work levels through farming larger areas per worker, as well as through increased off-farm employment in an effort to supplement farm earnings (see Appendix B, Table B.3).

Table 4.3 HOUSEHOLD DEMOGRAPHIC CHARACTERISTICS BY VILLAGE AND INCOME STRATUM

Variable	Village	Village Mean	Decile 1	Decile 2	Quintile 2	Quintile 3	Quintile 4	Decile 9	Decile 10	Elites
Size										
Residents (number)	Barbeji	6.6	10.7	5.0	7.4	5.6	6.3	4.0	7.3	
	Zoza	5.7	6.8	7.0	5.0	5.9	5.3	5.3	5.3	
	Rogo	7.8	6.0	16.0	8.1	6.7	8.1	4.3	5.7	19.5
	All	6.7	9.3	8.3	7.3	5.8	6.2	4.5	6.3	
Consumer man-equivalents[a] (number)	Barbeji	4.4	7.3	3.0	4.9	4.2	4.3	2.9	4.2	
	Zoza	3.9	5.1	5.0	3.7	3.9	3.5	3.4	3.2	
	Rogo	5.5	4.5	11.0	5.6	5.0	5.7	2.8	3.8	13.0
	All	4.6	6.4	5.9	5.0	4.1	4.3	3.1	3.7	
Workers[b] (number)	Barbeji	2.1	3.7	1.3	1.7	2.2	1.9	2.0	2.3	
	Zoza	1.9	2.8	2.1	1.8	1.9	1.7	1.6	1.3	
	Rogo	2.3	1.6	5.3	2.0	2.3	2.4	1.0	1.7	5.9
	All	2.1	2.8	2.8	2.1	1.9	1.9	1.8	1.6	
Composition										
Consumer to worker ratio	Barbeji	2.3	2.1	2.3	3.0	2.0	2.5	1.6	2.3	
	Zoza	2.3	2.0	2.5	2.5	2.0	2.3	2.1	2.7	
	Rogo	2.7	2.9	2.0	3.3	2.3	2.6	2.8	2.8	2.6
	All	2.4	2.4	2.6	2.2	2.3	2.3	2.0	2.7	
Number of wives (three village total)		1.40	1.30	1.30	1.70	1.35	1.35	1.40	1.20	2.50
Age of Household Head										
Mean	Barbeji	40.2	40.0	45.3	40.7	41.3	37.3	43.0	34.3	
	Zoza	36.3	32.0	36.7	40.4	35.7	37.8	31.7	35.0	
	Rogo	42.3	48.3	45.0	41.0	41.3	43.3	34.7	43.3	45.6
	All	39.6	39.5	43.9	39.0	39.9	39.2	29.9	36.3	
Frequency in extreme age groups (three village total)	-24		2	-	2	-	1	-	-	
	60+		2	-	2	-	-	-	-	
	Total extreme		4	-	4	-	1	-	-	-

a. Consumer man-equivalents have been determined by weighting each member of the household by a consumption coefficient on the basis of the person's age and sex.

b. The number of "workers" in each household is equal to the number of persons who engaged in weeding activities (the primary task during the agricultural labor bottleneck period) weighted by a productivity coefficient (see text).

When aggregated into income strata, no association is evident between the age of the household head and income per consumer. This is because low income households were disproportionately represented by both very young and elderly heads, and because peak incomes among nuclear and extended households tended to occur at different stages in their family development.

The demographic characteristics of the small set of households selected to represent village elites are of particular interest. Unusually large paternal gandu households, they provide examples of what has traditionally been considered the ideal Hausa family unit [Hill, pp. 165-167]. Each of the six elite heads had two or more wives, compared with only 36 percent of the random sample with greater than one. Moreover, they represent a select group of particularly strong extended units in which still active fathers are supported by a work force of several adult sons. It is important to recognize, however, that these elites were a clearly distinct and atypical subset of the most affluent.

4.2. The Distribution of Modern Education

Due to historical circumstances which limited the establishment of mission schools in the predominantly Moslem north, modern formal and informal education in this region of Nigeria is relatively recent and substantially below levels achieved elsewhere in the country.[1] This was

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[1] In 1975 the Federal Government of Nigeria committed itself to providing universal primary education, a program which is expected to importantly reduce regional inequalities by the early 1980s. These data reflect conditions preceding the initiation of that program.

clearly evident within the study villages. Only one percent of household heads among the random sample and only six percent of school aged children had attended primary school.[1] Eight percent of the random household heads had attended adult literacy class, and only 15 percent had met with an extension agent during the previous five years. Furthermore, literacy in either Hausa or Arabic was limited to only seven percent of the random heads. While these levels are too low to derive conclusive inferences, it should be noted that none of these measures of modern education reflected a consistent positive correlation with income.

The elite households present a minor exception. Although one of the village elites had gone to primary school, three of the six village leaders had attended adult education classes and two of the six were literate in at least one language. Similarly, 27 percent of school aged children in elite households were currently attending primary school. As expected in light of village institutions, the elites also enjoyed privileged access to the agricultural extension system with five of six having had contact with the extension agent during the previous five years.[2]

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[1]Among the three study villages, two primary schools were operating in Rogo, one in Zoza, but none in more remote Barbeji. Adult literacy classes had also been offered in both Rogo and Zoza in recent years. Similarly, the Rogo extension agent had worked in these two more accessible village areas.

[2]The majority of contacts with the agent were for the purpose of obtaining fertilizer and groundnut seed at subsidized prices. The village elites played a central role in the allocation of inputs received from government sources. It is important to note that in several instances they were observed to use this role to divert disproportionate shares of government supplied inputs to their personal use. For a further discussion of these activities and the resulting perceptions of villagers, see Matlon [1977, pp. 389-400].

It can be concluded that with the exception of a numerically small group of village leaders, the data do not suggest that current patterns of education within the study villages contribute either to a widening of income differences or to a transmission of income differentials across generations.

5. FACTOR USE AND PRODUCTIVITY

5.1. Land Use

Many rural income studies conducted in developing countries have found that access to land is the single most important factor explaining income differences. Indeed, in the absence of income data, land use is commonly employed as a proxy variable to stratify households into income or welfare classes [Mellor, 1975; King, 1976]. But while the land proxy has considerable intuitive appeal in a land shortage environment, or where land tenure institutions result in restricted access to land, its relevance to a more land abundant environment, such as northern Nigeria, is questionable. Indirect evidence of an association between the amount of cultivated land and income was seen earlier in the discussion of life-cycle income patterns. This relationship will now be examined more directly.

Land use patterns across income strata are shown in Table 5.1 It is clear that while higher income households farmed somewhat larger land areas, with the exception of the elite households the relationship was not strong. The simple correlation coefficient between income per consumer and cultivated area per household for the random sample is only .2045. As would be expected, a higher correlation was evident between income per consumer and cultivated area per consumer, reflected in a coefficient of .5428.

However, the size of this coefficient as well as the magnitudes of the hectare per consumer figures in Table 5.1 indicate that land use alone accounts for less than half of the variation in incomes. For example, in both Zoza and Barbeji the most land short income class was

Table 5.1 CULTIVATED LAND HOLDINGS BY VILLAGE AND INCOME STRATUM

Variable	Village	Village mean	Decile 1	Decile 2	Quintile 2	Quintile 3	Quintile 4	Decile 9	Decile 10	Elites
Cultivated hectares per household	Barbeji	3.0	3.1	1.1	2.7	2.1	4.0	3.6	4.2	
	Zoza	2.7	3.5	2.5	2.1	2.7	2.3	3.6	2.8	
	Rogo	1.9	1.0	2.7	1.5	1.9	2.3	1.5	1.6	
	All	2.5	2.2	2.4	2.2	2.4	2.9	2.7	3.2	11.4
Cultivated hectares per capita	Barbeji	0.45	0.29	0.22	0.36	0.38	0.63	0.90	0.58	
	Zoza	0.47	0.51	0.36	0.42	0.46	0.43	0.68	0.53	
	Rogo	0.24	0.17	0.17	0.19	0.28	0.28	0.35	0.28	
	All	0.37	0.24	0.29	0.30	0.41	0.47	0.60	0.51	.58
Cultivated hectares per consumer	Barbeji	0.68	0.42	0.37	0.55	0.50	0.93	1.24	1.00	
	Zoza	0.69	0.69	0.50	0.57	0.69	0.66	1.06	0.88	
	Rogo	0.35	0.22	0.25	0.27	0.38	0.40	0.54	0.42	
	All	0.54	0.34	0.41	0.44	0.59	0.67	0.87	0.86	.87

not the poorest decile. Indeed, in Zoza the land area farmed per consumer by the poorest decile was greater than or equal to all other strata with the exception of the ninth and tenth deciles.

