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HOUSEHOLD FOOD CONSUMPTION
IN RURAL SIERRA LEONE

By

Victor E. Smith, Sarah Lynch, William Whelan,
John Strauss and Doyle Baker

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HOUSEHOLD FOOD CONSUMPTION IN RURAL SIERRA LEONE*

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PREFACE

This report, which describes the food consumption patterns of rural households in Sierra Leone, constitutes the second stage of a study of the effects of economic policy on the consumption behavior and household nutrient intake levels of rural households in Sierra Leone. The first stage led to a report by Kathryn M. Kolasa, "The Nutritional Situation in Sierra Leone," Working Paper No. 2 in the MSU Rural Development Series.

The project as a whole is under the direction of Professor Victor E. Smith of the Department of Economics, Michigan State University, and financed under Contract No. AID/DSAN-C-0008 with the United States Agency for International Development (USAID). It makes use of data collected in Sierra Leone during 1974-75 by the Rural Employment Research Project at Njala University College, Sierra Leone. That project was financed by a contract (AID/cds 3625) between the United States Agency for International Development and Michigan State University, and by the Rockefeller Foundation.

The present study is based upon original data collected in Sierra Leone by the Njala Rural Employment Research Team under the direction of Dunstan S. C. Spencer, now with the West Africa Rice Development Association, Liberia, and Derek Byerlee, now with the International Wheat and Maize Improvement Center, Mexico. These two have been very generous with their time and knowledge in helping with the interpretation of the data, as have Robert P. King, now Assistant Professor, Department of Economics, Colorado State University, and Dean A. Linsenmeyer, formerly Research Fellow, Department of Agricultural Economics and Extension, Njala University College, Njala, and now Assistant Professor, Department of Agricultural Economics, University of Nebraska. In addition, we have had the assistance of Mr. Tom Roberts, Department of Agricultural Economics and Extension, Njala University College, Njala, and Joseph Tommy, Acting

Head, Department of Agricultural Economics and Extension, Njala University College, Freetown, both of whom were members of the Njala Rural Employment Research Team. Among those from the Michigan State University campus who have been particularly helpful to us are Alimani Kargbo, Graduate Student, Department of Agricultural Economics, Wayne Adams, Department of Crop and Soil Sciences, Mary Zehner and George Dike, Department of Agricultural Economics, and Lawrence Dawson and Jerry N. Cash, Department of Food Science and Human Nutrition. Finally, we thank our programmers, George Sionakides and Paul Wolberg, whose extra effort and patient perseverance were vital to the completion of this report. To all these and to many others we express our appreciation.

INTRODUCTION

Reutlinger and Selowsky recently estimated that in 1975 over a billion people would be receiving less than the recommended daily caloric intake. They saw little chance that growth in income and in food production would solve the problem. [1976, pp. 4, 7 and 30.] We know that population pressure and income inequality are major contributors to the problem of malnutrition. In many cases, however, the processes of economic development also contribute. In some cases, a worsening nutritional situation has been the unintended result of development policy choices. Even policies that increase food production do not necessarily improve the nutritional status of all segments of the population. In India, the Green Revolution brought improved wheat varieties but diverted land from use in the production of legumes badly needed in the Indian diet. In Latin America, the profitability of soybeans diverted land from the production of the black bean, used for food, and increased black bean prices. In Nicaragua, the development of shrimp and lobster fisheries provided an export industry for the country, but removed an important source of protein from the diets of local Indians. Adopting modern methods of agricultural production may force tenants off the land or reduce the quantity of labor hired. Lappé and Collins assert that in areas "where the production increases have been most notable, the well-being of the bottom half of the rural population, measured in levels of income and nutrition, has declined in not only relative, but absolute terms. The numbers of families below the poverty line quadrupled in the Punjab during the 1960's--the very state where the Green Revolution has most successfully increased yields." [1976, p. 3.]

Expansion of cash crop production may cause inadequate diets. In Nigeria, cocoyams and cassava have expanded at the expense of yams, to release land and labor for cocoa, rubber and palm oil. Because yams are traditionally grown with a mixture of other crops, lower yam production means fewer of the accompanying

crops, many of which are valuable sources of protein and vitamins. [Cf. Idusogie, 1969, pp. 39, 145, 156, 164-5, 208 and 233.]

Developing a capacity to predict the nutritional consequences of development policies is essential if we are to protect existing nutritional levels from harm and take effective action to reduce malnutrition. Only when we are able to predict the nutritional consequences of development programs will we be able to integrate the work of the agricultural, rural development, nutrition and health sectors and integrate policy making in these sectors with the planning process for the rest of the economy.

Lack of information about how the groups most at risk from malnutrition respond to changes in prices and incomes has been the principal barrier to the development of reliable estimates of the nutritional consequences of policies affecting income, employment and commodity prices. The purposes of the research project, of which this report is a part, are to develop methods for obtaining such information in the form of regression equations describing food consumption behavior and to use these regressions to estimate the consequences for food consumption and household nutrient intake of various economic policies.

We concentrate upon households producing large portions of their own food, for across the world as a whole such households constitute the greater number of those at risk from malnutrition. For these households we must depart from conventional economic analysis that regards the household as an agency that produces for the market and buys its food from the market. To understand decision-making processes in these households, it is necessary to use a combined household-firm model. The basic hypothesis of our research is that decisions concerning food consumption form part of a unified decision-making process which governs production decisions, decisions as to the extent to which households shall depend upon the market (either as a source of income or as a source of food) and

decisions as to the use of household labor in farm, non-farm or off-farm production activities. If food consumption decisions are affected not only by income and the prices of food purchased through the market, but also by the production decisions made in the course of deciding how to use resources for producing income, we shall obtain an adequate understanding of food consumption decisions only as we examine the whole set of decisions made by the household.

Little has been done along this line, partly because the data required are rarely available. In general, studies that collect data about the production process provide little or no information about food consumption, while studies that collect data about consumption expenditures provide little additional information about the individual household except family size, income or geographical location. Some studies do not provide even that, let alone information about prices, source of income or other relevant variables. In this study, however, we shall make use of an unusual data set collected by the African Rural Employment Survey in Sierra Leone during 1974-75. In this survey, detailed production and consumption information was collected for the same household. Data similar with respect to detail and coverage were also collected by Peter Matlon in three Kano State villages in northern Nigeria at about the same period. In a later stage of this research our project will use these two data sets to develop regression equations for the purpose of estimating food consumption behavior for households at risk from malnutrition.

Both sets of data were collected in a highly disaggregated form, extremely valuable for anyone interested in the nutritional consequences of food behavior. With such data it is possible to develop estimates of the complete set of food quantities consumed by each individual household in the sample. The purpose of this report is to present such estimates for the data from Sierra Leone.

The present report is concerned primarily with description, so we shall not push the analysis farther than is possible with simple tabulations of the quantities

of foods consumed for households of different characteristics. The tables will report the percentages of the various foods consumed that are produced at home and will show how food consumption patterns in our sample vary with the level of household income per consumer unit, the number of adult male consumer equivalents in the household, the dependency ratio, the geographical area, population density, the percentage of household labor devoted to upland rice, and the market orientation of the household. Data so detailed about food consumption patterns in rural Sierra Leone and the factors that affect them have simply not existed prior to this study. When we begin our econometric work, in the next stage of this research, we shall also take into account the effects of commodity prices, on which we provide no information in this report. These vary considerably from household to household and from one part of the country to another.

CHAPTER I

SIERRA LEONE

Sierra Leone is a country of some three million inhabitants (occupying an area of 28,000 square miles). It lies between seven and ten degrees north of the equator and ranges in altitude from sea level to 6,390 feet (the top of Mount Bintimani). [The International Bank for Reconstruction and Development, 1978, p. 27; Sierra Leone, Surveys & Lands Division, 1966, pp. 6, 7, III.] Mount Bintimani, or Loma Mansa, is the highest point in West Africa. [Kaplan et al., 1976, p. vii.]

Aside from the mountainous peninsula on which Freetown is located, the land rises gradually from coastal swamplands through plains and low plateaus, to scattered areas of hills and mountains in the far northeast. Annual rainfall varies from 200 inches along the coast to 80 inches in the north, with less than 80 inches in a very small area along the Guinea border. There are distinct wet and dry seasons, the rainy season extending from May through November. Some eighteen ethnic groups inhabit the country. The Mende and the Temne, nearly equal in number, constitute more than 60 percent of the total population. [Kaplan et al., 1976, pp. vii, 45-6.]

Except for the forest reserve areas, little is left of the primary rain forest that once covered much of Sierra Leone. The original forest has been replaced, for the most part, by secondary growth characteristic of the practice of shifting cultivation: after the period of cultivation comes farm bush, then thicket, and finally low secondary forest. North of the original forest area is a forest-savanna mosaic, with moist semi-deciduous forests and savannah woodland intermingled. North of the forest-savanna mosaic is a band of savanna woodland. Deviating from this major pattern are the mangrove swamp forests along the coast and two important types of grasslands: the bolilands of the Northern Province and the

riverain grasslands of the lower flood plains of the Sewa and Waanje rivers in southwest Sierra Leone. The boliland area is underlain by rocks that are rather easily eroded. This results in large saucerlike depressions (boli) which become flooded during the rainy seasons, retain water for a considerable part of the year, and are useful for wet rice cultivation. [Kaplan et al., 1976, pp. 49-51.]

Although 75 percent of the working population of Sierra Leone is engaged in agriculture (including forestry, hunting and fishing),[1] the sector provides only some 35 percent of the gross domestic product.[2] The total gross domestic product at factor cost was 521 million Leones in 1974-75 [Ibid., p. 53.]

The per capita gross national product (GNP) of Sierra Leone amounted to 190 U.S. dollars in both 1975 and 1976. Sierra Leone was one of 29 countries (over half of them in Africa) that had per capita incomes smaller than $200 per year in 1976. In real terms, the Sierra Leonese per capita GNP grew 1.5 percent per year over the period from 1964 to 1976, but between 1970 and 1976 it declined by 0.8 percent per year. [The International Bank for Reconstruction and Development, 1978, pp. 4, 6, 27.]

The Sub-Sahara low-income countries (including Sierra Leone) had an estimated population of 131 million in 1970; the projected population for this group of countries in 1985 is 197 million, according to the International Food Policy Research Institute. [1976, pp. 45-47. Hereafter cited as IFPRI.] This represents an increase of more than 50 percent in the number of people to be fed. IFPRI warns that the malnutrition that now exists in Sub-Saharan Africa is not likely to disappear:

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[1]The figure is for 1972. [Sierra Leone. Ministry of Development and Economic Planning, 1974, p. 23.]

[2]Thirty-six percent in 1974-75. [Sierra Leone. Central Statistics Office, 1976, p. 51.]

"The production growth rate of 1.9 percent runs substantially below population growth. During 1967-74, it was slightly negative. The cereal deficit is projected to rise from less than half a million tons in 1969-71 and over one million in 1974/75 to 4-5 million tons by 1985. Even if the deficit is met, per capita consumption will hardly be improved over 1969-71 levels. To meet the deficit internally, a production growth rate of 3.6 percent a year would be required." [IFPRI, 1976, p. 38.]

CHAPTER II

THE EXISTING SITUATION

Prior to 1978, most information available concerning the nutritional status and food consumption behavior of the people of Sierra Leone came from a few studies completed in the 1960s and early 1970s. The material dealt primarily with children under six years old and pregnant and lactating women. Little was known about other age groups. [Kolasa, 1979, pp. 1, 52.] Kolasa provides an excellent survey of the information available in 1978.

Nutrition

As the result of a National Nutrition Survey completed in early 1978 by the Ministry of Health of Sierra Leone (MOH), in cooperation with the University of California, Los Angeles, up-to-date information is now available concerning the nutritional condition of children under five. The principal nutritional problems in this group are undernutrition and anemia. Both are more serious in rural than in urban areas. (Anemia, of course, may stem from other than dietary causes.)

Undernutrition may be manifested as states of underweight, chronic undernutrition or acute undernutrition. In Sierra Leone as a whole 30.5 percent of the young children are underweight. The condition is most prevalent in rural Sierra Leone (32.4 percent) and least prevalent in Freetown (18.3 percent). The Eastern Province, with a rate of 26.0 percent, appears to be somewhat better off than the Northern and Southern Provinces, with rates of 32.7 and 33.4 percent, respectively. [Sierra Leone, National Nutrition Survey, 1978, pp. xv, 40. Hereafter cited as Nutrition Survey.]

In the MOH/UCLA survey a child was classified as underweight if he weighed less than 80 percent of the expected weight for a reference child the same age. If

a young child is underweight for his age, this indicates a prior lack of protein and/or calories available to the body tissues, but not when the problem began or how long it continued. The prevalence of underweight as a condition is frequently similar to that of chronic undernutrition. [Nutrition Survey, p. xv.]

Chronic undernutrition, in young children, results from a prolonged period of such a nutritional deficiency or recurrent episodes of deficiencies. The period or periods of deficiency usually occurred at least six months before the child was identified as chronically undernourished. Chronic undernutrition is usually the result of poor diet and/or poor health because of acute infection and diarrheal disease. [Nutrition Survey, p. xii.]

In the MOH/UCLA survey a child less than 90 percent of the expected height for a reference child of the same age was classified as chronically undernourished. In the country as a whole, 24.2 percent of the young children were chronically undernourished. The situation was the worst in rural Sierra Leone, where the prevalence rate was 26.6 percent. In urban areas generally, the rate was 17.4 percent, but in Freetown it was as low as 10.3 percent. [Nutrition Survey, pp. xii-xiii.]

Acute undernutrition was far less prevalent. Acute undernutrition reflects a recent period of protein and/or calorie deficiency, usually having begun no more than a few weeks prior to the date of the examination of the child. A child was classified as acutely undernourished if he weighed less than 80 percent of the expected weight for a reference child of the same height. In Sierra Leone as a whole, only 3.0 percent of the young children were acutely undernourished. However, the rate was three times as high (9.3 percent) for children of 12 to 14 months of age. The Nutrition Survey was taken between November and March, a period when food was relatively plentiful. Thus the more difficult circumstances that prevailed later in the agricultural year (during the rainy season) were not reflected in its observations. [Nutrition Survey, pp. xiv-xv.]

Anemia is widespread among children in Sierra Leone. Two different measures were used in the MOH/UCLA survey. Low hemoglobin values were found in 58.1 percent of the children aged 6 to 59 months. They were still more common (65.8 percent of the cases) among children aged 24 to 59 months. Again Freetown (25.7 percent) had the lowest rates. [Nutrition Survey, p. xxii.]

Identification of anemia by examination of thin blood films gave similar results for Sierra Leone as a whole. Among children aged 6 to 59 months, an anemic blood picture was found in 51.5 percent of the cases. Such blood pictures were exceedingly rare (3.7 percent) in Freetown, but occurred in 76.6 percent of the children in the Southern Province. In the Eastern Province they were found 57.2 percent of the time and in the North 42.7 percent of the time.

For the country as a whole, 73 percent of the cases of anemia were classified as mild, 26 percent as moderate, and 1 percent as severe. The type of anemia found suggested that iron deficiency was the major factor and that folate deficiency, although also important, was much less so. Malaria was another major factor contributing to anemia, as hookworm infestation may also have been. [Nutrition Survey, pp. xxii, xxiv, 86-89.]

In summary, the principal nutritional problems of young children in Sierra Leone were undernutrition and anemia. Chronic undernutrition and underweight affected 24 and 30 percent of the children under five, while anemia (which may be partly of nutritional origin) affected over 50 percent. Each of these problems was more serious in rural than in urban areas.

The completion of the National Nutrition Survey provided definitive information with respect to the incidence of malnutrition among young children. Its results are no less important because they confirmed what had previously been believed to be the situation; efforts to deal with nutritional problems are more effective when based on up-to-date facts than when the basis is opinion or outdated

information. It is unfortunate that comparable information is not available with respect to the adult population of Sierra Leone, but the decision to concentrate on the problems of young children was wise in view of the ever present limitation of resources.

Two inferences may be drawn about the adult population from the situation among the children. Presumably anemia is common among adult women as well as children, while chronic undernutrition among children would be expected to result in a rather short adult population some years later. These smaller adults might, however, be adequately fed for their size.

Food Consumption

Information on food consumption is still extremely limited. The principal sources are the household expenditure surveys conducted by the Central Statistics Office of the Government of Sierra Leone and the data on food expenditures in rural households collected in 1974-75 by the Rural Employment Research Project at Njala University College. The Central Statistics Office conducted its first general purpose household survey between 1966 and 1970, beginning in the Western Area, going next to the urban portions of the three provinces, and finally covering rural areas. The survey provides information on expenditures on fourteen groups of foods by geographic area, income group, household size and season of the year. There are data that give the average quantities of some 65 to 75 foods purchased per household per week, by geographical area. [Sierra Leone, Central Statistics Office. Household Survey: 1968; 1971a, b, c; 1972.] Another household expenditure survey was done in 1976, but the report has not yet been published [Rhodes, 1978].

Although these surveys provide a great deal of useful information about food expenditures and the quantities purchased, the quantity data do not extend to all of the foods consumed by the household, so it is not possible to evaluate nutrient

intake levels from them. Consequently it is impossible to examine the relationship between household nutrient intake and income or patterns of food expenditure. An adequate understanding of the determinants of malnutrition requires that these relationships be understood. Within the next few years the Central Statistics Office plans to conduct a nutrition-consumption survey which will help to fill this gap [Rhodes, 1978].

The only comprehensive study of expenditures based on recent data is the study of rural households done by King and Byerlee [1977]. It is based on a 1974-75 survey conducted by the Rural Employment Research Project, Njala University College, University of Sierra Leone. The value of food or other articles of consumption produced by the household is included as a part of "expenditures." (This value was estimated by subtracting farm sales from the value of output at the farm.)

According to the estimates of King and Byerlee, 48 percent of the value of household consumption consisted of goods produced and consumed by the same household. Food expenditures represented 70 percent of the value of all consumption, while rice alone accounted for over 39 percent of the total. Food expenditures, including beverages and tobacco, were grouped into only eleven categories, so not much detail is available. No data are given on the quantities of food consumed. [King and Byerlee, 1977, pp. 10-11, 15, 20-22.]

Anyone interested in the physical well-being and nutritional status of the people of Sierra Leone must be interested in the physical quantities of foods consumed, not simply in the amounts of money spent on food. Moreover, food consumption patterns must be described in considerable detail. To deal with broad groups of commodities like cereals, root crops, fruits, or vegetables overlooks entirely very real nutritional differences that exist between different components of those groups. The vitamin A and vitamin C content of dark green leaves

("spinach," pigweed, sweet potato tops and so forth) is high, but eggplant and dry onions are relatively low in these two vitamins. Mangoes and papayas are excellent sources of vitamin A; citrus fruits are relatively poor sources. In addition, the composition of any of these groups may change greatly from one part of the country to another, so the same classification may have different nutritional significance from area to area.

Fortunately, the same survey of rural households whence the King and Byerlee expenditure data came also obtained data on the physical quantities of items purchased or produced by the household, using an extremely detailed commodity list. These data form the basis for the estimates of household food consumption to be presented in this report.