This conclusion is amplified by comparing land use and incomes between the extreme deciles. The ratios between land per consumer levels observed in the richest and poorest strata are as follows: Rogo - 2.1:1; Zoza - 1.3:1; and Barbeji - 2.4:1. In contrast, the corresponding income per consumer ratios between extreme deciles are: Rogo - 6.6:1; Zoza - 4.5:1; and Barbeji - 5.9:1. Thus the income ratios in Zoza and Rogo are more than triple the corresponding land ratios, and in Barbeji more than double.

Factors other than land use clearly account for the major proportion of income variation. At the most general level, these factors must include either income generated in off-farm activities and/or interhousehold differences in land productivity. Table 5.2 presents the mean off-farm income per consumer and the average proportion of income generated in off-farm employment for households stratified by hectares per consumer and income. After controlling for differences in cultivated land it is clear that higher income households consistently earned greater off-farm incomes than did poor households. Higher income households also made more efficient use of their land resources. This can be seen in Table 5.3. Greater land productivity among richer households is most evident in the higher range of hectares per consumer, while among the most land short strata, higher income households gave considerably greater emphasis to their off-farm activities with a consequent decline in the value of crops production per unit of land. It is concluded that while incomes

Table 5.2 RELATIONSHIP BETWEEN OFF-FARM INCOME, HOUSEHOLD INCOME STATUS, AND HECTARES PER CONSUMER[a]

Variable	Hectares Per Consumer	Income Quintile 1	2	3	4	5	Total
Off-Farm Income Per Consumer (in Naira)	≤.29	9.37 (6)	17.22 (6)		-	140.71 (1)	23.10 (13)
	.3-.49	9.79 (10)	8.92 (6)	26.87 (5)	47.16 (6)	103.30 (4)	31.68 (31)
	.5-.69	10.25 (1)	7.73 (6)	12.19 (7)	28.69 (4)	33.10 (4)	17.69 (22)
	.7-.89	-	16.42 (2)	16.27 (6)	23.60 (6)	54.45 (3)	25.61 (17)
	.9+	1.56 (3)	-	2.81 (2)	26.70 (4)	34.31 (8)	23.03 (17)
	Total	8.45 (20)	11.80 (20)	16.35 (20)	32.31 (20)	56.21 (20)	25.02 (100)
Off-Farm Income as a Proportion of Income From All Sources (percent)	≤.29	.313 (6)	.325 (6)		-	.874 (1)	.362 (13)
	.3-.49	.270 (10)	.168 (6)	.360 (5)	.510 (6)	.745 (4)	.373 (31)
	.5-.69	.277 (1)	.129 (6)	.165 (7)	.278 (4)	.245 (4)	.195 (22)
	.7-.89	-	.257 (2)	.217 (6)	.224 (6)	.334 (3)	.245 (17)
	.9+	.048 (3)	-	.037 (2)	.287 (4)	.229 (8)	.188 (17)
	Total	.249 (20)	.213 (20)	.217 (20)	.333 (20)	.384 (20)	.279 (100)

a. The number of observations is in parenthesis.

Table 5.3 MEAN FARM INCOME PER CONSUMER BY INCOME STRATUM AND CULTIVATED HECTARES PER CONSUMER[a] (IN NAIRA)

Hectares per Consumer	Income Quintile					Total
	1	2	3	4	5	
≤.29	20.30 (6)	35.28 (6)	-	-	20.29 (1)	27.21 (13)
.3-.49	25.71 (10)	44.91 (6)	4[illegible].93 (5)	45.84 (6)	36.20 (4)	38.26 (31)
.5-.69	26.75 (1)	51.76 (6)	69.15 (7)	73.31 (4)	102.40 (4)	69.28 (22)
.7-.89	-	39.09 (2)	59.56 (6)	79.73 (6)	102.55 (3)	71.86 (17)
.9+	33.43 (3)	-	74.20 (2)	66.80 (4)	120.32 (8)	86.97 (17)
Total	25.30 (20)	43.49 (20)	61.47 (20)	65.69 (20)	92.25 (20)	57.64 (100)

a. The number of observations is in parenthesis.

do vary directly with farmed area, due to differences in off-farm earnings and in land productivity, land use alone is only a very rough proxy for income. It is further clear that for policy purposes, the stratification of households by size of land holding is an inappropriate tool for the identification of poverty households.

5.2. Land Tenure and Type

Within the study villages, as within Hausaland more generally, all lands under cultivation are retained through use rights held by family units and vested in the head of household. Permanent transfer of usufructuary rights between households or the expansion of farming onto bush lands must be done subject to approval of the village head. Variation in the proportion of land held under different types of tenure could influence incomes both through income transfers contained in rental payments and, due to differences in the security of tenure, through willingness to invest in land improvements thereby resulting in variation in land quality.

Five tenurial arrangements were observed. Fifty-eight percent of farmed areas consisted of fields inherited (gado) by the current operator. Purchased (saye) fields constituted 20 percent of farmed area. Rented (aro) fields constituted 16 percent and pledged (jingina) fields[1]

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[1]Jingina lands are those fields for which rights have been temporarily transferred from one who has borrowed cash to the household from which the cash loan was extended. The use rights remain with the loaner until repayment is completed. While only a small proportion of all cash loans involve the pledging of land, pledging is not uncommon in cases where the amount of the cash loan is relatively high and the borrower is a poorer farmer for whom the risk of default is high. Many such transfers become equivalent to purchases over time.

represented only 4 percent of farmed area. An even smaller proportion of land, 3 percent, had been initially cleared out of bush by the current operator.

Only the percentage of land held as pledged fields showed a consistent, and positive, association with income status reflecting the presence of creditor households among the upper income strata. But even this variation was relatively minor. The proportion of pledged fields varied from zero in the lowest decile to only 10 percent among households in the richest decile. No consistent patterns were evident relating the percentages of inherited, purchased, or rented holdings with income.[1]

The data also showed that there was little association between the distribution of high value lowland (fadama) soils and income. Only in Barbeji, where fadama fields constituted 5 percent of total cultivated area did the proportion of fadama soil increase with income. Among Barbeji's richest one-third of households, 9 percent of cultivated land was fadama, compared with only 3 and 2 percent, respectively, for the middle and lower income groups. Fadama land was most abundant in Rogo, representing 11 percent of cultivated area. Although among the richest third of its small sample 11 percent of farmed area was fadama, this was offset by the poorest third, whose much smaller land base was composed of 14 percent lowland soils. Thus the data suggest that neither access to high quality lowland soils nor tenurial arrangements were significant factors in explaining the observed income distribution.

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[1]The data are presented in Matlon [1977, p. 111].

5.3. Ownership of Non-Land Capital

Like land, the value of farm and non-farm capital equipment is a measure of production scale. Stocks of working capital and livestock are also a measure of accumulated wealth and represent a source of immediate cash in the event of a production shortfall or other household financial emergency.

The average values of livestock and working capital disaggregated by income class are presented in Table 5.4. Although both livestock and production capital were in general positively associated with income, comparing the value of these stocks with household income (Table 3.5) it is clear that capital was considerably more equally distributed than income among the income strata. Because all households were hand tool cultivators, the relatively minor variation in the value of farm tools per household and per worker reflect differences in the size of inventories and age of tools rather than in the types of capital employed. Since higher income households often supplied tools to hired farm laborers, their inventories were somewhat larger. Once again the subset of politically elite households stand out as atypical with the value of all capital nearly 20 times greater than the random sample average, and more than 10 times greater than households in the tenth decile.

5.4. Labor Use

Two aspects of labor use are briefly considered in this section. First, we examine how the levels of employment varied annually and by period of the year in order to determine the extent to which the supply of household labor may have been a factor constraining incomes

Table 5.4 AVERAGE VALUE OF LIVESTOCK AND WORKING CAPITAL PER HOUSEHOLD BY INCOME STRATA[a] (IN NAIRA)

Assets category	Decile 1	Decile 2	Quintile 2	Quintile 3	Quintile 4	Decile 9	Decile 10	Elites
1. Livestock-Total[b]	50.40	106.60	70.75	73.00	169.10	136.80	126.90	1579.67
Cattle	-	30.00 (0.40)	- -	- -	94.90 (0.80)	36.00 (0.40)	20.00 (0.30)	1301.67 (8.30)
Donkey	9.30 (0.80)	12.10 (0.70)	11.90 (0.90)	3.05 (0.30)	7.80 (0.40)	6.80 (0.80)	5.10 (0.50)	17.00 (.88)
Sheep and Goats	11.40 (1.50)	12.60 (1.70)	16.15 (2.25)	15.65)1.65)	17.70 (1.75)	32.30 (3.40)	32.20 (2.10)	277.50 (24.80)
Chicken	1.50 (4.00)	2.00 (4.20)	2.30 (7.40)	3.85 (8.45)	3.40 (8.40)	5.00 (14.60)	3.70 (8.90)	7.33 (16)
Other poultry	1.90	4.10	0.60	0.80	0.95	7.40	3.70	15.18
Other Livestock	6.00	-	1.20	-	0.15	-	-	27.77
2. Farm tools	6.20	9.50	8.55	5.40	10.15	8.60	13.00	40.41
3. Value of farm tools per worker	2.21	3.39	4.07	2.84	5.34	4.78	8.13	6.85
4. Non-farm capital[c]	4.30	12.30	23.95	6.60	36.00	2.60	19.60	141.13

a. Values are estimated as current sale value.

b. The average number of animals per household is included in parenthesis.

c. Included are all tools and other fixed assets (e.g., shop structures) used in off-farm occupations. Inventory stocks of non-farm trading items are not included.

within each income stratum. Second, we examine the allocation of labor to farm and off-farm enterprises to determine whether variation in the composition of employment is related to income. Since labor data was not obtained from the large sample, the data to address these issues are taken from the small sample of 35 households. Because of the smaller sample size, only three income classes are distinguished.

Average hours of employment for adult males during the entire year as well as during the three months of peak farm work are shown in Table 5.5. The overall employment levels were low, varying between only 1.8

Table 5.5 AVERAGE DAILY HOURS WORKED PER ADULT MALE (16+ YEARS) ACCORDING TO HOUSEHOLD SECTOR AND INCOME CLASS, SMALL SAMPLE[a]

		Income Class		
Period	Sector	Low	Middle	High
All Year	Farm	1.17	1.77	1.48
	Hired Farm Labor	.18	.06	.02
	Off-Farm Non-Agric.	.43	.24	.25
	Total Hours	1.78	2.07	1.75
May-July	Farm	2.29	3.50	2.78
	Hired Farm Labor	.31	.04	.05
	Off-Farm Non-Agric.	.33	.05	.09
	Total Hours	2.93	3.59	2.92
Number of persons observed within each income category.		20	24	24

a. Travel time to and from places of employment as well as work within the family compound are not included in these figures. In addition, these figures represent the mean daily work levels observed for each period, not the mean hours of work only for those days during which work was observed.

and 2.1 hours per day annually, and between 2.9 and 3.6 hours during the peak farming period.[1] Within both time frames, the highest relative work rates were recorded among middle income farmers. It is particularly important to note that when only labor on own fields is considered, low income farmers worked the least hours. Moreover, this was true both for the entire year and for the peak period during which the poorest farmers worked an average of only 2.3 hours per available man day.[2]

The low hours worked on the farms of the poorest households reflect at least four interrelated factors. First, as seen earlier, poorer households farmed somewhat smaller holdings. Second, although poor farmers expended least hours per unit area (see Section 5.5) the marginal value product of labor was lowest among low income producers - ₦0.055 per hour, compared to ₦.096 and ₦.139 for middle and high income farmers, respectively [Matlon, 1977, pp. 216-224].[3] Third, the calorie shortage experienced by the poorest households may have importantly limited the potential energy expenditure of low income workers. And fourth, in order

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[1]This range is well below the annual mean of 3.3 hours estimated by Norman [1968] in his three village Zaria study. Norman, however, did not actually collect data on the number of hours devoted to work other than on the family farm. Rather, that study obtained information only on the number of days during which off-farm activities were pursued and assumed that farmers worked as long at off-farm occupations during each day worked as they did on family farm work. That procedure almost certainly over-estimated the off-farm labor component of his total estimate.

[2]The magnitude of these on-farm employment levels are consistent with the average daily hours worked reported by Norman [1968] for the entire year of his survey (1.64 hours per man day) as well as being in general agreement with his peak period estimates.

[3]The average hourly wage rate for hired farm labor was ₦0.10 for adult males.

to generate an immediate cash inflow low income males allocated a substantial proportion of their labor time to off-farm activities. On an annual basis, low income males spent 34 percent of their total work time in off-farm activities, compared to only 14 percent among males in each higher income stratum. And during the peak farming months, when their cash and food reserves were at a minimum, low income males allocated 22 percent of their work time off the farm. This compared to less than 5 percent among adult males in higher income households. Nevertheless, in view of the low overall employment levels of poor adult males, it is clear that work off-farm was at best only partially responsible for low levels of on-farm work.

With one qualification, it can be concluded that labor time was not a significant constraint limiting the incomes of poor farmers generated in either farm or off-farm occupations. That qualification is the possibility that the time expended in job search activities and in travel to and from off-farm employment (time not accounted for in the survey) may have been substantial. It is clear that if important, such activities would have disproportionately reduced the available labor supply of low income farmers. Unfortunately data is not available to examine that issue directly.

5.5. Farm Productivity

In the examination of land use patterns above, it was seen that higher income households generated substantially greater farm incomes than poorer farmers after controlling for differences in size of holding (Table 5.3). Variation in land productivity can be caused by several

factors including: (1) differences in factor quality, especially soils; (2) variation in the combination of crops grown; and/or (3) variation in production technique - in particular, the intensity with which the land is farmed. Although data on soil quality was not available on a per-field basis, it was mentioned earlier that the distribution of high quality lowland soils was not generally associated with the household's income status. Moreover, a soil survey carried out in the study area concluded that there were no important differences in the physical and chemical properties of the upland soils tested which would result in significant productivity differentials. The possible effect of variation in cropping emphasis is examined in the next section. At this point it is useful to briefly examine in somewhat more detail how farming intensity and factor costs and returns in crop production varied by income strata. Because labor data was obtained only for the small sample, the analysis is again limited to those households. To control for general soil type differences only upland fields are examined.

Data summarizing average costs and returns per hectare for households in the low, middle, and high income classes are shown in Table 5.6. Three measures of productivity - the value of output per hectare, gross margins per hectare, and returns to household labor, management, and capital - all indicate a strong direct relationship between production efficiency and income. It is also clear that higher income households farmed their upland fields more intensively with respect to both fertilizer and labor. Although fertilizer use was generally low overall, high income farmers on average applied 27 percent more fertilizer per hectare than low income households. They also expended 21 percent more labor,

Table 5.6 AVERAGE COSTS AND RETURNS PER HECTARE FOR UPLAND FIELDS BY INCOME CLASS, SMALL SAMPLE (IN NAIRA)

Budget Item	Income Class		
	Low	Middle	High
Value of Output	99.73	120.44	148.97
Variable Costs (total)	29.78	28.68	33.88
Seed	7.64	7.89	5.57
Fertilizer (total)	1.76	2.04	2.25
Organic[a]	1.57	1.89	1.99
Inorganic[b]	.19	.15	.26
Hired Labor	20.38	18.75	26.06
Gross Margins	69.95	91.76	115.09
Opportunity Cost of Land[c]	5.01	4.36	4.52
Labor Use (hours)[d]	587	694	712
Family	406	430	349
Hired	181	264	363
Returns to Household Labor, Management, and Capital per Hour	0.16	0.20	0.32
No. of Field Observations	49	56	68

a. Organic fertilizers were valued at the mean purchase price for each type of manure applied. The average cost was ₦0.08 for an equivalent of 160 liters of compound sweepings or manure.

b. Chemical fertilizer was valued at the current subsidy price of ₦1.60 per cwt. for superphosphate and ₦2.00 per cwt. for ammonium sulfate.

c. All land, regardless of tenure, was valued at the average rental rates observed in each village.

d. Hours of labor are measured in terms of man-equivalent work hours.

primarily from hired workers. In comparison the differential in value of production between extreme income classes was 49 percent.

These relative differences indicate that unless there existed increasing returns to fertilizer and labor, variation in the amounts of conventional inputs applied does not alone explain the substantial production gradient. Production function analysis confirmed that both fertilizer and labor were subject to diminishing returns within the range of observed use levels [Matlon, 1977, Chapter VI]. Moreover, a Chow test applied to detect structural differences among the set of production functions fitted to each income class concluded that the null hypothesis of structural similarity across income classes could be rejected at the 2 percent level. The nature of these structural differences has not yet been identified.

One explanation is that management practices were systematically related to income. Familiarity with the farming systems of the area suggests that differences in cultural practices could include variation in the timing of operations, the selection of complementary crop mixtures, rotation practices, and the allocation of crops among fields showing micro-area soil variation. Although it is clear that an identification of such differences in essentially traditional production techniques would add importantly to an understanding of income distribution, these questions lie outside the scope of the present paper. An alternative explanation is that high income farmers gave greater emphasis to upland crops with more favorable returns characteristics than did low income farmers. This last hypothesis is examined in the following section.

6. ENTERPRISE SELECTION ACROSS INCOME CLASSES

This section examines the extent to which selection of cropping enterprises varied across income classes and how cropping emphasis affected returns to land. The relative emphasis given a set of off-farm activities, and implications for returns to labor in off-farm employment are also examined.