To understand the nutritional problems of any country, it is necessary not only to know what people are consuming but also what factors determine the quantities of food consumed. Most surveys of food consumption collect little information useful for explaining food consumption behavior other than family size, income, or geographical location. Some do not provide even that, let alone information about prices, source of income, or other relevant variables. The data we are using constitute a rare exception. The Rural Employment Research Project collected them as part of an integrated micro-level survey that obtained a wealth of information about each household: information about household size and composition, incomes, farm and nonfarm production activities (including trading, fishing and small-scale industry), prices of goods bought or sold, labor hired from or sold to other households, and a great deal more. The availability of supplemental information of this sort makes it possible to go beyond mere description of food consumption patterns to an inquiry into how consumption is affected by such factors as the number of consumer units in the household, the income per consumer unit, the dependency ratio, population density, the market orientation of the household, or the type of farming in which the household engages.

The tables in this report will show some of the relationships between food consumption behavior and such variables. In later reports, using econometric techniques, we shall also examine the influence of prices, consider the effects of several variables operating simultaneously, and obtain quantitative estimates of the relationships involved.

The fact that our consumption data were collected as part of a larger survey of household production activities creates limitations as well as opportunities. Food consumption was not the central focus of the investigation, so there was not the same emphasis on precision that there was with respect to the major farming activities (rice production, in particular). A study designed solely to obtain food consumption information for use in estimating household nutrient intake might have used shorter recall periods, for instance, or provided for weighing of the quantities of food consumed. Given these limitations, we use our data with caution, for we are reluctant to impose a burden they were not intended to carry. However, to conduct a survey of household consumption explicitly for the purpose of evaluating nutrient intake levels is an extremely expensive undertaking. Furthermore, such surveys normally concentrate on the accurate recording of food consumption to the exclusion of most of the information the economist needs for analysis of the economic determinants of food consumption patterns. Nutrient intake studies often are very casual about the household income data collected (if any), they rarely collect price information from the households actually being studied (or, indeed, any price information at all), and they almost never (if ever) obtain data concerning farm operations. In short, while our data are not ideal with respect to the description of food consumption patterns, they are at least adequate and far superior to the data usually available when it comes to information on household composition, incomes, the prices actually paid by the household, and farm production operations. With these data we can carry out an analysis of the

economic determinants of food consumption patterns such as is normally impossible with data collected primarily to record food consumption or nutrient intake levels.

CHAPTER III

THE AFRICAN RURAL EMPLOYMENT SURVEY

The Sierra Leone data were collected as a part of the African Rural Employment Project, undertaken for the purpose of providing an improved analytical and empirical foundation for evaluating the employment and output effects of alternative development policies. The Njala Rural Employment Research Team, based at Njala University College, Sierra Leone, carried out the data collection, under the direction of Dr. Dunstan S. C. Spencer, then Lecturer in the Department of Agricultural Economics at Njala University College. He was assisted by Dr. Derek Byerlee, Assistant Professor of Agricultural Economics at Michigan State University, as well as other staff members of Njala University College and Michigan State University. [Byerlee and Eicher, 1974, pp. 52-53.]

Purposes

The project consisted of a number of carefully designed interrelated studies at the core of which was a comprehensive nationwide survey of rural household farm and nonfarm activities in Sierra Leone. Associated with this was a study of the consumption expenditures of these households, a study of small-scale industry operations (whether rural or urban), a study of migration for which data were collected in both rural and urban areas, a marketing study, and a study of the fisheries industry (largely a rural activity). The farm level study was concerned with (1) determining costs, returns, and labor productivity under different farming systems in Sierra Leone; (2) evaluating the effects of alternative technological systems upon output, employment, and incomes among small farmers; (3) examining the rural household as a source of on-farm and off-farm employment and as a source of rural labor; and (4) identifying and describing the different types of small

farmers operating in Sierra Leone. [Byerlee and Eicher, 1974, p. 53; Byerlee, Tommy and Fatoo, 1976, p. 11; Spencer and Byerlee, 1977, p. 2.] The principal objectives of the consumption study were to (1) describe consumption patterns in rural Sierra Leone; (2) estimate income elasticities to be used in projecting consumer demands for specific commodities; (3) analyze the effects on labor, capital, and foreign exchange requirements of the changes in consumption patterns caused by changes in income levels; and (4) study the effects of changes in rural incomes on the factor intensities and location of production for rural consumption. [King and Byerlee, 1977, pp. 4, 69.]

The Sample

The food consumption data presented in this report come from the farm level study and the associated rural consumption study. In drawing the sample, the rural area of Sierra Leone was first divided into eight resource regions, based on their differing ecological characteristics. These are shown in Figure 3.1. Two parts of the country were not included: the Western Area because it is primarily urban and the area around Koidu because it is the diamond mining area. Each resource region was then subdivided into the enumeration areas used by the Central Statistics Office for the 1963 population census. (Each enumeration area was approximately 10 miles square and contained roughly 130 farm families, located in one to ten villages.) Each enumeration area was rejected that fell into or contained an urban area (defined as a locality of more than 2,000 people with more than 50% of the labor force engaged in nonfarm activity). From the enumeration areas that remained, three were selected at random to represent each resource region. This generated a total of 24 enumeration areas to be included in the sample. [Spencer and Byerlee, 1977, pp. 7, 9.]

Region Codes

1. Scarcies
2. Southern Coast
3. Northern Plains
4. Riverain Grasslands
5. Bolilands
6. Upper Moa Basin
7. Northern Plateau
8. Southern Plains

FIGURE 3.1
SIERRA LEONE RURAL RESOURCE REGIONS

Though the same number of enumeration areas was selected from each resource region, there was great variation in the percentage of rural households sampled in each region. This was due to the significant differences in the total population of each resource region. The range in percentage of households sampled per resource region was from .08% to .64% with a mean of .18%. [Spencer and Byerlee, 1977, p. 9.]

To establish the sample frame, enumerators visited each of the households in each enumeration area selected for study. Recorded for each household were the name and sex of the household head, the crops grown, and any nonfarm occupations of household members. A stratified sample of 20 farm households and 4 nonfarm households was then chosen at random from this sample frame. Given the intensive interview schedule to be followed, it was decided that 24 households per enumeration area was the maximum number that could be handled by one enumerator. [Ibid., pp. 7, 9.]

In the original survey design, more than 500 households were to be interviewed to obtain micro-level farm data. However, during the course of survey implementation and processing, certain households had to be dropped from the survey. Reasons for this included deaths within the household, movement from the village, unsatisfactory enumerators, and households where there were severe problems with missing data. [Ibid., p. 9.]

Approximately one-half of the households included in the farm production survey were chosen at random to participate in the consumption expenditure survey to be administered during the same period. Only part of the original sample was included in the expenditure survey in order not to overburden and fatigue respondents and/or enumerators. From each enumeration area one-half (12) of the households originally included were chosen randomly to participate in the expenditure survey. For convenience, the sample households were divided into four groups,

each containing three households. Each household in each group corresponded to a week in the month. Thus, the first household in each group was to be interviewed in the first week of each month, the second household in each group in the second week, and so on through the month.

Households chosen to participate in the consumption expenditures survey were administered two questionnaires. Different reference periods were used with the two questionnaires in order to reduce the bias in response due to memory decay. The C-1 questionnaire was used to record daily expenditures on food, beverages, tobacco, and other frequently purchased items. It was administered twice a month, each visit covering the expenditures of the four previous days.

The C-2 questionnaire asked respondents to report purchases of durable goods or less frequently purchased goods. This questionnaire was administered once a month, supposedly at the end of the month. It had a reference period of one month. Checks were made during data processing to ensure that purchases reported on one form were not also included on the other.

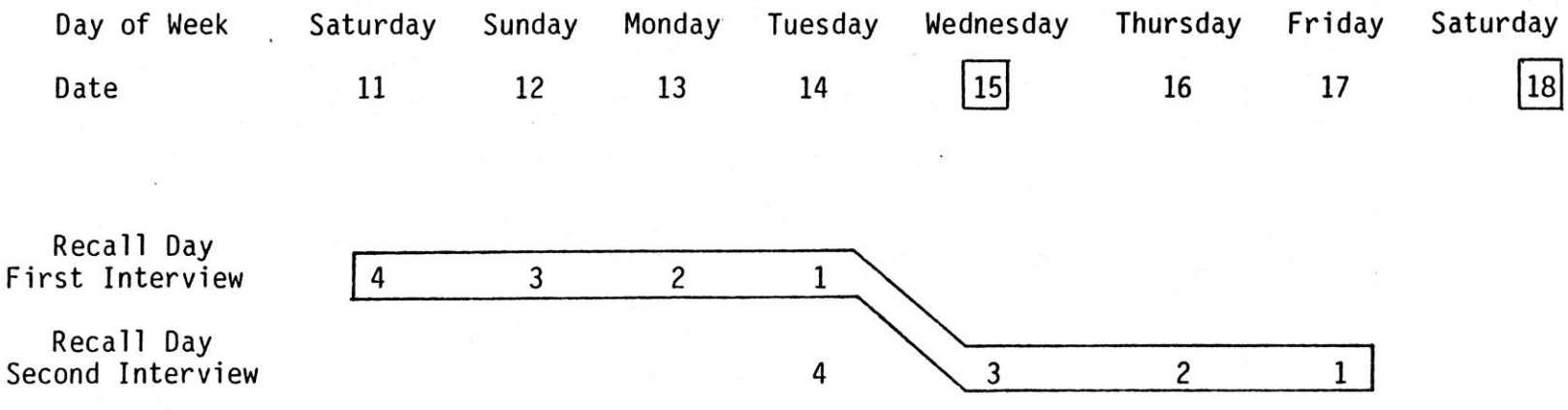
Both questionnaires allowed respondents to report purchases for a highly disaggregated set of commodities. Very specific information was requested on each purchase. The type and/or brand, if known, of each item was recorded. Both the quantity purchased and the total expenditure on each item were recorded. The unit in which the quantity was measured was also specified. In addition, detailed information was collected on where the item was purchased, e.g., in the village market, at a store, from a trader, etc.

The Interview Pattern

The farm production survey extended over the entire agricultural year, from March 1974 to May or June 1975. The households included were interviewed twice weekly over a 14-month survey period. Using a four-day reference period at each

interview session, daily data were obtained on labor inputs and outputs for farm and nonfarm activities and enterprises. Other types of farm production data were gathered through the use of seven other questionnaires, using varying interview schedules and reference periods.

The expenditure survey was given less frequently, but was intended to provide a record of daily expenditures for seven consecutive days in each month, plus a once-a-month record of all the larger or less frequent expenditures of the month. The C-1 questionnaire, which recorded daily expenditures on items purchased frequently, was given twice during one week of each month, the second interview taking place three days after the first. As each interview covered the four preceding days, the first day covered by the second interview was the same as the most recent day covered by the first interview. Figure 3.2 gives an example of an interview schedule for a given household. The numbers 4, 3, 2, and 1 refer to the day of recall for which the information was collected (whether the information was being recalled for 1, 2, 3, or 4 days before the interview date). If the first questionnaire was administered on the 15th of the month, then expenditures reported on Wednesday the 14th represent a one-day recall period, expenditures reported for Tuesday the 13th reflect recall for two days, Monday the 12th for three days, etc. The second interview took place three days later, in this example on Saturday the 18th. The same four-day reference period was used. As the figure indicates, there is an "overlap" day that is common to both the first and second interviews. This overlap day, the fourth day of recall at the second interview, was identified by a special code during the processing of the data so that it would not be counted twice. The only reason for its collection was to maintain a consistent pattern that would not be too confusing for interviewers and respondents.



Interview dates are Wednesday the 15th and Saturday the 18th.

FIGURE 3.2

SAMPLE INTERVIEW SCHEDULE

CHAPTER IV

INCOMES IN RURAL SIERRA LEONE

Food consumption patterns in developing countries are largely determined by agricultural production patterns and levels of income. The best recent information on rural incomes in Sierra Leone is that which was developed for 1974-75 from African Rural Employment Survey data, using a sample of 328 rural households. (Chapter III describes the sampling procedure.) Spencer and Byerlee [1977] and Matlon et al. [1979] have made comprehensive studies of income levels, sources of income and the distribution of income. In this chapter, using their data, we present a brief picture of income levels and the distribution of incomes among the households in their sample.

In 1974-75 the mean annual household income for the sample was 519 Leones; the median 397. Household incomes ranged from -5 Leones to Le 3284. Table 4.1 gives the frequency distribution. (See Column 1 and Figure 4.1.)

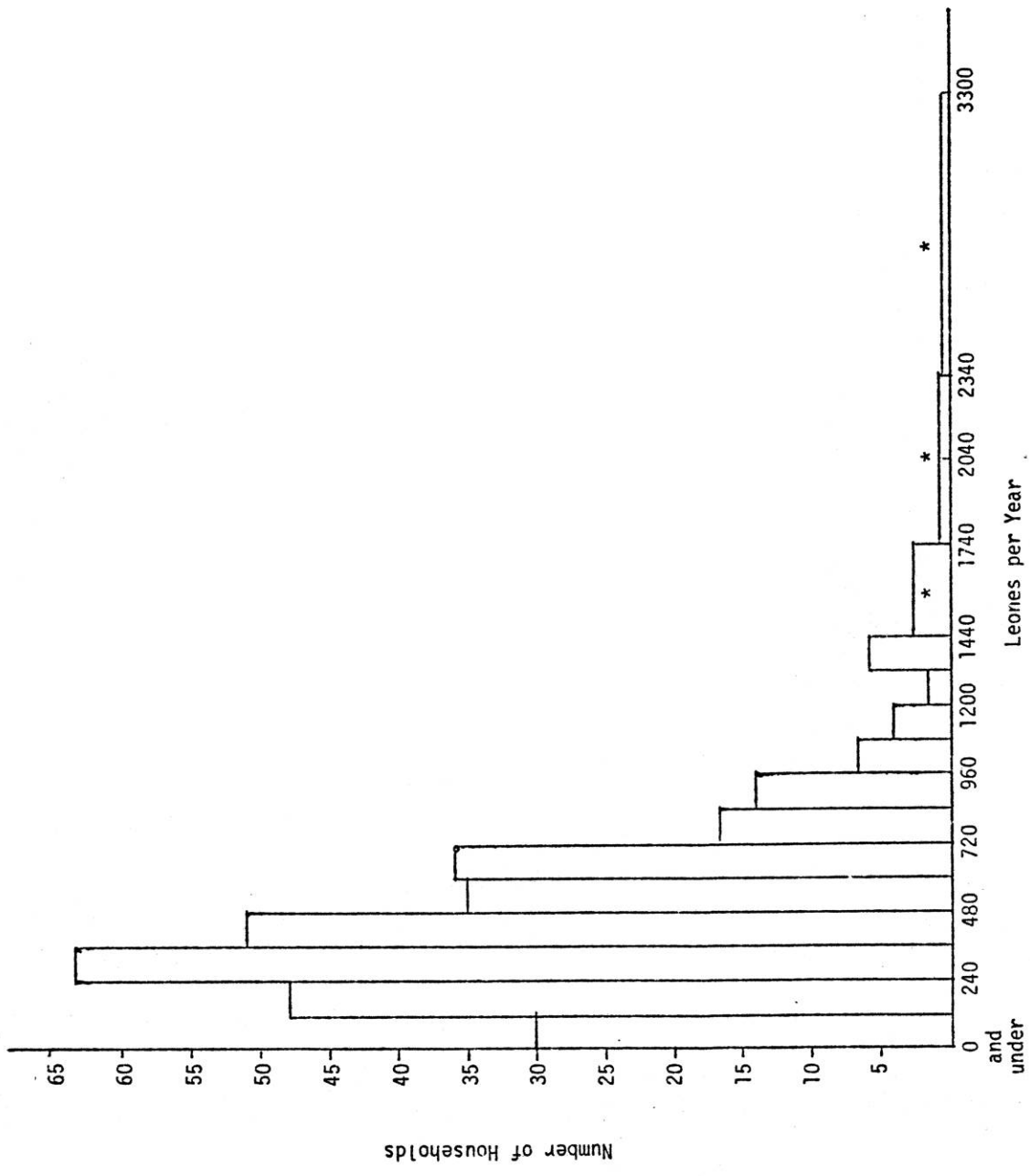
If we divide the distribution into deciles, 30 percent of the households received incomes of Le 280 or less and 90 percent incomes of Le 984 or less. The upper 10 percent of the sample, however, received incomes that ranged from Le 985 to Le 3284, a greater range than that covered by the incomes of all the remaining 90 percent.

The ability to provide an adequate diet depends less upon the amount of household income than upon the ratio of that income to the number of claimants upon it. Therefore we present also in Table 4.1 the distribution of households by income per capita (Column II) and income per adult male consumer equivalent (Column III). The adult male consumer equivalents were calculated by weighting

TABLE 4.1
HOUSEHOLD INCOMES, RURAL SIERRA LEONE

Income Class (Leones[a] per year, 1974-75)	Number of Households I Net Household Income	II Net Household Income per Capita	III Net Household Income per Consumer Equivalent	Income Class[a] (Leones per year, 1974-75)
-5.0 to 120	30	26	16	-2.0- 20
120.1-240	48	51	30	20.1- 40
240.1-360	63	53	47	40.1- 60
360.1-480	51	47	36	60.1- 80
480.1-600	35	37	41	80.1-100
600.1-720	36	25	33	100.1-120
720.1-840	17	22	24	120.1-140
840.1-960	14	9	20	140.1-160
960.1-1080	7	18	15	160.1-180
1080.1-1200	4	9	8	180.1-200
1200.1-1320	2	9	10	200.1-220
1320.1-1440	6	9	14	220.1-240
. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
1440.1-1740	8	7	19	240.1-290
1740.1-2040	2	5	8	290.1-340
2040.1-2340	2	0	4	340.1-390
. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
2340.1-3300	3	1	3	390.1-550
Total	328	328	328	

[a]At the official exchange rate, Le 1.00 = U.S. $1.10, during 1974/75.



*Frequencies adjusted for size of class interval.