6.1. Subsistence vs. Cash Crop Emphasis

It is sometimes assumed that poorer farmers tend to be more oriented to the production of subsistence crops. Guided by a food first objective, it follows that land and labor would be allocated to cash crops production only after their domestic consumption objectives are met. It is of direct interest to know whether this pattern applies to the present sample. For this purpose, the major crops in the area have been grouped into three categories: (1) cash crops, (2) subsistence grains and (3) intermediate crops. Although nearly 40 crops were grown by sample households, to simplify the analysis and presentation, only the 12 most important are examined. These major crops include over 95 percent of the total harvest value of each income stratum, and nearly 96 percent overall. Four crops stand out in terms of percentage sales: onion, pepper, groundnut, and sugar cane, each with over 70 percent marketed. Grown primarily for the market and only secondarily for domestic consumption, these crops have been grouped into the category of cash crops. The sorghums and millets, the most important food staples in the diet of rural northern Nigerians, have been similarly grouped to comprise the subsistence grains category. All remaining crops, including minor crops have been categorized as intermediate crops.

In Table 6.1 the percentage of total harvest value represented by the subsistence grains and cash crops is shown for each income stratum.

Table 6.1 THE PERCENT OF TOTAL HARVEST VALUE FOR SUBSISTENCE GRAINS AND CASH CROPS BY INCOME STRATUM[a]

Village	Crop Category	Decile		Quintile			Decile	
		1	2	2	3	4	9	10
Rogo	Subsistence Grains	41	31	27	27	25	31	26
	Cash Crops	58	61	54	58	65	68	64
Zoza	Subsistence Grains	58	49	60	38	46	54	46
	Cash Crops	37	42	29	39	38	37	31
Barbeji	Subsistence Grains	62	56	54	54	45	50	37
	Cash Crops	31	25	34	31	46	35	55
All	Subsistence Grains	42	46	45	47	36	44	42
	Cash Crops	52	39	45	36	55	45	47

a. The percentage of the residual crop category, intermediate crops, is not shown.

The emphasis given the major crop groups within the cropping systems of each income stratum are surprisingly uniform. From a 52 percent emphasis on cash crops in the first decile, the proportion falls to 36 percent in the third quintile, rises to the highest proportion, 55 percent, in the fourth quintile, then plateaus at approximately 45 percent in the top two deciles.

The three-village total, however, masks underlying patterns peculiar to each village. Reflecting the same village rankings with respect to inequality and degree of monetization, Rogo farmers on average gave the greatest emphasis to cash crops (61 percent of their total production), followed by Barbeji (40 percent), and Zoza (37 percent). The cash crop

share of total production in both Rogo and Barbeji showed a weak positive association with income levels, while little trend was evident in Zoza.

Of particular interest in the three-village aggregate pattern is the relative cash crop emphasis of the poorest households. It was seen earlier that the lowest two deciles experienced a calorie deficiency of approximately 20 percent of estimated requirements. Nevertheless, roughly 52 percent and 39 percent of the harvest value of the poorest two deciles, respectively, represented the production of cash crops. This is clearly inconsistent with the hypothesis that the primary objective of the poorest farmers is to produce a food supply sufficient to meet the domestic consumption needs. Several factors explaining the importance of cash crops among the poorest households are discussed later.

6.2. Crop Enterprise Balance by Village and Income Stratum

A more detailed breakdown of crop mix among income classes is displayed in Table 6.2. An index of crop emphasis has been computed by dividing the crop percent for each stratum by the overall mean percent for the entire sample, thereby standardizing at one. Values greater than one represent disproportionate emphasis given to that crop with values less than one reflecting lower than average emphasis.

The basic similarities in crop allocation among income strata are striking. With the exception of rice, sugar cane, and root crops, each of the 12 major crops was produced by households in each class of the overall sample, and in roughly similar proportions. The absolute size

Table 6.2 THE HARVEST VALUE OF 12 MAJOR CROPS EXPRESSED AS A PERCENT OF THE TOTAL HARVEST VALUE BY INCOME STRATUM[a]

Income strata	Early millet	Late millet	Tall sorghum	Short sorghum	Maize	Rice	Cowpea	Groundnut	Onion	Pepper	Sugar cane	Root crops	Total
Decile 1	7.8	2.1	18.5	13.4	1.5	-	2.4	50.0	0.5	1.8	-	-	98.0
" 2	7.7	2.3	18.7	17.4	1.7	3.1	3.1	31.1	4.9	3.0	-	2.3	95.3
Quintile 2	6.4	1.1	30.2	7.1	1.4	1.1	3.5	31.2	4.3	5.1	4.2	0.6	96.2
" 3	7.2	1.9	27.5	10.3	1.7	0.9	3.0	24.9	3.7	5.7	1.6	6.9	95.3
" 4	6.5	1.5	24.1	3.7	0.6	2.7	2.7	37.2	5.6	5.0	6.7	2.4	98.7
Decile 9	5.2	1.1	26.4	11.1	1.2	1.1	5.4	33.0	5.6	6.1	-	0.8	97.0
" 10	7.2	2.2	24.5	7.9	1.2	2.2	3.9	26.6	4.8	9.4	6.1	0.7	96.7
All	6.8	1.7	25.3	8.2	1.2	1.7	3.4	32.3	4.6	5.6	3.7	1.3	95.8
					Relative Cropping Emphasis Index[b]								
Decile 1	1.15	1.25	.73	1.63	1.25	-	.71	1.55	.11	.32	-	-	
" 2	1.13	1.35	.74	2.12	1.42	1.82	.91	.96	1.07	.54	-	1.77	
Quintile 2	.94	.65	1.19	.87	1.17	.65	1.03	.97	.93	.91	1.14	.46	
" 3	1.06	1.12	1.09	1.26	1.42	.53	.88	.77	.80	1.02	.43	5.31	
" 4	.96	.88	.95	.45	.50	1.58	.79	1.15	1.22	.89	1.81	1.84	
Decile 9	.76	.65	1.04	1.35	1.00	.65	1.59	1.02	1.22	1.09	-	.62	
" 10	1.05	1.29	.97	.96	1.00	1.29	1.14	.82	1.04	1.68	1.65	.54	

a. Percentages have been calculated as weighted means.

b. The relative cropping emphasis index has been calculated as the ratio of the percentage harvest value of each crop in each income class to the overall percentage harvest value for the respective crop.

of interstrata differences in production shares are particularly small for the millets, maize, rice, cowpea, onion, pepper, sugar cane, and root crops. The widest range is evident for groundnut.

Crops which comprised a greater than average share of harvest value among the lowest income classes with generally decreasing shares as incomes increase, include early millet, short sorghum, and maize. Crops which show the opposite pattern, that is lower than average share in total harvest value among households in the lowest income classes and a generally increasing share in the upper income strata, include cowpea, onion, pepper, and sugar cane. A U-shaped relationship with income describes the emphasis given late millet, short sorghum, and groundnut. The importance of groundnut in the cropping system of the lowest decile—representing 55 percent greater share than average—should be noted in particular. Given these patterns it is necessary to determine whether the relatively minor variations in interstrata crop mix reflect an underlying shift among high income households towards crops with more favorable returns characteristics.

6.3. Crop Mix Variation and Land Productivity

Farmers in the study area plant their crop in mixtures with sole-cropped fields representing only a minor proportion of sown area. Moreover, the heterogeneity of intercropped fields is high.[1] The variety

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[1]A total of 225 distinct mixtures were recorded on 205 separate fields. Of these, only 20, or less than 9 percent, were sole-cropped. The three most frequently observed combinations (tall sorghum, early millet, and cowpea; tall sorghum and cowpea; and sole cropped sorghum) occurred, respectively, on only 30, 27 and 18 plots, out of a total of 484 plots (plots were defined as contiguous pieces of land, not less than 100 square meters in area, on which a single crop or crop mixture was present).

of intercropped mixtures presented considerable problems to estimate the cost and return characteristics of individual crops. Except for actual planting and harvest activities, few labor inputs could be assigned to a specific crop. Similarly, the amount and value of fertilizers applied to intercropped plots could only be crudely disaggregated by crop. Finally, lacking plant stand counts with which it would have been possible to estimate adjusted crop areas, crop-specific costs and harvest values could not be directly related to a crop-specific hectare base.

These data problems prevented the use of standard farm management techniques, such as potential gross margins analysis, to measure the effect of enterprise choice on factor returns. Instead, a two step analytical procedure was used. First, analysis of variance was applied to derive estimates of average gross margins per hectare for each major crop enterprise.[1] Second, a weighted sum of gross margins was calculated for each income class to reflect the expected returns to land given the observed crop mix but controlling for interstrata variation in land productivity attributable to differences in technique or resource quality. The analysis is described in detail in Appendix C.

The results are shown in Table 6.3. These figures can be interpreted as representing the approximate change in the value of gross margins per hectare attributable to shifting from production of all minor

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[1]Gross margin per hectare was defined as the value of harvest less the imputed value of all seeds, cuttings, organic manures, chemical fertilizers, and seed dressing applied, and less the value of all cash and in-kind payments to hired labor, divided by field area. Observations for fields on which sugar cane and cassava were grown were excluded due to lack of full data sets. Both crops have growth periods which fell outside of the duration of the survey.

Table 6.3 THE EFFECT OF CROP MIX ON GROSS MARGINS PER HECTARE BY INCOME STRATUM (IN NAIRA)

	Decile		Quintile			Decile	
	1	2	2	3	4	9	10
Excluding Sugar Cane and Root Crops	-3.31	-11.24	-8.75	-12.54	-0.17	-6.57	-5.25
Including Sugar Cane and Root Crops[a]	-3.31	-10.48	-3.82	-8.30	+7.12	-6.35	+1.57

a. See Appendix C.

crops (the reference crops category) to the mix of major crops representative of each income class. In an effort to take into account the presence of sugar cane and cassava, weighted sums were also calculated using assumed coefficients. It is clear that the effect of variation in crop mix on interstrata differences in returns to land is relatively minor. Moreover, there is no consistent trend across strata. In short, the data suggest that choice of crop enterprise is not an important factor in explaining the strong direct relationship between farm productivity and household income status.

The results of the analysis also suggest a likely explanation for the high degree of cash cropping among low income producers. It was seen earlier that relatively greater emphasis on groundnut was seen among households in the lower and upper income extremes with a decline in emphasis evident among middle income households. The high level of groundnut production among the poorest households is initially puzzling in view of their calorie deficit position. A possible rationale follows.

Two general strategies can be pursued in supplying domestic calorie needs through crop production. Calories can either be directly produced for household consumption through the cultivation of food crops, or calories can be provided through the production and sale of cash crops with subsequent purchases of food in the market. Only three crops ranked higher than groundnut in terms of gross margins per hectare: onion, pepper, and maize.[1] It is significant that each of these crops

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[1]The analysis of variance procedure resulted in the following ordering of crops in terms of gross margins per hectare (in descending

was characterized by high requirements of purchased inputs, especially seed and fertilizer. Moreover, these expenditures occur during a period of cash shortage which is most acute among low income households. In contrast to the cash crops, the staple food grains ranked lowest in returns per hectare.

Given a limited land base, relative to their consumption objectives, such that meeting household food requirements was unattainable regardless of cropping emphasis, it is likely that the lowest income households allocated greater land and labor to the production of the most profitable crop compatible with their low capital position, groundnut. Revenues received from the sale of groundnut thus allowed a higher level of consumption of food through purchases of grains than if the entire land base had been allocated to less profitable food crops alone. Groundnut was made even more attractive to low income producers since it was the only crop for which there was an assured demand and an established price determined by marketing board purchases, thereby reducing the uncertainty of price variation.

Reasons for the declining share of groundnut as one moves above the poorest decile are less clear, but probably reflect a change in production objectives. While there is no direct social prohibition among the Hausa which limits a household's purchases of grain in the market—indeed grain purchases were observed among all strata—dependence on the market to meet household requirements is clearly associated with a social stigma.

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order): onion, pepper, maize, groundnut, cowpea, early millet, late millet, rice, tall sorghum, short sorghum.

The largest production shares of the major staple, tall sorghum, occurred in the second and third quintile, 30 percent and 28 percent of each stratum's total production, respectively. Given a more ample land base, middle income households were consequently able to meet a self-sufficiency objective, thereby reducing their dependence on the market, but only by decreasing their groundnut plantings. Thus self-sufficiency was attained at the cost of shifting to the less profitable food crop mix. That is, with a sacrifice in aggregate income.

6.4. Choice of Enterprise in Off-Farm Employment

Variation in the types of non-agricultural activities pursued by household members across income classes is shown in Table 6.4. Forty-eight off-farm occupations have been grouped according to the distribution of each occupation's market share among income classes.[1]

It is evident in Table 6.4 that characteristics of non-agricultural occupations shift systematically with household income status. All occupations classified as "only low income" are service occupations employing little or no working capital, while the number of occupations requiring substantial levels of working capital increases directly with the income category. An annual cash expenditure of only ₦2.10 per household was

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[1]If all gross sales of an occupation's products or services came from the lowest (highest) two income quintiles, the occupation has been included in the "Only Low (High) Income" category. If 75 percent or more, but less than 100 percent, of total gross sales occurred in the lowest (highest) two quintiles, the occupation was categorized as "Low (High) Income Biased." An occupation was categorized as "Intermediate" if it did not qualify in these other classes; that is, if less than 75 percent of total sales occurred in households falling within either the lower or upper two income quintiles.

Table 6.4 THE DISTRIBUTION AND SELECTED CHARACTERISTICS OF OFF-FARM OCCUPATIONS BY HOUSEHOLD INCOME CLASS

Income bias	Occupation	No. of household observations Barbeji	Zoza	Rogo	Total annual cash expenditure per household (in Naira)	Share of total market "sales" by income quintile[a] 1	2	3	4	5	Share of net household income derived from this occupation[b] 1	2	3	4	5
Only low income	Begging	-	1	-	-	1.00	-	-	-	-	.017	-	-	-	-
	Shoe repair	1	-	1	6.25	-	1.00	-	-	-	-	.010	-	-	-
	Calabash cutting	2	-	-	.05	1.00	-	-	-	-	.005	-	-	-	-
	Head transportation	-	1	-	-	1.00	-	-	-	-	.001	-	-	-	-
	Total				2.10[c]										
Low income bias	Selling grass	-	3	5	-	.15	.69	-	.06	.11	.001	.006	-	.001	-
	Hauling water	-	2	-	-	.82	-	.18	-	-	.001	-	.001	-	-
	Tailoring	2	1	5	37.89	.15	.74	.02	-	.09	.013	.010	.001	-	.004
	Spinning and weaving	1	-	2	4.13	.75	-	-	-	.25	.007	-	-	-	.001
	Lorry mate	-	1	3	-	.29	.65	-	.06	-	.023	.046	-	.002	-
	Provisions trading	2	8	5	41.88	.75	.04	.01	.07	.13	.018	-	.001	.002	.001
	Medicine trading	1	1	-	3.69	1.00	-	-	-	-	.001	-	-	-	-
	Bicycle repair	-	2	1	31.54	-	.98	-	.02	-	-	.01	-	.001	-
	Total				23.24[c]										
Intermediate	Hired farm labor	26	24	13	-	.25	.08	.37	.05	.25	.062	.040	.045	.012	.026
	Selling firewood	1	5	4	-	-	.41	.12	.01	.46	-	.013	.004	.001	.010
	Cap making	3	1	4	8.47	-	.39	.15	.46	-	-	.011	.004	.008	-
	Decorticating groundnut	-	1	-	-	-	-	1.00	-	-	-	-	.001	-	-
	Trans. crops from field	-	2	2	-	-	.63	.13	.21	-	.001	.002	.001	.001	-
	Mat making	1	2	-	12.80	-	-	1.00	-	-	-	-	.001	-	-
	Rope making	-	1	-	-	-	-	1.00	-	-	-	-	.001	-	-
	Bed making	-	1	-	-	-	-	1.00	-	-	-	-	.001	-	-
	Well digging	1	2	2	-	-	-	.71	.29	-	-	-	.026	.007	-
	Donkey transportation	8	2	3	-	.13	.43	.07	.15	.22	.012	.029	.004	.006	.010
	Cloth trading	1	1	2	141.64	-	.65	-	.32	.04	.004	.009	-	.002	.001
	Kola nut trading	2	1	2	206.14	.17	.36	-	.16	.32	.008	.005	-	.004	.006
	Local medicine	-	1	-	-	.09	-	.91	-	-	.003	-	.017	-	-
	Washing clothes	2	1	-	-	-	-	1.00	-	-	-	-	.001	-	-
	Butcher	1	3	2	463.97	.49	-	.01	.50	.01	.032	-	.005	.020	.001
	Total				35.06[c]										
High income bias	Labor processing sugar cane	-	-	3	-	-	.15	-	.59	.25	-	.002	-	.006	.002
	Selling roasted meat	3	1	-	228.95	-	.02	.14	.18	.65	-	.001	.014	.010	.058
	Mud block builder	4	7	3	-	.01	.03	.22	.45	.30	.001	.001	.009	.012	.009
	Processed food trading	3	4	4	252.96	-	.07	-	.10	.83	-	.006	-	.018	.060
	Cigarettes trading	1	3	-	-	-	.09	.14	.71	.05	-	.001	.002	.002	.001
	Koranic teacher	5	5	5	2.46	.14	.01	.15	.70	-	.011	.001	.008	.028	-
	Praise singer/musician	1	4	-	-	-	.01	.15	-	.84	-	.001	.004	-	.017