FIGURE 4.1
NET HOUSEHOLD INCOME

each member of the household by a coefficient representing approximate calorie requirements. The coefficients were as follows:

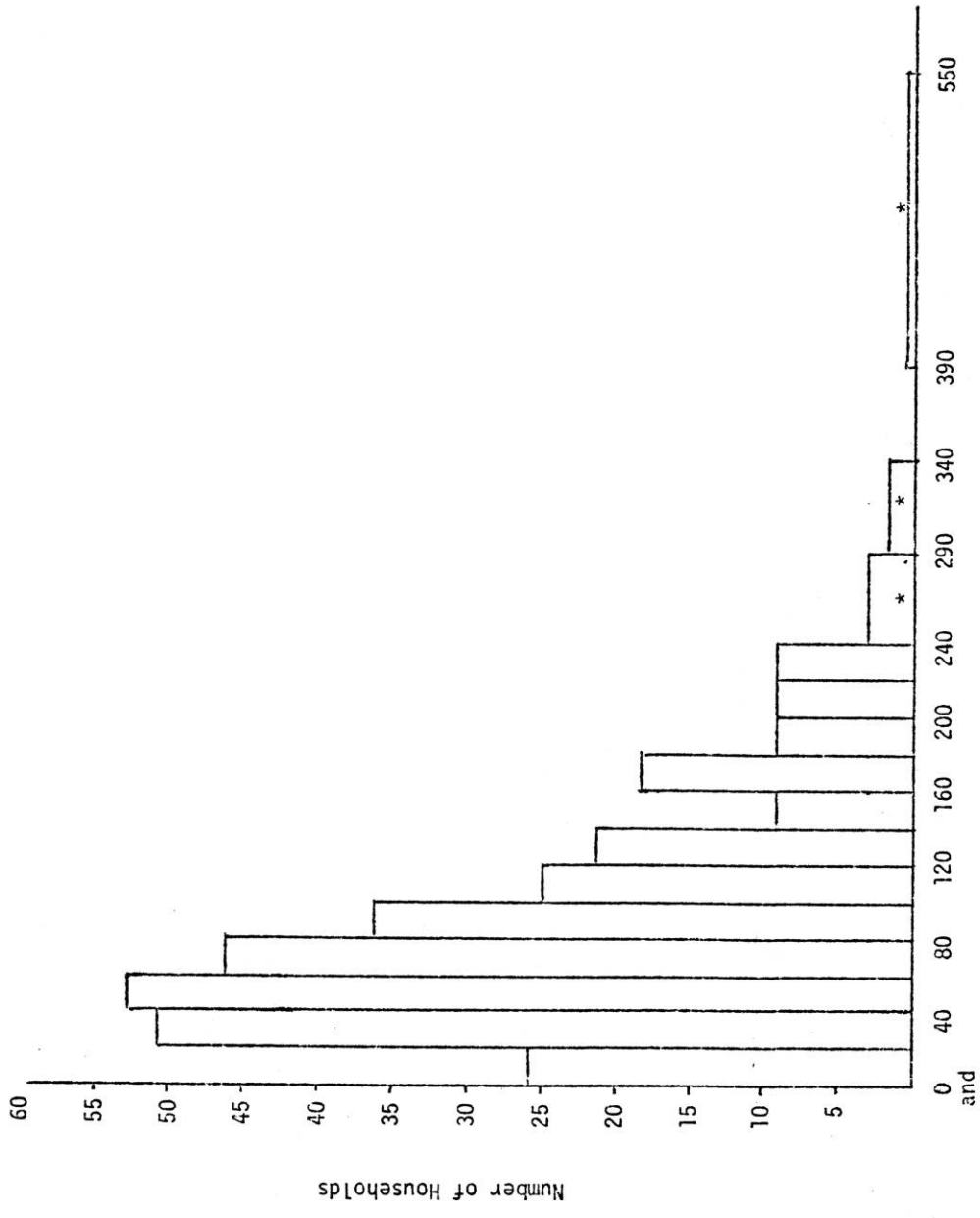
Sex	Age			
	0-5	6-10	11-15	16+
Male	.2	.5	.75	1.0
Female	.2	.5	.70	.9

The mean and median household incomes per capita were Le 94 and Le 74, respectively; per consumer equivalent the mean was Le 120 and the median Le 98.

Large households tend to have large incomes, because they are likely to have more workers, but if household size were the only variable accounting for differences in income, all the households would fall into the same income class when grouped by income per capita. That the frequency distribution in Column II (or Figure 4.2) is so much like that in Column I (or Figure 4.1) reveals the importance of variables other than size as determinants of household income.

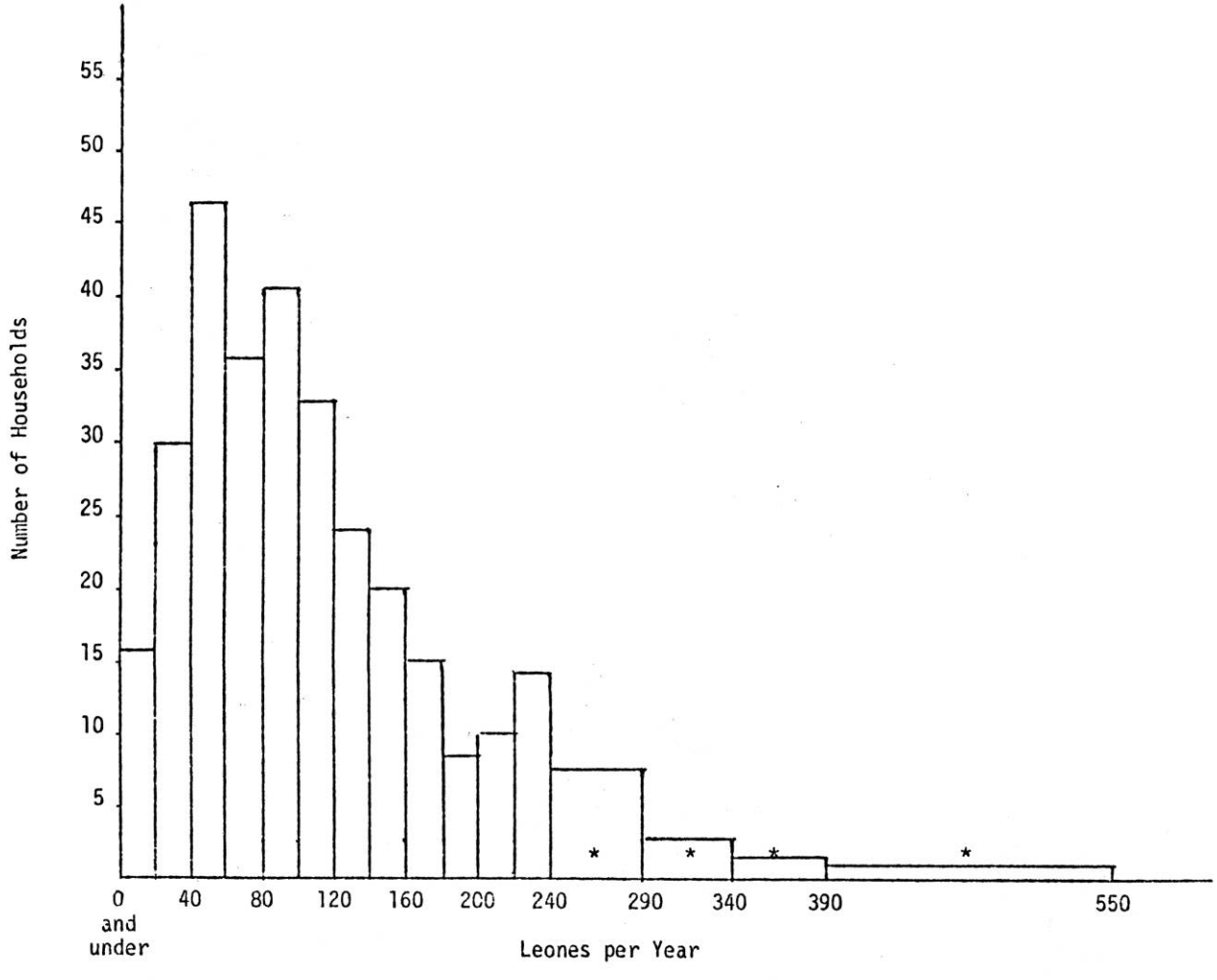
Of the three income measures presented in Table 4.1, the most relevant for food consumption choices is income per male consumer equivalent (Figure 4.3). This measure takes account of differences in food needs among the members of the household. The child of 18 months and the 18-year-old male impose very different demands on the household budget.

Incomes per consumer equivalent tend to be somewhat higher than per capita incomes because young persons and females are given smaller weights when



*Frequencies adjusted for size of class interval.

FIGURE 4.2
NET HOUSEHOLD INCOME PER CAPITA



*Frequencies adjusted for size of class interval.

FIGURE 4.3
NET HOUSEHOLD INCOME PER ADULT MALE CONSUMER EQUIVALENT

calculating the number of consumer equivalents than when counting the number of persons in the household. The figure that we will make most use of in our later analysis will be the income per consumer equivalent. We include the per capita income figures here because it is a more familiar concept which can provide a benchmark for our interpretation of income per consumer equivalent.

Table 4.2 shows how the size of the household varied within the sample. The median size was 5.15; the mean was 6.44. Forty percent of the households had 4 or fewer members; ten percent had 13 or more.

TABLE 4.2
SIZE OF HOUSEHOLD, RURAL SIERRA LEONE

Number of Persons	Number of Households	Number of Persons	Number of Households
1	4	13	11
2	28	14	11
3	44	15	4
4	54	16	0
5	29	17	2
6	34	18	0
7	30	19	1
8	31	20	0
9	15	21	1
10	10	22	1
11	8		
12	10	Total	328

CHAPTER V

FOOD CONSUMPTION PATTERNS

More than 100 different foods were consumed by the 141 households in our sample but only one food, rice, was consumed by every household. Palm oil was consumed by 96 percent of the households and salt, dried saltwater fish (other), and dried bonga by 90-92 percent, while cassava root was consumed by 82 percent.

The Data

These data, plus those presented in the rest of this chapter, were derived from a survey of the farm and nonfarm activities of rural households, conducted in Sierra Leone between March 1974 and June 1975. The survey was done by the Njala Rural Employment Research Team, based at Njala University College, Sierra Leone, under the direction of Dr. Dunstan S. C. Spencer and Dr. Derek Byerlee [Byerlee and Eicher, 1974, pp. 52-53]. We have described the sample and the interviewing procedures in Chapter III.

The food consumption figures presented here have two components, the quantities purchased (obtained through the market) and the quantities produced by the household that consumed them. Our estimates of the first component were based upon the interview responses obtained in the African Rural Employment (ARE) consumption expenditure survey, while our estimates of the quantities consumed from home production have been derived from the ARE farm level study.

The expenditure survey was designed to provide data on money expenditures and quantities purchased by each household for seven days in each month. In fact, the number of days for which data were obtained was sometimes less than seven and there were few households in the sample for which data were obtained for every month of the year. The estimating procedure used to fill in the missing data

is described in King and Byerlee [1977, pp. 73-75]. However, we used data from the expenditure file only for months in which the household provided at least three days of data during the month and used only those households for which we had usable data for at least six months during the year. The minimum criteria used for data from the production file were considerably higher. Moreover, our monthly indexes of consumption were calculated for fifteen or more commodity groups.

To determine for each food the quantity consumed from home production, we subtracted from the quantity harvested the quantities sold, used for seed (in the case of rice only),[1] paid out as wages in kind for hired labor, or used for processing, and adjusted for losses in storage.

Except for rice, the quantities produced are the quantities reported by the respondent. For rice, however, Byerlee and Spencer used five output measures. Our estimates are based upon the two that they felt to be the most reliable. Rice estimate A is based upon plot yield measurements of rice output, where the crop grown on the yield plot was harvested, threshed and weighed by the survey team. This method tends to give larger values for rice output than the other four, but it was regarded by Byerlee and Spencer as the most reliable. It does, however, lead to large estimates for the quantity of rice consumed at home. These may be accounted for by underreporting of sales rather than by any overestimation of the amount of rice harvested. Rice A may be regarded as setting an upper bound for the quantity of rice consumed.

Rice estimate B is based upon farmers' reports of the quantity of rice pounded (cleaned). After adjusting for sales in this form and other types of disappearance this can provide a good estimate of the amount of rice used at home, for practically all rice is pounded before it is cooked.

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[1]Nothing was used for animal feed.

As most rice is sold soon after harvest, in the form of husk rice, bias from underreporting of sales is less likely to affect this estimate seriously. (Moreover, farmers may have less interest in concealing the amount of pounded rice sold, both because clean rice sales represent a smaller part of their incomes and because they occur in smaller amounts and more evenly during the year.) The fact that rice pounding occurs in small amounts quite regularly through the year may also lead respondents to forget to report it, causing a downward bias in rice consumption estimates. We regard Rice B as a lower limit for the quantities of rice consumed.

The data that we present here have a number of desirable properties not often found together in a single set of food consumption data. They apply specifically to rural households; they include both home-produced food and food obtained through the market; they measure quantities consumed, not values (quantity data are essential for the analysis of nutrient intake levels);[1] they provide estimates for individual commodities, as are needed for nutritional analysis; they are derived from interviews covering the whole agricultural year; and for each of the 141 households in the sample, we have not only the estimates for each food consumed but also data on the household income, size, number of consumer equivalents, production patterns, sales prices (averages for the region), and various other variables. With such data, it finally becomes possible to analyze the relationships between the joint production and consumption decisions of the household that produces much of its own food.

Our purpose in this report is to describe the characteristics of the households in our sample and to identify factors that affect the consumption patterns within this sample. The tabular analysis presented brings out important features of the data and reveals useful relationships that can be detected with elementary tools.

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[1]We have the value figures, but are not presenting them in this report.

It cannot, however, take us far toward understanding the interactions among the determining variables nor toward discovering whether variables that appear to be related in the tables are indeed so related, or whether one of them is only a proxy for another variable or variables somewhere in the background. These questions and questions concerning the effects of other variables not dealt with in these tabulations--prices, in particular--will be examined by econometric analysis during the next stage of this research. At that time we shall also deal with questions of statistical significance that arise in evaluating our results.

Even if no questions of statistical reliability were to be raised, a description of the characteristics of the households in our sample would not constitute a description of the rural population as a whole, for our sample does not constitute a microcosm of that population. The sample was drawn, not to provide equal representation to the rural population in all parts of the country, but to represent the various types of agricultural systems employed. It is a stratified sample, intended to represent the ecological areas equally. It is a sample of ecological areas and farming systems, rather than of population. As our interest is to determine the effects on consumption patterns of variables related to farming systems and crop production decisions, the sample is well designed for our purposes. We seek not to describe the population, but to discover significant variables, many of them related to climate and ecological area, which affect household food consumption patterns. At a later stage we can adapt the sample for use in representing the characteristics of the population by weighting the observations in proportion to the populations of the areas they represent.

Consumption per Household, by Commodity

The foods consumed in largest quantity by an hypothetical average household (see the first column of Table 5.1) were rice, cassava, fish, palm kernel, palm oil, palm wine, groundnuts,[1] onions and sorghum.

By far the largest in terms of weight was the consumption of rice. Our two estimates of annual rice consumption give 897 kg as an upper bound and 627 kg as a lower bound. These are equivalent to 136 and 95 kg per person per year, .373 and .260 kg per person per day, and 1358 and 946 calories per person per day. They seem to be generally consistent with the few estimates that are available from other sources, although those almost all apply to the country as a whole. The FAO recently estimated that in 1974 each Sierra Leonean consumed about 1083 calories per day in the form of rice over the 1972-74 period. [United Nations. Food and Agriculture Organization, 1977.] Converted into pounds, approximately .65 pounds per day per capita were being consumed. Our own estimates, in pounds, are .82 and .57 pounds. The FAO estimate is in the same range as an earlier estimate by the USDA of .69 pounds per capita per day during 1961 [United States. Department of Agriculture, 1965, p. 30]. The two estimates available from the Sierra Leone Government are slightly lower. Rice consumption per capita per day was estimated at .61 pounds in the 1965/66 Agricultural Statistical Survey of Sierra Leone [cited in Mutti, et al., 1968, p. 44]. The only estimate available that deals with rural consumption levels is one by the Central Statistics Office (for 1969/70) which indicated that per capita rice consumption was 1.06 cups per day in the Southern Province and 1.0 cup per day in the North and East. At 8.467 ounces per cup these come to .56 and .53 pounds per day. [Sierra Leone. Central Statistics

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[1] Groundnut balls may be included here. The quantity given for groundnut balls includes only those produced at home; most of the groundnuts purchased in the market were also in the form of groundnut balls, but the data do not identify these purchases as such.

TABLE 5.1

MEAN ANNUAL HOUSEHOLD CONSUMPTION,
BY COMMODITY--SIERRA LEONE

COMMODITY	QUANTITY CONSUMED, MEAN OVER ALL HOUSEHOLDS (KILOGRAMS)	PERCENTAGE PRODUCED BY THE CONSUMING HOUSEHOLD-1	QUANTITY CONSUMED, MEAN OVER CONSUMING HOUSEHOLDS (KILOGRAMS)	PERCENTAGE OF HOUSEHOLDS CONSUMING
RICE,CLEAN,A	897	83	897	100
RICE,CLEAN,B	627	75	627	100
BENNISEED	23	98	65	35
FUNDI	35	97	164	21
MILLET	19	83	97	20
MAIZE,SHELLED	4	76	14	26
SORGHUM	51	88	78	66
RICE FLOUR	0	100	0	5
AGIDI	0	0	11	1
CAKES	1	0	7	11
BREAD	2	0	6	38
BISCUITS(NATCO)	0	0	3	15
CEREAL,PROCESSED,UNSPECIFIED	1	0	9	8
CASSAVA	326	79	397	82
GARI	17	96	98	18
FOOFOO	17	57	71	24
CASSAVA BREAD	0	0	2	6
YAM	0	0	11	2
WATER YAM	2	100	19	12
CHINESE YAM	0	100	2	1
COCOYAM	1	3	34	4
SWEET POTATO	2	42	20	10
GINGER	-1	100	-61	3
ROOT CROP,UNSPECIFIED	0	0	1	1
PALM KERNEL	303	100	441	69
PALM KERNEL OIL	1	24	3	30
PALM OIL	81	51	84	96
GROUNDNUT OIL	0	0	1	1
COCONUT OIL	0	52	3	7
COCOA BUTTER	12	100	211	6
MARGARINE	0	0	2	5
COOKING OIL	0	0	1	1
OIL,UNSPECIFIED	0	0	1	1
GROUNDNUT,SHELLED	72	83	97	74
GROUNDNUT BALLS	0	100	16	1

TABLE 5.1

MEAN ANNUAL HOUSEHOLD CONSUMPTION,
BY COMMODITY--SIERRA LEONE

COMMODITY	QUANTITY CONSUMED, MEAN OVER ALL HOUSEHOLDS (KILOGRAMS)	PERCENTAGE PRODUCED BY THE CONSUMING HOUSEHOLD-1	QUANTITY CONSUMED, MEAN OVER CONSUMING HOUSEHOLDS (KILOGRAMS)	PERCENTAGE OF HOUSEHOLDS CONSUMING
BLACKEYED BEAN,SHELLED	1	99	19	4
BROADBEAN,SHELLED	9	100	25	38
PIGEON PEA,SHELLED	14	92	87	16
SOYBEAN,SHELLED	0	100	5	3
GREEN BEAN,IN SHELL	0	0	1	2
LEGUME,UNSPECIFIED,SHELLED	0	100	0	1
FISH,SALTWATER,FRESH				
BONGA	4*	0*	19*	19*
OTHER	43*	89*	63*	68*
FISH,SALTWATER,DRIED				
BONGA	67*	0*	75*	89*
OTHER	79*	0*	87*	92*
FISH,FROZEN OR ICED	13*	0*	72*	18*
FISH,FRESHWATER,FRESH	17*	0*	55*	31*
FISH,TINNED	0*	0*	1*	6*
BEEF	1	67	15	10
PORK	0	0	7	1
GOATS AND SHEEP,DRESSED	5	21	78	6
POULTRY,DRESSED	1	0	6	16
DEER,DRESSED	0	100	29	1
BIRD,WILD,DRESSED	0	100	0	1
BUSH MEAT,DRESSED	7	26	14	55
MEAT,UNSPECIFIED	0	0	2	4
MILK,COW	0	0	9	1
MILK,TINNED	0	0	3	16
EGGS	0	0	1	2
HONEY BEE OUTPUT	1	100	47	3
LIVESTOCK PRODUCTS,UNSPECIFIED	0	0	35	1
ONIONS	59	77	90	66
OKRA	3	87	7	43
PEPPERS AND CHILLIES	23	71	28	84
CABBAGE	0	100	5	1
EGGPLANT	0	34	2	13
GREENS	4	91	27	13