Table 6.4 (continued)

Income bias	Occupation	No. of household observations Barbeji	Zoza	Rogo	Total annual cash expenditure per household (in Naira)	Share of total market "sales" by income quintile[a] 1	2	3	4	5	Share of net household income derived from this occupation[b] 1	2	3	4	5
High income bias	Barber	2	1	1	2.46	-	.06	.35	-	.59	-	.003	.016	-	.020
	Nail cutting	2	-	-	.25	-	.12	-	.88	-	-	.001	-	.004	-
	Local crops trading	12	10	5	314.42	.01	.03	.08	.24	.64	.003	.009	.046	.100	.101
	Livestock trading	20	19	10	44.53	.13	.02	.04	.24	.56	.007	.007	.004	.004	.005
	Egg sales	3	8	2	-	.05	.10	.14	.01	.71	.002	.003	.003	.001	.014
	Egg trading	-	2	1	38.08	.01	-	-	.99	-	.001	-	-	.005	-
	Total				101.97[c]										
Only high income	Selling tea	-	-	1	11.96	-	-	-	1.00	-	-	-	-	.002	-
	Carpenter	-	-	1	211.48	-	-	-	-	1.00	-	-	-	-	.034
	Selling spinning sticks	-	-	1	9.78	-	-	-	1.00	-	-	-	-	.007	-
	Bicycle transportation	-	1	-	-	-	-	-	-	1.00	-	-	-	-	.001
	Petrol trading	1	2	1	123.42	-	-	-	.68	.32	-	-	-	.004	.005
	Lime trading	-	-	1	518.89	-	-	-	1.00	-	-	-	-	-	.001
	Corn beer sales	-	1	-	-	-	-	-	1.00	-	-	-	-	.005	-
	Sack trading	-	3	-	54.78	-	-	-	.98	.02	-	-	-	.003	-
	Total				108.47[c]										

a. For trading occupations, market shares have been calculated as the ratio between the gross value of sales made by each income strata to the aggregate value of sales for that occupation. For service employment market shares represent the ratio of gross earnings within each quintile to aggregate gross earnings for that service occupation.

b. Calculated as the ratio of net income generated by each quintile in each occupation to the aggregate net household income for that quintile.

c. Calculated as the simple average of each occupation mean in this income bias category.

recorded for "only low income" occupations, rising consecutively to ₦23.24, ₦35.06, ₦101.97, and ₦108.47 for each higher income occupational set.

Earnings shares from hired farm labor on fields of other households were symmetrically distributed among the income quintiles. The high (25 percent) market share derived by households in the richest quintile is an initially surprising result. The greatest proportion of labor time allocated to hired farm labor among high income households, however, was contributed by either young girls or elderly women working as pickers—activities pursued as much for social interaction with other women in the village as for economic gain. It is also clear that while both the lowest and highest quintile received one quarter of total farm labor earnings, these earnings were of considerably greater importance to the poorest quintile, representing 6.2 percent of total net household earnings, compared with only 2.6 percent of earnings for the richest quintile.

Of particular interest is the distribution of earnings obtained from three food related occupations —trading in local crops, trading in processed foods, and selling roasted meat. Each has been classified as "high income biased" with over 80 percent of gross sales occurring in the highest two quintiles. Earnings from trading in local crops constituted 10 percent of total income for the fifth quintile, while earnings from processed food trading and roasted meat sales each contributed approximately six percent to the total incomes of these high income households. The annual cash outlays associated with these activities were correspondingly substantial —₦314.42 for local crop trading, ₦352.96 for processed food trading, and ₦228.95 for roasted meat sales.

6.5. Average Labor Earnings in Non-Agricultural Occupations

Since hourly labor data were not collected from households in the large sample it was not possible to calculate returns to labor for each type of off-farm activity directly. Such data were obtained, however, for 23 occupations from the 35 households in the small sample. Table 6.5 summarizes these data disaggregating occupations according to the income bias categories derived from the large sample. It is clear that average returns to labor were consistently higher among those occupations pursued by higher income households.[1]

In summary, the types of off-farm employment pursued by the sample population varied systematically with household income status. High income households were more heavily engaged in those off-farm enterprises which required greater use of working capital and which as a result realized higher returns per labor hour. Because of their capital shortage, lower income households were excluded from the most profitable types of off-farm employment and instead tended to pursue lower return service activities. It can be concluded that the selection of off-farm occupations did tend to widen income disparities by providing profitable investment outlets for the surplus income generated by higher income households in their cropping enterprises.

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[1] Average hourly returns have been calculated as the net cash flow, plus additions to stocks valued at purchase prices, less depletions in stocks valued at sales prices, divided by the total hours worked by all household members. Depreciation of capital equipment were not costed. However, since most activities involved little or no fixed capital equipment, the results are not importantly affected. It is recalled that the occupational categorization set out in Table 6.4 was derived from the large sample whereas the observations used to estimate returns to labor were taken from the small sample. Thus the direct relation between returns to labor and income status is not the result of a simple tautology but reflects the profitability characteristics of the respective occupations.

Table 6.5 AVERAGE RETURNS PER HOUR REALIZED IN 23 OFF-FARM OCCUPATIONS DISAGGREGATED BY INCOME BIAS CATEGORY, SMALL SAMPLE[a] (IN NAIRA)

Income bias category	Occupation	No. of household observations	Average return per labor hour (in Naira)	Range of observed returns per hour (in Naira) Low	High
Low income only	Callabash cutting	1	.087	-	
	Total	1	.087[c]	-	
Low income bias	Trading provisions	1	.071	-	
	Tailoring	1	.203	-	
	Selling grass	3	.064	.063	.10
	Hauling water	1	.115	-	
	Total	6	.138[c]	.063	.203
Intermediate	Cap making	1	.154	-	
	Groundnut decortic.	1	.085	-	
	Selling firewood	8	.132	.057	.258
	Washing clothes	1	.075	-	
	Trading kola nuts	2	.128	.116	.132
	Trading used clothes	1	.151	-	
	Trading cloth	1	.268	-	
	Transporting soil[b]	4	.193	.118	.219
	Transporting crops[b]	1	.140	-	
	Mat making	1	.125	-	
	Total	21	.154[c]	.057	.268
High income bias	Barber	2	.151	.049	.160
	Praise singer/musician	2	.088	.087	.100
	Crop trading agent	4	.259	.064	.670
	Building construction	5	.110	.070	.123
	Sugar cane processor	1	.315	-	
	Trading groundnut oil	1	.043	-	
	Total	15	.195[c]	.043	.670
High income only	Bicycle transport	1	.075	-	
	Bicycle rental	1	.439	-	
	Total	2	.309[c]	.075	.439
	Total	45	.148[c]	.043	.670

a. Average hourly returns for each occupation were calculated by dividing aggregate net earnings by the total hours worked in the respective occupation or occupational category.

b. With donkey.

c. Calculated as the simple average of each occupation mean in this income bias category.

7. CONCLUSIONS AND POLICY IMPLICATIONS

The objective of this paper has been to examine the distribution and structure of personal income among a sample of farmers in the north of Nigeria and to provide insights into the factors influencing income variation. The study has placed particular emphasis on the lowest income households in an effort to better understand who constitutes the rural poor and why they remain in poverty. It is clear that the study's conclusions must be strictly qualified by the nature of the sample from which the data were drawn. Three villages were purposively chosen to minimize variation in climate and soils. Moreover, the surveyed populations were relatively homogenous with respect to both ethnic background and systems of production. Greater inequality would be expected if a wider range of conditions had been included in the survey. Similarly, major income correlates would be expected to vary regionally according to changing ecological, market, and institutional conditions.

7.1. Summary of Major Findings

Compared to estimates obtained through rural surveys conducted elsewhere in Nigeria and in other developing countries, a high degree of income equality was found within the study area. The Gini coefficient calculated on income per capita was only .2823, and the ratio of mean per capita incomes between the poorest and richest deciles was only 1:5. From a national perspective, however, the average income was at such a low level that even the richest households would be considered among the relatively poor in Nigeria more generally. The average per capita income of the upper 10 percent of households, for example, was only ₦99, or approximately half of the national average. Even among a subset of political elites who represented

the extreme rich in the three villages, the mean per capita income was only four fifths of the national average.