TABLE 5.1

MEAN ANNUAL HOUSEHOLD CONSUMPTION,
BY COMMODITY--SIERRA LEONE

COMMODITY	QUANTITY CONSUMED, MEAN OVER ALL HOUSEHOLDS (KILOGRAMS)	PERCENTAGE PRODUCED BY THE CONSUMING HOUSEHOLD-1	QUANTITY CONSUMED, MEAN OVER CONSUMING HOUSEHOLDS (KILOGRAMS)	PERCENTAGE OF HOUSEHOLDS CONSUMING
JAKATO	0	89	1	35
PUMPKIN	2	0	19	11
TOMATO	5	96	12	37
TOMATO PASTE	0	0	1	23
WATERMELON	1	6	24	2
CUCUMBER	0	100	2	9
EGUSI(THE FRESH MELON)	3	100	88	4
VEGETABLES,OTHER	-1	100	-11	20
ORANGE	14	93	43	34
LEMON	0	100	-69	1
PINEAPPLE	2	59	13	14
BANANA	0	100	-3	21
PLANTAIN	0	18	2	7
AVOCADO	0	0	4	2
PAWPAW	0	100	3	3
MANGO	3	82	23	13
GUAVA	0	100	-6	1
BREADFRUIT	0	0	9	1
COCONUT	14	97	87	16
FRUIT,UNSPECIFIED	0	76	4	4
SALT	14	0	15	93
SUGAR	3	0	6	52
CONDIMENTS,UNSPECIFIED	0	0	4	9
MAGGI CUBES	1	0	1	79
KOLA NUT	13	97	21	61
COFFEE	5	94	21	22
TEA	0	0	1	2
SOFT DRINKS,BOTTLED	0	0	4	12
GINGER BEER,LOCAL	0	0	8	1
PALM WINE	113	94	306	37
RAFFIA WINE	1	23	9	9
BEER,STAR AND HEINEKEN	0	0	4	2
OMOLE	3	0	17	18
GIN,LOCAL	0	100	7	6

TABLE 5.1

MEAN ANNUAL HOUSEHOLD CONSUMPTION,
BY COMMODITY--SIERRA LEONE

COMMODITY	QUANTITY CONSUMED, MEAN OVER ALL HOUSEHOLDS (KILOGRAMS)	PERCENTAGE PRODUCED BY THE CONSUMING HOUSEHOLD-1	QUANTITY CONSUMED, MEAN OVER CONSUMING HOUSEHOLDS (KILOGRAMS)	PERCENTAGE OF HOUSEHOLDS CONSUMING
LIQUOR(RUM,ETC)	0	0	5	1
FOOD,OTHER	0	0	5	1
MEALS	-35**	100	-36**	99

1 TOTAL QUANTITY CONSUMED FROM OWN HOUSEHOLD PRODUCTION DIVIDED BY TOTAL CONSUMPTION.
* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

Glossary of Food Names

Agidi: A preparation of fermented benniseed, used as flavoring in preparing sauce

Benniseed: Sesamum indicum. An oilseed.

Blackeyed bean: Vigna sinensis or Vigna unguiculata. Cowpea.

Egusi: Various names are given: Citrullus vulgaris, Cucumeropsis edulis, Colocynthis citrullus. A melon. Only the seed is used.

Foofoo: Fermented cassava, grated and pounded.

Fundi: Digitaria exilis. Fonio, hungry rice.

Gari: Grated dried cassava.

Greens: Amaranthus hybridus var. cruentus. Native spinach or plasas, bush greens, spinach greens.

Jakato: A form of eggplant, also known as "bitter tomato".

Lemon: Also called lime.

Omole: A locally distilled hard liquor.

Pawpaw: Carica papaya. Papaya.

Tangerine: Also called lemon.

Office. 1972b, pp. 45, 48, 51.] Our lower estimate, .57 pounds, corresponds closely to these.

Cassava root (326 kg), palm kernel (303 kg)[1] and fish (219 kg) rank well below rice in terms of weight. Palm wine (112 kg) is the principal beverage and palm oil (80 kg) the principal oil.

A few items in the commodity list of Table 5.1 represent processed foods, the ingredients of which are included as part of another entry. Thus the cassava used in the preparation of gari, foofoo and cassava bread is already included in the listing for cassava; the groundnuts in groundnut balls are also included as groundnuts; local gin is presumably made from some of the starchy foods already included in the table, although we do not know from which; and bread, cakes and rice flour have ingredients contained in other listings in the table. The processed forms are listed in the table, despite the apparent double-counting, for the benefit of the reader interested in knowing the forms in which some of these foods are consumed and the extent to which home processing is involved in the preparation of the foods in these forms.

The quantities reported in the first column of Table 5.1 are the total quantities consumed by the 141 households in the sample, averaged over all households, non-consuming as well as consuming households. However, as the fourth column of the table shows, most commodities are consumed by only a fraction of the households.[2] Rice was the only food consumed by all households; palm oil, dried saltwater fish and salt were consumed by at least 90 percent of the

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[1]We have some reservations about the reliability of this figure. Moreover, the quantity measurements for cassava root were very rough.

[2]Every commodity listed in Table 5.1 was consumed by some household in the sample. A zero entry means simply that the precise value is positive but less than 0.5.

sample. (The figures given in the table for dried saltwater fish exclude fish consumption by the households in Enumeration Area 13 where commercial fishing is a dominant activity. Adding those households to the sample raises the percentage consuming to 90 or more.) Eighty-two percent of the sample consumed cassava. Other items consumed by 60 percent of the sample or more were Maggi cubes (bouillon cubes), groundnuts (peanuts), fresh saltwater fish (other), palm kernels, sorghum, onions and kola nuts. Seventy-seven of the items in that table were consumed by fewer than 30 percent of the households. Meals were paid or received in exchange for labor by 99 percent of the households, with the average household paying out 36 more meals than it received during the year.

Where not all households consume the commodity, the quantity consumed per consuming household is a better measure of what an average household actually consumes of any particular food than the average over all households. However, the set of quantities consumed per consuming household exaggerates the overall quantity of food consumed, for no household is likely to consume all the foods on the list. For an overall estimate of quantities consumed the average over all households is the better measure.

Several commodities are eaten in quite large amounts by those households that consume them. These include benniseed, fundi, millet, pigeon pea, coconut, palm kernel, goats and sheep (reported as consumed by only 6 percent of the households), cocoa butter (consumed by 5% of the households), and egusi (consumed by 3% of the households).[1] The palm kernel consumption, 440 kg per consuming household, seems high; this amounts to 0.2 kg or 0.4 pounds per day per consuming equivalent. Palm fruit and palm nut are also eaten but the data did not warrant

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[1]Where a commodity is consumed infrequently the percentage of households consuming it may be understated. Unless the commodity was consumed during the week of the interview it did not appear in the records for that household.

presenting estimates for these. Both palm kernel and palm nut are available for collecting from the wild at almost any time of the year. The cocoa butter consumption, of 211 kg per consuming household, is an average over only 7 households; an error in the data could easily account for a magnitude such as this. The consumption level for egusi (88 kg), however, is not as large as it seems. Eighty-eight kilograms represents the weight of the fresh melon. Only the seeds (from 2 to 2.75% of the total weight) are used.

Every commodity listed in Table 5.1 was eaten by some household in the sample. A zero entry means that the precise value is positive but less than 0.5. A few negative entries appear, usually when the commodity is purchased by only a small number of households (for instance, lemon, guava or ginger root). A negative entry, with 100 percent of the consumption grown at home (ginger, among others), must be interpreted as indicating that some ginger was consumed (although the data do not tell us how much) and that whatever was consumed was grown at home.

The entries for fish describe consumption practices for all households in the sample except those in Enumeration Area 13. That is an area with much fishing and fish drying for the market. The consumption of fish by households in that area would be unrepresentative of consumption in the remainder of rural Sierra Leone.

The entry for greens should not be read as an estimate of the total quantity of green leaves consumed by the household, or of the percentage of households consuming them. Green leaves of many sorts (the okra, sweet potato and cassava leaf, for instance) are an important part of the diet, but are not likely to be fully reported because collecting them is quite a casual matter.

The entry for meals states the number, not the weight, of meals paid or received for labor hired or sold out. A negative entry means that more meals were paid out than received. Almost every household paid or received such meals, but on balance the number amounted to about 0.1 per day.

For all the major food items except dried fish and palm oil the percentage produced at home exceeds 75 percent. Fifty percent of the palm oil consumed is produced by the household that consumes it. The list of major and minor food items of which more than 75 percent is produced within the consuming household is a long one. It includes rice, the other cereals, cassava root, gari, palm kernel, groundnuts, almost all the beans, fresh saltwater fish other than bonga, onions, okra, peppers and chillies, greens, jakato, tomato, mango, coconut, kola nut, coffee and palm wine.

The rural households in our Sierra Leone sample consumed a wide range of commodities, although there was a marked concentration on eight or nine major items, among them rice, dried fish, cassava and palm wine. At the same time there was considerable variation in the percentage of households consuming a number of significant items, while 77 percent of the items listed in Table 5.1 were consumed by fewer than 30 percent of the households.

Adjustments for Household Size

Knowing how much a household consumes is not very useful unless we also know how large the household is. Therefore Table 5.2 converts quantities per household into quantities per person and per adult male consumer equivalent. In this table, the individual foods reported in Table 5.1 have been combined into 29 groups, groups that will also be used for the remaining tables of the report. While the more detailed analysis is useful, few readers could be expected to remain patient if the commodity list carried all 103 items in all the tables.

The items in Table 5.1 that contained ingredients also included under other headings in that table were dropped when the data were grouped, with the exception of cassava products. That group is retained because it seems useful to know how much cassava is consumed in the processed form. Little comment is

TABLE 5.2

MEAN ANNUAL CONSUMPTION, ALL HOUSEHOLDS,
BY COMMODITY GROUP - RURAL SIERRA LEONE
(KILOGRAMS)

COMMODITY GROUP	QUANTITY PER HOUSEHOLD	QUANTITY PER CAPITA	QUANTITY PER CONSUMER EQUIVALENT
CLEAN RICE,A	897	136	184
CLEAN RICE,B	627	95	129
OTHER CEREALS	133	20	27
CASSAVA	326	50	67
CASSAVA PRODUCTS	35	5	7
YAMS	4	1	1
OTHER ROOT CROPS	0	0	0
PALM OIL	81	12	17
PALM KERNEL OIL	1	0	0
PALM KERNEL	303	46	62
OTHER OILS AND FATS	12	2	3
GROUNDNUTS	72	11	15
OTHER LEGUMES	24	4	5
FISH:SALTWATER,FRESH OR FROZEN	59*	9*	12*
FISH:SALTWATER,DRIED	146*	23*	31*
OTHER FISH	17*	3*	4*
GAME	8	1	2
OTHER MEAT	8	1	2
OTHER ANIMAL PRODUCTS	2	0	0
VEGETABLES	98	15	20
CITRUS FRUITS	16	2	3
BANANA,PLANTAIN AND AVOCADO	0	0	0
OTHER FRUITS	17	3	3
SUGAR	3	0	1
SALT AND OTHER CONDIMENTS	15	2	3
KOLANUT	13	2	3
BEVERAGES,NON-ALCOHOLIC	5	1	1
BEVERAGES,ALCOHOLIC	117	18	24
MEALS	-35**	-5**	-6**

* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

called for about the content of this table except to remind the reader that the number of consumer equivalents is normally less than the number of persons in the household. Every person not an adult male is reckoned as only a fraction of a person when calculating the consuming equivalent to the adult male. The Rice B estimate of 95 kg per capita becomes 129 kg per consuming equivalent, while the mean for dried saltwater fish goes from 23 kg per capita to 31 kg per consumer equivalent.

Even though the data have been grouped, occasional entries of zero still appear in the table. These represent commodities consumed in positive quantities, but in amounts smaller than .5 kg per year.

The averages in Table 5.2 represent the quantities consumed if every person in every household consumes equal amounts of every food group in the list. In fact, most food groups are consumed by fewer than 100 percent of the households and some by fewer than 20 percent of the families. Table 5.3 gives the averages per consuming household and the percentage of households consuming. Counting only the consuming households can make significant differences in the quantities consumed per consuming equivalent.

The average will not be affected, after rounding to the nearest kilogram, if the number of consuming equivalents in the consuming households is nearly the same as for all households. This can be the case when the percentage of households consuming the commodity is 100 or nearly so (rice, palm oil and salt, for instance), especially if the number of consuming equivalents in the excluded households is small. Other average consumption levels are affected greatly; the mean for cassava root rises from 67 to 84 kg per consumer equivalent, while that for fruit (other) rises from 3 to 12 kg per consumer equivalent.

TABLE 5.3

MEAN ANNUAL CONSUMPTION, CONSUMING HOUSEHOLDS,
BY COMMODITY GROUP - RURAL SIERRA LEONE
(KILOGRAMS)

COMMODITY GROUP	QUANTITY PER HOUSEHOLD	QUANTITY PER CAPITA	QUANTITY PER CONSUMER EQUIVALENT	PERCENTAGE OF HOUSEHOLDS CONSUMING
CLEAN RICE,A	697	136	184	100
CLEAN RICE,B	627	95	129	100
OTHER CEREALS	163	24	33	82
CASSAVA	397	63	84	82
CASSAVA PRODUCTS	98	12	17	35
YAMS	22	4	6	17
OTHER ROOT CROPS	2	0	0	13
PALM OIL	84	13	17	96
PALM KERNEL OIL	3	0	1	30
PALM KERNEL	441	73	97	69
OTHER OILS AND FATS	72	11	14	17
GROUNDNUTS	97	14	19	74
OTHER LEGUMES	50	7	10	48
FISH:SALTWATER,FRESH OR FROZEN	77*	12*	17*	76*
FISH:SALTWATER,DRIED	151*	23*	32*	97*
OTHER FISH	48*	9*	11*	36*
GAME	14	2	3	56
OTHER MEAT	22	3	4	34
OTHER ANIMAL PRODUCTS	11	1	2	20
VEGETABLES	102	15	21	96
CITRUS FRUITS	41	6	8	38
BANANA,PLANTAIN AND AVOCADO	-1	0	0	26
OTHER FRUITS	55	9	12	30
SUGAR	6	1	1	52
SALT AND OTHER CONDIMENTS	15	2	3	97
KOLANUT	21	3	4	61
BEVERAGES,NON-ALCOHOLIC	16	2	3	33
BEVERAGES,ALCOHOLIC	212	34	45	55
MEALS	-36**	-5**	-6**	99

* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

Income, the Number of Consuming Equivalents and the Dependency Ratio

The data to this point have described the sample as a whole, a sample drawn to represent all rural areas in Sierra Leone. They have given no information about the variation in consumption levels that occurs among regions, among income classes, or among other groupings of households. The following tables provide that for us. The most conspicuous feature of every table that follows is how much the consumption level of most commodities varies among the different classes of households, by whatever classification is used. It is an unusual commodity that is consumed in about the same amounts by all classes of households.

The variation among household consumption levels was much greater than anything shown in these tables, for each figure in the table is an average for the group. We shall take account of household-to-household variation when doing the regression analysis of these data.

Table 5.4 shows consumption per consuming equivalent when households are classified in accordance with incomes per consuming equivalent. The income class limits are defined by deciles derived from the production sample of 328 households. Our 141 households constitute a sub-sample of this group. As the next to the last line of the table shows, only 20 percent of the households in our sub-sample have incomes that fall in the bottom 30 percent of the larger sample, while 50 percent of the smaller sample have incomes that place them in the middle 40 percent of the larger group. We have enough households in each group, however, to provide useful information concerning food consumption patterns in each income class. The highest decile is represented by only 11 households, but it deserves to be kept distinct from the others nonetheless, for the behavior of households in that decile differs in a number of ways from that of the remaining households in the sample.

The households in the lowest 30 percent of the income distribution consume quantities of most foods that are well below average levels: 77 kg of rice (the Rice

TABLE 5.4

MEAN ANNUAL CONSUMPTION PER CONSUMER EQUIVALENT,
ALL HOUSEHOLDS, BY INCOME GROUP-1
(KILOGRAMS)

COMMODITY GROUP	INCOME GROUP: LOWEST 3 DECILES UNDER 63 LEONES	DECILES 4 THROUGH 7 63-142 LEONES	DECILES 8 AND 9 143-242 LEONES	HIGHEST DECILE 243-515 LEONES
CLEAN RICE,A	87	161	318	343
CLEAN RICE,B	77	117	192	230
OTHER CEREALS	12	26	59	11
CASSAVA	51	61	128	10
CASSAVA PRODUCTS	6	8	7	4
YAMS	0	1	3	0
OTHER ROOT CROPS	0	1	1	-9
PALM OIL	6	18	28	17
PALM KERNEL OIL	0	0	0	0
PALM KERNEL	7	59	104	162
OTHER OILS AND FATS	0	2	7	1
GROUNDNUTS	14	15	14	17
OTHER LEGUMES	4	5	3	13
FISH:SALTWATER,FRESH OR FROZEN	4*	10*	28*	18*
FISH:SALTWATER,DRIED	22*	26*	49*	61*
OTHER FISH	0*	5*	5*	0*
GAME	1	1	2	1
OTHER MEAT	0	1	4	4
OTHER ANIMAL PRODUCTS	0	0	0	4
VEGETABLES	0	23	20	66
CITRUS FRUITS	4	4	4	-5
BANANA,PLANTAIN AND AVOCADO	0	0	0	0
OTHER FRUITS	0	4	4	11
SUGAR	1	1	1	1
SALT AND OTHER CONDIMENTS	2	3	4	3
KOLANUT	5	2	3	0
BEVERAGES,NON-ALCOHOLIC	0	1	3	0
BEVERAGES,ALCOHOLIC	27	28	12	12
MEALS	-4**	-5**	-13**	-8**
PERCENT OF HOUSEHOLDS IN EXPENDITURE SAMPLE	20	49	23	8

1 INCOME PER CONSUMER EQUIVALENT.
* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

B estimate), 51 of cassava root and 22 of dried saltwater fish, for instance. In the highest income class rice and dried fish consumption are at nearly three times these levels, but only about 20 percent as much cassava is eaten.

Rice, palm kernel, dried fish and vegetables are consumed in increasing quantities as income rises, as are cereals (other), cassava, palm oil and fresh fish (except that consumption of these last four groups by families in the tenth decile falls off sharply). Families in the tenth decile consume even less cassava per consuming equivalent than families in the lowest tercile. The quantities of alcoholic beverages consumed are essentially the same in the two lowest income classes (the bottom 70 percent of the income distribution) and are more than double the quantities consumed by the top 30 percent of the distribution. The table suggests a number of hypotheses about the income-consumption relation that deserve to be examined by econometric techniques.

Table 5.5 relates consumption per consuming equivalent to the number of consuming equivalents in the household. For a number of the more important foods consumption levels fall as the number of consuming equivalents rises. This may mean that there is a non-linear relation between quantities consumed and the number of consuming equivalents in the household, but the result in the table could also occur if larger households normally have smaller incomes per consuming equivalent. The regression studies will clear up this point.

Households with only 1-3 consuming equivalents pay out more than twice as many meals on the average as those in any of the other three groups. Presumably this reflects the fact that they hire relatively more labor than an average household in the other groups.

Table 5.6 shows the effect of the dependency ratio (the ratio of the number of persons less than 16 or more than 65 years old to the number of persons between 16 and 65 years of age inclusive). The first column of the table refers to households

TABLE 5.5

MEAN ANNUAL CONSUMPTION PER CONSUMER EQUIVALENT,
ALL HOUSEHOLDS, BY NUMBER OF CONSUMER EQUIVALENTS
(KILOGRAMS)

COMMODITY GROUP	NUMBER OF CONSUMER EQUIVALENTS 1-3	4-5	6-7	8-14
CLEAN RICE,A	259	207	168	131
CLEAN RICE,B	158	156	100	112
OTHER CEREALS	48	19	16	33
CASSAVA	161	71	48	23
CASSAVA PRODUCTS	12	6	7	5
YAMS	3	0	1	0
OTHER ROOT CROPS	0	-2	1	1
PALM OIL	22	21	18	7
PALM KERNEL OIL	0	0	0	0
PALM KERNEL	141	45	38	53
OTHER OILS AND FATS	7	0	4	0
GROUNDNUTS	15	10	13	21
OTHER LEGUMES	3	5	4	6
FISH:SALTWATER,FRESH OR FROZEN	21*	21*	6*	4*
FISH:SALTWATER,DRIED	39*	34*	32*	20*
OTHER FISH	7*	2*	6*	0*
GAME	3	1	1	1
OTHER MEAT	2	2	1	1
OTHER ANIMAL PRODUCTS	0	0	0	1
VEGETABLES	24	22	16	20
CITRUS FRUITS	7	-1	6	3
BANANA,PLANTAIN AND AVOCADO	0	0	0	0
OTHER FRUITS	1	7	4	1
SUGAR	1	1	0	1
SALT AND OTHER CONDIMENTS	5	3	3	2
KOLANUT	10	1	2	0
BEVERAGES,NON-ALCOHOLIC	0	1	1	2
BEVERAGES,ALCOHOLIC	26	19	25	27
MEALS	-14**	-3**	-6**	-6**
PERCENT OF HOUSEHOLDS IN PRODUCTION SAMPLE	37	34	15	16
PERCENT OF HOUSEHOLDS IN EXPENDITURE SAMPLE	35	30	21	15

* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

TABLE 5.6

MEAN ANNUAL CONSUMPTION PER CONSUMER EQUIVALENT,
ALL HOUSEHOLDS, BY DEPENDENCY RATIO-1
(KILOGRAMS)

COMMODITY GROUP	DEPENDENCY RATIO 0	0-.9	1.0-1.9	2.0-3.9
CLEAN RICE,A	200	207	167	164
CLEAN RICE,B	122	161	115	96
OTHER CEREALS	17	30	30	22
CASSAVA	121	97	41	26
CASSAVA PRODUCTS	6	6	9	4
YAMS	5	0	0	1
OTHER ROOT CROPS	0	1	-1	1
PALM OIL	34	17	12	15
PALM KERNEL OIL	0	0	0	0
PALM KERNEL	132	43	80	12
OTHER OILS AND FATS	2	3	3	0
GROUNDNUTS	13	18	11	18
OTHER LEGUMES	3	5	5	5
FISH:SALTWATER,FRESH OR FROZEN	15*	19*	6*	13*
FISH:SALTWATER,DRIED	43*	29*	29*	29*
OTHER FISH	6*	7*	1*	1*
GAME	4	2	1	1
OTHER MEAT	1	3	1	1
OTHER ANIMAL PRODUCTS	0	0	1	0
VEGETABLES	19	13	31	11
CITRUS FRUITS	7	0	3	10
BANANA,PLANTAIN AND AVOCADO	0	0	0	0
OTHER FRUITS	1	4	5	1
SUGAR	0	0	1	1
SALT AND OTHER CONDIMENTS	5	3	3	3
KOLANUT	12	0	3	0
BEVERAGES,NON-ALCOHOLIC	1	0	1	4
BEVERAGES,ALCOHOLIC	18	27	24	23
MEALS	-7**	-5**	-6**	-10**
PERCENT OF HOUSEHOLDS IN EXPENDITURE SAMPLE	18	36	31	14

1 NUMBER OF PERSONS LESS THAN 15 OR MORE THAN 65 YEARS OF AGE DIVIDED BY NUMBER OF PERSONS AGED 16-65.
* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

with no dependents (exactly zero). The other three columns refer to households that have some dependents, although the rounded value of the dependency ratio may be as low as 0.0. For rice, cassava and palm kernel, consumption levels seem to fall as the dependency ratio rises, except that households with no dependents appear to consume less rice, on the average, than households with small numbers of dependents. Whether the relationship operating here is anything other than the effect of a high dependency ratio on the household income per consumer equivalent is a question that will have to be answered by the regression analysis.

Region, Market Orientation and Upland Rice

Tables 5.7 and 5.8 give us two regional classifications, the first one essentially by provinces (although our Resource Region lines do not match the provincial boundaries exactly) and the second by population density. Table 5.7 shows provincial differences in consumption patterns; others would appear if the more detailed commodity classification of Table 5.1 were to be used. The Southern Province (in terms of our Resource Regions, Regions 2, 4 and 8) consumed large quantities of cassava, palm kernel and fresh fish. Annual cassava consumption was 153 kg per consumer equivalent, nearly double the national average. The Northern Province (our Resource Regions 1, 3, 5 and 7) consumed large quantities of vegetables and alcoholic beverages and small quantities of cassava, palm kernel and palm oil. The Eastern Province (represented by Resource Region 6) consumed large quantities of kola nut and citrus fruit and negligible quantities of cassava. The rice estimate derived from the rice pounding data behaves strangely in this table, not moving in line with the Rice A estimate in the Eastern Province.

When grouped by population density (Table 5.8), there is little evidence of systematic relationships, although the net number of meals paid out for hired labor seems to decrease as population density increases. Possibly the measure of

TABLE 5.7

MEAN ANNUAL CONSUMPTION PER CONSUMER EQUIVALENT,
ALL HOUSEHOLDS, BY REGION
(KILOGRAMS)

COMMODITY GROUP	REGION 1 SOUTHERN	2 NORTHERN	3 EASTERN
CLEAN RICE,A	206	181	131
CLEAN RICE,B	143	135	64
OTHER CEREALS	37	23	11
CASSAVA	153	10	5
CASSAVA PRODUCTS	14	3	0
YAMS	1	0	4
OTHER ROOT CROPS	0	0	0
PALM OIL	27	7	20
PALM KERNEL OIL	0	0	0
PALM KERNEL	124	6	72
OTHER OILS AND FATS	0	0	19
GROUNDNUTS	14	16	12
OTHER LEGUMES	4	6	1
FISH:SALTWATER,FRESH OR FROZEN	18*	8*	9*
FISH:SALTWATER,DRIED	31*	30*	31*
OTHER FISH	6*	1*	3*
GAME	2	1	3
OTHER MEAT	2	1	2
OTHER ANIMAL PRODUCTS	0	1	0
VEGETABLES	14	29	8
CITRUS FRUITS	1	0	23
BANANA,PLANTAIN AND AVOCADO	0	0	0
OTHER FRUITS	1	7	0
SUGAR	1	1	0
SALT AND OTHER CONDIMENTS	4	2	4
KOLANUT	1	0	16
BEVERAGES,NON-ALCOHOLIC	2	0	0
BEVERAGES,ALCOHOLIC	11	42	0
MEALS	-10**	-4**	-5**
PERCENT OF HOUSEHOLDS IN EXPENDITURE SAMPLE	48	36	16

* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

TABLE 5.8

MEAN ANNUAL CONSUMPTION PER CONSUMER EQUIVALENT,
ALL HOUSEHOLDS, BY RURAL POPULATION DENSITY-1
(KILOGRAMS)

COMMODITY GROUP	DENSITY, IN PERSONS PER SQUARE MILE			
	49,53 (REGIONS 7 AND 4)	72 (REGIONS 8 AND 2)	97,101 (REGIONS 5 AND 6)	125,160 (REGIONS 3 AND 1)
CLEAN RICE,A	233	197	134	207
CLEAN RICE,B	138	139	88	165
OTHER CEREALS	35	33	24	19
CASSAVA	220	99	3	17
CASSAVA PRODUCTS	7	16	2	3
YAMS	1	0	1	0
OTHER ROOT CROPS	1	0	1	0
PALM OIL	31	21	11	9
PALM KERNEL OIL	0	0	0	0
PALM KERNEL	99	120	29	10
OTHER OILS AND FATS	0	0	8	0
GROUNDNUTS	4	17	21	11
OTHER LEGUMES	0	6	7	4
FISH:SALTWATER,FRESH OR FROZEN	15*	17*	7*	14*
FISH:SALTWATER,DRIED	25*	32*	24*	54*
OTHER FISH	15*	1*	1*	3*
GAME	2	1	2	1
OTHER MEAT	0	2	1	3
OTHER ANIMAL PRODUCTS	0	0	1	0
VEGETABLES	19	9	4	58
CITRUS FRUITS	1	0	10	-1
BANANA,PLANTAIN AND AVOCADO	0	0	0	0
OTHER FRUITS	0	1	0	14
SUGAR	0	1	0	1
SALT AND OTHER CONDIMENTS	4	3	2	4
KOLANUT	3	0	7	0
BEVERAGES,NON-ALCOHOLIC	0	3	0	0
BEVERAGES,ALCOHOLIC	58	12	33	6
MEALS	-14**	-8**	-4**	-4**
PERCENT OF HOUSEHOLDS IN EXPENDITURE SAMPLE	20	32	30	18

1 EXCLUDES TOWNS OF MORE THAN 2000 PERSONS.
* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

population used (an average for the whole resource region) was too crude, or other variables were more important.

Cassava root consumption in Resource Regions 4 and 7 was very high (220 kg per consumer equivalent). Our cassava consumption estimates were quite rough, as we have said. Dried saltwater fish consumption at 54 kg per consumer equivalent was well above the national mean in Regions 1 and 3. Region 1, adjacent to Region 3, produces large quantities of fish, so fish may be less expensive for these households than elsewhere in the country.

Geographical factors clearly affect consumption levels in Tables 5.7 and 5.8, but not in a fashion easily understood. Econometric methods of analysis are required. In Table 5.8, moreover, one cannot say whether the operating factor is indeed population density or unspecified geographical factors that happen to be correlated with density levels. Even if population density is the relevant variable, we still need to know whether a high population density indicates pressure upon limited resources or a concentration of population in response to unusual opportunities for earning a living. Further analysis of these questions is required.

The percentage of labor devoted to upland rice (Table 5.9) shows no clear and simple relationship to food quantities consumed per consumer equivalent, although cultivation of upland rice can be taken as an indication of the emphasis given by the household to production for its own use. Nutritionists often assert that upland rice, normally grown in mixture with other crops, contributes to the quality of the diet because the crops grown with the rice provide particularly valuable nutrients. Cassava consumption certainly reached very low levels (18 kg per consumer equivalent) in those households that devoted less than 18 percent of their labor to upland rice, perhaps because cassava is commonly grown in mixture with upland rice. Cassava consumption is notably higher for those households that devote at least 54 percent of their labor to upland rice. However, cassava would not usually

TABLE 5.9

MEAN ANNUAL CONSUMPTION PER CONSUMER EQUIVALENT,
ALL HOUSEHOLDS, BY PERCENT OF LABOR DEVOTED TO UPLAND RICE
(KILOGRAMS)

COMMODITY GROUP	PERCENT OF LABOR DEVOTED TO UPLAND RICE				
	0.0-17.9	18.0-35.9	36.0-53.9	54.0-71.9	72.0-89.9
CLEAN RICE,A	166	173	155	209	288
CLEAN RICE,B	110	125	133	118	227
OTHER CEREALS	11	21	33	43	17
CASSAVA	18	83	47	114	149
CASSAVA PRODUCTS	5	6	7	10	5
YAMS	0	0	1	2	0
OTHER ROOT CROPS	1	2	1	0	-9
PALM OIL	11	50	15	16	13
PALM KERNEL OIL	0	0	0	0	1
PALM KERNEL	70	86	46	58	88
OTHER OILS AND FATS	0	0	4	4	1
GROUNDNUTS	19	9	12	19	1
OTHER LEGUMES	0	8	6	7	9
FISH:SALTWATER,FRESH OR FROZEN	5*	25*	12*	12*	24*
FISH:SALTWATER,DRIED	29*	48*	24*	31*	46*
OTHER FISH	1*	6*	2*	6*	6*
GAME	1	3	2	2	1
OTHER MEAT	1	5	2	1	1
OTHER ANIMAL PRODUCTS	1	0	0	0	0
VEGETABLES	36	15	9	17	19
CITRUS FRUITS	8	0	3	2	-4
BANANA,PLANTAIN AND AVOCADO	0	0	0	0	0
OTHER FRUITS	8	1	0	0	11
SUGAR	1	1	0	1	1
SALT AND OTHER CONDIMENTS	2	4	2	4	4
KOLANUT	1	16	3	1	0
BEVERAGES,NON-ALCOHOLIC	3	0	1	0	0
BEVERAGES,ALCOHOLIC	2	51	50	13	18
MEALS	-4**	-6**	-3**	-11**	-14**
PERCENT OF HOUSEHOLDS IN EXPENDITURE SAMPLE	25	10	26	28	11

* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

be regarded as improving the quality of the diet. Households that devote at least 54 percent of their labor to upland rice also seem to pay out more meals for labor hired, on the average, than other households. Vegetable consumption is largest (36 kg per consumer equivalent) in households that use less than 18 percent of their labor for upland rice. Some of these may be households growing vegetables for the Freetown market. The regression analysis may help us untangle the influence of this variable.

Table 5.10 classifies households by market orientation (the ratio of the value of their total sales to the value of their total output). Thirty-five percent of the households in the sample sell no more than three percent of their total output by value. Again, the simple one-way classification reveals no clear patterns except that vegetable consumption appears to rise with market orientation and the consumption of alcoholic beverages appears to fall. Cassava root consumption is small (20 kg per consumer equivalent) among the seven households that sell more than 48 percent of their total value product.

The vegetable consumption behavior is the opposite of that which nutritionists often fear, but in this case it may reflect the fact that vegetable growing is most important in Sierra Leone in areas near Freetown where vegetables are grown for the market. Again, multiple regression analysis will be required if we are to test the common hypothesis that an increasing degree of market orientation is harmful to the quality or quantity of the diet.

TABLE 5.10

MEAN ANNUAL CONSUMPTION PER CONSUMER EQUIVALENT,
ALL HOUSEHOLDS, BY MARKET ORIENTATION
(KILOGRAMS)

COMMODITY GROUP	VALUE OF TOTAL SALES AS PERCENT OF VALUE OF TOTAL OUTPUT					
	0-3	4-7	8-15	16-28	29-48	49-93
CLEAN RICE,A	178	232	207	168	125	153
CLEAN RICE,B	99	127	148	210	87	139
OTHER CEREALS	38	36	18	7	10	33
CASSAVA	63	99	78	52	61	20
CASSAVA PRODUCTS	4	11	16	9	0	3
YAMS	1	1	2	1	0	1
OTHER ROOT CROPS	0	0	-4	1	4	0
PALM OIL	8	24	13	40	7	14
PALM KERNEL OIL	0	0	0	0	0	0
PALM KERNEL	43	108	37	112	61	1
OTHER OILS AND FATS	3	6	0	2	0	0
GROUNDNUTS	21	13	7	5	23	10
OTHER LEGUMES	8	5	4	2	3	0
FISH:SALTWATER,FRESH OR FROZEN	6*	14*	12*	28*	10*	0*
FISH:SALTWATER,DRIED	23*	33*	35*	45*	30*	0*
OTHER FISH	2*	8*	3*	3*	1*	0*
GAME	2	2	3	1	1	0
OTHER MEAT	0	2	2	4	0	3
OTHER ANIMAL PRODUCTS	1	0	0	0	0	1
VEGETABLES	8	18	13	15	29	101
CITRUS FRUITS	5	8	7	5	-10	-6
BANANA,PLANTAIN AND AVOCADO	0	0	0	1	0	0
OTHER FRUITS	0	0	7	0	6	23
SUGAR	0	0	0	1	1	1
SALT AND OTHER CONDIMENTS	2	3	3	4	4	4
KOLANUT	2	0	1	5	10	0
BEVERAGES,NON-ALCOHOLIC	1	0	3	3	-1	0
BEVERAGES,ALCOHOLIC	39	29	23	8	1	0
MEALS	-6**	-5**	-6**	-13**	-4**	-1**
PERCENT OF HOUSEHOLDS IN EXPENDITURE SAMPLE	35	19	16	15	10	5

* HOUSEHOLDS IN ENUMERATION AREA 13 NOT INCLUDED.
** MEALS MEASURED IN NUMBERS.

CHAPTER VI

CONCLUSION

Eighty percent or more of the households in our sample consumed rice, palm oil, dried saltwater fish, cassava root and salt; every household consumed rice. According to our lower estimate the average household consumed 627 kg of rice during the year. This amount would provide 95 kg per person per year or 946 calories per person per day. (Our upper bound estimate would provide 1360 calories per person per day.) The mean consumption per consuming equivalent (Rice B estimate) was 129 kg per year (1285 calories per day). Annual cassava root consumption (the mean over all households) was 67 kg per consumer equivalent; the mean consumption of dried saltwater fish outside Enumeration Area 13 was 31 kg per year per consuming equivalent.

The poorest households (those in the lowest tercile of the income distribution) consumed distinctly smaller quantities of most foods: only 77 kg of rice (according to our lower estimate), 51 of fresh cassava and 22 of dried saltwater fish per consumer equivalent. This comes to 8/13 as much rice, 5/7 as much cassava and 2/3 as much dried saltwater fish. One would expect nutritional problems to arise in these households. The problem is to understand the factors affecting the diets of families in this lowest group and to find means of improving them.

Although regional differences in consumption patterns in Sierra Leone are believed to be significant, they have probably been concealed to a large extent by the grouping that was done to reduce the length of the commodity list. Nonetheless some regional variations appear, perhaps most clearly in the case of cassava. (The quantity measurements available were rough in the case of cassava.)