An important consequence of the low average level of income was the presence of absolute impoverishment. It was estimated that during the survey year the poorest quintile of households consumed approximately 20 percent fewer calories than the minimum F.A.O. standard. In short, while incomes were not highly concentrated within the survey villages, they reflected a high degree of relative poverty compared with the national population and a serious incidence of absolute poverty among the poorest households at the village level.

An examination of income correlates found that no single factor alone explained the major part of income variation. Instead a number of factors including the demographic makeup of the household, land use, levels of employment, and factor productivity, each contributed in various degrees to the income status of particular households. Thus the data suggested that the poorest households could not be accurately represented by a single farm type, but rather various combinations of factors accounted for the poverty status of particular subsets of low income households. Moreover, the relative importance of these causal factors was importantly related to village location.

An analysis of data on household size, composition, and age of head, for example, revealed that a life-cycle earnings pattern explained at least part of the poverty incidence. Three groups representing distinct stages in family development were disproportionately represented among the poorest households: (1) households headed by men under 25 years of age, (2) households headed by men 60 years or older, and (3) nuclear family units with

greater than average size. In each case, households within these poverty subsets were characterized by either extremely unfavorable consumer to worker ratios, or by low land inheritance.

The presence of a life-cycle earnings pattern is important for two reasons. First, it indicates that among traditional small farmers a significant proportion of poverty may be associated with the factors internal to the family. As a result only income transfers rather than production oriented policies would be effective in the short-run in reducing this type of poverty. Second, since households currently in poverty due to demographic factors represent stages through which most families pass in the course of normal development, if a longer term income concept were applied the degree of income equality would be even higher than that observed.

Although land holdings tended to be somewhat smaller among lower income households, the correlation between land and income was not high and showed important intervillage variation. Two sets of factors accounted for the weak association. First, in the two study villages with easiest access to external markets, higher income households generated a substantially greater proportion of their incomes in off-farm occupations. Second, an analysis of farm budgets showed that poorer households were less efficient producers realizing significantly lower returns to both land and labor compared with middle and high income producers. Reasons for variation in factor returns were not fully explored in this paper. Although lower income households farmed their land less intensively than high income producers, with respect to both labor and fertilizer differences in conventional factor use alone failed to explain a large proportion of the output differential. Moreover,

the data showed that differences in crop mix among income strata did not contribute to the productivity gap.

Patterns of labor use among adult males revealed a substantial degree of underemployment among all households, with particularily low employment recorded among low income farmers. Adult males from the lowest income families worked an average of only 1.8 hours per day annually, and 2.9 hours during the three month peak farming period. It was suggested that the low levels of employment among the poorest households reflected the combined effects of low marginal returns to farm labor, a relative land shortage, caloric inadequacy which may have reduced potential energy expenditure, and an insufficient demand for off-farm employment.

Off-farm employment, however, did provide an important supplemental source of immediate cash income for low income males to which they allocated 34 percent of their total working hours annually, and 22 percent during the peak farming months. These figures were substantially greater than the proportions recorded among middle and high income males. Moreover, the types of off-farm occupations were found to vary importantly among income strata. Lower income households specialized in unskilled, labor intensive, and low capital using activities which realized hourly returns to labor not significantly different from the hired farm labor wage. In contrast, off-farm enterprises of higher income households required greater inputs of working capital and as a result generated significantly higher returns to labor. Thus, variation in the types of off-farm occupations across income strata, due largely to corresponding variation in capital use, did tend to widen existing disparities.

A particularily interesting result of the analysis of crop mixtures was the high emphasis which the poorest farmers placed on groundnut production in spite of being in a calorie deficit situation. It was suggested that the lowest income households were too poor to pursue a food self-sufficiency strategy. A higher level of calorie consumption was achieved by the poorest households through the production and sale of groundnut, matched by subsequent grain purchases, than would have been possible through the domestic production of staple food grains. Due to the disproportionate emphasis given to groundnut, however, the poorest households were highly dependent upon the marketed surplus of high income producers in meeting their subsistence requirements.

7.2. Policy Conclusions

In drawing policy implications, it is necessary to distinguish between relative income inequality and absolute poverty, and between current patterns of distribution and future trends. Because incomes in the study area were not highly concentrated but rather displayed a relatively equal distribution, policy interventions to correct existing disparities are not called for. Given current technologies, the farming systems of the area are not sufficiently profitable, capital intensive, or technically complex to permit wide income differentials. In addition the continued availability of surplus land and a relatively egalitarian land tenure system have contributed to the maintenance of income equality.

Nevertheless in spite of the comparatively narrow range over which incomes varied, because average incomes were not greatly in excess of minimum subsistence requirements, a serious degree of absolute impoverishment was observed. For policy purposes, however, the problem of absolute

poverty is improperly addressed within a framework of relative inequality, that is, in the context of a redistribution strategy. Rather the major policy problem is the generally low level of income overall. Sufficiently improved and proven new farm technologies appropriate to farmers' conditions are not now available in northern Nigeria. As a result, yields of all crops remain at traditionally low levels. Furthermore, the extended dry season ensures considerable underemployment for most workers over a substantial part of each year.

In contrast to current patterns of relative income equality, the study identified several indicators which point toward the emergence of widening income disparities in the future. These include both structural changes in the composition of employment which are secularly associated with growth, as well as some preconditions for the emergence of agricultural dualism. When the three study villages were compared, income inequality was directly associated with the early stages of urban growth, with increasing population pressure, and with the growing importance of non-agricultural occupations. Moreover, within each village access to both modern formal education and extension assistance was disproportionately high among a limited number of political elites. Indeed, in several instances it was observed that village leaders used their positions of influence to divert government supplied inputs for their personal use. As employment in the modern sector increases, and as more profitable crop production technologies are developed which increase returns to extension assistance, it is clear that such patterns of privilege could lead to greater inequality.

The challenge for researchers and policy makers, then, is to devise interventions which not only make farming more profitable, but which ensure

the participation of low income household is thereby restricting the tendency towards dualism in the future. Perhaps the most fundamental means of increasing incomes while promoting broad benefit incidence is through the development of improved crop production packages which are compatable with the factor endowments of low income producers. Since the poorest households are currently net grain purchasers, priority should be given to the development of improved food grain technologies. Furthermore, in order to permit broad patterns of adoption, the technical package should economize on those factors most limiting for low income producers - capital and, quite possibly, management. "Minimum input" packages offer one possible approach. If an increased use of purchased inputs is required, it is clear that credit is essential for the poorest households.

Evidence of wide but unexplained farm productivity differentials among income classes suggests that systematic variation in either the production environment or management skills underlies the income distribution. Production environments could differ among income classes as the result of variation in the quality of land, labor, or variable inputs. Alternatively, because of their low liquidity position, poorer households may be more constrained in their ability to carry out prefered farming practices. It is possible, for example, that the need for low income households to divert their labor during critical farming periods to generate cash in off-farm employment may restrict them from performing key farm operations at required levels or at optimal times. An identification of such factors could provide valuable guidance in the design of improved technologies which are truly appropriate to low income producers. Such research is currently underway using the same data set.

A second strategy which holds considerable potential for improving incomes of a broad range of households is the generation of increased off-farm wage employment. The data showed that a shortage of capital effectively excludes most low income households from participation in a number of relatively profitable off-farm occupations. An increase in the rural demand for unskilled labor, for example through public works projects, would probably have an equitable though short-term income effect. The development of small scale labor intensive industries in rural areas to absorb surplus labor may hold even more promising longer run potential.

Finally it must be recognized that obstacles to ensuring broad participation in programs of development are not only technical and economic in nature but also institutional. Although existing village political systems can provide a vehicle to facilitate greater local involvement in both the design and implementation of village level programs, it should not be automatically assumed that the traditional leadership will, in fact, represent and promote the interests of all classes. The record on this issue is not yet clear in northern Nigeria generally. In order to minimize the abuses which may occur at the village level regarding access to development assistance, the role of traditional local leaders should be more closely monitored and, if necessary, circumscribed. Ultimately, the formation of alternative village institutions which mobilize wider segments of the rural population and which promote a broader range of interests may be necessary.