In the Southern Province cassava consumption was 153 kg per consuming equivalent, nearly twice the average for the whole sample. In the Northern and

Eastern Provinces cassava consumption was negligible. In addition, cassava consumption was very low (18 kg per consumer equivalent) in households using less than 18 percent of their labor for upland rice and in the most market-oriented households (20 kg per year). However, the sample in the latter class was small--only seven households. It may be that market orientation, the percentage of labor used for upland rice, and geographical location are all reflections of an unspecified mechanism that brings about low levels of cassava consumption. The average consumption of cassava was greatest (220 kg per adult male equivalent) in Resource Regions 4 and 7. Dried saltwater fish consumption was also strongly influenced by location in at least one part of the country. The mean quantity consumed was 54 kg per consumer equivalent in Resource Regions 1 and 3, 74 percent more than the mean for the whole sample. Region 1 produces large quantities of dried fish. The regional variable here may be a proxy for price differences related to transportation costs.

Wide variability in consumption levels was evident in all of the tabular classifications of the data, but only the income variable offered much by way of consistent relationships, easily understood. Household-to-household variability was much greater than the variability among the group means compared in these tables. What is now required is analysis of the simultaneous operation of these and other variables, using the household as the unit of observation. Only in this way will it be possible to identify and measure the relationships operating and to calculate the demand elasticities necessary in order to identify the relative strengths of the different effects.

The fund of information presented in this report, while going well beyond anything previously known about levels of household food consumption in Sierra Leone, leaves much yet unknown about the reasons for these dietary patterns, the factors that may cause them to change, and the effects that changes in dietary

patterns have upon the quantities of nutrients available to the household. These data, when used in the form of observations for the individual household, permit us to examine these questions. The tabulations presented here suggest hypotheses that can be tested and that must be tested by econometric analysis, analysis that can take interactions among the variables into account and introduce other variables (prices, in particular) that were not considered in these tables. It is to this task that we next turn our attention in the project of which this report is a part.

In addition to understanding the determinants of food consumption behavior, we must know what nutrient intake levels result from each behavioral pattern. Therefore we shall calculate the nutrient content of each household diet and study the direct relationships between the economic variables and the amounts of various nutrients provided by the diet. We must know what dietary changes may result from changes in prices, income or other variables, but we must also know whether those changes increase or decrease the quantities of the important nutrients available to the household. In particular, we must discover the factors that have most effect upon the diets and nutrient intake levels of low income families, for the data show clearly that they are much less well fed than the average and are therefore at much greater risk from malnutrition.

We have at our disposal an exceptional set of data, data that allow us to examine hypotheses about relationships between production and consumption decisions in households that produce both for the market and for home use. Few data sets have been collected that provide such comprehensive coverage of potentially relevant variables as our data set for rural Sierra Leone and the similar set for three Kano State villages in Nigeria with which we shall also work. In the few cases where such comprehensive data have been collected the study has usually been limited to a single village or possibly a region. Data on food consumption that

span such a range of ecological zones and farming systems as the Sierra Leone data are nearly, if not quite, non-existent. It is to the econometric analysis of these data that we now turn.

APPENDICES

I: NOTES ON METHOD

The overriding purpose of the research project to which this report is a contribution is to develop methods for use in predicting the effects of economic policy decisions upon the food consumption behavior of households that produce large portions of their own food. The basic hypothesis of the research is that decisions concerning food consumption form part of a unified decision-making process which governs production decisions, decisions as to the extent to which households shall depend upon the market (either as a source of income or as a source of food) and decisions as to the use of household labor in farm, non-farm or off-farm production activities. If food consumption decisions are affected not only by income and the prices of food purchased through the market, but also by the production decisions made when using resources for producing income, we shall obtain an adequate understanding of food consumption only as we examine the whole set of decisions made by the household. For this purpose it is imperative that we have data from an integrated survey of farm and non-farm production activities of the household as well as data for household consumption. Such data are extremely rare, but they do exist for Sierra Leone as a result of the micro-level survey conducted in 1974-75 by the African Rural Employment (ARE) Project. Data similar with respect to detail and coverage were also collected by Peter Matlon in three Kano State villages in northern Nigeria at about the same period. Our project will use these two data sets to test the usefulness of a household-firm model as a basis for the analysis of household food consumption behavior among families that produce large parts of their own food.

The Comprehensive Approach

The use of an integrated approach to household decision-making is essential, but inevitably it requires that a great deal of time and effort be spent on data collection. Detailed information must be obtained concerning a wide range of interrelated activities, so questionnaires will be lengthy and much time must be spent in administering them. The more subjects have to be dealt with, the more difficult it is to design satisfactory questionnaires and train interviewers capable of administering them satisfactorily. The more production activities must be considered, the more difficult it will be to obtain complete information about all of them. The longer the list of expenditure items to be recorded, the more likely it is that some will be overlooked.

In this survey all expenditures for consumption were to be reported, including, for instance, payments for school fees, drummers, gambling, clothing, services, household items and food products. The instructions for interviewers included a list of 75 food items commonly purchased for consumption.

Clearly a study of this magnitude places strains on the patience of the respondent and the energy and capacity of the interviewer. Interviewers are sometimes irresponsible; even the most carefully trained are fallible. As we might expect, some enumerators in the ARE survey were far more successful than others in obtaining detailed and complete records of consumer expenditures. In two enumeration areas the enumerators were so inadequate that those areas were dropped during data collection. Two more areas were dropped during data analysis because data from those areas were unreliable.

Whenever a survey has to be carried out with limited funds, priorities must be established. In a survey which will provide data to be used in a variety of later studies, those priorities involve choices between data needed for several studies and data needed for only one or two, as well as decisions with respect to the

importance of the various potential studies. Data that are central to the major purpose of the research will be collected with more care and attention than data that have peripheral usefulness. The relative weight attached to various types of data will be revealed in the way in which questions are designed, the time spent in training interviewers to deal with particular questions, the sequence in which questions are asked, and in the amount and type of pretesting done while constructing the questionnaires. If the questionnaire is a long one, the information obtained toward the end of the interview period may be affected by impatience or fatigue on the part of either respondent or interviewer. Moreover, the order in which questions are asked may convey to the respondent the feeling that the early questions are more important than the later ones.

Instances of different emphasis upon different types of data are readily found in the African Rural Employment Survey. Among the major studies the survey was designed to serve were investigations of farm production practices, measurements of rural incomes, and an inquiry into how changes in rural income might affect employment opportunities through their effects upon consumption expenditure patterns. Naturally much energy was spent in obtaining accurate measures of the output of the major agricultural crop, rice. The survey was designed to provide five different measurements of the output of rice production, including one based upon the use of yield plots for each farm. From these plots the outputs were weighed, but the other four measures were based upon farmers' reports of the quantities of rice harvested, threshed or pounded (cleaned). The investigators (Byerlee and Spencer) concluded that the yield plot measurements gave the most accurate measures of output quantity.

Data for outputs of other farm products, not to be studied in such detail, were based upon farmers' reports, as were data on inputs used in production and household expenditures for production or for food and other consumption items.

The quantities of outputs, inputs and household consumption purchases were expressed in local units (with the exception of the rice measured from the yield plots). Much care was devoted to determining the meanings of the various local units used as quantity measures. For some of the more important crops farm level measurements were made of such local units as ties or bundles in order to establish conversion factors appropriate for the crop and the geographic area. In the case of the household consumption expenditure data, however, while quantity data were collected, the primary concern was with the expenditure data, in line with the original purpose of determining how income changes affected expenditure and thus the employment opportunities created by the production of goods for sale in rural areas.

The interviewer schedule (two visits per week throughout the year) was designed to provide complete coverage of farm input and output decisions for the full agricultural year. Consumption expenditure data were collected less frequently (for one week out of each month) and from a sample which contained only half the households in the production sample.

Using By-Product Data

The decision to use data from the African Rural Survey for a study of household food consumption behavior was made two or three years after the end of the field survey. There are both problems and benefits associated with using survey data for a study conceived after the original survey was completed. The major benefit is that the data already collected are available at essentially zero cost. It would have been tremendously expensive to obtain the comprehensive data required for determination of household food consumption behavior if the whole cost of collecting those data had to be borne by this one research project. The data collection process could have been designed with more attention to the

specific needs of research into household food consumption but, considering the cost of field research, in all probability the data would not have been collected at all. The food consumption survey that provides adequate information about the economic determinants and farm production aspects of the household decision process is a rare, if not non-existent, phenomenon. Given the limited funds normally available for study of the economic determinants of food consumption behavior, the researcher concerned with these problems may have to reconcile himself to using data that are at best a joint product, and most often a by-product.

Other benefits accrue in the process of coding, editing and organization of the data. Much of the material needed for the study of consumption behavior was also needed for the measurement of rural incomes or the analysis of farm production practices, so those data are often available in final form simply by reading the tape on which they are stored.

The sacrifices inherent in using by-product data stem mainly from the fact that the original decisions may have been better tailored to the needs of studies dealing with other aspects of the household than to the needs of a study of food consumption. Decisions that were optimal in terms of the studies anticipated at the time of the survey would not be likely to be optimal from the standpoint of unanticipated studies. Differences in objectives lead to differences in procedures.

One example of this concerns the period covered by the survey. A 12-month survey that begins just before planting season is ideal for studying production problems, for it permits relating planting decisions to harvest outcomes and input use to outputs obtained. The best cycle for the measurement of food consumption, however, would begin with the harvest and end one year later. Market expenditures would be expenditures out of the income earned in that harvest and the consumption of food produced at home would be the consumption of food produced during that harvest. The objectives of the production and consumption studies are inherently inconsistent.

One way of dealing with the conflicting objectives would be to conduct the survey over a period of perhaps 18 months or so, beginning with a harvest period. Thus one could obtain a 12-month record of food consumption and market expenditures based on the harvest at the beginning of the period plus a complete record of inputs and resulting outputs during the year ending at the close of the next harvest. Problems will arise in applying this principle wherever harvests are spread over several months, or harvest and planting seasons overlap. The chance of this happening increases when several types of crops are grown. In any case, collecting data over a long enough period to cover both the consumption and the production cycles is far more expensive than covering a single 12-month period.

The data obtained in the African Rural Employment Survey cover the period from May 1974 through April 1975. The period corresponds essentially to the production year, defined as beginning with the planting season. Actually, some planting of rice and groundnuts occurs in April, while rice planting in the tidal swamps begins in March. Cassava cuttings, of course, may be planted in any month. [Mutti, 1968, pp. 34, 50.] This is a good schedule for studies of production, but less well suited to the analysis of consumption behavior.

With May to April scheduling the dominant income influence between May and the fall harvest season of 1974 will be from income obtained from the 1973 harvest (although expectations concerning the coming harvest in 1974 may also matter). Between the 1974 harvest season and April 1975 the income stemming from the 1974 harvest season will be controlling. Expenditure data collected from May through April represent responses to income figures for two different years.

The same phenomenon occurs with respect to the consumption of foods produced by the household. Withdrawals from stocks between May 1974 and the fall harvest period clearly depend upon the outcome of the 1973 harvest, while sales and other forms of disappearance from the harvest period through April 1975 depend

upon the outcome of the 1974 harvest season. If we assume, however, that 1973 income and harvests were the same as in 1974, the problem disappears. That is, we may take the 1974 harvest results and the income thereby generated as our income estimate for the whole May to April consumption year, thus arriving at a consumption year that coincides with the production year. This implies also the assumption that beginning inventories in May 1974 equal ending inventories in April 1975. Some adjustment for year-to-year variations in harvest could be made if accurate information were available for stocks in storage at the beginning of the planting year, but accurate reporting of storage stocks is difficult to obtain.

Another way of viewing the situation is to think of a harvest-to-harvest consumption year. We may then regard both expenditures and sales and other forms of disappearance of physical commodities between May and the 1974 harvest period as estimates of the sales and commodity disappearance to be expected from May 1975 to the end of a consumption period that began with the 1974 harvest season. This interpretation leads to the same results as the assumptions presented in the previous paragraph.

As has already been indicated, the study that is peripheral to the central purposes of a survey, or that comes as a late addition to the anticipated uses of the data may run into serious difficulties in making use of data from that survey. In this respect we are very fortunate, for a study of the household food consumption of households producing a large part of their own food will make essentially the same judgments concerning the importance of different kinds of data as will a study concerned primarily with the production operations of those households. For instance, rice is not only the major crop of most farms in Sierra Leone, it is also the largest component of the diet for most households. The decision to devote special effort to obtaining accurate information concerning rice outputs is useful for our purposes as well as for the purposes of the production studies. Similarly, oil

palm products, groundnuts and fish are products of importance to the household diet as well as to the entire production operation, so the extra attention given to these products benefits the study of food consumption behavior as well as the study of farm incomes and production practices. In general, the correspondence between the needs of a food consumption study and the needs of a study of household production is high. A possible exception is the production of cassava, a significant item in the diet but one for which accurate information on output is extremely difficult to obtain. This is partly because the output is ordinarily measured as "ties" or as numbers of roots and partly because cassava may be harvested at various times throughout the year, usually in small amounts as needed for immediate consumption or sale.

The collection of consumption data did not get as much attention as the collection of production data, but even here we have benefited from the fact that one of the products of the original survey was to be a study of the relationship between household income and (1) the place of origin of commodities purchased and (2) the proportion of labor to capital that was used in producing the product. As a result of these interests, the data on consumer expenditures were collected in extraordinary detail and provide the kind of specific information about the kinds of commodities purchased that is rarely available.

The by-product study, or the study using by-product data, also benefits from the editing, cleaning and other processing already done on some of the data being used. But not all such work will have been done. In our case, for instance, the expenditure data had been cleaned and edited, but the data on quantities purchased had not. The remaining work may be more time-consuming than it would have been had it been done earlier, because the researchers engaged in the new study will not be familiar with the data and will lack detailed familiarity with the history of the decisions made in the course of collecting and processing the data from the original

survey. Additional problems arise if those who carried out the original survey and the processing of the data have moved on to other studies or other places.

Local Units

Expenditure surveys normally measure quantities (if they measure them at all) in units used in local markets. To weigh the individual items bought by the household would be extremely costly for any survey covering large numbers of households or more than a few days during the year. Weighing is especially difficult in developing countries where even getting scales to weigh with is a problem.

Interpreting local units raises problems, though less so in advanced countries where weights are commonly used as units of measurement and measurements are more likely to be standardized. In the developing countries, quantity units are less likely to be standardized and sales by volume or by count are far more common than sales by weight. In Sierra Leone, for instance, groundnuts (peanuts), cassava, tomatoes, jakato (a kind of small eggplant sometimes called bitter tomato), okra and peppers are often sold by the heap at retail while cassava roots and green leaves (plasas) are often sold by the tie. The weight of a tie or heap varies from commodity to commodity. Cassava, fish, most fruits, some vegetables, the smaller meat animals (including bushmeat--various unspecified wild animals), Maggi cubes (bouillon cubes), kola nuts and groundnut balls are commonly sold by the count.

The problem is not insuperable, however. We were fortunate in having weighings of groundnut balls (made as part of a marketing study done in conjunction with the African Rural Employment Survey) and detailed information on weights of the various species of fish caught in Sierra Leone (done as a part of Dean Linsenmeyer's study of the fisheries industry, also a part of the African Rural Employment Project work [Linsenmeyer, 1976]). Fish and groundnut balls are

important ingredients of the diet in Sierra Leone. There are also various published items of information concerning many of the units.

Volume units, even though often unfamiliar to the Western ear, are in fact quite well standardized in Sierra Leone. For instance, the cigarette cup (or tin), the penny pan, the threepence pan (equal to two penny pans), the kettle and the tin have standard definitions. [Sierra Leone. Ministry of Agriculture and Natural Resources, 1965, p. 47. Hereafter cited as Ministry of Agriculture.]

The containers commonly used are often themselves by-products, e.g., the cigarette tin (which had become quite scarce by the summer of 1978) and the tin (a 4-gallon kerosene tin). The kerosene tin is no longer readily available since most fuel is now supplied in 44-gallon drums or in bulk. In the summer of 1978 the Blue Band margarine cup (8 ounces) was being used widely. Many kinds of bottles are used, including Atwood's Bitters, the small beer (reputed to contain a pint), the large beer (reputed to contain a quart), the cod liver oil, the baby cham (champagne) and so forth. [Mutti, 1968, p. 193; data from the African Rural Employment Marketing Study questionnaires; Sierra Leone, Ministry of Agriculture, 1965, p. 47.]

Occasionally published definitions of commodity units are in conflict. The Agricultural Statistical Survey in Sierra Leone, 1970/71 states [1972, p. 740] that there are three threepence pans in one kettle (a kettle is one-fourth of a bushel), but the table of weights and measures in the 1965 report of the Ministry of Agriculture [1965, p. 47] specifies five threepence pans to the kettle. Both sources agree that there are eight cigarette cups in one threepence pan. The weighings of cigarette cups of rice that were done in the African Rural Employment Marketing Survey make it clear that the correct ratio is five threepence pans to the kettle.

Familiar unit names do not always refer to the quantities that we expect. Volume measures are based on, but not identical with, the British Imperial system

of measures. The gallon corresponds to the Imperial gallon, but the "pint" contains eleven fluid ounces while the British pint contains twenty. The bottle (reputed quart) contains 22 fluid ounces according to Mutti [p. 193] and 23 fluid ounces according to the conversion ratios used in the African Rural Employment Survey. At 23 ounces to the bottle, there are seven bottles in the gallon. The 1965 report of the Ministry of Agriculture gives six reputed quarts to the gallon [p. 47].

With the dry measures the problem is still different. The practice is to heap up the contents until no more will stay on [Ministry of Agriculture, p. 47]. Consequently, the "bushel" in Sierra Leone is some 10 percent larger than the Imperial bushel. The percentage excess of the bushel weight in Sierra Leone varies from commodity to commodity because the amount of heaping that is feasible varies with the commodity.

Making wise use of quantity records reported in local units creates problems for the researcher that are not insuperable but can be extremely time-consuming. Fortunately, the units are well defined for the most important foods. The principal nutritional problem in Sierra Leone is deficient calorie intake, so the food commodities of major importance are rice, cereals, groundnuts and palm oil. The quantity units are well defined for all of these, as well as for fish, an important source of protein. They are less well defined for fruits (sold usually by the count) and rather poorly defined for vegetables and beverages. However, there is little evidence of widespread nutritional deficiencies of the sort that would require exact information concerning the consumption of fruits and vegetables.

II. THE INTERVIEW PLAN

By Sarah Lynch

[The interviewing procedure designed for the African Rural Employment Survey provided for a 7-day sample of household consumption expenditures, to be collected once a month. In a number of cases, however, data were actually obtained for only three or four days in the month. The practical problem was to decide whether to use these 3-or 4-day samples along with the 7-day samples (plus some with even more days). Sarah Lynch's analysis of the data indicated that the 4-day samples in themselves yielded satisfactory estimates of expenditure levels (possibly even more accurate than the 7-day samples, though with higher variance).

Miss Lynch also discovered that the households for which only 4-day samples were available in particular months behaved differently than the others. As a consequence we concluded that they should be retained in our sample to provide more comprehensive representation of the rural households of Sierra Leone, as well as for the reasons advanced in the previous paragraph.

Miss Lynch's analysis deals specifically with questions relating to frequency of interview and length of the reference period. She presents here a statement of her major findings. Greater detail may be found in her Master's thesis: "An Analysis of Interview Frequency and Reference Period in Rural Consumption Expenditure Surveys: A Case Study from Sierra Leone" (Department of Agricultural Economics, Michigan State University, East Lansing, Michigan, 1979).]

Introduction

Two issues are of critical importance in the design of rural consumption expenditure surveys. The first is interview frequency, that is, the number of times within a month or other relevant period a household is visited. The second issue is

the reference period used in an interview. The reference period is the length of time over which a respondent is requested to report purchases during one interview. This could be anywhere from a 24-hour, or one-day, recall period, to a week, month, 6-month or even a year reference period. Both these issues influence significantly the reliability and usefulness of the data as well as the cost and amount of time required to obtain the data.

There now exists very little empirical evidence on the trade-offs involved in making decisions concerning interview frequency and length of reference period in consumption expenditure surveys. The purpose of this study is to make an empirical assessment of these two issues, using expenditure data collected in a comprehensive micro-level study conducted in rural Sierra Leone in 1974-1975. The design of the Sierra Leone study used the method of frequent visit surveys. Such surveys use interview schedules that include repeated visits to participating households during each month and extend over a relevant period such as one crop season or calendar year.

Interview Frequency

The plan was that households participating in the Sierra Leone consumption expenditure survey were to be interviewed two times each month for 14 months, obtaining data for expenditures on seven contiguous days. Each interview used a four-day reference period, one day being common to both interviews. Of course not all interviews could be carried out exactly as scheduled.

We divided the monthly household records that resulted into three categories in order to analyze the influence of interview frequency on expenditure estimates. The two-interview set, to be identified later by the subscript T, consisted of those household-month records which contained two interviews during which information on seven contiguous days was collected. A one-interview subset (to be identified

later by the subscript S) was drawn from the same household-month records as the two-interview set by using data from only one of the interviews. The third group, the one-interview independent set (to be identified later by the subscript I), consisted of household-month records which, for any number of reasons, had complete expenditure records for only one interview in a month.

Non-Parametric Analysis

Several approaches were used to examine the influence of interview frequency on expenditure estimates. Non-parametric sign tests were used to compare the data in their most disaggregated form. The use of non-parametric tests allows the relaxation of the assumption that the underlying population has a normal distribution. It is, however, assumed that the observations are random and independent, and that with a large sample the binomial probability distribution approaches the normal distribution, permitting the computation of test statistics with which to test the research hypotheses.

The use of the non-parametric sign test assumes a dichotomized variable, that is the outcome of any trial or comparison, can result in only one out of two outcomes. It is further assumed that the probability of one of those outcomes occurring is 50%. The non-parametric sign test was used in this study to compare the mean monthly expenditure estimates and variances calculated for each of the 257 commodities and services using data obtained from the two-interview sets, the one-interview subset, and the one-interview independent set. The differences between the means of these three samples were calculated using paired data. The number of times that the difference was greater than or less than zero was counted. Similarly, a ratio of variances was constructed for each pair. The number of times the ratio was greater than or less than one was counted.

The research hypothesis being tested here was that there was no difference in the probability distribution of the means and variances when comparing the two-interview set with the one-interview subset, the two-interview set with the one-interview independent set, and the one-interview subset with the one-interview independent set. Put in another way, the hypothesis stated that there was a 50-50 chance that the commodity mean (and variance) from one set or subset would be larger than that from the other.

1. Comparison of the Two-Interview Set with the One-Interview Subset

In the first test of the research hypothesis it was found that $\bar{X}_{Tjk}$, the mean monthly expenditure on the j^{th} commodity (1, 2, ..., 257) in the k^{th} month (1, 2, ..., 14), based on two interviews per month, was larger in 509 cases than $\bar{X}_{Sjk}$, the mean monthly expenditure on the j^{th} commodity in the k^{th} month, based on the one-interview subset. The opposite was true in 617 cases. Using this information a Z statistic of -3.22 was computed. This information is summarized in Table A.1. The Z statistic has a two-tailed significance level of .0014. (If the two samples were drawn from the same population, a Z value as large as 3.22 would occur by chance only 14 times in 10,000.) On the basis of these sets of data the research hypothesis of no difference between the means cannot be accepted at the .05 level of significance.

TABLE A.1

RESULTS OF NON-PARAMETRIC TESTS COMPARING THE TWO-INTERVIEW SET WITH THE ONE-INTERVIEW SUBSET

Ho: $p = .5$
Ha: $p \neq .5$

where p = probability that $(\bar{X}_{Tjk} > \bar{X}_{Sjk})$

where: $\bar{X}_{Tjk}$ = mean monthly expenditure on the j^{th} commodity (1,...,257) in the k^{th} month (1,...,14) based on two interviews per month.

$\bar{X}_{Sjk}$ = mean monthly expenditure on the j^{th} commodity (1,...,257) in the k^{th} month (1,...,14) based on one interview per month which is a subset of $\bar{X}_{Tjk}$.

$n = 1126$

From the estimates for $\bar{X}_{Tjk}$ and $\bar{X}_{Sjk}$ the following were calculated:

$\bar{X}_{Tjk} - \bar{X}_{Sjk} > 0$ in 509 cases and

$\bar{X}_{Tjk} - \bar{X}_{Sjk} < 0$ in 617 cases.

These are standard binomial random variables with a standardized normal distribution $\simeq N(0,1)$.

$$Z = \frac{509-.5(1126)}{\sqrt{1126(.5)(1-.5)}} = -3.22$$

The inability to accept the null hypothesis offers some evidence that the frequency of interview does influence expenditure estimates, at least in statistical terms. In practical terms, however, the numbers are not extremely dissimilar. They indicate that approximately $6/11^{ths}$ of the time the mean expenditure estimates from the one-interview subset are larger than the means derived from the two-interview set. The opposite is true approximately $5/11^{ths}$ of the time. This

suggests that there is on average a tendency for expenditure estimates based on one interview to be larger than those based on two interviews per month.

The variances drawn from the two-interview set tend to be smaller than those from the one-interview set. In 721 cases σ^2_{Tjk}, the variance of the two-interview expenditure records for the j^{th} commodity group (1, 2, ..., 257) over k months (1, 2, ..., 14) was smaller than σ^2_{Sjk}, the variance of the expenditure records for the one-interview subset for the j^{th} commodity group over k months. The opposite was true in 401 cases. No significance test was computed for the variances. The generally smaller variances observed in the two-interview set are expected, given that variations in expenditures are averaged over a greater number of days.

2. Comparison of the Two-Interview Set with the One-Interview Independent Set

The same research hypothesis was tested again, this time comparing $\bar{X}_{Tjk}$, the mean monthly expenditure for the j^{th} commodity, (1, 2, ..., 257) in the k^{th} month (1, 2, ..., 14) based on two interviews per month and $\bar{X}_{Ijk}$, the mean monthly expenditure for the j^{th} commodity in the k^{th} month derived from the one-interview independent set. The means derived from the two-interview set are larger in this analysis than the one-interview means in 973 cases. The opposite is true in 425 cases. Table A.2 summarizes this information.

TABLE A.2

COMPARISON OF THE TWO-INTERVIEW SET WITH THE ONE-INTERVIEW INDEPENDENT SET

Ho: $p = .5$
Ha: $p \neq .5$

where p = probability that $(\overline{X}_{Tjk} > \overline{X}_{Ijk})$

where: $\overline{X}_{Tjk}$ = mean monthly expenditure on the j^{th} commodity (1,...,257) in the k^{th} month (1,...,14) based on two interviews per month.

$\overline{X}_{Ijk}$ = mean monthly expenditure on the j^{th} commodity (1,...,257) in the k^{th} month (1,...,14) based on the one-interview independent set.

n = 1398

From the estimates for $\overline{X}_{Tjk}$ and $\overline{X}_{Sjk}$ the following were calculated:

$\overline{X}_{Tjk} - \overline{X}_{Sjk} > 0$ in 973 cases and

$\overline{X}_{Tjk} - \overline{X}_{Sjk} < 0$ in 425 cases.

These are standard binomial random variables with a standardized normal distribution $\simeq N(0,1)$.

$$Z = \frac{973-.5(1398)}{\sqrt{1398(.5)(1-.5)}} = 14.656$$

These results are the reverse of those obtained in the previous test. In that test the one-interview means tended on average to be larger than the two-interview means. Not only are the means of the two-interview set larger in this test on average than those from the one-interview independent set but the frequency of this occurrence is much greater, as evidenced by the large Z statistic of 14.655.

This is a very important contrast. In the first test of the research hypothesis the only difference between the two samples was the frequency of interview.

Since the one-interview subset was taken from the two-interview data set, the households contained in each sample were the same. This significantly reduced the possibility that other factors such as income, household size or education might have an influence on the results. Thus, to the extent possible the impact of interview frequency on expenditure estimates at the monthly level was isolated. The data suggested that the isolated effect of the difference in interview frequency was for one-interview mean expenditures to be on average larger than those based on two interviews per month. On the other hand, when the one-interview households were different households than the two-interview group, their mean expenditures tended to be lower than those of the two-interview group.

3. Comparison of the One-Interview Subset with the One-Interview Independent Set

The final test of this research hypothesis compared $\bar{X}_{Sjk}$, the mean monthly expenditure on the j^{th} commodity (1, 2, ..., 257) in the k^{th} month (1, 2, ..., 14) based on the one-interview subset and $\bar{X}_{Ijk}$, the mean monthly expenditure for the j^{th} commodity in the k^{th} month derived from the one-interview independent set. The mean monthly expenditure estimates from the one-interview subset are larger than the mean monthly estimates from the one-interview independent set 767 times while the reverse is true 429 times. The frequency with which the one-interview subset means tend to be larger is well in excess of what might have been expected purely from chance. This is supported by the large Z statistic (9.744), given in Table A.3. The variance of estimates from the one-interview subset also tends to be larger than those derived from the one-interview independent set. (It is larger in 794 cases while the reverse is true in 403 cases.)

TABLE A.3

COMPARISON OF THE ONE-INTERVIEW SUBSET WITH THE ONE-INTERVIEW INDEPENDENT SET

Ho: $p = .5$
Ha: $p \neq .5$

where p = probability that $(\bar{X}_{Sjk} > \bar{X}_{Ijk})$

where: $\bar{X}_{Sjk}$ = mean expenditure for the j^{th} commodity (1,...,257) for the k^{th} month (1,...,14) based on the one-interview subset.

$\bar{X}_{Ijk}$ = mean expenditure for the j^{th} commodity (1,...,257) for the k^{th} month (1,...,14) based on the one-interview independent set.

$n = 1198$

From the estimates for $\bar{X}_{Sjk}$ and $\bar{X}_{Ijk}$ the following were calculated:

$\bar{X}_{Sjk} - \bar{X}_{Ijk} > 0$ in 767 cases and

$\bar{X}_{Sjk} - \bar{X}_{Ijk} < 0$ in 429 cases.

$$Z = \frac{767-.5(1196)}{\sqrt{1196(.5)(1-.5)}} = 9.774$$

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4. Implications of These Findings

The lack of information on the characteristics of the households contained in the two sets prohibits conclusive explanation of these observed differences. However, one possible explanation is that the two samples were not drawn randomly from the same population. This would imply that the two samples reflect different population characteristics. This might occur for two reasons. One deals with the willingness of respondents to participate while the other deals with an enumerator's interviewing techniques. In the former case a respondent's willingness or unwillingness to participate in a survey might be reflected in whether or not the household was interviewed according to schedule. A householder's receptiveness to the survey, his availability during interview sessions, and general interest in the survey, could influence the number of times per month and per year the household was visited by the enumerator. Problems in the reliability of the data can be caused if this difference in receptivity is not random but is based on specific population characteristics such as income, education, type of employment or ethnic group. In survey design this is known as the problem of self-selection.

Quite aside from the receptivity of the respondent, various differences in population characteristics could influence the number of times an enumerator visited a particular household. Enumerators could be less vigorous in their attempts to interview households of a particular ethnic group, income bracket, or level of education.

This hypothesis could be used to explain the results obtained when comparing the two-interview set, the one-interview subset, and the one-interview independent set. The latter might reflect a greater proportion of households with lower incomes or remote from urban areas and, thus, would be both more difficult to reach and less involved in a market economy. If this were the case, the lower means might reflect fewer purchases, less variety in purchases and/or less total

income spent on commodity purchases. This would also explain why the variances of estimates from the one-interview independent set are characteristically smaller than the variances of estimates from either the two-interview set or its one-interview subset.

One of the purposes of the comparison of expenditure records from the two-interview set and the one-interview independent set was to determine whether data from the one-interview independent set should be used, even though those interviews did not accord entirely with the original plan of the survey. If the one-interview independent set represents households with different characteristics than those represented by the two-interview set (characteristics that are not a random sample of the whole set of households surveyed), the data from the one-interview set must be used, or a potentially significant distortion would be introduced into the data. Failure to use the data from this genre of households could result in biased expenditure estimates and policy conclusions which might have undesired consequences.

Some Parametric Tests

1. Total Mean Monthly Expenditure Estimates

While these non-parametric tests indicate that there is a tendency for the one-interview subset expenditure estimates to be greater than estimates based on two interviews, the figures do not tell the magnitude of this difference. To obtain a rough indication of this magnitude, the mean monthly expenditure estimates for all commodities and months were totaled for both the two-interview set and the one-interview subset. This yielded two estimates of total mean expenditure, given in Table A.4.

TABLE A.4

COMPARISON OF TOTAL MEAN MONTHLY EXPENDITURES

Ho: $\bar{X}_{TE} = \bar{X}_{SE}$
Ha: $\bar{X}_{TE} \neq \bar{X}_{SE}$

where: $\bar{X}_{TE}$ = total of mean monthly expenditures for all commodities for all months, based on two interviews per month.

$\bar{X}_{SE}$ = total of mean monthly expenditures for all commodities for all months, based on the one-interview subset.

n = 1126

and where:

$$\bar{X}_{TE} = \sum_{j=1}^{257} \sum_{k=1}^{14} \bar{X}_{Tjk}/n = 25.095 \text{ Leones}$$

$$\bar{X}_{SE} = \sum_{j=1}^{257} \sum_{k=1}^{14} \bar{X}_{Sjk}/n = 26.910 \text{ Leones}$$

j = commodity $(1,\ldots,257)$
k = month $(1,\ldots,14)$

$$t = \frac{25.095 - 26.910}{\sqrt{[\sigma^2_{TE} + \sigma^2_{SE} - 2(COV)]\frac{1}{n-1}}} = -3.135$$

The total mean expenditure estimate for all commodities for the two-interview data set for fourteen months of information is 25.095 Leones. The total mean expenditure estimate for the one-interview subset is 26.910 Leones. Using the correlated t-test procedure to test the difference between the two means the test statistic derived was -3.135. From a statistical point of view the difference between these two means is significant at the .05 level. Therefore the research

hypothesis that the total mean expenditure estimate based on two interviews per month is equal to the mean expenditure estimate obtained from a one-interview subset cannot be accepted. These figures support the results obtained earlier that the expenditure estimates based on one interview have a tendency to be slightly larger than those based on two interviews per month.

2. Analysis by Commodity Groups

The analysis to this point has compared mean monthly expenditure estimates based on different interview frequencies for a highly disaggregated set of commodities. Another approach is to look at groups of commodities. Here we compare annual expenditure estimates derived from the two-interview set and the one-interview subset by using 16 commodity groups derived from the original commodity list. (See Table A.5)

TABLE A.5

COMMODITY GROUPS

1. Rice	9. Sugar
2. Grains	10. Fresh Fish
3. Cassava and Other Root Crops	11. Dried Fish
4. Vegetables, Beans and Fruit	12. Bakery Items
5. Groundnuts	13. Other Processed Foods
6. Palm and Other Oils	14. Alcoholic and Non-Alcoholic Beverages
7. Meat and Other Livestock Products	15. Tobacco and Kola Nuts
8. Salt and Other Condiments	16. Fuel and Light

We used the data for only twelve months and included in the sample only households with data for more than eight months of those twelve. If the data for one or more months were missing for any of the households to be included, monthly expenditure figures for those months were estimated, using commodity indices. Separate monthly indices were created for the two-interview set and the one-interview subset for each of the 16 commodity groups. Using these indices annual expenditure estimates were calculated for each household. (The procedure is described in fuller detail in [Lynch, 1979].)

The research hypothesis, that the means of the two estimates were equal, was tested for each of the 16 commodity groups, using the correlated t-test. The alternative hypothesis was that the means were not equal. The results are provided in Table A.6.

The differences were insignificant at the .05 level for 14 out of the 16 commodity groups. Rice and Palm and Other Oils were the two commodity groups where the difference between the means was determined to be significant. These results provide very weak evidence against the research hypothesis that the means generated by two interviews in a month are equal to those based on one interview per month.

TABLE A.6
RESULTS OF COMPARISON OF MEAN ANNUAL ESTIMATES

Ho: $\bar{X}_{TAj} = \bar{X}_{SAj}$
Ha: $\bar{X}_{TAj} \neq \bar{X}_{SAj}$
n = 104

$\bar{X}_{TA}$ = two-interview mean annual commodity expenditure estimate
$\bar{X}_{SA}$ = one-interview subset mean annual commodity expenditure estimate
j = commodity (1,...,16)

Commodity	$\bar{X}_{TA}$ (Leones)	$\bar{X}_{SA}$ (Leones)	T-Value	Probability	Significance
1. Rice	58.96	69.99	-3.13	.002	S
2. Other Grains	1.75	2.35	-1.01	.315	NS
3. Cassava and Other Root Crops	3.18	3.72	- .98	.330	NS
4. Vegetables, Beans and Fruit	3.11	3.62	-1.38	.170	NS
5. Groundnuts	.57	.63	- .74	.462	NS
6. Palm and Other Oils	36.55	29.60	3.94	.000	S
7. Meat and Other Livestock Products	5.98	5.52	.61	.541	NS
8. Salt and Other Condiments	10.59	11.08	-1.34	.184	NS
9. Sugar	2.42	2.27	.79	.434	NS
10. Fresh Fish	8.19	7.96	.60	.550	NS
11. Dried Fish	34.47	36.73	-1.33	.186	NS
12. Bakery Items	2.84	2.50	.97	.336	NS
13. Other Processed Food	1.08	1.33	-1.67	.099	NS
14. All Beverages	3.63	3.79	- .37	.713	NS
15. Tobacco and Kola Nuts	13.52	13.55	- .07	.946	NS
16. Fuel and Light	16.05	15.61	.73	.470	NS

*NS = not significant at the .05 level
S = significant at the .05 level

3. Total Annual Expenditures

Estimates of total annual expenditures were also calculated for the same two data sets. These estimates were based on data covering only 12 months and drawn from only those households for which data were available for at least 8 months of the 12. (The estimates in Table A.4 made use of the data for any month in which the two-interview data were available for a particular household and averaged these household-month figures, using all 14 months for which data had been collected.) In addition, the data examined in this section do not cover all expenditures, but only expenditures for commodities included within the 16 commodity groups listed in Table A.5.