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APPENDIX A

Prices used to impute values to non-traded items were calculated as follows:

1. Crop harvest values - Harvest data were recorded during interviews in terms of local units of measure. These units were converted to final form (threshed or shelled) kilogram weights applying weight and conversion coefficients obtained in small sample supplemental interviews. Price data were obtained during monthly surveys conducted in each village market in which a sample of all crops available for sale were weighed and the retail price recorded. A weighted average of the monthly retail prices per kilogram observed for each crop was calculated for each village and applied to the harvests recorded in that village. The weights were computed separately by village and represented the proportion of each crop which was retained by the average farmer during each month. Since most crops were both consumed domestically and sold in the market, this approach is believed to reflect most accurately a weighted sum of the monthly opportunity costs of retention. In effect this weighting procedure gave greater weight to early post-harvest prices as opposed to later prices when stocks available for consumption and sale were correspondingly lower. The pricing procedure can be expressed as:

$$\bar{P}_j = \sum_{i=1}^{12} W_{ij} P_{ij}$$

where

$\bar{P}_j$ = weighted average price per kilogram for crop j

P_{ij} = retail price of crop j during month i

$$W_{ij} = \frac{(R_{i-1,j} - D_{ij}) / H_j}{\sum_{i=1}^{12} [(R_{i-1,j} - D_{ij}) / H_j)]}$$

$R_{i-1,j}$ = amount of crop j retained during the previous month

D_{ij} = total disposal of crop j during month i due to sales, consumption, and gifts

H_j = total harvest of crop j

and where R_{i-1j} D_{ji} and H_j were measured in kilograms. These calculations were made for each village using aggregated village data.

2. Seed and cuttings - The value of seed and cuttings planted was determined in each village as the simple average of observed prices actually paid for the seed or cutting of each crop, calculated in local units of measure.

3. Fertilizers - Organic fertilizers applied were also valued in each village as the simple average of observed prices actually paid for each type of manure in the respective units of measure. Chemical fertilizers applied were valued at the then current subsidized price set by Kano State (₦1.60 per cwt. for superphosphate and ₦2.00 per cwt. for ammonium sulfate).

4. In-kind payments - Payments in crops were valued at the weighted averages determined above. Payments of processed foods were valued at their current retail prices.

5. Changes in inventory - Positive changes in stocks of livestock, traded crops, and non-agricultural trading items were valued at their mean purchase value on an item by item basis. Negative changes were valued at the mean sale value of the respective items.

Table B.1 MEAN CONSUMER TO WORKER RATIO BY SIZE OF HOUSEHOLD AND AGE OF HEAD FOR NUCLEAR AND EXTENDED FAMILIES

Number of Residents Per Household	Age of Household Head													
	Nuclear Households							Extended Households						
	-24	25-29	30-39	40-49	50-59	60+	Total	-24	25-29	30-39	40-49	50-59	60+	Total
1-2	2.00	2.00	2.00				2.00							
3-4	2.25	3.00	1.90	2.17	2.13	3.0	2.29			1.75		1.50		1.60
5-6	4.00	3.50	3.10	2.70	2.00	4.0	3.00			2.00	1.51		2.5	1.72
7-8		4.00		3.33	2.25		3.03	1.67	2.00	2.17		2.4		2.22
9-10			3.00				3.00			2.42	2.12		2.33	2.24
11-12			2.33		7.00		4.67				2.67	2.50	2.25	2.47
13-14										4.00		3.00		3.50
15-16										2.20	1.83			2.01
17-18										1.71				1.71
19-20											2.6			2.60
21+												2.11		2.11
Total	2.63	3.13	2.42	2.55	3.00	3.50	2.66	1.67	2.00	2.21	1.90	2.22	2.33	2.10

Table B.2 MEAN HECTARES PER CONSUMER BY SIZE OF HOUSEHOLD AND AGE OF HEAD FOR NUCLEAR AND EXTENDED FAMILIES

Number of Residents Per Household	Age of Household Head													
	Nuclear Households							Extended Households						
	-24	25-29	30-39	40-49	50-59	60+	Total	-24	25-29	30-39	40-49	50-50	60+	Total
1-2	.55	.70	.73				.63							
3-4	.82	.55	.78	.65	.77	.27	.68			.92		1.26		1.12
5-6	.40	.58	.82	.52	.39	.35	.60			.84	.71	.53	.28	.70
7-8		.90		.50	.16		.44	.32	1.35	.66		.57		.62
9-10			.21				.21			.53	.43	.56		.48
11-12			.31		.20		.26				.98	.66	.35	.63
13-14										.15				.41
15-16										.24	.32			.28
17-18										.37				.37
19-20											.33			.33
21+												.15		.15
Total	.65	.62	.70	.58	.49	.31	.60	.32	1.35	.62	.62	.70	.42	.62

Table B.3 RELATIONSHIP BETWEEN AREA FARMED PER WORKER OFF-FARM INCOME AND THE CONSUMER TO WORKER RATIO

Variable	Cultivated Hectares per Worker	Consumer to Worker Ratio			
		1-1.9	2-2.9	3+	Total
Value of Off-Farm Income per Consumer (in Naira)	0-.4	-	11.93	-	11.93
	.5-.9	18.37	32.18	39.11	29.43
	1-1.4	18.98	20.78	13.18	18.69
	1.5-1.9	10.14	17.59	31.52	20.99
	2-2.4	9.75	39.77	49.00	37.46
	2.5-2.9	-	31.65	-	31.65
	3+	-	-	35.15	35.15
	Total	16.42	25.04	27.73	23.71
Off-Farm Income as a Percent of Income from all sources (in percent)	0-.4	-	30.8	-	30.8
	.5-.9	24.5	36.1	43.8	33.3
	1-1.4	15.2	24.8	26.0	22.9
	1.5-1.9	8.4	19.9	37.1	23.7
	2-2.4	6.3	29.9	38.8	29.1
	2.5-2.9	-	13.7	-	13.7
	3+	-	-	26.5	26.5
	Total	17.9	28.6	34.8	28.0
Cultivated Hectares per Worker		1.11	1.15	1.99	1.38

APPENDIX C

The effect of crop enterprise mix on land productivity variation across income strata was identified through the following procedures. The value of gross margins per hectare was regressed against a set of dummy variables indicating either the presence or absence of each of the major crops. To control for village effects, two village dummy variables were included as independent variables. To control further for differences in technique and productivity which might be associated with the income level of the farmer, dummy variables representing the income stratum of the operator of each farm were also included. Three income classes representing the low, middle, and high third of households were defined on the basis of the income per consumer calculated for each small sample household. The effect of differences in soil type was controlled by the inclusion of a dummy variable for lowland soil.

The regression equation was specified as follows:

$$Y_{km} = c + \sum_{y=1}^{2} b_y D_{ym} + \sum_{v=1}^{2} b_v D_{vm} + b_t D_{tkm} + \sum_{j=1}^{10} b_j D_{jkm} + e$$

where

Y_{km} = gross margins per hectare on field k for household m,

c = constant,

D_{ym} = dummy variable for income class y of household m,

D_{vm} = dummy variable for village v of household m

D_{tkm} = dummy variable for soil type t of field k of household m,

D_{jkm} = planting of crop j on field k of household m such that D_{jkm} is equal to 0 if crop j was not planted on field k, and

D_{jkm} is equal to 1 if crop j was planted on field k, and

e = error term.

Minor crops constituted the reference category for use of the crop dummy variables. The results of the regression are shown in Table C.1.

In order to determine whether the returns to land implied in the aggregate crop mix of each income class showed any systematic variation with income, a weighted sum of gross margins was calculated for each stratum. Ideally, the weights used in this calculation should be the proportion of land allocated to each major crop. As discussed in the text, however, the high degree of intercropping prevented this procedure. Instead, the share which each crop represented in the total harvest value of each stratum has been used. Although this approach gives disproportionate weight to higher valued crops and thus tends to exaggerate differences among strata, since the objective of this exercise is simply to determine the existence of systematic variation with income class, this bias does not pose a problem.

The weighted sum was calculated as follows:

$$R_s = \frac{\sum_{j=1}^{10} \left(\frac{V_{js}}{V_{ts}} \cdot R_j\right)}{\sum_{j=1}^{10} \frac{V_{js}}{V_{ts}}}$$

where

R_s = returns to land index for income stratum s,

V_{js} = the harvest value of crop j for stratum s,

V_{ts} = the total harvest value of all crops for stratum s, and

R_j = the returns to land coefficient for crop j.

Table C.1 RESULTS OF REGRESSION TO ESTIMATE EFFECT OF CROP MIX ON GROSS MARGINS PER HECTARE

Variable	Value of Coefficient	t-ratio
Constant	93.23	
Village		
Barbeji	11.56	.54
Rogo	.69	.03
Income Class		
Middle	17.02	.76
High	63.55	2.83
Land Type		
Lowland	-7.63	.20
Crops		
Onions	66.54	1.71
Peppers	46.32	1.27
Maize	38.73	1.35
Groundnut	32.37	1.68
Cowpea	31.64	1.67
Early Millet	1.64	.08
Late Millet	.21	.01
Rice	-52.36	1.75
Tall Sorghum	-62.79	2.17
Short Sorghum	-78.00	2.55

Number of observations = 160

R^2 = .3139

$\bar{R}^2$ = .2430

The division by $\sum_{i=1}^{10} \frac{V_{js}}{V_{ts}}$ has been done to adjust for differences among strata as to the proportion of total harvest value represented by the major crops. The results are presented in Table 6.3 in the text.

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