In this test $\bar{X}_{TA}$, the annual mean expenditure for each commodity group (1,...,16), based on two interviews per month, was compared with $\bar{X}_{SA}$, the annual expenditure figures derived from the one-interview subset. Tested again was the research hypothesis that the two means were equal, with the alternative hypothesis being that the two means were not equal. The results are summarized in Table A.7.

TABLE A.7

RESULTS OF COMPARISON OF TOTAL ANNUAL EXPENDITURE ESTIMATES

Ho: $\bar{X}_{TA} = \bar{X}_{SA}$

Ha: $\bar{X}_{TA} \neq \bar{X}_{SA}$

$\bar{X}_{TA}$ = Total annual expenditure for all commodities (1,...,16) based on two interviews per month.

$\bar{X}_{SA}$ = Total annual expenditure for all commodities (1,...,16) based on the one-interview subset.

n = 104

$\bar{X}_{TA}$ (Leones)	$\bar{X}_{SA}$ (Leones)	T-value	Probability	Significance
202.87	210.24	-1.36	.177	NS*

*NS = not significant at the .05 level

Using the correlated t-test, the research hypothesis that the two means are equal cannot be rejected. At the .05 level of significance the difference between the means is not significant.

Length of Recall Period

The Sierra Leone study also provides the opportunity to examine the characteristics of daily expenditure records with respect to the length of the recall period involved (the number of days of recall). In the first attempt to explore these characteristics, the mean daily expenditure records were compared from each of the days in a four-day reference period. The data contained in the one-interview subset were used in this analysis. This data set consisted of household expenditure records covering four consecutive days, obtained during one interview per month. Each household included in the sample had a reference period which

included the first, second, third and fourth day of recall. The 16 commodity groups were used for this analysis. Mean expenditure totals were computed for each of the days of recall for each of the 16 commodity groups, using all 14 months of data.

The purpose of this analysis was to detect significant differences among the estimates of mean expenditures generated by the different days of recall. Assuming that the properties of independent random sampling hold, one would expect that the mean commodity expenditures from each of the four different days of recall would, on the average, be equal. Significant differences among the mean estimates obtained from different recall periods would suggest the existence of some problems associated with the respondent's ability to remember events.

The research hypothesis tested first in this analysis was that the individual mean expenditure estimates derived from each of the four different days of recall were equal. Using Hotelling's T^2 statistic to test this hypothesis, the four means differed significantly in 5 out of 16 cases at the .05 level of significance (Table A.8). The probability of obtaining 5 rejections out of 16 by chance is very slim. Therefore, one would conclude that there is a statistically significant difference between expenditure estimates obtained from the four successive days of recall.

TABLE A.8
TEST STATISTICS FOR EQUALITY OF MEANS OF THE FOUR INDIVIDUAL DAYS OF RECALL FROM THE FIRST INTERVIEW

Ho: $\bar{X}_{Aj} = \bar{X}_{Bj} = \bar{X}_{Cj} = \bar{X}_{Dj}$

Ha: not all the $\bar{X}$'s are equal

n = 1784

$\bar{X}_A$ = mean expenditure based on the first day of recall from the first interview
$\bar{X}_B$ = mean expenditure based on the second day of recall from the first interview
$\bar{X}_C$ = mean expenditure based on the third day of recall from the first interview
$\bar{X}_D$ = mean expenditure based on the fourth day of recall from the first interview
j = commodity (1,...,16)

Commodity	T^2	F Statistic	Probability	Significance*
1. Rice	3.87	1.29	.277	NS
2. Other Grains	3.56	1.18	.315	NS
3. Cassava and Other Root Crops	2.58	.86	.462	NS
4. Vegetables, Beans and Fruits	3.16	1.05	.369	NS
5. Groundnuts	2.47	.82	.482	NS
6. Palm and Other Oils	3.79	1.26	.286	NS
7. Meat and Other Livestock Products	4.14	1.38	.248	NS
8. Salt and Other Condiments	25.44	8.47	.000	S
9. Sugar	6.74	2.25	.082	NS
10. Fresh Fish	8.53	2.84	.037	S
11. Dried Fish	25.36	8.44	.000	S
12. Bakery Items	3.11	1.04	.376	NS
13. Other Processed Foods	2.90	.97	.407	NS
14. All Beverages	.52	.17	.914	NS
15. Tobacco and Kola Nuts	25.92	8.63	.000	S
16. Fuel and Light	20.77	6.92	.000	S

*NS = not significant at the .05 level
S = significant at the .05 level

Unfortunately, these statistics do not reveal any information about the relationships among the individual days of recall. For our purposes, more specific information was needed on the characteristics of records obtained from the different days of recall. To obtain this, a simple comparison of expenditure means was made between each pair of recall days. A count was made of the number of times the mean from a particular day of recall was larger than that from another day of recall. The results of this simple non-parametric test indicate that the expenditure means based on the first day of recall are higher in almost every case than those from the second, third and fourth day of recall. (See Table A.9)

TABLE A.9
COMPARISON OF MEAN EXPENDITURES OF EACH DAY OF RECALL

A = 1st day of recall mean expenditures
B = 2nd day of recall mean expenditures
C = 3rd day of recall mean expenditures
D = 4th day or recall mean expenditures

	Frequency		Frequency		Frequency		Frequency
A > B	15	B > A	1	C > A	1	D > A	0
A > C	15	B > C	6	C > B	10	D > B	7
A > D	16	B > D	9	C > D	10	D > C	6

Guided by the insights gained through the use of the non-parametric test, a stronger statistical test was developed to examine more rigorously the relationships among the four days of recall. This was accomplished by comparing the mean daily expenditures based on the sum of recall days two through four with the means based on the first day of recall. Here the research hypothesis tested was that the daily expenditure means based on the sum of the last three days of recall equaled those generated by the first day of recall. To make this a stronger test a

one-tailed alternative hypothesis was used that stated that the means of the first day of recall were greater than the daily means of the sum of the second, third and fourth days of recall. The research hypothesis was rejected in 8 out of 16 cases. The results are given in Table A.10. This analysis provided strong statistical evidence that the mean expenditure estimates derived from the first day of recall were significantly different from the average of the other three days of recall at the .05 level of probability.

The results also indicate that the observed difference was always in one direction. The mean expenditures based on the first day of recall were higher in 15 out of 16 cases than those based on the average of the second, third and fourth day of recall. The sum of the first-day means for all commodity groups exceeded the sum of the means based on the other three days by 40 percent.

TABLE A.10
COMPARISON OF FIRST DAY OF RECALL WITH THE AVERAGE OF THE SECOND, THIRD AND FOURTH DAY OF RECALL

Ho: $\bar{X}_{A_j} = \bar{X}_{T_j}$

Ha: $\bar{X}_{A_j} > \bar{X}_{T_j}$

n = 1787

$\bar{X}_A$ = mean daily expenditure based on the first day of recall

$\bar{X}_T$ = mean daily expenditure based on the second, third, and fourth day of recall

j = commodity (1,...,16)

Commodity	$\bar{X}_A$ (Leones)	$\bar{X}_T$ (Leones)	T-Value	Probability	Significance*
1. Rice	.177	.173	.14	.446	NS
2. Other Grains	.013	.002	1.24	.108	NS
3. Cassava and Other Root Crops	.006	.011	- .98	.163	NS
4. Vegetables, Beans and Fruit	.012	.008	1.30	.097	NS
5. Groundnuts	.004	.002	1.55	.061	NS
6. Palm and Other Oils	.120	.082	1.74	.041	S
7. Meat and Other Livestock Projects	.052	.011	1.77	.038	S
8. Salt and Other Condiments	.043	.029	3.89	.000	S
9. Sugar	.018	.005	1.91	.028	S
10. Fresh Fish	.032	.022	2.08	.018	S
11. Dried Fish	.129	.085	4.05	.000	S
12. Bakery Items	.009	.006	1.14	.127	NS
13. Other Processed Foods	.008	.003	1.36	.088	NS
14. All Beverages	.010	.009	.41	.339	NS
15. Tobacco and Kola Nuts	.046	.032	5.09	.000	S
16. Fuel and Light	.057	.041	4.10	.000	S
Total for All Groups	.736	.521			

*NS = not significant at the .05 level of significance
S = significant at the .05 level of significance

To ascertain further whether or not it was the influence of the first day of recall which resulted in the rejection of the original research hypothesis, the test was run again with observations from the first day of recall eliminated. Thus, the research hypothesis tested was that the mean expenditure estimates based on the sum of the second, third and fourth days of recall were equal.

Again the hypothesis was tested using Hotelling's T^2 test. In not one case out of 16 was the research hypothesis rejected. These results give strong statistical support to the hypothesis that expenditure records from the first day of recall were significantly different, and generally higher than daily expenditure data from the sum of the other three days of recall.

Another comparison of individual days of recall was made between the data collected in the first interview and those collected in the second interview in a month. The data base used in this analysis was the two-interview set. This data set consisted of household expenditure records covering seven consecutive days obtained during two interviews per month. Each household included in the sample had available four days of data from the first interview in a month and three days of data from the second interview in a month. A comparison was made of the mean annual expenditure estimates based on the first day of recall from the first interview with those based on the first day of recall from the second interview. Mean annual expenditure estimates based on the sum of the second and third day of recall from the first interview were also compared with the sum of the second and third day of recall from the second interview in a month.

The test procedure was the same in both cases. Data from the individual days of recall being compared were raised to monthly estimates. Indices were created for use where necessary in estimating the household data for any missing month. A different set of indices was used for first-interview expenditure estimates and second-interview estimates. Indices were created in the case of the

former using only data from the first interview, while in the case of the latter only data from the second interview were used.

Using these indices to fill in missing data on households with eight months or more of data yielded a sample size of 104 households. This procedure facilitated the generation of 16 annual commodity expenditure estimates. Once these were obtained, the correlated t-test was used to test the research hypothesis that the means from the paired sets were equal.

This hypothesis was first tested comparing the annual expenditure estimates based on the first day of recall from the first interview with those from the first day of recall from the second interview. This represents an important comparison as the first day of recall is believed to represent the most accurate recall. Memory of expenditures is freshest in a one-day recall.

The tests indicate that there was not a significant difference for any of the 16 commodity groups at the .05 level of significance. There was, however, as Table A.11 indicates, a tendency for the expenditure estimates from the first interview to be larger than those of the second interview. In 9 cases out of 16 the first-interview estimates were larger than those of the second interview. The average percentage difference was (unweighted) 57 percent. If the commodity category of Other Grains was excluded because of the extreme difference between the two estimates, unweighted average of the percentage differences would still be 13 percent higher for the first-interview estimates. The weighted average difference was 16 percent. (The total of the first interview estimates over all groups was 16 percent greater than the total of the second-interview estimates.)

TABLE A.11
RESULTS OF COMPARISON OF ANNUAL EXPENDITURE ESTIMATES FROM THE FIRST AND SECOND INTERVIEW BASED ON THE FIRST DAY OF RECALL

Ho: $\bar{X}_{Aj} = \bar{X}_{Bj}$
Ha: $\bar{X}_{Aj} \neq \bar{X}_{Bj}$
n = 104

$\bar{X}_A$ = first interview one-day recall mean annual expenditure estimate
$\bar{X}_B$ = second interview one-day recall mean annual expenditure estimate
j = commodity (1,...,16)

Commodity	$\bar{X}_A$ (Leones)	$\bar{X}_B$ (Leones)	T-Value	Probability	Significance*
1. Rice	72.97	46.77	1.59	.115	NS
2. Other Grains	7.05	.87	.99	.323	NS
3. Cassava and Other Root Crops	2.48	1.51	1.25	.213	NS
4. Vegetables, Beans and Fruit	5.66	4.15	.52	.605	NS
5. Groundnuts	.85	.62	.64	.526	NS
6. Palm and Other Oils	36.94	28.81	1.12	.267	NS
7. Meat and Other Livestock Products	9.50	12.03	- .51	.613	NS
8. Salt and Other Condiments	16.02	14.32	.72	.475	NS
9. Sugar	2.97	4.07	-1.00	.321	NS
10. Fresh Fish	9.64	10.03	- .21	.831	NS
11. Dried Fish	45.16	47.70	- .50	.617	NS
12. Bakery Items	2.70	3.05	- .33	.742	NS
13. Other Processed Foods	1.27	.99	.41	.682	NS
14. All Beverages	4.88	3.56	.87	.389	NS
15. Tobacco and Kola Nuts	16.24	17.42	- .55	.583	NS
16. Fuel and Light	17.27	21.28	-1.02	.311	NS
Total for All Groups	251.60	217.18			

*NS = not significant at the .05 level of significance

Comparison of the first and second interview results by using mean annual expenditure estimates based on the average of the second and third days of recall yields a similar outcome. As Table A.12 shows, the research hypothesis that the two means are equal is not rejected in 13 out of 16 cases at the .05 level of significance. The research hypothesis is rejected in three cases--Rice, Dried Fish and All Beverages. The first interview means, in this test, were larger than those based on the second interview in 14 out of 16 cases. In percentage terms (using an unweighted average) they were approximately 31 percent larger; the weighted average was 33.6 percent larger.

TABLE A.12
RESULTS OF COMPARISON OF ANNUAL EXPENDITURE ESTIMATES FROM THE FIRST AND SECOND INTERVIEW BASED ON THE AVERAGE OF THE SECOND AND THIRD DAYS OF RECALL

Ho: $\bar{X}_{Cj} = \bar{X}_{Dj}$
Ha: $\bar{X}_{Cj} \neq \bar{X}_{Dj}$
n = 104

$\bar{X}_{Cj}$ = first interview, average of the second and third day of recall mean annual expenditure estimate
$\bar{X}_{Dj}$ = second interview, average of the second and third day of recall mean annual expenditure estimate
j = commodity (1,...,16)

Commodity	$\bar{X}_C$ (Leones)	$\bar{X}_D$ (Leones)	T-Value	Probability	Significance*
1. Rice	72.40	43.28	2.50	.014	S
2. Other Grains	1.09	.74	.91	.366	NS
3. Cassava and Other Root Crops	5.49	3.09	.80	.424	NS
4. Vegetables, Beans and Fruit	2.87	1.68	1.79	.077	NS
5. Groundnuts	.52	.40	.55	.587	NS
6. Palm and Other Oils	27.79	24.16	.45	.657	NS
7. Meat and Other Livestock Products	5.12	4.48	.64	.521	NS
8. Salt and Other Condiments	9.49	7.74	1.54	.126	NS
9. Sugar	2.03	1.91	.27	.791	NS
10. Fresh Fish	7.38	7.71	- .35	.728	NS
11. Dried Fish	31.53	23.12	3.51	.001	S
12. Bakery Items	2.54	3.44	- .81	.418	NS
13. Other Processed Foods	1.18	.64	1.42	.159	NS
14. All Beverages	4.45	3.44	.55	.586	NS
15. Tobacco and Kola Nuts	12.38	10.24	2.17	.032	S
16. Fuel and Light	14.70	14.34	.23	.819	NS
Total for All Groups	200.96	150.41			

*NS = not significant at the .05 level
S = significant at the .05 level

Implications of Results

The observed tendency of expenditure records from the first day of recall to be different from those of the second, third and fourth day of recall gives an indication of the degree of memory decay occurring in the sample. It is assumed that memory declines over time. While the rate of memory decay may vary depending on culture, the item, its importance, and the frequency of purchase, memory nevertheless declines. Memory decay is generally believed to be a more serious problem for frequently purchased goods than for the less common purchase. The 16 commodity groups used in this analysis, primarily food categories, clearly fall into the category of frequently purchased goods. Thus, the evidence suggests that memory decay begins in the Sierra Leone study in the second day of recall and continues through the third and fourth. Expenditure records from the first day of recall are assumed to be the most accurate of the four days available and should, therefore, be the standard of comparison. This is because the first day of recall reflects the shortest recall period.

The results from the comparison of the same recall days from the first and second interview help to explain the observed differences between the two-interview set and the one-interview subset. In this latest analysis the expenditure estimates from both the first and the sum of the second and third day of recall from the first interview were larger than those from the second interview, but the difference rarely had statistical significance.

This research finding has several possible explanations. One explanation concerns the possibility that a significant amount of telescoping of purchases into the first interview is occurring. This might be because the first interview represents an unbounded reference period. Less telescoping occurs in the second

interview as it is bounded by the first interview. This is reflected in lower mean expenditure estimates from data collected in the second interview.[1]

Another possible explanation for the observed differences between the first and second interview centers around the conditioning process. This is a process associated with repeated visits to survey participants. In the process of being interviewed repeatedly, the level of accuracy of reported expenditures decreases because of the respondent's fatigue. In this case, by the time the second interview takes place three days later, respondents have become fatigued by the process and are no longer willing to take the time and use the energy necessary to remember expenditures accurately. This results in lowering the expenditures reported during the second interview.

A third possible explanation is that respondents go through a kind of learning process in the course of the two interviews. The first interview can sensitize the participants, making them more aware of their expenditures, thereby improving the expenditure records obtained during the second interview. In the second interview respondents might be less likely to telescope purchases. This would result in lower expenditure estimates derived from the second interview.

Conclusion

Comparison of the two-interview data set with its one-interview subset revealed a tendency for the expenditure estimates from the one-interview subset to be larger than those from the two-interview set, but the differences were small and not always statistically significant at the .05 level. Comparison of estimates from the first and second interviews, but based on specific days of recall (Tables A.11 and A.12), gave much larger differences in the estimates, but almost none of

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[1]The same telescoping mechanism may also assign to the first day of recall some expenditures that actually occurred on previous days [V.E.S.].

the differences were statistically significant. Estimates based on the first day of recall, however, differed from those based on longer recall periods more often than would be expected by chance while those based on the second, third and fourth day of recall do not differ significantly.

Although the expenditure records from the first day of recall have been found in the Sierra Leone study to be statistically different from the average of the second, third and fourth, it would not, for many purposes of analysis, be beneficial to use or collect only one-day recall expenditure records. Choices concerning the number of days of recall to be used reflect a trade-off between sample and measurement error. This is because a four-day interview reference period permits the collection of more data points during the one interview. When more data points are collected, this tends to capture more of the variation in the expenditures of a population, thus reducing the standard error.

If the day-to-day variation in expenditures is large, a one-day sample may be quite unrepresentative. This danger is particularly important if there is a systematic pattern during the week and the day sampled occurs at a high or low point. The use of two interviews covering a total of seven consecutive days allows the data to capture either systematic or irregular variation during the week. If such variations do exist (and they will, if market days occur at more or less fixed times during the week), a one-day sample is quite likely to be unrepresentative of weekly purchases. Systematic variation could conceivably be dealt with even when using only the one-day recall period, if the interviews were carefully timed so as to sample each phase of the weekly cycle proportionally. However, this is possible only if enough information about expenditure patterns has already been collected to define them precisely. In addition, the number of interviews required may have to rise to a point where interviewing costs become excessive.

On the other hand, a four-day reference period increases the possibility of response error due to memory decay. A decision must thus be made as to the point at which the benefits brought about by the reduction in measurement error caused by memory loss are offset by the increase in standard error that is associated with a reduced number of data points.

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